CE 2102 DATA STRUCTURES AND ALGORITHMS I

Teaching Scheme
Lectures: 3 Hrs/Week
Tutorials: 1Hr/Week

Examination Scheme
In Semester : 50 Marks
End Semester : 50 Marks
Credits : 4

Prerequisite:

1. ES 1202 Fundamentals of Programming Language - II

Course Objectives:
To facilitate the learners:

1. To recall and understand the concepts of problem solving, algorithms and data structures.
2. To understand data representation, implementation and applications of linear data structures.
3. To learn, apply and analyze various data searching and sorting techniques.
4. To analyze algorithms using time and space complexity.

Course Outcomes:
By taking this course, the learner will be able to:

1. Apply appropriate linear data structure to construct efficient algorithms to approach the given problem .
2. Apply the concept of Linked list to solve given problem.
3. Distinguish between various linear data structures based on their representations and applications.
4. Solve examples using data searching and sorting techniques.
5. Analyse algorithms using time and space complexity.

Unit 1: Introduction to Algorithm, Data Structures and Analysis of Algorithms (07)
Concept of Problem Solving, Introduction to Algorithms, Characteristics of Algorithms, Pseudo code and Flowchart , Abstract Data Types (ADT), Set as an ADT. Introduction to Data Structures, Classification of Data Structures. Frequency Count, Analyzing Algorithm using Frequency count, Time complexity and Space complexity of an Algorithm, Asymptotic notations, Best, Worst and Average case analysis of an Algorithm.

Unit 2: Linear Data Structures Using Sequential Organization (06)
Concept of Sequential Organization, Concept of Linear Data Structures, Array as an ADT, Storage Representation of an Array – Row major and Column major, Introduction to Multidimensional Arrays. Concept of Ordered List , Application: Polynomial as an ADT using Array. Introduction to Strings and operations on Strings. Sparse Matrices

Unit 3: Linked List (08)
Concept of Linked List, Comparison of Sequential and Linked Organizations, Linked List using Dynamic Memory Management, Linked List as an ADT, Introduction to types of Linked List, Linked List operations. Time complexity analysis of Linked List operations. Application: Polynomial as ADT using Linked List.

Unit 4: Stacks (07)
Stack as an ADT, Representation and Implementation of Stack using Sequential and Linked Organization. Applications of Stack- Simulating Recursion using Stack, Arithmetic

Expression Conversion and Evaluation, Reversing a String. Time complexity analysis of Stack operations.

Unit 5: Queues (06)

Queue as an ADT, Representation and Implementation of Linear Queue, Circular Queue, Priority Queue, Double Ended Queue. Applications: Job scheduling, Queue simulation, Categorizing data. Time complexity analysis of Queue operations. Comparison of Linear Data Structures.

Unit 6: Sorting and Searching Techniques (08)

Need of Sorting and Searching, Sorting Order and Stability in Sorting. Concept of Internal and External Sorting. Bubble Sort, Insertion Sort, Selection Sort, Quick Sort and Merge Sort, Radix Sort, Shell Sort. Time complexity analysis of Sorting Algorithms. Linear Search, Binary Search, Time complexity analysis of Searching Algorithms.

Text Books:

1. E. Horwitz , S. Sahani, D. Mehta, **"Fundamentals of Data Structures in C++"**, *University Press*, (2nd edition) (2008).
2. R. Gilberg, B. Forouzan, **"Data Structures: A Pseudocode approach with C++"**, *Brooks* (1st Edition) (2001).

References:

1. Yedidyah Langsam, Moshe J Augenstein, Aron M Tenenbaum, **"Data Structures using C and C++"** , *Pearson Education*, (2nd edition) (2009).
2. A. Aho, J. Hopcroft, J. Ulman, **"Data Structures and Algorithms"**, *Pearson Education*, (2nd edition) (2008) .
3. Brassard and Bratley, **"Fundamentals of Algorithmics"**, *Prentice Hall India/Pearson Education*, (2nd edition) (2009).
4. Goodrich, Tamassia, Goldwasser, **"Data Structures and Algorithms in C++"**, *Wiley publication*, (2nd edition) (2011).
5. R. Gillberg, B. Forouzn, **"Data Structures: A Pseudocode approach with C"**, *Cenage Learning*, (2nd edition) (2003).
6. M. Weiss, **"Data Structures and Algorithm Analysis in C++"**, *Pearson Education*, (4th edition) (2002).

List of the Tutorial Assignments:

Every student should perform 12 to 14 tutorials which will cover topics of all units mentioned in the syllabus of Data Structures and Algorithms I. Tutorial assignments will enhance the understanding of the concepts of problem solving, algorithms and data structures. Students will perform practice exercise on data representation and corresponding implementation of the data structures. Students will get opportunity to develop their logic building abilities.

Following list of tutorials can be considered as guideline for designing tutorials:

1. Demonstration of C++ program implementation and execution using eclipse tool.
2. Design an algorithm for simple problems like GCD calculation, power calculation etc.
3. Calculate frequency count, time complexity of sample algorithmic constructs.
4. For given algorithms of array operation, write equivalent C++ code.
5. Practice exercise on sorting algorithms for set of predefined inputs.
6. Calculate time complexity of sorting algorithms using concept of frequency count.
7. Practice exercise on searching algorithms for set of predefined inputs.
8. Run through code of searching algorithms.
9. Create a linked list and write algorithms for traversal, delete a node, add a node operations on a list.
10. Create a doubly or circular linked list and write algorithms for traversal, delete a node, add a node operations on a list.

11. Solve brain teaser based on recursive code snippets.
12. Demonstration on debugging techniques.
13. Select appropriate data structures and design algorithmic solution to given application.
14. Solve puzzles based on queue data structure.

CE 2105 PRINCIPLES OF PROGRAMMING LANGUAGES LABORATORY

Teaching Scheme
Lecture : 4 Hrs/week

Examination Scheme
In semester : 25 marks
Oral : 25 marks
Credits : 2

Course Objectives:
To facilitate the learners :
1) To explore the principles of object oriented programming
2) To apply object oriented programming concept for developing applications using Java
3) To apply Java collection framework for simple application development
4) To handle built-in and user defined exceptions
5) To explore functional language programming in python using simple examples

Course Outcome:
By taking this course, the learner will be able to :
1) Develop programming application using object oriented programming language Java
2) Make use of Java collection framework for effective programming.
3) Handle exceptions using inbuilt classes and user defined exceptions
4) Implement functional programming language concepts in python.

A large part of CE 2105 lab would be in understanding the syntax or semantics of languages which fall under various paradigms like Object Oriented (Java), and Functional and Scripting (Python). Main focus would be on Java programming whereas Python assignments are of introductory level as an example of programming paradigm. Assignment statements are in brief. Faculty members are encourage to expand problem statements with variations. Assignments can be framed and expanded in such a way that it explores concepts, language constructs, logic of solution and simple application.

List of assignments:

Group A: (Mandatory)
1. Design a user defined abstract data type 'Complex' in Java. Write a program to perform arithmetic operations of two complex numbers
2. Implement the following concepts by constructing suitable classes in Java - a. Constructors b. Constructor Overloading c. Function Overloading d. Function Overriding e. Inheritance
3. Implement the following concepts by constructing suitable classes in Java - a. Abstract classes and abstract methods b. Interfaces
4. Create an application for a book shop and maintain the inventory of books that are being sold at the shop.
5. Write a Python program to count the number of articles in a given text.

Group B: (Any Four)
1. Create User defined exception to check the specific conditions for recruitment system and throw the exception if the criterion does not met in Java.
2. Create a student result database in Java. Calculate the grades of students. Decide a criteria for best student and short-list students who satisfies the criteria.
3. Find appropriate class hierarchy in banking application and implement it.
4. Find suitable class hierarchy in the human resource department of an organization and implement it.
5. Write a JAVA program to perform String operations.
6. Write a JAVA program to create an abstract data types like Stack/Set/Queue/List as an interface and implement its methods.
7. Write a Python program for sorting students marks.

Group C: (Any one)

1. Write a Python program that prompts a user to enter a list of words and store in another list only those words whose first letter occurs again within the word (e.g. Baboon). The program should display resulting list
2. Write a program in Python using functional paradigm for generating two sub-lists of even and odd numbers from given list. Perform addition of individual sub-list and display the result

CE 2106 DATA STRUCTURES AND ALGORITHMS I LABORATORY

Teaching Scheme	**Examination Scheme**
Practical : 4 Hrs/Week	In Semester : 25 Marks
	Practical : 25 Marks
	Credits : 2

Prerequisite:

1. ES 1202 Fundamentals of Programming Language - II
2. ES 1206 Fundamentals of Programming Language Laboratory - II

Course Objectives:

To facilitate the learners:

1. To develop algorithmic foundations to solve problems.
2. To select and use appropriate linear data structure for a given problem statement.
3. To analyze algorithms using time complexity.
4. To implement sorting and searching algorithms.

Course Outcome:

By taking this course, the learner will be able to:

1. Select linear data structures for given problem.
2. Develop the solution for the given problem using programming language.
3. Analyze solutions using time complexity.
4. Design a small application using linear data structure.

List of Assignments

The laboratory assignments are designed in a set of group A, B and C such that students will be able to design and implement solution for a given problem. Group A assignments are designed in such a way that students will choose appropriate data structures to implement solution of a given problem. All the units of the syllabus of Data Structures and Algorithms II are covered in group B assignments. Some assignments of group B are designed to make students able to implement Abstract Data Type of a data structure and use it for a given application. In group C assignments students will design an algorithmic solution for selected problem using concepts covered in the subject Data Structures and Algorithms II.

The laboratory assignments of group A and B are to be submitted by student individually using C++/JAVA object oriented programming language. Group C assignments may be performed in a group of 2 to 4 students from the same batch. For each assignment program code with sample output is to be submitted as a soft copy. Handwritten write up (Title, Objectives, Problem Statement, Algorithms, and Outcomes) of each assignment is to be submitted by students.

Group A: (Mandatory)

1. Shopkeeper keep a record for different items purchased by customers on a day. Select appropriate data structure and write a program to perform various operations on given information.
2. Design a system to maintain CSI student branch membership information. Choose appropriate data structure.
3. College Library maintains records of books. Write a program to implement sorting, searching operations on it. Use appropriate data structure.
4. Implement Queue as ADT using linked list or array. Use Queue ADT to simulate 'waiting list' operations of railway reservation system.

Group B: (At least six)

1. Implement permutation and combination based on word problem.

2. In a group of M persons, some people can speak English and some people can speak French. Write program to find union, intersection, difference of given sets.
3. Write a program to represent polynomial equation and perform operations to add and evaluate polynomials.
4. Write a program to perform add, multiply, transpose operations on matrices.
5. Write program to perform various operations on strings.
6. A mobile phone list stores name and contact number in ascending order. Write program to search a contact details of specified name.
7. Write a program to store first year CGPA of students. Use various sorting algorithms to sort data.
8. Implement Doubly Linked List as ADT .Use same ADT to simulate Browser URL application.
9. Implement Singly Linked List as ADT. Use same ADT to simulate deck of cards application.
10. A 'concordance List' is an alphabetical list of words that appear in the book . Implement concordance list using ordered Linked List with insertion function that restrict duplicate value to be inserted in the list.
11. Implement Singly Linked List as ADT. Use it to simulate banking operations.
12. Student's information along with their percentage is stored in linked list for every division. Generate a combine list of students which is sorted in descending order based on their percentage.
13. Implement Stack as ADT using linked list or array. Use same ADT to check given expression is well formed parenthesized.
14. Implement Stack as ADT using linked list or array. Use same ADT to evaluate given postfix expression.
15. Implement Priority Queue as ADT using linked list or array. Use ADT to simulate pizza parlor order management.
16. Operating system stores N jobs and processing time require to complete each job in data structure. Design a program to simulate the job execution sequence.

Group C:

Design a game OR Design a small application to manage library data / medical shop data/ College admission data / P.M.P.M.L. bus scheduling data etc. using appropriate data structures.

CE 2201 DATA STRUCTURES AND ALGORITHMS II

Teaching Scheme
Lectures : 3 Hrs/Week
Tutorials : 1 Hr/Week

Examination Scheme
In Semester : 50 Marks
End Semester : 50 Marks
Credits : 4

Prerequisite:
CE 2102 - Data Structures and Algorithms I

Course Objectives:
To facilitate the learners:

1. To learn and understand representation, implementation and applications of trees, search trees, graphs, multiway trees data structures.
2. To choose and apply data structures for developing solutions for solving problems in various domains.
3. To analyze algorithms using time complexity analysis.
4. To understand and apply the concepts of hashing and file handling.

Course Outcomes:
By taking this course, the learner will be able to

1. Apply appropriate non linear data structure to construct efficient algorithms to approach the problems.
2. Distinguish between various non linear data structure based on their representations and applications.
3. Apply the concept of Hashing techniques for solving a problem.
4. Make use of File handeling and Java collection Frameworks for solving a problem.

Unit 1: Trees **(08)**
Introduction to Non Linear Data Structure, Binary Trees,Types of Binary Trees,Properties of Binary Trees, Binary Tree as Abstract Data Type, Representation using Sequential and Linked Organization, Binary Tree creation , Recursive and Non Recursive Tree Traversals, Threaded Binary Tree and operations, Traversals of Inorder Threaded Binary Tree, Applications of Binary Trees.

Unit 2: Search trees **(08)**
Representation of Symbol Tables- Static Tree Table and Dynamic Tree Table, Binary Search Tree and its operations, Binary Search Trees as Abstract Data Type, Height Balanced Tree : AVL Tree and operations ,Red Black Tree.

Unit 3: Graphs **(07)**
Basic Terminologies, Storage Representation, Graph Traversals, Graph as Abstract Data Type, Spanning Trees, Minimum Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Single Source Shortest Path Algorithm,Topological Sorting, Case Study : Data structures used in Google map.

Unit 4: Multiway trees and Heap **(06)**
Multiway search tree , B Tree and operations, B+ Tree,Applications of Btrees, Heap basic concepts, Realization of Heap, Heap as an Abstract Data Type, Heap implementation, Heap Sort, Heap as a Priority Queue.

Unit 5: Hashing **(07)**
General idea of Hashing, Hash Table, Hash function, Rehashing, Issues in Hashing, Collision Resolution Strategies: Linear Probing, Quadratic Probing, Double Hashing, Open addressing and Chaining.

Unit 6: File Organization and Java Collection Framework **(06)**

File Organization, Sequential File, Direct Access File and its Primitive operations, Java Collection Framework : Arraylist , Treeset, Hashset and Hashmap Class.

Text Books:

1. Sartaj Sahani, **"Data Structures, Algorithms and Applications in JAVA",** *Universities Press* (2nd edition), (2007).
2. Robert Lafore , **"Data Structures Algorithms in JAVA"**, *Techmedia*,(1st edition), (2006).
3. Ivor Horton, **"Beginning Java"**, *Wiley India Edition*,(Java 7 edition),(2012).
4. E. Horowitz, S. Sahni, D. Mehta, **"Fundamentals of Data Structures in C++"**, *Galgotia Publications* ,(2nd edition), (2008).

References:

1. Sartaj Sahani, **"Data Structures, Algorithms and Applications in C++",** *Universities Press* (2nd edition), (2007).
2. R. Gillberg, B. Forouzn, **"Data Structures: A Pseudo code approach with C++",** *Cenage Learning* (2nd edition) (2007).
3. Y. Langsam, M. Augenstein and A. Tenenbaum, **"Data structures using C and C++",** *Prentice Hall of India* (2nd edition), (2005) .
4. M. Weiss, **"Data Structures and Algorithm Analysis in C++",** *Pearson Education* (3rd edition), (2009).
5. A. Aho, J. Hopcroft, J. Ullman, **"Data Structures and Algorithms"**, *Pearson Education* (3rd Impression), (2008).

List of the Tutorial Assignments:

Every student should perform 12 to 14 tutorials which will cover topics of all units mentioned in the syllabus of Data Structures and Algorithms II. Students will perform practice exercise on data representation and corresponding implementation. Tutorial assignments will help students to enhance their ability of problem solving using appropriate data structures.

Following list of tutorials can be considered as guideline for designing tutorials:

1. Practice exercise on creating a binary tree and perform recursive and non recursive traversals of binary tree on given data.
2. Create a binary search tree for the given data and perform its inorder, preorder, postorder traversals.
3. Practice exercise on searching and deleting data values from given binary search tree. Analyze the time complexity of used algorithm.
4. Create a binary search tree for the given data and perform its inorder, preorder, postorder traversals.
5. Practice exercise on different rotations of AVL tree.
6. Construct AVL tree for the given numeric data elements. Perform the appropriate rotations whenever needed.
7. Simulate flight path data using graph data structure to find minimum cost path.
8. Practice assignment on converting a binary tree to threaded binary tree and its traversals.
9. Design a heap data structure for student data and find out minimum/maximum marks obtained in particular subject.
10. Use sequential file to maintain employee information. Write algorithm to add, delete and search employee information from the file.
11. Design a solution for company survey about its products in an area. Choose the appropriate algorithm to complete the survey within short time period and cover all

houses under that area. Give justification for your answer and also analyze your algorithm for time complexity.

12. Given the input data and hash function , show the result using following hashing methods

    a. Linear Probing b. Quadratic Probing c. Double hashing h2(x)=7-(x Mod 7)

13. Use different hashing functions to hash given values.

14. Construct a Btree of order 3 by inserting numbers of given data.

CE2202 FUNDAMENTALS OF COMPUTER NETWORKS

Teaching Scheme
Lectures : 3 Hrs/Week
Tutorials : 1Hr/Week

Examination Scheme
In Semester : 50 Marks
End Semester : 50 Marks
Credits : 4

Course Objectives:
To facilitate the learners

1. To learn and understand fundamental concept of networking.
2. To learn different methods for framing, flow control, error control.
3. To understand OSI model & TCP/IP protocol stack.
4. To learn various functions of physical & data link layer.

Course Outcomes:
By taking this course, the learner will be able to

1. **Build** the knowledge of fundamental concepts of networking to recognize various network standards and protocols.
2. **Build** the knowledge of design requirements of layered network architecture.
3. **Analyze** different error and flow control strategies.
4. **Experiment with** different line coding techniques, modulation techniques and switching techniques to build design requirements of physical layer.

Unit 1: Introduction to Computer Networks (08)
Concept of Data in Networking-Representation, Transmission, Data Flow, types of Connection- Point to Point ,Point to Multi Point , Network Standards, type of Networks-LAN,WAN,MAN, Ad-hoc Network, Networking Topologies: Bus, Mesh, Star, Ring and Hierarchical , The Internet-dial up,DSL service, Internet Standards, Internet administration.

Unit 2: Network Models (06)
Principles of protocol layering,The TCP/IP Protocol suite:Layers, description of each layer , encapsulation and decapsulation, addressing,multiplexing and demultiplexing, OSI Model, OSI verses TCP/IP suite.

Unit 3: Physical Layer (08)
Digital signals,Digital to digital conversion:line Coding techniques(unipolar,polar and bipolar), analog to digital conversion:(PCM, DM),Transmission modes:parallel,serial, introduction to Multiplexing and types: FDM, TDM,Transmission Media- Guided(Twisted pair cable, coaxial cable, Fiber Optic),Unguided media:propagation methods, types of waves (radio waves,microwaves and infrared waves) .Introduction to Switching-Circuit Switching, Packet Switching, Message Switching.

Unit 4: Logical Link Control Sublayer (LLC) (08)
Design issues, services, functions, Framing, Error Control and Flow Control, Error Control-Parity Bits, Hamming Code & CRC, Flow Control-Unrestricted Simplex Protocol, Stop and Wait, Sliding Window Protocol.

Unit 5: Medium Access Control Sublayer (MAC) (08)
Channel Allocation-Static and Dynamic, Multiple Access Protocols: CSMA, , IEEE

802.Standards and Frame Formats, CSMA/CD, CSMA/CA.

Unit 6: Connecting Devices and Virtual LAN **(04)**

Various Network Devices NIC, Switches, Hub, Routers, Repeaters, Bridge and Access Point. Virtual LANS : membership, configuration, communication between switches, advantages.

Text Books:

1. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill, Publications, 2006.
2. William Stallings “Data and computer communication”, Pearson, 8th Edition, ISBN: 0-13-243310-9

References:

1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”,6th edition (March 5, 2012), Pearson , ISBN-10: 0132856204.
2. Andrew S. Tenenbaum, “Computer Networks”, 5th Edition, PHI, ISBN 81-23-2175-8.

List of the Tutorial Assignments:

Every Student should perform 12-14 tutorials which will cover topics of all units mentioned in the syllabus of Fundamentals of Computer Network.

Tutorial assignments will help students learn and explore the subject in greater detail. Students will be able to recall and practically apply the concepts learnt. Students will emulate algorithms to get insight of the strategies used for flow control.

1. Basic concepts of Computer Networking.
2. Execute and understand basic Networking Commands.
3. Problems on bit rate , baud rate, simplex, half duplex , full duplex , synchronous and asyncronous communication
4. Study and discuss various Network components, devices and Structured Cabling components.
5. Problems on Line Coding techniques- POLAR (RZ, NRZ)
6. Problems on Line Coding techniques- Polar Biphase: Manchester and Differential Manchester encoding
7. Problems on framming texhniques.iowfinsnendroko
8. Problem solving on Error Control coding through Hamming code technique.
9. Problem solving based on CRC technique.
10. Problem solving on basic Flow Control strategies: Sliding Window protocol (Go Back N).
11. Problem solving on basic Flow Control strategies: Sliding Window protocol (Selective repeat).
12. Create Peer to Peer network and LAN network to share files within the created network.

CE 2205 DATA STRUCTURE AND ALGORITHMS- II LABORATORY

Teaching Scheme
Practical : 4 Hrs/Week

Examination Scheme
In Semester : 25 Marks
Practical : 25 Marks
Credits : 2

Prerequisite:
CE2107 - Data Structures and Algorithm Laboratory I

Course Objectives:
To facilitate the learners

1. To choose and apply appropriate Data Structures for a given problem statement.
2. To design algorithmic solution for a given problem.
3. To analyze and compare algorithms.
4. To implement non linear data structures using Object Oriented Programming.

Course Outcome:
By taking this course, the learner will be able to

1. Develop a solution of the given problem using tree data structure.
2. Develop a solution of the given problem using graph data structure.
3. Apply hashing techniques to solve a given problem.
4. Make use of sequential file handling operations.
5. Design small application using non linear data structures.

List of Assignments
The laboratory assignments are designed in a set of group A, B and C such that students will be able to design and implement solution for a given problem. Group A assignments are designed in such a way that students will choose appropriate data structures to implement solution of a given problem. All the units of the syllabus of Data Structures and Algorithms II are covered in group B assignments. In group C assignments students will design an algorithmic solution for selected problem using concepts covered in the subject Data Structures and Algorithms II.
The laboratory assignments of group A and B are to be submitted by student individually using C++/JAVA object oriented programming language. Group C assignments may be performed in a group of 2 to 4 students from the same batch. For each assignment program code with sample output is to be submitted as a soft copy. Handwritten write up (Title, Objectives, Problem Statement, Algorithms, Outcomes) of each assignment is to be submitted by students.

Group A (Mandatory)

1. Create a Dictionary that stores keywords and its meanings, using appropriate data structure. Implement its operations such as add, delete, display, search and update its values.
2. Create a reasonably balanced tree to maintain names and telephone numbers of all the customers of a shopkeeper and perform operations on it. Test your program for at least 10 names.
3. A news paper delivery boy every day drops news paper in a society having many lanes and houses. Design a program to provide different paths that he could follow. Solve the problem by suggesting appropriate data structures. Design necessary class.
4. Write a program to create telephone book database of N clients. Make use of a hash table implementation to quickly look up client‘s telephone number.

Group B (At-least Six)

1. Create a binary tree and perform inorder ,preorder and postorder traversals.
2. Implement Binary Search Tree as Abstract Data Type and perform operations on it.
3. Write a program to create a binary tree if inorder and preorder or inorder and postorder any two traversals are given.
4. Create inorder threaded binary tree and perform its traversals.
5. Company wants to lease phone lines to connect its offices of different cities, with each other. Company charges different amounts of money to connect different pairs of offices. Solve the problem by suggesting appropriate data structures to connect all offices of a company with a minimum cost.
6. Write a modular program to implement primitive operations on Min/Max Heap.
7. Write a program to implement Symbol Table as an ADT.
8. Use sequential file to maintain student information. Write algorithm to add, delete and search student information from the file.
9. Implement hash table ADT and handle the collision using linear probing and chaining (with or without replacement). Perform operations on it.

Group C

Create a small application using appropriate data structures to process stock data / organization's data / college data.

CE 2206 MICROPROCESSOR ARCHITECTURES LABORATORY

Teaching Scheme:
Lectures: 2 hrs./Week

Examination Scheme:
Oral – 25 marks
Credit(s): 1

Prerequisite:

1. Digital Systems and Computer Organization (CE 2104)

Course Objectives:
To facilitate the learners

1. To understand and apply x86 instructions to write assembly language program.
2. To learn, apply and analyze microprocessor and peripherals interfacing techniques.
3. To learn and use the interfacing of assembly language and higher level language.
4. To able to solve moderately complex problems using modular assembly language programming.
5. To understand and use privileged instructions.

Course Outcomes:
By taking this course, the learner will be able to

1. Choose x86 instructions to write assembly language programs.
2. Build a small system using microprocessor interfacing techniques.
3. Solve a given problem using advanced assembly language methods.
4. Apply the modular programming using assembly level language.

The Microprocessor Architectures laboratory assignments are designed using assembly language programming as well as hardware interfacing techniques. The laboratory work also covers the assembly language interface with higher level language like 'C'. The students are introduced to advanced protected mode instructions.

Group A Assignments (Perform all assignments)

1. Write ALP to perform basic arithmetic operations and check the output in debugger.
2. Write ALP to accept a string and display it on the screen.
3. Write ALP to accept a signed number and check if it is positive or negative. Display appropriate message.
4. Write 8086 ALP to interface DAC and generate following waveforms on oscilloscope
   (i) Square wave – Variable Duty Cycle and frequency.
   (ii) Ramp wave – Variable direction
   (iii) Trapezoidal wave
   (iv) Stair case wave
   (v) Temple wave
   (vi) Sine wave – using look up table
5. Write 8086 ALP to program 8251 for serial communication between two 8251s.
6. Write 8086 ALP to program 8253 to observe outputs of different modes using counter display.
7. Write ALP using STRING instructions to accept a string from user and perform following operations
   (a) Convert a string to uppercase / lowercase

(b) Toggle the case of the string
(c) Concatenation of another string
(d) Find if it is palindrome
(e) Find a substring

(For this assignment make a group of 4 students, each one performing each task and then combine all functions to apply modular programming.)

Group B Assignments (Perform any two)

1. Write ALP to perform following using command line arguments to simulate TYPE or COPY command.
2. Write ALP to find the largest number from an array using PUBLIC/GLOBAL and EXTERN.
3. Write a C/ inline program for PC to PC communication.
4. Write ALP for Mouse interface.
5. Write inline code to perform file operations.
6. Write ALP for floating point operations.

Group C Assignments (Perform any one)

1. Write ALP for to read GDTR/LDTR and IDTR and display the table content pointed by GDTR and IDTR.
2. Write ALP to implement multitasking using Pentium programming.

Text Books:

1. 8086 and peripherals – Intel Manual
2. Pentium Architecture – Intel Manual
3. Douglas Hall, **'Microprocessors & Interfacing'**, *McGraw Hill*, (Revised 2^{nd} Edition), (2006)
4. James Antonakos, **'The Pentium Microprocessor'**, *Pearson Education,* (2^{nd} Edition), (2004)

Reference Books:

5. Sivarama P. Dandamudi, **'Introduction to Assembly Language Programming For Pentium and RISC Processors'**, *Springer*,(2^{nd} Edition), (2004)
6. Peter Abel, **'Assembly language programming'**, *Pearson Education*,(5^{th} Edition),(2002)
7. John Uffenbeck, **'The 8086/88 Family: Design, Programming & Interfacing'**, *PHI*, (2^{nd} Edition), (2002)
8. A.Ray, K.Bhurchandi, **'Advanced Microprocessors and peripherals: Architecture, Programming & Interfacing'**, *Tata McGraw Hill*, (2^{nd} Edition), (2004)
9. Liu, Gibson, **'Microcomputer Systems:The8086/88Family'**,*PHI*,(2^{nd} Edition),(2005)
10. Kip Irvine, **'Assembly language for IBM PC'**, *PHI*, (2^{nd} Edition),(1993)

Web References:

1. NPTEL series – nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/
2. service.scs.carleton.ca/sivarama/org_book/org_book_web/slides/chap_1_versions/ch7_1.pdf

CE 2207 OPERATING SYSTEMS LABORATORY

Teaching Scheme
Practical : 4 Hrs/week

Examination Scheme
In Semester : 25 Marks
Oral : 25 Marks
Credits : 2

Prerequisites:

1. Data Structures and Algorithms-I (CE2102)
2. Fundamentals of Programming Language Lab-II (ES1206)
3. Digital Systems and Computer Organization(CE2104)

Laboratory Objectives:
To facilitate the learners -

1. To understand the fundamentals of Operating Systems.
2. To understand shell scripting to automate operating system operations.
3. To understand the operations performed by Operating System as a resource manager.
4. To apply the concepts of Operating System for Process and Memory management.
5. To analyze various scheduling algorithms.
6. To understand the communication among the processes.

Laboratory Outcomes:
By taking this course, the learner will be able -

1. To choose Unix/Linux Commands for Shell Programming.
2. To make use of different CPU scheduling algorithms.
3. To apply Memory Management algorithms.
4. To apply various disk scheduling algorithms.
5. To examine the Inter-Process Communication concepts.

Every student should perform 9-10 assignments in this laboratory which will cover topics of all units mentioned in the syllabus of Operating Systems. Following is the list of assignments that can be considered as guideline for designing assignments and give basic knowledge of operating systems and its services. The choice of the assignments for each student is given in such a way that all topics should be distributed and covered amongst all batches.

List of Assignments:
Group A: (Mandatory)

1. Write a shell script to implement mount and un-mount commands to mount device and un-mount it.
2. Exploration of Unix/Linux Commands (File, Directory and Process commands).
3. Write a program to implement Banker's Algorithm for deadlock handling.
4. Write a program to implement Reader-Writer problem using semaphores.

Group B: (Any four)

5. Write a program to implement following Non- Pre-emptive scheduling algorithms : First Come First Serve (FCFS), Shortest Job First (SJF).
6 .Write a program to implement following Pre-emptive scheduling algorithms: Round-Robin (RR), Shortest Remaining Time First (SRTF)
7. Write a program to implement following memory allocation strategies: First Fit, Best Fit and Worst Fit.
8. Write a program to implement following Page replacement algorithms: a) First-In-First-Out (FIFO). b) Least Recently Used (LRU) c) Optimal page replacement.
9. Write a shell script for adding users / groups and modifying permissions of file / directory accordingly.
10. Write a program to implement following disk scheduling algorithms: First Come First Serve (FCFS), SCAN, Circular - SCAN(C-SCAN), Shortest Seek Time First (SSTF).

Group C: (Any one)

1. Installation of Linux Operating System.
2. Implement producer-consumer algorithm using multi-threading concept.

EC2101 Electronic Devices and Circuits

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination scheme:
In Semester: 50 Marks
Semester: 50 Marks
Credits: 4

Course Objectives:

1. Introduce the characteristics, working principles as well as concept of load line and operating point of FETs for analysing DC circuits
2. Explain the concepts of employing simple models to represent non linear elements such as JFETs and MOSFETs
3. Analyse JFET and MOSFET amplifiers and discuss general frequency response of amplifiers
4. Impart the knowledge of feedback and its effects on characteristics of amplifier
5. Familiarise the students with audio power amplifiers using BJTs

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Explain characteristics of FETs and determine transistor parameters
2. Analyse RC coupled amplifier for DC and AC conditions
3. Determine the frequency response of transistorised RC coupled circuits
4. Analyse effect of negative feedback on amplifier parameters. Explain principle of working of oscillators and calculate frequency of oscillation for given circuit
5. Calculate efficiency and harmonic distortion for Class A, Class B and Class AB Power Amplifiers and compare them

Unit 1: JFET **(09)**

Introduction, Construction and working, JFET characteristics (Transfer and Drain), Schockley's equation, JFET biasing and DC analysis, JFET as amplifier and its configurations (CS/CD/CG) and comparison, CS amplifier analysis.

Unit 2: MOSFET **(10)**

Two terminal MOS structure, EMOSFET-construction, symbols, Ideal EMOSFET V-I characteristics, additional MOSFET structures (DMOSFET and CMOS), non-ideal V-I characteristics of EMOSFET (finite output resistance, body effect, break down effect, temperature effect, short channel effects), MOSFET biasing and DC circuit analysis, MOSFET small signal amplifier (CS configuration).

Unit 3: Frequency response of amplifiers **(07)**

General frequency response for RC coupled amplifier, Low frequency response, Miller effect, High frequency response, Multistage frequency effects, square wave testing for RC coupled amplifiers.

Unit 4: Feedback Amplifiers and Oscillators **(08)**

Classification of amplifiers, feedback concept, General characteristics of negative feedback amplifiers, Feedback Topologies, Barkhausen criterion, sinusoidal oscillators: RC Phase shift and LC oscillators, Crystal oscillators.

Unit 5: Power Amplifiers **(08)**

Types (Class A, B, AB and C) and their comparison, Second Harmonic distortion, Analysis of Class A, Class B and Class AB amplifiers, Introduction to Class C amplifiers.

Text books:

1. R.L.Boylstad, L.Nashlesky, **'Electronic Devices and Circuits Theory'**, *PrenticeHall of India*, (9th Edition), (2006).

2. Donald Neaman,**'Electronic Circuit Analysis and Design'**, *Tata McGraw Hill*, (3rd Edition), (2007).

Reference Books:

1. David A. Bell, **'Electronic Devices and Circuits'**, *Oxford*, (5th Edition), (2008).
2. Millman , Halkias, **'Integrated Electronics- Analog and Digital Circuits and Systems'**, *Tata McGraw Hill*, (2nd Edition), (2010).

Websites:

1. http://nptel.ac.in/courses/117103063/24
2. http://nptel.ac.in/courses/117103063/17
3. http://www.iitg.ac.in/apvajpeyi/ph218.html
4. http://nptel.ac.in/courses/117101105/3

List of Tutorials:

1. Design biasing circuit for JFET.
2. Analyse JFET amplifier.
3. Analyse MOSFET amplifier.
4. Analyse Multistage amplifiers.
5. Analyse effect of negative feedback on amplifiers.
6. Design Oscillator Circuit.
7. Analyse Power Amplifiers.

EC 2103 Digital Electronics
Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs/Week In-Semester: 50 Marks
Tutorial: 1Hr/Week End-Semester: 50 Marks
Credits: 4

Course Objectives:
1. Introduce the techniques for the simplification of logic function and design arithmetic circuits

2. Make students familiar with design and applications of combinational circuits using basic logic gates and MSI chips

3. Introduce the sequential circuits, their functionality, design and applications

4. Acquaint the students with the design and implementation of state machines

5. Make students familiar with logic families, Programmable Logic Devices and VHDL

Course Outcomes:
Having successfully completed this course, the student will be able to:
1. Apply reduction techniques to design basic combinational circuits
2. Design combinational and sequential circuits using basic gates and MSI chips
3. Design sequential circuits using state machines.
4. Explain digital logic families and Programmable Logic Devices.
5. Explain modelling styles of VHDL and design combinational and sequential circuits using VHDL

Unit 1: Combinational Logic Design (07)
Standard representations for logic functions, k map representation of logic functions, SOP and POS forms, min-terms and max-terms, minimization of logical functions up to 4 variables, don‘t care conditions. Design Examples: Arithmetic Circuits: Adders and subtractors, Digital Comparator, ALU, code converters.

Unit 2: Combinational Logic Design using MSI chips (06)
Circuit design using adder, comparator ICs. Multiplexers and their use in combinational logic designs, multiplexer trees, Demultiplexers and their use in combinational logic designs, Demultiplexer trees, Decoders.

Unit 3: Sequential Logic Design (08)
One bit memory cell, Clocked SR, D, MS J-K flip-flop and T flip-flops, Use of preset and clear terminals, Excitation table for flip-flops, Conversion of flip-flops. Application of flip-flops: Shift registers, sequence generators, counters: ripple counters, up/down counters, synchronous counters.

Unit 4: State Machines (06)
Mealy and Moore machines representation. Design of state machines using State diagram, State table, State reduction, State assignment. Design of sequential circuit using Finite state machine
8

Unit 5: Digital Logic Families (05)
Classification of logic families, Characteristics of digital ICs: Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity,

operating temperatures and power supply requirements. Operation of TTL NAND gate, active pull up, wired logic. CMOS logic: CMOS inverter, NAND, NOR gates, Comparison between TTL, CMOS technologies.

Unit 6: Introduction to VHDL, Programmable Logic Devices (06)
Introduction to VHDL, Entity declaration, architecture, modelling styles, data objects, concurrent and sequential statements. Simple design examples using VHDL for basic combinational and sequential circuits, attributes. Introduction to Programmable logic devices and their types: ROM, PLA, CPLD, FPGA.

Text Books:
1. R.P. Jain, „Modern digital electronics‟, TMH Publication, (4th edition), (2007).
2. Anand Kumar, „Fundamentals of digital circuits‟, PHI Publication, (1st edition),(2001).
3. J. Bhaskar, „VHDL Primer‟, PHI Publication,(3rd Edition), (2015).
Reference Books:
1. Wakerly, „Digital Design Principles and Practices‟, Pearson Education, (3rd edition),(2004.)
2. Stephen Brown, „Fundamentals of digital logic design with VHDL‟, TMH Publication, (1st edition), (2002).
Website:
1. http://nptel.ac.in/courses/117106086/1
List of Tutorials:
1. Minimize the logic functions and realize using universal gates.
2. Design code converters using basic gates.
3. Design a combinational circuits using multiplexer.
4. Realize the multiple output functions using decoder.
5. Conversion from one type of Flip- Flop to another type.
6. Design mod-N asynchronous counter.
7. Design mod-N synchronous counter.
8. Design sequence generator using sh

EC 2104 Data Structures

Teaching Scheme
Lecture: 3 Hours/Week

Examination Scheme
In-Semester: 50Marks
End-Semester: 50Marks
Credits: 3

Course Objectives:

1. Introduction to the theory, practice and methods of data structures
2. Introduce elementary data structures such as Arrays, Linked lists and model other data structures
3. Learn modelling of linear data structures like stacks and queues
4. Learn modelling of non-linear data structures like trees and graphs

Course Outcomes:
Having successfully completed this course, the student will be able to:

1. Classify and categorize data structures that make up for a programming language
2. Infer to the modelled data structures from the premise of the baseline models
3. Make use of algorithms on linear and non-linear data structures for performing different operations on data
4. Perceive the importance of appropriate memory allocation and efficient management in the time-space domain

Unit 1: Introduction, Arrays & Functions in C
(09)

Introduction: Overview of Compiler and the 'C' development life cycle, brief overview of Operating System. Software Development Life Cycle (SDLC), Arrays: Single dimensional & Two dimensional Arrays. Searching Methods: Algorithms for Sequential Search, Indexed Sequential Search, and Binary Search. Sorting Methods: Algorithms for Selection sort, Bubble sort, Insertion sort. Introduction to Time complexity and Space complexity, brief overview of the Big Oh, and other notations as performance metrics for the algorithms. Abstract Data Type (ADT): Definition, ADT for arrays. Functions: Types of functions and their categories with appropriate examples. Parameter passing by value, parameter passing by reference, recursive functions.

Unit 2: Pointers & Structures in C
(07)

Pointers: Basic concepts. Pointer declaration & initialization. Scale factor. Pointer to a pointer. Strings: Basic concepts. Structures in C: Concept, comparison with arrays as a data structure. Array of structures, pointers and arrays, pointers and structures. Bitwise Operators, Concept of ordered list & polynomial representation using array of structures.

Unit 3: Data Structure Using Linked Organization
(07)

Concepts and definition of data, data type, data object, data structures. Concept of Singly Linked List: Algorithms for Creation, Insertion, deletion and traversals of above data structure.

Concept of Doubly Linked List and Circular Linked List. Applications of Linked lists. Generalized linked list: Representation of polynomial using GLL.

Unit 4: Stacks and Queues **(07)**

Stacks: Definition & example, representation using arrays & linked list. Applications of Stacks: Concept of infix, postfix and prefix expressions, conversion of infix to postfix expression, evaluation of postfix expression. Queues: Definition & example, representation of queue using array and linked list. Concept of circular queue, concept of priority queue, applications of Queue.

Unit 5: Trees **(07)**

Difference between Linear and Non-linear data structures. Binary trees (BT): Basic terminology. Types of Binary Trees. Binary Search Tree (BST): Difference between BST and BT. Representation of BST(Static and Dynamic), Algorithms for BST traversals – pre-order, in-order & post-order(recursive), Primitive operations on BST: Create, insert, delete. Algorithm for Non-recursive in-order traversals for BST.

Unit 6:
Graphs **(05)**

Graphs: Concepts and terminology, Types of graphs—directed graph, undirected graph, planar graph, representation of graph using adjacency matrix, adjacency list, Traversals: DFS & BFS. Minimal spanning tree: Kruskal’s and Prim’s algorithm.

Text Books:

1. Seymour Lipschutz, ‘**Data Structures with C’,** Schaum’s Outlines, *McGrawHill Education (India) Pvt. Ltd,* Special Indian Edition, (2013).
2. E Balgurusamy, ‘**Programming in ANSI C**’, *Tata McGraw-Hill*,(3rd Edition), (2008).

Reference books:

1. Richard F. Gilberg & Behrouz A. Forouzan, ‘**Data Structures A Pseudocode Approach with C**’, *Cengage Learning*, (2nd Edition) , (2005).
2. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum, ‘**Data structures using C and C++**’, *PHI Publications*, (2nd Edition), (2004).
3. Ellis Horowitz, SartajSahni, ‘**Fundamentals of Data Structures in C’**, *Universities Press,* (2nd edition), (2008).

EC2105 Electronic Devices And Circuits Lab

Teaching Scheme:
Practical: 4 Hrs/Week

Examination Scheme:
Practical: 25 Marks
Credits:2

Course objectives:

1. To build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators
2. To compare the measurements with the behaviour predicted by mathematic models and explain the discrepancies
3. To use simulation tool for verifying circuit performance

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Plot characteristics for JFET and calculate gm,rd.
2. Design biasing circuit for amplifier and feedback circuit for oscillators.
3. Build electronic circuits like amplifiers and oscillators and measure circuit response.
4. Compare experimental results with theoretical values of performance parameters of amplifiers and oscillators.

List of Experiments:

1. Plot V-I characteristics of JFET.
2. Implement biasing circuit for JFET and verify DC operating point.
3. Implement JFET CS Amplifier and calculate Av, Ri and Ro.
4. Determine fL and fH of amplifier using square wave testing method.
5. Implement CG and CD amplifier.
6. Analyze the effect of different capacitors on bandwidth of amplifier.
7. Plot V-I characteristics of MOSFET.
8. Plot voltage transfer characteristics of CMOS inverter.
9. Simulate current mirror circuit.
10. Analyze effect of feedback on Av, Ri and Ro.
11. Simulate Oscillator Circuits.
12. Simulate large signal amplifier.

EC 2106 Digital Electronics Lab
Teaching Scheme: Examination Scheme:
Practical: 2 Hrs/Week In-Semester: 25 Marks
Credits: 1

Course Objectives:
1. Design digital circuit based on reduction techniques and digital logic
2. Implement combinational logic circuits using MSI chips
3. Design and implement sequential logic circuits using counter ICs
4. Use software tools for simulation of digital circuits

Course Outcomes:
Having successfully completed this course, the student will be able to:
1. Identify the functionality of ICs as a multiplexer, decoders and counters
2. Design digital building blocks such as multiplexer, code converter, adder and counters
3. Implement and test digital circuits and verify the truth tables
4. Use the software tools for the simulation of digital circuits

List of Experiments
1. Design and implement combinational circuits using Multiplexer.
2. Design and implement multiple output function using decoder.
3. Design and implement 1 digit BCD adder using IC7483.
4. Design 8 bit magnitude comparator.
5. Design and implement MOD-N asynchronous BCD counter using counter ICs.
6. Design and implement 4 bit counter using Synchronous counter IC.
7. Write and simulate VHDL code for D FF using reset input.
8. Write and simulate VHDL code for 4 bit logical and arithmetic operations for ALU.

EC 2107 Data Structures Lab

Teaching Scheme
Practicals: 4 Hours/Week

Examination Scheme
Oral: 50 Marks
Credits: 2

Course Objectives:

1. Understand various data searching and sorting methods with pros and cons
2. Understand various algorithmic strategies to approach the problem solution
3. Operate on the various structured data

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Utilize the principal algorithms of sorting and searching on the given data
2. Perceive the representation of data structures like arrays, records, linked lists and their use
3. Implement stacks & queues from the base models
4. Build, represent and traverse non-linear data structures

List of Assignments

Write a C program to implement:

1. Sorting methods – bubble, selection and insertion.
2. Searching techniques- linear and binary.
3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.
4. Polynomial addition using array of structures.
5. Create a singly linked list with options:
   a. Insert (at front, at end, in the middle), b. Delete (at front, at end, in the middle),
   c. Display, d. Display Reverse, e. Revert the SLL.
6. Implement Stack using arrays. Perform following operations on a stack a. Push b. Pop c. Display.
7. Implement Stack using Linked List. Perform following operations on a stack a. Push b. Pop c. Display.
8. Evaluation of postfix expressions (input will be postfix expression).
9. Implement Queue using arrays. Write a menu driven program to perform following operations on a Queue a. Insert b. Delete c. Display.
10. Implement Queue using Linked List. Write a menu driven program to perform following operations on a Queue a. Insert b. Delete c. Display.
11. Binary search tree: Create, search, recursive traversals.
12. Graph using adjacency Matrix with BFS and DFS traversals.
13. Hash Table(Beyond the Syllabus)

EC 2203 Integrated Circuits and Applications

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

1. Introduce the working principle of Op-Amp
2. Discuss characteristics of Op-Amp and explain practical limitations
3. Familiarize the students with linear and non-linear applications of Op-Amp
4. Introduce signal converters (A/D, D/A)
5. Explain the characterstics of active filters, oscillators and operating principles of PLL

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Explain the significance of internal stages to determine the performance of general purpose Op-Amp
2. Interpret and calculate performance parameters of Op Amp
3. Design and analyze linear and non linear applications of Op Amp
4. Explain the operation and charecteristics of A/D and D/A converters and phase lock loop
5. Calculate performance parameters of A/D and D/A converters and phase lock loop
6. Design Op Amp based butterworth filters

Unit 1: OP-AMP Basics **(07)**

Block diagram of OP-Amp and significance of each block, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configuration, Methods for improving CMRR of Differential Amplifier, Need of level shifter, Output stage of Op-amp.

Unit 2 : OP-AMP Performance Parameters **(06)**

Symbol and ideal equivalent circuit of OP-Amp, DC characteristics: Offset Voltage, Bias current, Offset current, Thermal drift, AC characteristics: Slew rate, Rise Time, CMRR, Frequency characteristics. Ideal parameters and practical parameters of OP-AMP and their comparison, Frequency compensation.

Unit 3 : Linear Applications of OP-AMP **(08)**

Inverting and Non-inverting amplifier, Voltage follower, Summing amplifier, Difference Amplifier, Instrumentation Amplifiers, Instrumentation Amplifier Applications. Ideal integrator, errors in ideal integrator, practical integrator, design of practical integrator, Ideal differentiator, errors in ideal differentiator, practical differentiator.

Unit 4 : Non-linear Applications of OP-AMP **(08)**

Comparator, Characteristics of comparator, Applications of comparator, Schmitt trigger, Square wave generator, Triangular wave generator, Need of precision rectifier, Half wave and Full wave precision rectifiers.

Unit 5 : Signal Converters **(06)**

I to V and V to I converter, DAC: Characteristics, Specifications and Types, ADC: Characteristics, Specifications and Types.

Unit 6 : Active filters and PLL **(07)**

First order and second order Active LP Butterworth filter, Filter design and frequency scaling, Block diagram of PLL and its function, Applications of PLL.

Text books:

1. Ramakant A. Gaikwad, '**Op Amps and Linear Integrated Circuits**', *Prentice Hall*, (4th Edition), (2000).
2. George Clayton and Steve Winder, '**Operational Amplifiers**', *Newnes Publication*, (4th Edition), (2004).
3. Salivahanan and Kanchanabhaskaran, '**Linear Integrated Circuits**', *McGraw Hill Education,(*1st Edition), (2013).

Reference Books:

1. Sergio Franco, '**Design with Operational Amplifiers and Analog Integrated Circuits**', *McGraw Hill Education*, (3rd Edition), *(2002)*.
2. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
   Sedra Smith, '**Microelectronic Circuits**', *Oxford Publications*, (5th Edition), *(2004*).
3. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
4. Sedra Smith, '**Microelectronic Circuits**', *Oxford Publications*, (5th Edition), *(2004*).
5. D. Roy Choudhury and S. B. Jain, **'Linear Integrated Circuits**', *New age International publishers*, (2nd Edition), (2003).

Websites:

1. www.ti.com
2. www.nptel.ac.in

List of Tutorials:

Analyse differential amplifier circuits.

1. Calculate Op Amp Parameter.
2. Op-amp datasheet- Pin packages, Manufacturers, Technical specifications.
3. Design of integrator and differentiator.
4. Design of instrumentation amplifier.
5. Analyse an application based on Op - Amp.
6. Design of waveform generator.
7. Analyse phase-locked loop (PLL).

EC 2204 Object Oriented Programming

Teaching Scheme
Lecture: 3 Hours/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Make the students familiar with the basic concepts and techniques of OOP paradigm
2. Understand C++ and Java as programming languages
3. Develop ability to program in C++ and Java

Course Outcomes:
After completion of course, students will be able to:

1. Explain the principles of Object Oriented Programming
2. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
3. Identify the basic program constructs in Java
4. Apply the concepts of multi-threading, inheritance, interface, exception handling and applets in Java

Unit 1: Introduction to Object Oriented Programming (07)
Principles of Object-Oriented Programming, Beginning with C++, Tokens, Expressions and Control Structures, Functions in C++.

Unit 2: Concepts of Object Oriented Programming with C++ (07)
Classes and Objects, Constructors and Destructors. Operator overloading, Inheritance and their types. Virtual functions and polymorphism

Unit 3: Java Fundamentals (07)
Java Evolution, Overview of Java Language, Constants, Variables, and Data Types, Operators and Expressions, Decision making.

Unit 4: Classes Methods and Objects in Java (07)
Classes, Objects and Methods, Arrays and Strings. Overloading methods, Recursion

Unit 5: Inheritance, packages and Interfaces (07)
Inheritance basics, constructors in derived class. Object class. Packages, access protection, importing packages. Interfaces: Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.

Unit 6: Multithreading, exception handling and Applets (07)
Introduction to multithreading: Introduction, creating thread and extending thread class. Concept of Exception handling, types of errors, multiple catch statements. Applets: Concept, difference between applets and applications. Life cycle of an applet, types of applets.

Text Books:

1. E Balagurusamy, 'Object Oriented Programming with C++ and Java', McGraw Hill Education (India) Pvt. Ltd., First Reprint 2013.
2. Herbert Schildt, Java: The Complete Reference, McGraw Hill, (7th Edition), (2007).

Reference books:

1. Robert Lafore, **"Object Oriented Programming using C++"**, *SAMS publishing*, (4th Edition),(2002).
2. E Balagurusamy, "**Programming with Java A Primer"**, *Tata McGraw Hill*, (3rd Edition), First Reprint 2007.

Website:

http://onlinecourses.nptel.ac.in/noc16-cs19.
nptel.ac.in/courses/106105153.

EC 2205 Analog Communication Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme:
Practical: 25 Marks
Credit: 1

Course objectives:

1. Explain the mechanism of AM, FM generation and detection
2. Explain the use of the spectrum analyzer
3. Measurement of performance characteristics of superheterodyne radio receiver
4. Explain generation of flat top and natural sampling

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Draw waveforms AM, FM and explain the spectrum of the same
2. Observe effect of changes in modulating and carrier signal parameters on spectrum of AM and FM
3. Measure and plot performance characteristics of superheterodyne radio receiver
4. Draw sampling waveforms and observe effect of sampling frequency on detection of Pulse Amplitude Modulation

List of Experiments:

1. AM generation and calculation of modulation index with the graphical and trapezoidal method
2. AM generation using class C amplifier and AM detection with simple and practical diode detector
3. DSB-SC generation and synchronous detection with balanced modulator
4. SSB generation and detection with phase shift method
5. FM generation with direct method and measurement of deviation ratio for different amplitudes of modulating signal
6. FM Detection using PLL
7. Measurement of performance characteristics of Superheterodyne AM Receiver
8. Generation and detection of pulse amplitude modulation (PAM)
9. Simulation of AM generation with suitable software
10. Simulation of FM generation with suitable software

EC 2206 Integrated Circuits and Applications Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme:
In-Semester: 25 Marks
Credit: 1

Course Objectives:

1. To measure Op-Amp performance parameters and understand the difference between ideal and practical values for different ICs
2. To design and implement linear and non-linear applications of Op-Amp and verify the functionality

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Design Op-Amp based circuits
2. Select an appropriate Op-Amp IC for given application
3. Construct Op-Amp based circuits and analyse their performance

List of Practicals

1. Verify virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Measure Op-Amp parameters and compare with the specifications: Input bias current, input offset current, input offset voltage, slew rate, CMRR.
3. Design, build and test integrator for given frequency fa.
4. Design, build and test three Op-Amp instrumentation amplifiers for typical application.
5. Build and test precision half and full wave rectifier.
6. Design, build and test Schmitt trigger and plot transfer characteristics.
7. Design, build and test square and triangular waveform generator.
8. Build and test 2 bit R-2R ladder DAC.

EC 2207 Object Oriented Programming Lab

Teaching Scheme
Practicals: 4 Hours/Week

Examination Scheme
Oral: 25 Marks
Credits: 2

Course Objectives:

1. Exposure to object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
2. Implement, test and debug programs in the object-oriented paradigm.

Course Outcomes:

1. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
2. Develop programs in Java utilizing the basic constructs.
3. Apply the concepts of polymorphism, inheritance and exception handling to develop Java programs.
4. Utilize the concepts of multi-threading & applets in Java programming.

List of Experiments

Write a program in C++ :

1. To sort the numbers in an array using separate functions for read, display, sort and swap. Objective is to learn the concepts of input/output, functions and call by reference in C++.
2. To perform the following operations on Complex numbers: Add, subtract, multiply, divide, complex conjugate. The objective is to learn the concepts of classes and objects.
3. To implement a Stack. Design the class for stack and the operations to be performed on stacks using constructors and destructors.
4. To implement a database of people having different professions e.g. engineer, doctor, student etc. using the concept of multiple inheritance.
5. Write a program in Java:
   i) To find factorial of a number
   ii) To display first 50 prime numbers
   iii) To find sum and average of N numbers
6. To implement a calculator with simple arithmetic operations such as add, subtract, multiply, divide and factorial using switch case and other simple Java statements
7. To define a class rectangle with the data fields width, length, area and colour. Create two objects of rectangle and compare their area and colour.
8. To sort i) List of integers ii) List of names
9. To add two matrices. The objective is to learn arrays in Java.
10. Write a program in Java to implement multi-level inheritance. Objective is to learn the concepts of inheritance in Java.
11. Write a Java program which uses TRY and CATCH for exception handling.
12. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
13. Create an Applet with three text fields and four buttons ADD, SUBTRACT, MULTIPLY and DIVIDE.

ECSP1101 Image Processing and Analysis

Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs/Week In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:
1. To understand image fundamentals and mathematical operations performed on images.
2. To apply image enhancement techniques.
3. To understand different image segmentation and representation techniques.
4. To study image restoration techniques and image transforms for image compression.
5. To understand morphological image processing and classification techniques.
Course Outcomes:
After completion of the course, students will be able to
1. Describe image processing fundamentals and implement basic mathematical operations on digital images.
2. Apply image enhancement techniques in spatial and frequency domain.
3. Apply 2-D data compression techniques on digital images and explain image compression and
restoration algorithms.
4. Implement segmentation techniques and morphological operations on images.
5. Apply image classification and boundary and region description techniques.
Unit–I: Digital image fundamentals and filtering (13)
Image Representation, Color models – RGB, CMY, YIQ, HSI, Image Enhancement: Spatial domain
methods: point processing - intensity transformations, histogram processing, image addition, subtraction, image scaling, image compliment. Spatial filtering - smoothing filter, sharpening filter.
Frequency domain filtering: low pass filtering, high pass filtering.
Unit – II: Image restoration and Segmentation (08)
Degradation model - Inverse filtering - Wiener filter - Constrained Least squares restoration, Image
segmentation Detection of discontinuities - point, line and edge and combined detection, Edge linking Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging, thresholding.
Unit – III: Image compression (04)
Image compression using DCT, zig-zag scanning, still image compression standard - baseline JPEG.
Unit – IV: Morphological operations and Region and boundary
descriptors

(05)

Morphological image processing: Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, thinning, thickening, skeletons.

Unit – V: Classification and Recognition (06)

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms: Minimum distance classifier, Correlation based classifier, Bayes classifier.

Reference Books:

1. R.C. Gonzalez, R.E. Woods, ‘Digital Image Processing’, Pearson Education. (3rd Edition), (2014).

2. S. Jayaraman, S. Esakkirajan, T. Veerakumar ‘Digital Image Processing’, McGraw-Hill, (1st Edition),(2009).

3. K. Jain, ‘Fundamentals of Digital Image Processing’, Prentice Hall, (3rd Edition), (2004).

4. W.K. Pratt, ‘Digital Image Processing’, John Wiley & sons, (3

rd Edition), (2006).

5. R.O. Duda, P.E.Hart and D.G. Stork, ‘Pattern Classification’, John Wiley, (2nd Edition), (2002).

ECSP1104 Advanced Digital Signal Processing

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. Learn the fundamentals and applications of multirate signal processing and to design multirate filters.
2. Realize the significance of linear prediction and optimum filters for prediction and filtering.
3. Introduce the concepts of adaptive filters and algorithms for system modeling and filtering applications.
4. Understand parametric and non-parametric spectral estimation methods.

Course Outcomes:

After completion of the course, students will be able to-

1. Explain the concepts of sampling rate conversion, adaptive filters, linear prediction and spectral estimation.
2. Make use of design equations to construct and realize multirate filters, to predict the filter coefficients.
3. Apply computationally efficient algorithms to solve normal equations.
4. Design adaptive filters for denoising, echo cancellation, signal prediction applications.
5. Choose appropriate spectral estimation methods and compare their performance.
6. Explain the applications of multirate and adaptive filters.

Unit – I: Multirate DSP **(09)**

Overview of digital filters, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, efficient implementation of decimator and interpolator, polyphase filter structure, multistage filter design, applications of multirate DSP.

Unit – II: Linear Prediction and Optimum Filter **(09)**

Random signals and random processes, Forward and backward linear prediction, Linear Prediction of Signals, Levinson-Durbin Algorithm, Wiener filters for filtering and prediction.

Unit – III: Adaptive Filters **(09)**

Need of adaptive filters, steepest descent method, LMS algorithm- stability and performance analysis, Method of Least squares, RLS algorithm, Applications of adaptive filters- Adaptive channel equalization, Echo cancellation, Adaptive line enhancer, Linear predictive coding, Adaptive noise canceling etc.

Unit – IV: Spectral Estimation **(09)**

Need of spectral estimation, Spectral estimation methods: Periodogram, Bartlett method, Welch method, Blackman-Tukey method, non-parametric Power spectrum estimation using AR model, Eigenanalysis.

Reference Books:

1. J. G. Proakis, D. G. Manolakis, **'Digital Signal Processing- Principles, Algorithms and Applications'**, PHI, (4th Edition), (2013).
2. E.C. Ifeachor and B.W. Jervis, **'Digital signal processing – A practical approach'**, *Pearson Edu.* (2nd Edition), (2002).
3. Bernard Widrow, Samuel D. Stearns, **'Adaptive Signal Processing'**, *Tata McGraw Hill*, (1st Edition), (2006).
4. D. G. Manolakis, V. K. Ingle, S. M. Kogon, **'Statistical and Adaptive Signal Processing'**, McGraw-Hill, (1st Edition), (2000).
5. P. P. Vaidyanathan, **'Multirate Systems and Filter Banks'**, *Prentice Hall*, (1st Edition), (2004).

ECSP1105 Image Processing and Analysis Lab

Sr. No.	Title
1	Introduction to Digital Image Processing Lab.(To create a digital image)
2	To perform basic operations on image/images.
3	To perform histogram equalization on dark/ low contrast/bright image.
4	To apply different spatial domain filters-Box, Weighted, Median, Laplacian, Previtt.
5	To perform frequency domain filtering techniques using low pass filters and high pass filters.
6	To perform DCT on an image and regenerate it using IDCT.

7 To perform colour model conversions

8 To perform image thresholding using histogram and psuedocoloring.

9 To perform image segmentation/representation/description using python

10. To develop an application in image processing

M. Tech. (Signal Processing) (First Year) (A. Y. 2019-20)

Semester-I

ECSP1105-Advanced Digital Signal Processing Lab

Teaching Scheme:
Practical: 02 Hrs./Week

Examination Scheme:
Oral: 25 Marks
Credit: 01

Course Objectives:

1. Comprehend the fundamentals of multirate signal processing and design multirate filters.
2. Introduce the concepts of adaptive filters and algorithms for system modeling and filtering applications.
3. Learn spectral estimation methods.

Course Outcomes:

1. Apply concept of sampling rate converter for multirate filters
2. Design adaptive filters and evaluate their performance
3. Apply spectral estimation methods to study real-life signals.
4. Implement and compare power spectrum estimation methods.

List of Experiments:

1. Write a program to implement an interpolator and decimator
2. Write a program to implement a sampling rate converter
3. Write a program to perform Levinson-Durbin recursion
4. Write a program for adaptive linear prediction using LMS algorithm
5. Write a program for noise cancellation using Wiener filter
6. Write a program to plot periodogram of a noisy signal and estimate PSD
7. Write a program for power spectrum estimation by Bartlett and Welch method

* Mini Project

An Autonomous Programme Structure of

M. Tech. Electronics and Telecommunication Engineering

Specialization: Signal Processing

M. Tech. (First Year)
Semester-I
ECSP1107 Mixed Signal Processing System and Design Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme:
Oral: 25Marks

Credits: 1

List of Experiments:

MSPSD: Mixed Signal Processing & System Design
1. Introduction of SPICE software
2. To generate SPICE code for 8 bit ideal DAC
3. To generate SPICE code for 8 bit ideal ADC
4. To analyze the DAC and ADC for SNR,SNDR,SFDR for given reference voltage, sampling frequency and input voltage. Comment on the performance enhancement of practical ADCs and DACs
5. To realise and analyse the performance of high Q SC biquad circuit and low Q SC biquad circuit using MATLAB.
6. To design SC amplifier using SPICE.
7. To implement PLL.
8. To build circuit using Microwind software

Dr. Seema H. Rajput
Name of Faculty

Dr. Prachi Mukherji
H. O. D. (E&TC)

M. Tech. (Signal Processing)

Semester I

PEECSP1101 Mixed Signal Processing System and Design

Experiment No.	Title of Experiment	Week
1	Introduction of SPICE software	First Week Sep (1-9-17)
2	To generate SPICE code for 8 bit ideal DAC	Second Week Sep (8-9-17)
3	To generate SPICE code for 8 bit ideal ADC	Third Week Sep (15-9-17)
4	To analyze the DAC and ADC for SNR,SNDR,SFDR for given reference voltage, sampling frequency and input voltage. Comment on the performance enhancement of practical ADCs and DACs	Fourth Week Sep (22-9-17)
5	To realise and analyse the performance of high Q SC biquad circuit and low Q SC biquad circuit using MATLAB.	Fifth Week Sep (29-9-17)
6	To design SC amplifier using SPICE.	First Week Oct (6-10-17)
7	To implement PLL.	Second Week Oct (13-10-17)
8	To build circuit using Microwind software	Fourth Week Oct (27-10-17)

Dr. Seema H. Rajput | Dr. Prachi Mukherjee
Name of Faculty | H. O. D. (E&TC)

ECSP1204 Biomedical Signal Processing

Teaching Scheme:
Lectures: 3Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:
1. To understand the basic bio-signals.
2. To study origins and characteristics of some of the most commonly used biomedical signals, especially ECG, EEG, and EMG.
3. To understand sources and characteristics of noise and artefacts in bio signals.
4. To understand use of bio signals in diagnosis, patient monitoring and physiological investigations.
5. To explore research domain in biomedical signal processing.
6. To explore applications of established engineering solutions to complex biomedical signal problems.

Course Outcomes:
After completion of the course, students will be able to
1. Explain methods of acquiring bio signals.
2. Identify various sources of bio signal distortions and apply its remedial techniques.
3. Analyze ECG and EEG signal with characteristic feature points.
4. Compare various Image processing techniques for biomedical image analysis.

Unit – I : Introduction to bio-medical signals and their acquisition (07)
Origin of bio-signal, action potential, nerve and muscle cells and their electrical activity, electrical activity of the heart, genesis of ECG, ECG lead systems, electrical activity of the brain, EEG signal and its acquisition, EMG signals and its acquisition. Sources of contamination and variation of biosignals.

Unit – II: Analog signal processing of bio-signals (08)
Biomedical instrumentation systems, biomedical transducers, electrodes and their characteristics, instrumentation amplifier, isolation amplifier, active filters(commonly used topologies), ADC, aliasing effect, anti-aliasing filters, grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding with reference to Biomedical equipment.

Unit – III: Digital Signal processing of bio-signals (13)
Review of FIR, IIR Filters, Weiner filters, adaptive filters. Time-frequency methods: Spectrogram, Principal Component Analysis, Independent Component Analysis, Continuous Wavelet Transform, and Discrete Wavelet transform,
Electrocardiogram: Signal analysis of event related potentials, morphological analysis of ECG waves, Phonocardiography.

Unit – IV: Diagnostic Biomedical Imaging (10)
Types of Medical Images, CT, PET, and SPECT, MRI, Functional MRI, ultrasonic diagnostic imaging. Feature extraction, analysis and classification. Introduction to soft computing approaches for biomedical signal and image diagnostics: Artificial Neural networks, (Multilayer Perceptron, Radial basis function networks) as classifiers.

Reference Books:

1. J. L. Semmlow, **'Signals and Systems for Bioengineers: A MATLAB-Based Introduction'**, *Academic Press*, (2nd Edition), (2011).
2. J. L. Semmlow, **'Biosignal and Biomedical Image Processing MATLAB-Based Applications'**, *Marcel Dekker*, (2nd Edition), (2008).
3. W. J. Tompkins, **'Biomedical Signal Processing'**,*Prentice – Hall*,(1st Edition), (1993).
4. E. N. Bruce, **'Biomedical Signal Processing and Signal Modelling'**, *John Wiley & Sons,* (1st Edition),(2000).
5. R. M. Rangayyan, **'Biomedical Signal Analysis A case study approach'**, *John Wiley & Sons*, (1st Edition),(2002).
6. R. M. Rangayyan, **'Biomedical Image Analysis'**, *CRC*

Seminar - ECSP1208

CNO	R.No	Name	Title of the Seminar Topics
C32018111002	7201	Amruta Chaudhari	Object Detection Algorithm for Video Surveillance Application
C32018111005	7202	Arude Priyanka Kisan	An Emotion Recognition System for Mobile Application
C32018111004	7203	Firke Ankita Liladhar	A Bayesian Approch for Anti Scatre Grid Extraction in X -Ray Imaging
C32018111007	7204	Inmulwar Shital	Biological Inspired Speech Emotions Reccognition
C32018111006	7205	Kale Giteshri Kailas	Applying Machine Learning Techniques for Speech Emotion Recognition
C32018111010	7206	Mrunal Sanjay Adsod	Occupancy Detection uisng Baysian Network and Hidden Markov Model
C32018111009	7207	Pishe Tejashree Prakash	An Unbiased Estimation for Denoising Image in Presence of Gaussian Poisson Noise Model
C32018111001	7208	Sayli Dinkar Hulwan	Brain Tumour Detection and Classification using SVM Classifier
C32018111003	7209	Smital Vishwabharat Vhatkar	Automatic Age Estimation from Face Image
C32018111011	7210	Swarnim Sushmita	Detection of Brain Tumour from MRI images by using Segementation and SVM
C32018111008	7211	Taley Divyani Shivkumar	Wavelet Transform for Speech Compression and Denosing

ECSP2103 Multimedia Signal Compression Standards

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:
1. To understand the basic principles of Video Compression
2. To study JPEG 2000 Standard
3. To study audio standards
4. To Study H.263 standard
5. To understand MPEG1, MPEG2 and MPEG4 Standard

Course Outcomes:
1. Appreciate the need of standards
2. Compare algorithms for Image Compression
3. Understand Video Basics
4. Understand Audio Standard
5. Compare and Select appropriate Standard as per application(TV, Internet, Video conferencing, Mobile Networks)

Unit–I: Basics of Video Compression (08)
Analog Video (Comparison of NTSC, PAL, SECAM), Digital Video, Temporal Redundancy, Motion Estimation.

Unit – II: Still Picture Compression standard JPEG 2000 (12)
Wavelet Based Image Compression 'Embedded Zero Wavelet (EZW)‟, SPIHT, EBCOT, Rate control, Pre-processor, Core Encoder, Post-processing, ROI, Encoding, Scalability.

Unit – III: Video and Audio Compression Standards (12)
MPEG 1- Video structures, Picture slice, group of pictures, macro-block, coding of pictures, video buffers and decoders MPEG - 2, H-263, Audio Standards like MP3.

Unit-IV Advanced Compression Techniques (08)
MPEG-4, MPEG-7.

Reference Books:
1. M. Ghanbhari, „Standard Codecs: Image Compression to Advanced Video Coding‟, IET Publication, (2003).
2. E. G. Richardson, „H.264 and MPEG-4 Video Compression‟, John Wiley And Sons, (2nd Edition), (2010).
3. K. Sayood, „Introduction to Data Compression‟, The Morgan Kaufmann Series in Multimedia Information and Systems, Series Editor, Edward A. Fox, Virginia Polytechnic University

ECSP2201 Project stage 2

Sr. No.	Roll No.	Name of student	Project Topic
1	7101	BEHELE KETAKI DATTATRAY	Human emotion recognition from EEG signals using multiscale support vector machine
2	7102	BELEKAR VRISHALI MAHESH	Improved Microstrip Patch antenna with Enhanced Bandwidth, Efficiency and Reduced Return Loss using DGS
3	7103	BOLAJ NAMRATA SANJAY	Licence plate identification of fast moving vehicles
4	7104	DESHMUKH GAURI ARVIND	Supervised Classification of Type of Crowd Motion in Video Surveillance
5	7105	DUGAD PAYAL PRAVIN	Generalisation of OFDM with index modulation
6	7106	GAIKWAD YOGITA SADASHIV	A new approach of emotion recognition in music using regression analysis

7	7107	JADHAV JAYSHREE SHIVAJI	Person Detection in indoor environment using Deep Learning - Convolutional Neural Network
8	7108	KAWADE HARSHADA DILIP	Implementation of Video Stabilization Algorithm for Surveillance System
9	7109	MAHAJAN PRIYA KISAN	An Improved Mean - Shift Algorithm with Self-Scaling Tracking Window
10	7110	OIMBE SONAL PRAKASH	Design & analysis of signal processing of ground penetrating RADAR for soil parameter measurement
11	7111	PATIL SHIVANI UTTAM	Performance analysis of multiuser MIMO wireless communication system
12	7112	RAJKUNTHWAR POOJA PANDHARINATH	Speech segregation using deep stacking architecture
13	7113	RANADE POOJA ULHAS	EEG Signal Classification using Frequency Band analysis towards Epileptic Seizure Detection.

14	7114	TAMBE RUCHI KAILASRAO	Object Detection and Tracking in Thermal Videos using Directed Acyclic Graph (DAG)
15	7115	TUPE KOMAL SANJAY	Applying Bacterial Colony Optimization To Cognitive Cellular Network For Evaluating SINR
16	7116	UKARANDE RAJASHWINI BHANUDAS	Network Traffic Intrusion Detection System Using Fuzzy Logic and Neural Network

ES 1102 Fundamentals of Programming Languages - I

Teaching Scheme: **Examination Scheme:**

Lectures : 1 hours/week **In-Semester: :** 25 Marks

Credit : 1

Course Objectives:

Familiarize students with

1. Learn the fundamentals of building blocks of computer.
2. Understand how to formulate the programming language statements from description of a problem in English.
3. Understanding of decision and iteration interpretation in a programming language.
4. Understand basic building blocks of simple website.

Course Outcomes:

Students should be able to

1. Write algorithm based on given problem statement.
2. Draw flow chart for a given problem statement
3. Write the code for simple problem statement.
4. Debug the code snippets manually.

Unit – I Introduction to Programming 2 Hours

Introduction to computer, Anatomy of a computer: Hardware and software, Operating system, Types of programming languages: Machine language, Assembly language, High level languages, Selection of language, Algorithm: As a program, As a flow-chart, Pseudo code

Unit – II Writing First C Program 2 Hours

Structure of a C program, Writing C program, Introduction to library functions in C, Files generated in C program, Comments, Indentation

Unit – III Variables and Operations 3 Hours

C language variables: Numeric, Character, Declaring and Initializing variables, Constants: Integer, Floating point, Character, String, Operators: Arithmetic, Relational, Equality, Logical, Unary, Conditional, Bitwise, Assignment, Comma, Sizeof, Operator precedence, variable scope: Local and Global scope, Type casting and conversion

Unit – IV Control flow in C Language 3 Hours

Conditional branching statements: if statements, if-else Statement, Switch case, Iterative statements: while loop, do-while loop, for loop, Nested loops, break and continue statements

Unit – V Arrays 2 Hours

Introduction to Arrays, Accessing Array elements, Internal representation of Arrays in C, Working with one-dimensional array, Introduction to two-dimensional arrays

Unit – VI Introduction to Website Development 2 Hours

Introduction to blogging and Word Press : Creating a simple website, Content creation, Pages and Blogs, Page linking, Comments, Adding contents like Multimedia, Presentations, Themes

Text Books

1. Reema Thareja, ‘Introduction to C programming’, Oxford University Press (2nd edition), (2015)
2. Pradeep Day, ‘Computer Fundamentals and programming in C’, Oxford University Press, (2nd edition) (2013)

Reference Books

1. B Kernighan, D Ritchie, ‘C programming Language’, Prentice Hall Software Series, (2nd edition) (1988)

ES 1103 Engineering Graphics

Teaching Scheme:
Lectures: 2Hrs/Week

Examination Scheme:
In-Semester: **25** Marks
End-Semester: **25** Marks
Credits: 2

Course Objectives:

1. To apply theory of projections and standard conventions in engineering drawing.
2. To understand the methods to draw various engineering curves.
3. To develop the visualization and interpretation skills, for the physical objects.
4. To develop free hand sketching skills.

Course Outcomes:

Students will be able to,

1. Draw orthographic views of given object.
2. Draw engineering curves by applying the given method.
3. Draw isometric projection and development of surfaces of the given object.
4. Draw free hand sketches of simple machine elements.

Unit – I: Introduction to Engineering Drawing **(02)**

Layout and sizes of drawing sheets, drawing instruments, types of lines used in drawing practice, dimensioning systems, representation of tolerances, standard codes by B.I.S (SP-46).

Unit – II: Curves in Engineering Practice **(05)**

Construction of ellipse, parabola, hyperbola, involute, cycloid, archimedean spiral, helix on cone and cylinder.

Unit – III: Orthographic Projections **(08)**

Theory of projections, methods of obtaining orthographic views,sectional orthographic projections.

Unit – IV: Isometric Projections **(08)**

Isometric axes, Isometric scale, isometric projections and views, construction of isometric view from given orthographic views.

Unit – V: Development of lateral surfaces of solids **(05)**

Parallel line development, radial line development, methods to transfer points for development of prisms, pyramids, cylinder and cone.

Unit – VI: Free hand sketching **(02)**

Free hand sketching of front view and/or top view of standard machine elements –thread forms, hexagonal headed bolt and nut, screws, shaft and keys, spring, welded and riveted joint.

Text Books:

1. N. D. Bhatt and V. M. Panchal,**'Engineering drawing, plane and solid geometry'**, *Charotor Publication House.*

2) R. K. Dhawan,**'A text book of Engineering Drawing'**, *Pearson Education Inc*.

3) P.S. Gill, **'Engineering Graphics'**, *Kataria and sons Publications.*

4) M.L.Dabhade, **'Engineering Graphics'**, *Vision Publications.*

Reference Books:

1) Warren J. Luzzader, **'Fundamentals of Engineering Drawing'**, *Prentice Hall of India, New Delhi.*

2) Fredderock E. Giesecke, Alva Mitchell, **'Principles of Engineering Graphics'**,*Maxwell McMillan Publishing.*

3) Dhananjay A. Jolhe, **'Engineering Drawing'**, *Tata McGrawHill Publishing Co. Ltd.*

ES1105 Basic Electrical and Electronics Engineering Lab 1

Teaching Scheme:

Practical: 2 Hrs/Week

Examination Scheme:

Practical Exam: 25 marks

Credits: 1

List of Course Outcomes:

After completion of the course students will be able to:

1. Perform basic domestic wiring.
2. Apply the circuit laws and network theorems to find parameters of a given electrical network
3. Build a basic regulated DC power supply
4. Analyze the performance of the Transistor in CE configuration.
5. Write technical report of conducted experiment

List of experiments:

1. Study of different electrical and electronics components and instruments.
2. To perform electrical wiring to control lamps using one way and two-way switches.
3. Determination of Temperature Rise of a Medium Resistance
4. Verification of kirchoff’s laws & superposition theorems
5. Verification of Thevenin’s theorem.
6. Performance analysis of half wave,full wave rectifier with center tap transformer and bridge rectifier with and without filter.
7. Performance analysis of three terminal IC voltage regulator
8. Determination of frequency response of CE amplifier.

ES 1106 Fundamentals of Programming Language Lab - I

Teaching Scheme: **Examination Scheme:**

Practical :2 hours/week **Practical : **25 Marks

Credit : 1

Course Objectives:

Familiarize students with

1. Learn basics of C programming
2. Learn to write C program for a given logical solution.
3. Learn to make validation checks at required places.
4. Learn to apply programming concepts to solve problems

Course Outcomes:

Student will be able to :

1. Write algorithm based on given problem statement
2. Apply appropriate programming constructs
3. Write program for simple problem statement
4. Test program for different inputs

Section 1 (any 08 assignments)

1. A) Write a C program to accept the length of three sides of a triangle and to test and print the type of triangle - equilateral, isosceles, right angled or none of these.
   B) Find out area, perimeter of a given trigonometric figure
2. Write a C Program to display the table of any given number
3. Write a C Program to reverse a given number
4. Write a C Program to find whether a given number is Armstrong number or not.
5. Write a C Program to calculate Simple Interest
6. Write a C Program to convert temperature from Celsius to Fahrenheit
7. Write a C program to display all the prime numbers between 1 to n
8. Write a C program to generate a series (like Fibonacci)
9. Write a C Program to display the numbers divisible by 7 in a given range(e.g. 11 to 90)
10. Write a C Program to accept a number and convert every digit into word and display it
11. Write a C Program for finding roots of Quadratic Equation

12. Write a C Program to find the greatest possible length which can be used to measure exactly the lengths 4m 95cm, 9m and 16m 65cm (Hint HCF)

Section 2 (any 02 assignments)

1. The traffic light at three different road crossings change after every 48, 72 and 108 sec, if they all change simultaneously at 8:20:00 hrs., then at what time will they again change simultaneously? (Hint : LCM)
2. The average of 25 results is 18. The average of first twelve of them is 14 and the average of last twelve of them is 17. Find the thirteenth result. (Hint Average).
3. The taxi fare is Rs. 14 for the first kilometer and Rs. 2 for each additional kilometer. What will be the fare for 10 kilometers?(Hint: Arithmetic Progression)
4. Roma's mathematics test had 75 problems, i.e. 10 arithmetic, 30 algebra and 35 geometry problems. Although she answered 70% of the arithmetic, 40 %of algebra and 60% of geometry problems correctly she did not pass because she got less than 60% of the questions right. How many more questions she would have needed to solve to earn 60% of passing grade?(Hint Percentage.)
5. A radio is purchased for Rs. 490/- and sold for Rs.465.50. Find the loss percentage(Hint: Profit and Loss)
6. In how many ways can a cricket 11 be chosen out of a batch of 15 players?(Hint Permutation and Combination)
7. Write a C Program to accept a number and convert every digit into word and display it

Section 3 (study assignment)

Design and develop a small application using Wordpress

Text Books

1. Reema Thareja, ‘Introduction to C programming’, Oxford University Press (2nd edition), (2015)
2. Pradeep Day, ‘Computer Fundamentals and programming in C’, Oxford University Press, (2nd edition) (2013)

Reference Books

1. B Kernighan, D Ritchie, ‘C programming Language’, Prentice Hall Software Series, (2nd edition) (1988)

ES 1107 Engineering Graphics Lab

Teaching Scheme: Practical: 2Hr/Week

Examination Scheme: Practical: 25 Marks

Credits: 1

I: Introduction to Engineering Drawing **(01)**

Drawing sheet layouts, drawing instruments, standard codes by B.I.S (SP-46)

II: Assignments and Drawing Sheets **(12)**

- Engineering Curves.
- Orthographic Projections
- Isometric Projections
- Development of surfaces of solids.
- Free hand sketching.

III: Introduction to computer aided drafting package **(02)**

Features and applications of computer aided drafting packages, basic operations, and various commands for drawing, dimensioning, editing, saving and plotting the drawings.

ES 1202 Fundamentals of Programming Languages - II

Teaching Scheme: **Examination Scheme:**

Lectures : 1 hours/week **In-Semester: :** 25 Marks

Credit : 1

Course Objectives:

Familiarize students with

1. Understand role of functions and it's utility in programming.
2. Understand the use of pointers in memory management.
3. Understand the utility of need and utility of user defined data types.
4. Learn and explore mobile application development environment.

Course Outcomes:

Students should be able to

1. Write program using functions
2. Write code for effective memory management
3. Write code using appropriate user defined data types for various applications
4. Write code with user defined functions similar to inbuilt functions

Unit – I Functions in C 3 Hours

Concept of Function, Function declaration, Function definition, Function Call, Return statement, Passing parameters: Call by value, Recursion

Unit – II Strings 2 Hours

Introduction, Reading Strings, Writing Strings, Strings Operations: Counting characters in String, Converting into upper case and lower case, Concatenation, Appending, Comparing, Reverse

Unit – III Introduction to Pointers in C 2 Hours

Understanding Computer memory, Introduction to Pointers, Declaring pointer variable, Function Call by reference, Pointer and Arrays, Role of Pointers in Passing an Array to a Function, Pointers and Strings

Unit – IV Structures 2 Hours

Introduction to Structures: Declaring Structure and Structure Variables, Initializing Structure, Accessing members of Structure

Unit – V Unions, Enumeration Data types 2 Hours

Declaring Union and its members, Accessing members of Union, Enumeration Types

Unit – VI Mobile application Development 2 Hours

Introduction, Web apps vs. Native apps, Introduction to mobile operating System like Android / IOS / Windows, Features and architecture of Mobile Operating System, Generating GUI and views, Layouts and Application Components, Creating simple mobile application.

Text Books

1. Reema Thareja, ‘Introduction to C programming’, Oxford University Press (2nd edition), (2015)
2. Pradeep Day, ‘Computer Fundamentals and programming in C’, Oxford University Press, (2nd edition) (2013)

Reference Books

1. B Kernighan, D Ritchie, ‘C programming Language’, Prentice Hall Software Series, (2nd edition) (1988)

ES 1204 Engineering Mechanics

Teaching Scheme:

Lectures: 2Hrs/Week

Tutorial: 1Hr/Week

Examination Scheme:

In-Semester: **25** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To develop the ability of students to analyze any problem in a simple and logical manner.
2. To make the students understand the fundamental principles of mechanics which are the foundation of much of today's engineering.
3. To develop logical thinking of the students for application in engineering.
4. To provide an introduction to the basic quantities of mechanics.

Course Outcomes:

A student should be able to obtain/develop:

1. An ability to apply knowledge of mathematics, science and engineering
2. A recognition of the need for, and an ability to engage in, life-long learning.
3. Application of Newton's laws of motion
4. Knowledge of kinematic & kinetic analysis

Unit – I: Introduction to Statics **(06)**

a) Fundamental concepts and principle (The parallelogram law of addition of forces, the principle of transmissibility, Newton's laws of motion, Newton's law of gravitation).
   Introduction to a force in a plane, Types of force system, resolution & composition of forces, Methods of composition to find resultant, moment of force, Varignon's theorem, couple, equivalent force couple system.
b) Introduction to force in a space, problems on resultant of concurrent force system
c) Equilibrium- Introduction to concept of equilibrium, Conditions of equilibrium, Free body diagram, equilibrium under different forces, equilibrium of concurrent parallel & general forces in a plane.

Unit – II: Introduction to type of Supports and Beam **(05)**

a) Types of supports (Fixed, roller, hinged support)

Types of loads on a beam (point load, uniformly distributed load, uniformly varying load)

Types of beams (simple beam, cantilever beam, compound beam)

b) Problems on Reactions & analysis of beams

c) Centroid- Definitions (Center of gravity of two dimensional body, center of mass, centroid), procedure to find centroid of regular plane lamina.

Unit – III: Introduction to Friction **(03)**

Definition and classification of friction, coefficient of static and kinetic friction ,angle of friction, angle of repose, problems on block friction and ladder friction

Unit – IV: Rectilinear Motion **(05)**

a) Variables in Rectilinear motion- Time, Position, Displacement, Distance travelled, Velocity, Acceleration

Equations of motion for constant acceleration & motion under gravity, variable acceleration, relative motion based on kinematic equations.

b) Application of Newton's second law of motion for rectangular co-ordinate system(D' Alembert's principle)

Unit – V: Curvilinear Motion **(05)**

a) Equation of motion in rectangular components, Normal & Tangential components, Radial & Transverse components.

b) Projectile motion- Definition and derivation (time of flight, horizontal range, angle of projection, maximum height, trajectory), Projectile on horizontal plane only

Unit – VI: Work Energy Principle **(04)**

a) Introduction and definition of Work, power, energy, conservative & non- conservative forces, Conservation of energy, work-energy principle.

b) Problems on Work done by different forces (External force, Frictional force, Gravitational force, Spring force).

Text books:

1) A Nelson, **'Engineering Mechanics Statics and Dynamics'**, *Mc Graw Hill Education.*

2) R.S. Khurmi, **'A Textbook of Engineering Mechanics'**, *S. Chand & Company Ltd.*

Reference books:

1) Beer & Johnson, '**Vector mechanics for engineers**', *Mc Graw hill publication.*
2) I. H. Shames & G.K.M. Rao, '**Engg. Mechanics**', *Pearson.*
3) R. C. Hibbler, '**Engg. Mechanics statics & dynamics**', *Pearson publication*
4) S. Timosenko, DPT.young & J.V.Rao, '**Engineering mechanics**', *Tata Mc Graw hill education pvt. Ltd. New delhi.*

ES 1206 Fundamentals of Programming Language Lab - II

Teaching Scheme: **Examination Scheme:**

Practical :2 hours/week **Practical : **25 Marks

Credit : 1

Course Objectives:

Familiarize students with

1. Learn and acquire art of computer programming.
2. Learn advanced C programming features.
3. Learn to write C program for a given logical solution.
4. Learn to apply programming concepts to solve simple problems using arrays, functions and structures.

Course Outcomes:

Student will be able to :

1. Write program using functions for given problem statement.
2. Write code using sequential memory management
3. Apply appropriate user defined data types for given statement.
4. Write program with user defined functions similar to library functions.

Section 1 (any 07 assignments)

1. Write a C program to swap 2 integers using user defined functions (call by value, call by reference).
2. Write a program in C to compute the factorial of the given positive integer using recursive function.
3. Write functions to convert feet to inches, convert inches to centimeters, and convert centimeters to meters. Write a program that prompts a user for a measurement in feet and converts and outputs this value in meters. Facts to use: 1 ft = 12 inches,
   1 inch = 2.54 cm, 100 cm = 1 meter.
4. Write a menu driven program to perform following operations using Array of integers like (accept, display, print alternate number, sum of all numbers, search a number).
5. Write a program in C to sort n integers using bubble sort.
6. Write a menu driven program to perform string operations using library functions.

7. Write a menu driven program to perform string operations using user defined functions.
8. Define an integer pointer array of 10 integers. Initialize them to any integer values from the keyboard. Find the sum, average, minimum, and maximum of these 10 integers. Sort the 10 integers in descending order.
9. Write a program in C to compute addition / subtraction / multiplication of two matrices. Use functions to read, display and add / subtract / multiply the matrices.
10. For a class an examination is conducted and the results for the students of all the 5 subjects are recorded. Write C program to display the record of students. On the basis of the record compute
11. Write a menu-based program in C that uses a set of functions to perform the following operations:
    i. reading a complex number
    ii. writing a complex number
    iii. addition of two complex numbers
    iv. Iv.subtraction of two complex numbers
    v. multiplication of two complex numbers
    vi. Represent the complex number using a structure.Represent the complex number using a structure.
12. Write a C program to create an employee database using structure and perform operations such as accept, display, search by name, search by number, update a record.

Section 2 (any 02 assignments)

1. A string is provided from the user. Calculate the total number of characters in the string and the total number of vowels in the string with the number of occurrence in the string
2. College library has n books. Write C program to store the cost of books in array in ascending order.
   Books are to be arranged in descending order of their cost
3. Write a recursive function to obtain the first 25 numbers of a Fibonacci sequence. In a Fibonacci sequence the sum of two successive terms gives the third term.
   Following are the first few terms of the Fibonacci sequence:1 1 2 3 5 8 13 21 34 55 89
4. A factory has 3 division and stocks 4 categories of products. An inventory table is updated for each division and for each product as they are received. There are three independent suppliers of products to the factory:
   (a) Design a data format to represent each transaction
   (b) Write a program to take a transaction and update the inventory
   (c) If the cost per item is also given write a program to calculate the total inventory values.
5. Write a program that compares two given dates. To store date use structure say date that contains three members namely date, month and year. If the dates are equal then display message as "Equal" otherwise "Unequal".

6. Create a structure to specify data of customers in a bank. The data to be stored is: Account number, Name, Balance in account. Assume maximum of 200 customers in the bank.
   (a) Write a function to print the Account number and name of each customer with balance below Rs. 100.
   (b) If a customer request for withdrawal or deposit, it is given in the form: Acct. no, amount, code (1 for deposit, 0 for withdrawal)

   Write a program to give a message, “The balance is insufficient for the specified withdrawal”

7. An automobile company has serial number for engine parts starting from AA0 to FF9. The other characteristics of parts to be specified in a structure are: Year of manufacture, material and quantity manufactured.

Section 3 (study assignment)

Students should design and develop a small Android application for mobile.

Text Books

1. Reema Thareja, ‘Introduction to C programming’, Oxford University Press (2nd edition), (2015)
2. Pradeep Day, ‘Computer Fundamentals and programming in C’, Oxford University Press, (2nd edition) (2013)

Reference Books

1. B Kernighan, D Ritchie, ‘C programming Language’, Prentice Hall Software Series, (2nd edition) (1988)

ES1207: ENGINEERING MECHANICS LAB

Teaching Scheme:

Practical: 2Hr/Week

Examination Scheme:

Practical/Oral:-25 Marks

Credit: 1

Course objective:

1. To co-relate the theoretical concepts with practical applications.
2. To develop logical thinking of the students for applications in engineering.

Course outcome: A student should be able to obtain/develop:

1. An ability to apply knowledge of mathematics, science and engineering
2. An ability to analyze and interpret data for related experiment.

List of practicals :-

Experiments

1. Verification of law of polygon of forces.
2. Verification of Varignon's theorem.
3. Verification of Lami's theorem.
4. Support reactions of simple beam.
5. To determine forces in space force system.
6. Study of Curvilinear motion.
7. Determination of coefficient of restitution.
8. To compare coefficient of friction of various pair of surfaces in contact.

Graphical analysis

9. To find resultant of concurrent force system
10. To find resultant of non-concurrent force system
11. To find reactions of simple beam
12. To find centroid of plane lamina

ES 1208 Workshop Practice I

Teaching Scheme:

Practical: 2 Hr/Week

Credit: 1

Examination Scheme:

Practical/Oral Examination: 25 marks

Course Objectives:

1. To provide knowledge and skill to use tools, machines, equipment, and measuring instruments, which are used in manufacturing industries.
2. To educate students for Safe handling of machines and tools in manufacturing environment

Course Outcomes:

1. The student will be able to apply concept related to workshop safety & use of measuring instruments during process of manufacturing.
2. The student will be able suitably select basic manufacturing practices for making of component.
3. The students will be able to manufacture/produce given product from raw material using different manufacturing methods.

Unit – I: Introduction to Workshop Safety and Measuring Instruments: **(05)**

- Safety precautions while working in shop, safety equipment's and their use.
- Brief introduction to instruments like – Steel rule, Calipers, VernierCaliper, Micrometer, etc. Least counts, common errors and care while using them, use of marking gauge, 'V'block and surface plate.
- Introduction & working of different tools used in workshop.

Unit – II: Manufacturing Practice:(Any Two Trades) **(13)**

- Fitting: Preparation of joints, markings, cutting and filling for making joints like V or T for making part of any component.
- Carpentry: Wood working consists of planning, marking, sawing, chiseling and grooving to make joint like lap, T, dovetail.
- Tin smithy: Making of small parts using sheet metal such as Tray, Funnel.
- Welding Joints: Introduction to use of MIG/ TIG, arc welding for making joints like Lap, Butt joint.

Unit – III: Information technology: **(06)**

- Identify the peripherals of computer components in a CPU and its functions
- Disassemble and assemble the PC back to working condition
- Loading of operating system.

Unit – IV: Plumbing

- Hands on practice on Cutting, bending and external threading of GI pipes using Die
- Plumbing on PVC pipes.
- Different Joint preparation on GI & PVC Pipes

Text Books:

ES-2101 Electrical and Electronics Engineering

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 04

Prerequisites:
ES 1101 Basic Electrical and Electronics Engineering I
ES 1201 Basic Electrical and Electronics Engineering II

Course Objectives:
Students should be conversant with Electrical and Electronics controls basic
1. To study Electrical drive system required to drive machines
2. It will be prerequisite for Mechatronics.
3. To study Micro controllers

Course Outcome:
At the end of this course students will demonstrate the ability to:
1. Understand and interpret the working of D.C motor, various methods of speed control and its industrial application.
2. Interpret the performance and torque -slip characteristic of I.M.
3. Understand and analyze the electrical drive system.
4. Apply the knowledge of microcontrollers in automation.

Unit I: D.C. Machines
Construction, working principle of D.C. generator, emf equation of D C generator. Working principle of D.C. motor. Types of D. C. motor, back emf, torque equation for D.C. motor, characteristics of D. C. motor (series, shunt and compound), Three point starter for D.C Shunt motor, Braking of D.C. Motor, methods for speed control of D.C shunt and series motors, Industrial applications.

Unit II: Three phase Induction Motor
Constructional feature, working principle of three phase induction motors, types, torque equation, torque slip characteristics, power stages and efficiency. Types of starters, braking of induction motor, methods of speed control & Industrial applications.

Unit III: Electrical Drives
Advantages of Electrical Drives,, Parts of electrical drives, choice of electric drive ,Status of ac and dc drives, Brush less dc motor drives , stepper motor drives, synchronous motor variable speed drive.

Unit IV: Introduction to Microcontrollers

Introduction to microcontroller and microprocessors, role of embedded systems, open source embedded platforms, Atmega 328P-features, architecture, port structure, sensors and actuators, data acquisition systems, introduction to Arduino IDE- features, IDE overview, programming concepts: variables, functions, conditional statements

Unit V: Peripheral Interface - 1

Concept of GPIO in Atmega 328P based Arduino board, digital input and output, UART concept, timers, interfacing with LED, LCD and keypad, serial communication using Arduino IDE

Unit VI: Peripheral Interface – 2

Concept of ADC in Atmega 328P based Arduino board, interfacing with temperature sensor (LM35), LVDT, strain gauge, accelerometer, concept of PWM, DC motor interface using PWM

Text Books:

1. Electrical Machines-D P Kothari and I J Nagrath, Tata McGraw Hill ,Third Edition
2. Electrical Machinery-S.K. Bhattacharya, TTTI Chandigad
3. Fundamentals of Elecrical drives-G K Dubey
4. Ajay Deshmukh-Microcontrollers Theory and Applications, TATA McGraw Hill
5. Arduino microcontroller processing for everyone -Steven F Barret,Morgan and Claypool Publisher.
6. C programming with ardino - Warwick Smith Elektor Publication

Reference Books:

1. Electrical Technology-Edward Hughes, Pearson Education.
2. Electrical Machines by Ashfaq Husain, Dhanpat Rai & Sons.
3. Electrical Technology- Vol I & Vol II- B. L.Theraja, S Chand Publication Co Ltd.
4. The 8051 Microcontrollers - Architecture, Programming and Applications by K. J. Ayala, Penram International Publishing (I) Pvt Ltd.
5. Started with Arduino by Massimo Banzi and Michael Shiloh Published by Maker Media, Inc.
6. Getting Started With Arduino: A Beginner's Guide by Brad Kendall (Author), Justin Pot (Editor), Angela Alcorn (Editor)
7. Arduino Cookbook, 2nd Edition by Michael Margolis published by O'Reilly Media.
8. Application notes from ATMEL micro controller data book.

Tutorials

1. Study of AC and DC starter
2. Verification of speed control of D.C. shunt motor by armature voltage and flux control method.
3. Load test on three phase induction motor.
4. Interfacing of LED to blink after every 1 sec.
5. Interfacing with transducer.
6. Display data using serial communication.
7. Interfacing of LCD to display the message.

HS 2201/2101 Principles of Economics and Finance

Teaching Scheme: Examination Scheme: Lectures: 3 Hrs/Week In-Semester: **50** Marks
Tutorial: Nil End-Semester: **50** Marks **Credits: 3**

Course Objectives:

1. Enable students to acquire knowledge and develop an understanding of basic concepts and principles of Economics & Finance
2. Make students acquaint with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector 3. Sensitize students to the current economic issues of the nation
4. Develop an understanding of the role of institutions in the functioning of an economy 5. Enhance financial literacy of engineering students
6. Understand Markets and the behaviour of the firm

Course Outcomes:

1. Students will understand and demonstrate core micro and macro economic terms, concepts and theories
2. Students will learn to apply economic theories and methodologies in analysing economic issues in various subfields of economics.
3. Apply mathematical and statistical tools to solve economic problems.
4. Describe and evaluate the role of key economic entities.

Unit 1 : Introduction 3 hrs 1.1 The Scope and Methods of Economics- Definition of Economics, Why study Economics, Scope of Economics-Micro and Macro, Methods of Economics- Positive, Normative, Descriptive, Economic Theory, Economic Policy, Criteria for judging Economic outcomes 1.2 Basic Economic Problems

Unit 2 : Consumer Preferences and Demand Analysis 5 hrs 2.1 Theory of Consumer Behaviour – Marginal Utility and Indifference Curve Analysis, Consumer's Equilibrium, Consumer Surplus
2.2 Concept of Demand- meaning, Law of Demand, Elasticity of Demand- Price, Income and Cross
2.3 Concept of Supply- meaning, Law of Supply, Elasticity of Supply
2.4 Market Equilibrium

Unit 3 : Factor Pricing 5 hrs 3.1 Firm & Industry, Forms of Business Organisation, Goals of the Firm
3.2 Theories of Rent, Wages, Interest and Profit Determination

Unit 4 : Production and Cost Analysis 7 hrs 4.1 Production Fuction- meaning, Cobb Douglas, CES, Translag Production Functions 4.2 Law of Variable Proportions, Law of Returns to Scale
4.3 Production Possibility Frontier
4.4 Cost and Revenue Functions- Short run and Long run
4.5 Break-even Analysis

Unit 5 : Market Structures and Equilibrium 6 hrs Features and Equilibrium in Perfect Competition, Monopolistic Competition, Monopoly and Oligopoly

Unit 6 : Macro Economics 10 hrs 6.1 GDP, Inflation, Unemployment, Theories of Economic Growth and Development 6.2 Central Bank – meaning and Functions, Monetary Policy-Objectives and Tools 6.3 International Trade and Comparative Advantage- Meaning, Free trade Vs Protectionism 6.4 Public Finance- Scope, Fiscal Policy

Unit 7 : Corporate Financing 6 hrs 7.1 Sources of Finance
7.2 Financial statements of the companies
7.3 Financial Ratios
7.4 Time Value of Money
7.5 Risk and Return

Text Books:

1. Geetika, Ghosh P. & Choudhury, P.R. (2018), *Managerial Economics,* 3rd Edition, Mc Graw Hill Education.
2. Gitman, L.J. (2016), *Principles of Managerial Finance,* 11th Edition, Pearson Education. Cherunilam, F. (2008), *International Economics,* , the Mc Graw Hill Companies. 3. Todaro, Michael & Stephen S. (2015), *Economic Development*, 12th Edition, Pearson Addison- Wesley.

Reference Books:

1. Samuelson, P.A. & Nordhaus, W.D. (2007), *Economics*, 19th Edition, Tata Mc Graw Hill. 2. Henderson, J.M.& Quandt R.E. (1980), *Microeconomic theory: A mathematical approach*, 3rd Edition, Mc Graw Hill.
4. Lipsey, R.G. & Chrystal, K.A. (2007), *Economics*, 11th Edition, Oxford University Press.

HSEL2101 Fundamentals of Disaster Management

Teaching Scheme:

Lectures: 3 Hrs/Week In-Semester: 75Marks

Tutorial: 1 Hr/Week End-Semester: 50 Marks

Credits: 4

Course Objectives:

1.To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences

2. To increase the knowledge and understanding of the International Strategy for Disaster reduction and to increase skills and abilities for implementing the Disaster Risk Reduction Strategy.

3. To ensure skills and ability to design, implement and evaluate research on disasters.

Course Outcomes:

1. Integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

2. Describe, analyse and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

3. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.

4. Manage the Public Health aspects of the disasters.

5. Obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them

Unit – I: Introduction :Concepts and definitions (06)

Disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility Authority.

Unit-II: Disaster Impacts **(**06)

Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit-III : Disaster Risk Reduction (DRR) (06)

Disaster management cycle its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. P. Sahni, 'Disaster Risk Reduction in South Asia', Prentice Hall. (2004)

4. B. K. Singh, 'Handbook of Disaster Management: techniques & Guidelines', Rajat Publication, (2008)

5. G. K. Ghosh, 'Disaster Management', APH Publishing Corporation, (2006)

IN2101: Sensors and Transducers I

Teaching Scheme
Lectures: 3 Hr/week
Tutorial: 1 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Course Objectives:

1. To acquire the knowledge of basic principles of sensing various parameters
2. To study principles, working, mathematical relation characteristics, advantages and limitations of various sensors and transducers
3. To select appropriate transducer for the typical application

Course Outcomes: The student will be able to

1. define and list performance characteristic of different sensors and transducers.
2. compare features of different sensors and transducers.
3. select sensors and transducers for particular application.
4. analyze the performance of sensors and transducers for various applications.

Unit 1: Introduction (06)

Concepts and terminology of measurement system, transducer, sensor, range and span, classification of transducers, static and dynamic characteristics, selection criteria, sources of errors and their statistical analysis, standards and calibration.

Unit 2: Pressure Measurement (06)

Definition, pressure scale, standards, working principle, types, materials, design criterion: Manometers, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, force balance type, motion balance type, capacitive (delta cell), ring balance, vibrating cylinder type, high-pressure sensors, low-pressure sensors, Pressure switch

Unit 3: Temperature Measurement (05)

Temperature scales, classification of temperature sensors, standards, working principle, types, materials, design criterion: Non electrical sensors (thermometer, thermostat), electrical sensors (RTD, thermocouple, thermistors), radiation sensors (pyrometers).Temperature switch

Unit 4: Level Measurement (06)

Standards, working principle, types, materials, design criterion: float, displacers, bubbler, and DP- cell, ultrasonic, capacitive, microwave, radar, radioactive type, laser type transducers, level gages, resistance, thermal, TDR/ PDS type, solid level detectors, fiber optic level detectors, Level switch.

Unit 5: Flow Measurement (06)

Standards, working principle, types, materials, design criterion: primary or quantity meters (positive displacement flow meter), secondary or rate meter (obstruction type, variable area type), electrical flow sensors (turbine type, Electromagnetic type, and ultrasonic type, Flow switch.

Unit 6: Allied Sensors (07)

Standards, working principle, types, materials, design criterion: Chemical sensors (pH and conductivity), leak detector, flame detector, smoke detector, humidity, density, viscosity sensors, and, Sound sensors, introduction to advanced sensors (MEMS) ,Non-destructive Sensor

Text Books:

1. A.K. Sawhney, "Electrical & Electronic Instruments & Measurement", Dhanpat Rai and Sons, Eleventh ed., 2000.
2. B. C. Nakra and K. K. Choudhari, "Instrumentation Measurements and Analysis", Tata McGraw Hill Education, Second ed., 2004.
3. D.V.S. Murty, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003.
4. C. D. Johnson, 'Process Control Technology' PHI-Seventh Edition.
5. C.S. Rangan ,G..R.Sharma, V.S.V Mani , "Instrumentation Devices and Systems"
6. HKP Neubert .'Instrument Transducers'

Reference Books:

1. E.O. Doebelin, "Measurement Systems", McGraw Hill, Fourth ed., 1990.
2. D. Patranabis, "Principle of Industrial Instrumentation", Tata McGraw Hill, Second ed., 1999.
3. Sabrie Soloman, "Sensors Handbook", McGraw Hill Publication, First ed., 1998.
4. B.G. Liptak, "Process Measurement & Analysis", Chilton Book Company, Third ed., 1995.

List of Tutorials:

1. Understanding of internal mechanism of pressure gauge
2. Construction and performance testing of pressure switch
3. Construction and working of thermostat solid state
4. Principle and testing of pyrometer using light source and thermocouple
5. Testing of lead wire compensation of RTD
6. Study of float switch
7. Study of electromechanical level sensor

8. Study of turbine flow meter
9. Study of smoke detector
10. Characterization of Thermistor

IN2102: Basic Instrumentation

Teaching Scheme
Lectures: 3 Hr/week

Examination Scheme
In-Semester: 50 Marks
End-Semester: 50 Marks
Credit: 3

Prerequisite: Basics of Electrical and Electronic Systems.

Course Objectives:
1. To introduce the fundamentals of measurements and instrumentation.
2. To explain the working principle of DC & AC meters for voltage, current, energy, power.
3. To study different bridges used for measurement of electrical parameters such as R, L, C.
4. To learn the operation of Oscilloscope, Signal Generator, Digital instruments and Recorders.

Course Outcomes: The student will be able to
1. define different characteristics of instrumentation system.
2. select proper instrument with appropriate characteristics for given application.
3. calibrate and monitor a variety of electronic instruments.
4. analyze and troubleshoot instrument problems.

Unit 1: Introduction to Instrumentation System (06)
Instrumentation system block diagram, Static and Dynamic characteristics of instruments, loading effects, Errors, calibration of instruments, Standards NEMA, BIS, DIN and ANSI.

Unit 2: Analog Indicating Instruments (06)
Working Principle, Construction Derivation, Applications of DC galvanometer, PMMC, Watt meters, Energy meters, DC Potentiometers

Unit 3: Bridge Circuits (06)
Network Theory Basics, Circuit Diagram, General equations for bridge balance Derivation, Phasor Diagram, Applications of DC & AC bridges.

Unit 4: Oscilloscope (06)
Block Diagram, Front Panel Functioning, Measurement of electrical parameters like voltage, current, frequency, phase

Unit 5: Digital Instruments (06)
Block diagram, principle of operation, Digital Multi meter, Specifications of DMM, Digital Panel Meter

Unit 6: Recording Instruments (06)
Principle and working of strip chart and X-Y recorders. Basics of virtual instrumentation

Text Books:

1. Sahwaney A K, Electrical and Electronics Measurements and Instruments
2. Cooper, W.D. and Helfric, A.D., Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 1991.

Reference Books:

1. Kalsi.H.S., Electronic Instrumentation, Tata McGraw Hill, New Delhi, 1995.
2. David.A.Bell, Electronic Instrumentation and Measurements, Second Edition, Prentice

Hall, New Jersy, 1994.
3. R. Subburaj, ‘The foundation for ISO 9000 and TQM’,
4. Bouwens A. J., ‘Digital Instrumentation’
5. Anand M. M. S., ‘Electronic Instruments and Instrumentation Technology’,PHI, 2004

IN2103: Linear Integrated Circuits

Teaching Scheme
Lecture: 3 Hr/week
Tutorials: 1 Hr/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credit: 4

Prerequisite:
1. Concepts in basic electrical and electronics engineering
2. Concept of Transistor theory and application

Course Objectives:
1. To illustrate the concepts of the basic characteristics, construction, open loop & close loop operations of Operational-Amplifier (Op-amp)
2. To enable students to analyse and design different linear and non-linear circuits using Op- amp and to introduce applications of various configurations of amplifiers.
3. To enable students to demonstrate Electronic Circuits for Multivibrator and Voltage regulator using special purpose Ics
4. To illustrate types of filter, their applications and enable students to implement active filter circuits.

Course Outcomes: The student will be able to
1. define different characteristics of operational amplifier (op-amp).
2. select proper configuration of op-amp for given application.
3. develop op-amp based special purpose integrated circuits.
4. implement and test the performance of designed circuits.

Unit 1: Operational Amplifier Fundamentals (06)
Block diagram of Operational amplifier, Noise in Op-amp, types of Noise(definitions of Shot noise, Thermal noise, Flicker noise, Burst noise, Avalanche noise), Introduction to Open and Closed Loop configurations of Op-Amplifier, Characteristics of Operational amplifier, Causes of Slew rate, Measurement of Slew rate (SR), Common Mode Rejection Ratio (CMRR), Power Supply Rejection ratio (PSRR/SVRR), Frequency response, Offset nullification techniques, comparative study of different amplifiers (LM741,LM324,OP07)

Unit 2: Effect of Feedback in Op Amps (06)
Introduction to feedback amplifiers, Voltage series feedback (Non-inverting amplifier with feedback): deriving close loop gain, input impedance, output impedance and bandwidth; Voltage follower and its applications, Voltage shunt feedback (Inverting simplifier with feedback): deriving close loop gain, input impedance, output impedance and bandwidth; Inverter circuit, Differential amplifier with one op-amp: deriving close loop gain

Unit 3: Linear Applications of Op Amps (06)
Voltage summing with average, Voltage subtractor, Current booster, Integrator, and practical integrator, Differentiator and practical differentiator, Instrumentation amplifier with three Op-amps, Current to Voltage converter, voltage to current converter (grounded and floating load), Isolation amplifiers, chopper stabilized amplifiers, Equation solving with Op-amp

Unit 4: Non Linear Applications of Op Amps (05)
Comparator and its characteristics, Study of IC-LM311, Zero Crossing Detector (ZCD) and its use, Schmitt trigger with external bias, window detector, Precision half wave and full wave rectifiers,

Sine wave oscillators using op-amp.: Barkhausen criteria, Wein bridge and RC phase shift oscillator

Unit 5: Timers and Voltage Regulators (06)

Design and applications of Multi-vibrators: Astable, Monostable (Retrigger able and Non- retrigger able), Bi-stable using IC- LM555, Pulse generator using LM555

Voltage regulators: Performance parameters (line regulation, load regulation, ripple rejection), Fixed voltage regulators (IC78xx, 79xx), Working Principle of Switching regulator

Unit 6: Active Filters (06)

Butter-worth approximations, Low pass (LP), High pass (HP), Band pass(BP), Narrow band pass, Band reject, Notch filter, First and second order filters, (Design of LP, HP filter and BP filter), Difference between active and passive filters and their merits and demerits. Filter terminology: Pass band, Stop band, cut off, Ripple, Q and order of the filter

Text Books:

1. Ramakant Gaikwad, "Operational Amplifiers" PHI, 3 rd ed., 1992.
2. William D. Stanley, "Operational Amplifiers with Linear Integrated Circuits", 4th edition, Pearson Education India, 2002.
3. D. Roy Choudhury, "Linear Integrated Circuits" New Age International, 4th edition Electronic 4. Instrumentation by Oliver Cage, McGraw Hill.

Reference Book:

1. Paul Horowitz, Winfield Hill , "The Art of Electronics", 2nd Ed., Cambridge University press,

List of Tutorials:

1. Practical method of measurement of input and output resistance of an op-amp
2. Significance of loading effect in amplifier
3. Designing and implementation of equation solving circuits.
4. Designing and implementation of Celsius to Fahrenheit converter circuit.
5. Concept of SPAN and ZERO in signal conditioning circuits.
6. Signal detection and conversion using op-amp.(V to I, current booster, I to V)
7. Designing and testing of speed pick-up using Zero Crossing Detector (ZCD).
8. Designing and testing of Automatic Street light control using LM555.
9. Designing and testing of different sirens using LM555.
10. Effects of filters on audio signals.

IN2104: Digital Techniques

Teaching Scheme
Lectures: 3 Hr/Week
Tutorial: 1 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Prerequisite:
Basics of Transistor Theory and Basic Electronics.

Course Objectives:
1. To learn and understand basic digital design techniques.
2. To learn and understand design and construction of combinational and sequential circuits.
3. To lay the foundation for further studies in embedded systems, VLSI, micro-processor etc.

Course Outcomes: The student will be able to
1. Represent numerical values in various number systems and perform number conversions between different number systems.
2. List the basic logic gates and apply various reduction techniques to digital logic circuit.
3. Analyze, design and develop combinational and sequential digital circuits.
4. Design counters, multiplexers, demultiplexers and implementation of digital circuits using various building blocks.

Unit 1: Number System, Codes & Boolean Algebra (07)
Introduction: Binary, Octal, Decimal, Hexadecimal Numbers, Number Conversion and their arithmetic, Signed Binary number representation, 1's & 2's complement representation.
Codes: BCD, Excess-3, Gray Code, Error Detecting & Correcting Codes, Code Conversions.
Classical Reduction Technique-Boolean Algebra: DeMorgan's Rules, Basic Theorems and Properties of Boolean Algebra.

Unit 2: Logic Circuit Minimization Techniques & Logic Families (08)
Reduction Techniques: SOP/POS form, Canonical SOP/POS form, Don't care Condition, Simplification by K-Maps up to 4 variables and Quine-McClusky Technique.
Logic Families: Standard Characteristics: Propagation Delay, Power Dissipation, Fan-In, Fan-Out, Current and Voltage Parameters, Noise Margin.
TTL & CMOS Family: Standard TTL Characteristics, Operation of TTL NAND gate-Totem Pole, Open Collector, Wired AND. CMOS Characteristics, CMOS Inverter, Tri State Logic, Comparison of TTL & CMOS.
Interfacing: Interfacing TTL to CMOS and CMOS to TTL.

Unit 3: Combinational Logic (05)
Circuits: Half-Adder, Full Adder, Half Subtractor, Full Subtractor, BCD Adder, Parity Generator and Checker, Magnitude Comparator.
Decoders & Encoders: Working of Decoder, Implementation of expression using decoders, IC 74138, BCD to 7 segment decoder circuits, decoder driver IC 7447. Working of Encoders, Priority Encoders.
Multiplexers (MUX): Working of MUX, Implementation of expression using MUX (IC 74151).
Demultiplexers (DEMUX): Working of DEMUX, Implementation of expression using DEMUX.

Unit 4: Sequential Logic (07)
Introduction to Sequential Circuits: Difference between Combinational Circuits and Sequential Circuits.

Flip-Flops: Internal Design, Truth Table, Excitation Table of SR, JK, D, T Flip Flops, Conversion of Flip Flop, Study of Flip Flop ICs – 7473, 7474, 7476.
Registers: Buffer Register, Shift Register, Universal Shift Register IC 7495.

Unit 5: Sequential Logic Design and Applications (09)
Counters: Definition of modulus of counter, Asynchronous Counters, Synchronous Counters, Ring and Johnson counters, Divide by N-counter, Timing Diagram of Counters, Realization of Counters using ICs 7490, 7492, 7493 and 74193 (Programmable Counter IC)
Sequence Generator/Pulse Train Generator: Using Shift Registers and Counters.

Unit 6: PLDs & Applications (03)
PLD: PLA- Input, Output, AND, OR, Invert/Non-Invert Matrix.
Design Example: 4 variables SOP function using PLDs, study of basic architecture of FPGA and CPLD.
Applications of Digital Circuits: Digital Clock and Alarm Annunciator.

Text Books:

1. R. Jain, *"Modern Digital Electronics"*, 3rd Edition, Tata McGraw-Hill.
2. Malvino and Leach, *"Digital Principals & Applications"*, 4th Edition, Tata McGraw-Hill.
3. Ronald J. Tocci, Neal S. Widmer and Gregory L. Moss, *"Digital Systems, Principals and Applications"*, 10th Edition, Pearson Education International.
4. Gothman, *"Digital Electronics"*, 2nd Edition, PHI.
5. Thomas Floyd *"Digital Principles"*, Pearson Education.
6. M. Morris Mano, *"Digital Design"*, Pearson Education Asia, 3rd Edition.

List of Tutorials: Conduct any eight tutorials

1. Problems based on number conversion and their arithmetic.
2. Problems based on Boolean Algebra reduction technique.
3. Problems based on 4/5 variable Quine-McClusky method.
4. Design Priority Encoder.
5. Design Magnitude comparator and implement it in Proteus.
6. Study SISO, SIPO, PISO & PIPO mode of Universal Shift Register IC 7495 (on Digital Trainer Kit)
7. Design counters using ICs 7490, 7492 and 7493 in combination.
8. Design Pulse Train Generator using shift register and its implement in Proteus.
9. Batch wise power point presentation on 'Evolution of PLDs to FPGAs'.
10. Batch wise power point presentation on any one interesting application of flip-flops (Application has to be out of syllabus)

IN2105: Programming Practice

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
In Semester: 25 Marks
Credit: 1

Course Outcomes: The student will be able to
1. list and identify the steps for the given problem statement.
2. apply different programming tools for logic development.
3. implement the developed logic in the given programming language.
4. develop and design appropriate programs for practical applications.

List of Experiments:
1. Factorial of entered number and printing the first 20 elements in the Fibonacci series usingfunctions.
2. String reversal and swap and exchange of array data.
3. Simple calculator with the basic 4 operations using switch case.
4. Any 2 Sorting methods using arrays.
5. Linear and Binary Search methods using arrays.
6. Addition and multiplication of matrices using nested for loop.
7. Stack using arrays.
8. Queue using arrays.
9. Operation on Polynomials.
10. Database management.

IN2106: Sensors and Transducers I Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Practical: 25 marks
Credit: 1

Course Outcomes: The student will be able to

1. select instruments required for characterization of given sensors.
2. setup an experiment to compute characteristics of sensors and transducers.
3. plot and verify the characteristics.
4. analyze and inter operate the performance characteristic of sensors and transducers.

List of Experiments:

1. Study the working of Dead weight pressure gauge tester and calibration of pressure gauge using it.
2. Study the working of Dead weight vacuum gauge tester and calibration of a vacuum gauge using it.
3. Plot the characteristics of RTD and calculate its time constant.
4. Plot the characteristics of Thermocouple and study cold junction compensation.
5. Design and Test Air purge probe for Level Measurement.
6. Flow measurement using Rotameter, orifice and Electromagnetic flow meter.
7. Measurement of viscosity of various liquids using Red wood Viscometer.
8. Water level measurement using Piezoresistive MEMS sensor.
9. Non-destructive testing using ultrasound transducer
10. Measurement of PH of given sample

IN2107: Basic Instrumentation Lab

Teaching Scheme **Examination**
Scheme
Practical: 2 Hr/week In Semester: 25
Marks

Credit: 1

Course outcomes: The student will be able to
1. select proper measuring instrument with proper specifications for measurement.
2. calibrate the instruments for minimizing errors in the measurement.
3. troubleshooting of instrument for measurement purpose.
4. design different measurement meters based on the given range and parameter.

List of Experiments:
1. Design and implementation of multi-range ammeter using PMMC Ammeter.
2. Conversion of given PMMC Ammeter into multi-range Voltmeter by implementing the designedcircuit.
3. Design and implementation of series and shunt type ohmmeter using PMMC ammeter andcompare the measured unknown resistance values with the color code.
4. Design of Wheastone's Bridge for measurement of unknown resistance and calculate thesensitivity for different P/Q ratios.
5. Calibration of D.C. potentiometer and measurement of unknown voltage using it.
6. Power measurement using Electrodynamometer type Wattmeter (Single phase) and testing itsperformance.
7. Power measurement using Induction type Energy-meter (Single phase) for resistive load.
8. Measurement of Voltage, Frequency and Phase using CRO in Y-t and X-Y mode of the givensignals.
9. Study construction and working of Y-t, X-Y recorders.
10. Demonstration of Lab-View Software.

IN2108: Linear Integrated Circuits Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Practical: 25 marks
Credit: 1

Course Outcomes: The student will be able to
1. find and compare the performance characteristics of different OP AMP.
2. design and implement linear circuits using OP AMP.
3. design and implement non-linear circuits using OP AMP.
4. design and test signal conditioning circuits for industrial application.

List of Experiments:
1. Band width measurement of inverting and no inverting amplifier.
2. Measurement of CMRR, Slew rate and output offset voltage.
3. Designing and implementation of Instrumentation amplifier using IC LM324.
4. Designing and implementation of Integrator.
5. Designing and implementation of Differentiator.
6. Designing and implementation of Wien bridge oscillator.
7. Designing and implementation of Comparator, Schmitt trigger and Zero Crossing Detector.
8. Designing and implementation of Astable and Monostable multivibrator using LM555.
9. Voltage regulators: linear variable regulator LM723.
10. Measurement of performance of 78xx regulator.
11. Butterworth filter design and realization of first/second order Band Pass Filter.

IN2109: Digital Techniques Lab

Teaching Scheme
Practical: 2 Hr/Week

Examination Scheme
Practical: 25 Marks
Credit: 1

Course Outcomes: Students will be able to,
1. Apply different minimization techniques for nymber system conversions.
2. Select and use hardware and software tools for digital system realization.
3. Analysze various interfacing techniques for TTL and CMOS.
4. Design and implement various combinational and sequential digital circuits.

List of Experiments:
1. Study of Gates and Implementation of Gates using NAND & NOR Logic.
2. Code Conversion: Binary to Gray, Gray to Binay and Excess-3 to BCD.
3. Study of Interfacing of TTL and CMOS ICs.
4. Design and Implementation of Adder and Subtractor using logic gates.
5. Study of Multiplexer IC74151. Implementation of Adder/Subtractor and SOP expression using MUX IC.
6. Interfacing of 7 segment LED display using IC 7447.
7. Study of Flip–Flop ICs and conversion of flip –flop from one other.
8. Design Ring & Johnson Counters using D-FF IC 7474 or Shift Register IC 7495.
9. Implementation of MOD-N Counters using 7490, 7492 & 7493 ICs.
10. Study of Preset table Up/Down Counter using IC 74193.
11. Design of Non Sequential Counter using flip –flop ICs.
12. Simulation of Digital Clock using Proteus Software by Labcenter.
13. Simulation of various digital circuits using Proteus Software by Labcenter.
14. Simulation of Alarm Annuncitaor using LabVIEW by National Instruments.

IN2201: Sensors and Transducers II

Teaching Scheme Examination Scheme

Lecture: 3 Hr/week In Semester: 50 marks
Tutorials: 1 Hr/week End Semester: 50 marks
Credit: 4

Course Objectives:

1. To study measurement of some physical parameters
2. To learn analog and digital signal conditioning schemes for sensors/transducers
3. To design and study instruments based on applications

Course Outcomes: The student will be able to

1. define and list performance characteristic of different sensors and transducers.
2. compare features of different sensors and transducers.
3. build various signal condoning circuit.
4. design signal conditioning circuit for sensors and transducers for different application.

Unit 1: Displacement Measurement (06)

Resistive: Potentiometer, Linear and rotary, Loading Effect types of strain gauges. Inductive: LVDT and Eddy current type Transducers. Capacitive: Capacitance pickups, Differential capacitive cells. Piezoelectric, Ultrasonic transducers and Hall effect transducers Optical transducers. Precision measuring instrument (gauges), Angular measurement.

Unit 2: Velocity and speed Measurement (06)

Standards ,working, principle, types, material ,design criteria:
Moving magnet and moving coil, Electromagnetic tachometer, photoelectric tachometer, Toothed rotor variable reluctance tachometer, magnetic pick-ups, encoder, Photoelectric pick up, shaft speed measurement. Applications of velocity measurement sensor

Unit 3: Vibration and Acceleration (05)

Standards working principle, types, material, design criteria: Eddy Current type, piezoelectric type, Seismic transducer.
Accelerometer: Potentiometric type, LVDT type, piezoelectric type. Application of Acceleration ion and vibration sensor

Unit 4: Force and Torque Measurement (06)

Basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, Strain gauge torque meter, Inductive torque meter, Magneto-strictive transducers, torsion bar dynamometer

Unit 5: Principles of Analog and Digital Signal conditioning (06) Introduction, signal level and bias changes, linearization, conversation faltering and impedance matching, concept of loading, divider circuits, bridge circuits, lead compensation, RC filters (low pass, high pass), Readout/ meter. Converters, Readout/display

Unit 6: Design of Signal conditioning circuit (07) Thermocouple, RTD, Thermistor, load cell, potentiometric sensors, capacitive level sensor, LVDT, Optical Sensors (LDR, photodiode, photo transistor, photo cell).

Text Books:

1. Rangan, Sarma, Mani, 'Instrumentation Devices and Systems' Tata McGraw-Hill, Second Edition.
2. D.V.S. Murthi, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003.
3. B. C. Nakra and K. K. Choudhari, "Instrumentation Measurements and Analysis" by, Tata McGraw Hill Education, Second ed., 2004.
4. A.K. Sawhney, "Electrical & Electronic Instruments & Measurement", Dhanpat Rai and Sons,
5. Eleventh ed., 20005 D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw- Hill-second edition 1999.
6. C. D. Johnson, 'Process Control Technology' PHI-Seventh Edition.
7. Art of electronic book for signal condoning by harwitz

Reference Books:

1. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard, 'Mechanical Measurements',
2. International Student edition, Addison- Wesley- 5thEd.
3. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw-Hill- 1986.
4. B.G. Liptak, "Process Measurement & Analysis", Chilton Book Company, Third ed., 1995.
5. E.O. Doebelin, 'Measurement Systems Application and Design', McGraw Hill, 4th Edition, 1990.

List of Tutorials:

1. Construction and working of speedometer
2. Study of digital dial gauge & digital micrometer
3. Study of Anemometer
4. Study of 3 axis MEMS accelerometer

5. Spring balance as a overload alarm
6. Study of optical source detector
7. Measurement of temperature using LM35
8. Measurement of temperature using thermocouple

IN2202: Electronic Instrumentation and System Design

Teaching Scheme
Lecture: 3 Hr/week
Tutorial: 1 Hr/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credit: 4

Prerequisite:
1. Concepts covered in Basic Instrumentation subject
2. Concepts covered in Linear Integrated Circuits subject

Course Objectives:
1. To provide an overview and understand the internal structure of various laboratory measuring Instruments and Signal Conversion techniques.
2. To teach the theory of different types ADCs and DACs.
3. To introduce the theory and applications of various special purpose ICs.
4. To teach the various grounding shielding techniques and ESD, EMI/EMC effects.
5. To introduce the concept of reliability.
6. To understand concepts related to PCBs – their types, design considerations, soldering techniques.

Course Outcome: The student will be able to
1. analyze the operation and describe working of different types of measuring instruments.
2. select suitable ADC and/or DAC for given application.
3. apply the knowledge of special purpose ICs for real time problems.
4. design own PCBs and solder the circuits

Unit 1: ADCs and DACs **(07)**
Sampling Theorem, Sample and Hold Circuit, ADC types like Flash, Counter, SAR and Dual-Slope, ADC Specifications, ADC Numerical, DAC types like Weighted-Resistor and R-2R ladder, DAC Specifications, DAC Numerical, Study of CD4051 and ICM7107

Unit 2: Measuring Instruments **(05)**
RMS concept and True RMS Meter, DVM and Automation in DVM – auto ranging, auto zeroing and auto polarity, Digital LCR-Q Meter, Concept of frequency measurement and Universal Counter and Its Mode like Frequency, Totalizing, Period, Time Interval, Ratio, Measurement Errors in counter.

Unit 3: Generators and Signal Analyzers **(05)**
Types of Frequency synthesis, Direct Digital Synthesis, Arbitrary Waveform Generator, Study of IC8038
Signal Analyzers - Distortion Analyzer, Spectrum Analyzers, FFT Analyzer

Unit 4: Guidelines for enclosure, components and accessories **(05)**
Grounding and shielding techniques, EMI and EMC, Source of EMI, Protection against EMI, EMI and EMC effects minimization methods, ESD, Protection against ESD

Unit 5: Special Application ICs **(08)**
Instrumentation amplifier AD620, Linear opto isolator IL300, V to I converters XTR110, Signal conditioners AD594/595, Phase Locked Loop CD4046, Programmable counter

ICM7217, Optoisolator MCT2E, Power drivers ULN2803

Unit 6: PCBs and Reliability **(06)**

Printed circuit board - Design rules for analog and digital circuit PCB's, Single, Double, Multi layer and SMD boards, Soldering materials and techniques, need of flux and its characteristics

Reliability - Definition, Distinction between Quality and Reliability, Availability, Maintainability, (MTBF, MTTF, MTTR) Life Cycle and Bathtub curve

Text Books:

1. Modern Electronic Instrumentation and Measurement Techniques by Helfrick and Cooper, PHI
2. Digital Instrumentation by A. J. Bowen
3. Electronic Instrumentation Handbook by Coombs.
4. Electronic Instrumentation by Oliver Cage, McGraw Hill.
5. Electronic Instruments and Instrumentation Technology by Anand M. M. S., PHI
6. Electrostatic Discharge and Electronic Equipment, Warren Boxleitner IEEE press.
7. Printed Circuit Boards, Walter C. Bosshart, CEDT series, TMH.
8. Reliability Engineering,.E. Baiguruswamy.
9. Data manual for analog and digital lCs

References:

1. Electrical and Electronic Measurements and Instrumentation by David A. Bell, Prentice Hall of India.
2. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co.
3. Electronic Instrumentation by J. J. Carr.
4. Electronic Instrumentation by H. S. Kalsi, McGraw Hill.
5. Noise Reduction Techniques, Ott.

List of tutorials:

1. Study of IC0809 in detail – pin details, internal schematic, working
2. Study of IC0808 in detail – pin details, internal schematic, working
3. Study of RMS meter – internal schematic, features
4. Study of Universal Counter - internal schematic, various modes
5. Study of IC8038 in detail – pin details, internal schematic, working
6. Study of Distortion meter – internal schematic, features
7. Study of MCT2E and ULN2803 – application for driving different types of loads
8. Study of IL300 – typical application circuit
9. Study of CD4046 as frequency multiplier
10. Study of XTR110 as 0A to 10A output voltage to current converter

IN2204: Control Systems I

Teaching Scheme
Lecture: 3 Hr/week
Tutorials: 1 Hr/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credit: 4

Prerequisite:
Basics of Laplace transform Linear algebra and complex number

Course Objectives:
1. Understand the basic components of control system, types of control systems.
2. Learn the developing relationship between system input and output.
3. To learn to develop system's mathematical models.
4. To understand the basic mathematical tools for analysis of the control systems.

Course Outcome: The student will be able to
1. classify and represent the various physical systems using differential equations.
2. develop mathematical models of control systems.
3. analyze the system in time and frequency domain.
4. compare classical control system with modern control systems.

Unit 1: Introduction to Control Systems **(06)**
Introduction, brief classification of control systems: Representation of: Electrical, mechanical, electromechanical, thermal, pneumatic, hydraulic systems, with differential equations, Concept of transfer function and state space representation. Advantages of state space representation over classical representation, Terminology of state space (state, state variables, state equations, state space).

Unit 2: Transfer function, block diagram algebra and signal flow graph **(07)**
Representation of transfer function of electrical, mechanical with force to voltage and force to current analogies, Block diagram algebra, Signal flow graph.

Unit 3: Time domain analysis of control systems **(07)**
Standard test signals, dynamic error constants. First order, second order systems and their response, Time domain specifications of first order and second order control systems, static error constants (kp, kv, ka, ess).

Unit 4: Stability Analysis **(06)**
Concept of Stability in *s* domain, Classification of Stability (BIBO stability and asymptotic stability), stability analysis by Hurwitz criterion and Routh array, concept of relative stability and its analysis using Routh array.

Unit 5: Root locus **(06)**
Definition, Evan's conditions for magnitude and angle, construction rules, determination of system gain at any point on root locus (from magnitude condition and by graphical method), Root locus of systems with dead time: Concept, approximation of dead time and construction rules.

Unit 6: Frequency Domain Analysis and Introduction to state space representation **(07)**
Bode plot, with and without dead time, determination of transfer function from asymptotic Bode plot, Polar plot, Nyquist plot
Representation of state models: direct (companion I and II *i.e.* controllable canonical and

observable canonical forms), parallel and cascade decomposition.

Text Books:

1. I. J. Nagrath, M. Gopal, “Control System Engineering”, 6th Edition, New Age International Publishers.
2. B. S. Manke, “Linear Control Systems”, Khanna Publishers, New Delhi.
3. A. K. Jairath, “Problems and Solutions of Control Systems”, CBS Publishes, New Delhi.

Reference Books:

1. K. Ogata, “Modern Control Engineering”, PHI, New Delhi.
2. Norman S. Nise, “Control System Engineering”, John Wiley and Sons.
3. B. C. Kuo, “Automatic Control Systems”, PHI, New Delhi

List of Tutorials:

1. Introduction to computational software (MATLAB).
2. Introduction to Basic MATLAB commands and functions.
3. Introduction to Control system toolbox.
4. Study of standard test signals.
5. Analysis of time domain specifications using MATLAB.
6. Analysis of stability using root locus approach
7. Analysis of stability in frequency domain (Bode plot)
8. Analysis of stability in frequency domain (Nyquist plot)
9. Conversion of SS to TF and TF to SS.

IN2205: Sensors and Transducer II Lab

Teaching Scheme Examination Scheme
Practical: 2 Hr/week Practical: 25 marks

Credit: 1

Course Outcomes: The student will be able to

1. Select instruments required for characterization of given sensors.
2. Setup an experiment to compute characteristics of sensors and transducers.
3. Design signal condoning circuit for different application.
4. Implement and test the designed signal condoning circuit.

List of Experiments:

1. Design and implementation of signal conditioning for RTD
2. Measurement of Displacement using L.V.D.T. and testing of its performance characteristics.
3. Measurement of Displacement using Linear and Rotary Encoders and compare their resolutions.
4. Measurement of unknown weight using load cell and computing its hysteresis.
5. Design and implementation of weighing machine using load cell.
6. Design and implementation of liquid level indicator using electromechanical system
7. Design and implementation of liquid level indicator using capacitive transducer.
8. Design and implementation of through beam / reflected beam type optical proximity switch.
9. Angular speed measurement using optical Encoder and plot its characteristics.
10. Motor Speed measurement using contact and non-contact type tachometers and calculate error.
11. To measure vibration of a platform using piezoelectric type Vibrometer and calculate maximum amplitude of vibration.
12. Measurement of acceleration using Piezoelectric accelerometer and study its response.

IN2206: Electronic Instrumentation and System Design Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Practical: 25 marks
Credit: 1

Course Outcomes: The student will be able to
1. design electronic circuits for given application.
2. use various electronic instruments for measurement and analysis.
3. design of given problem using suitable application ICs.
4. apply the knowledge of the various electronic instruments and application ICs to real time problem.

List of Experiments:
1. Implement ADC IC 0808 along with IC4051 and analyse its characteristics.
2. Implement DAC IC 0808 and analyse its characteristics.
3. Check the performance of True RMS meter and multi meter for various waveforms.
4. Study and verify different modes of Universal Counter.
5. Design and implement signal generator using IC8038.
6. Measure distortion of various signals using Distortion Meter
7. Implement optoisolator MCT2E and ULN2803 for driving different loads.
8. Verify output of optocoupler IL300 for unipolar and bipolar inputs.
9. Design and implement PLL CD4046 for given application.
10. Study of XTR110

IN2208: Analytical Instrumentation Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
In Semester: 25 marks
Credit: 1

Course Outcomes: The student will be able to
1. analyze working of different types of spectroscopic instruments.
2. co-relate various principles of spectroscopy with working of the analytical instruments.
3. identify, formulate and solve a real world problem based on different types of spectroscopy.
4. critique spectroscopy and perform simple analytical procedures on a given sample using colorimeter and UV-Visible spectrophotometer.

List of Experiments:
1. Analysis by using Photoelectric colorimeter
2. Analysis by using Densitometer
3. Study of Signal beam spectrometer
4. Analysis by using Double beam spectrometer
5. Analysis by using Flame photometer
6. Analysis by using Spectrofluorometer
7. Study of NMR Spectroscopy
8. Study of Atomic Absorption spectroscopy
9. Study of Gas Chromatography
10. Study of High Performance Liquid Chromatography

IN2209: Lab practice I

Teaching Scheme
Practical: 2 Hr/Week

Examination Scheme
In Semester: 25 marks
Credit: 1

Course Outcomes: The student will be able to
1. apply Kirchhoff's Law and Node and Mesh Analysis to circuits.
2. apply Thevenin Theorem and Superposition Theorem to circuits to measure lectrical parameters.
3. record and analyze physiological parameters.
4. analyze the characteristics of power electronics components and Implement the speed control methods for Motors.

List of Experiments:
1. Circuit solving using Kirchhoff's law
2. Network Analysis using Mesh current and Node voltage Method
3. Network Analysis using Superposition Theorem
4. Network analysis using Thevenin Theorem.
5. Study of Homeostasis for Blood sugar level, Temperature and Water level.
6. Anatomy of heart and its functioning- Explain concept of heart rate, arrhythmia, tachycardia and
7. bradycardia.
8. Measurement of blood pressure using Sphygmomanometer.
9. Study the characteristics and applications of SCR and UJT
10. Speed and direction control of DC motor
11. Speed and direction control of stepper motor.
12. Application of ICM7217
13. Application of MM7107

INBI 1102 Transducer Design

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:
1. To understand basic principles of sensing various bio signals.
2. To select appropriate sensor/transducer for typical application.
3. To design transducer scheme for given parameter with specifications.
4. To develop mathematical background of sensor design.

Course Outcomes:
1. Ability to select and suggest transducers for various body parameters.
2. Ability to design transducers and signal conditioning for given range and application.
3. Ability to identify, formulate and solve a problem related to Bio signal measurements.
4. Demonstrate an ability to use appropriately and safely the techniques, sensors, and selected modern engineering tools necessary for bio engineering practice

Unit–I: Review of Fundamentals of Transducers for Measurement of: (08)
Physical parameters like pressures, Flow, temperature. Chemical parameters like pH, conductivity. Proximity sensors, Pathological parameters, Detection of alpha, beta and gamma radiation

Unit – II: Review of Signal Conditioners for: (06)
Resistive, Inductive, Capacitive, Piezo Electric and Optical Transducers

Unit – III: Design of Electromechanical Transducers for: (05)
Force, Pressure, Stress, Vibration using Strain-gauge, LVDT , Capacitive Elements, Optical Device, Typical application in each design case such as measurements for Hydraulic and Pneumatic Instruments.

Unit – IV: Case Studies: (06)
Discussion of Selection Criteria Selection of transducers for various biological parameters

Unit – V: Introduction to Advanced Sensors: (05)
Chemical Sensors, Bio sensors, Gas Sensors. Discussions on Nano Sensors and MEMS applications.

Unit – VI: LASER applications (05)
Introduction to LASERS, Applications of Laser in biomedical field

Text Books:

1. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill.(2nd edition), (2002)
2. C.S. Rangan, G.R. Sharma and V.S.V. Mani ‘Instrumentation Devices and Systems’, Tata Mcgraw- Hill Publishing Company Ltd. New Delhi.
3. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis”, Tata McGraw Hill

Reference Books:
1. H K P Neubert, ‘Instrument Transducers’, Oxford University Press (2nd edition), (2003).
2. Bella G Liptak, ‘Instrument Engineer Handbook, Vol 1, 2 and 3 CRC Press (3rd edition), (2002).
3. E.O. Doebelin, “Measurement Systems”, McGraw Hill.
4. J. Wilson, J.F.B. Hawkes, ‘Laser Principles and Applications’ , Prentice-Hall, New York

INBI 1201 Advanced Electronic Instrumentation

Teaching Scheme: Lectures: 3 Hrs/Week

Examination Scheme: In-Semester: **50** Marks; End-Semester: **50** Marks; **Credits: 3**

Course Objectives:
1. To be able to analyze and justify the requirement of Instrument and Systems.
2. To design various electronic circuits and measurement systems.
3. To study noise identification and appropriate elimination methods related to instrument.
4. Understand the use of advanced electronic instruments.

Course Outcomes:
1. Ability to analyze the signals using electronic analyzers
2. Design amplifier circuits for biosignals
3. Students would be able to select, design appropriate enclosure, cables, PCB.
4. The capability to estimate, analyze, improve the reliability of instrument and system.

Unit – I: Study of Electronic Instruments: **(07)**

Universal counter & its modes, Measurement errors in counters, Applications of counter, True RMS meter, Automatic Test Equipment, IC based bio-signal amplifier (INA 333, INA 128), isolation amplifier

Unit – II: Electronic Analyzers: **(06)**

Distortion meter, Wave analyzer, Spectrum analyzer, Heterodyne spectrum analyzer, frequency synthesizers

Unit – III: PCB Design Concepts: **(06)**

PCB layout and design, Types of PCB, Analog and digital PCB design guidelines

Unit – IV: Grounding and Shielding: **(06)**

Grounding techniques, Shielding techniques: near field, far field, absorption loss and reflection loss, ESD and protection against ESD

Unit – V: Electromagnetic Compatibility: **(06)**

EMI/EMC, Noise, noise coupling, interference, cabling, grounding, ground loops.

Unit – VI: ADC and DAC Design: **(05)**

Review of Successive approximation, flash and dual slope ADC, Quantization, ADC and DAC Specifications, Selection of ADC and DAC parameters for various applications

Text Books:

1. Clyde F. Coombs, '**Electronic Instrument Handbook**', *Tata McGraw Hill*, (Third Edition)(2000)
2. Helfrick A.D, Cooper W.D, **' Modern Electronic Instrumentation and Measurement Techniques'**, *Prentice Hall of India, 2005*
3. David A. Bell, '**Electrical and Electronic Measurements and Instrumentation'**
4. Henry W Ott, John , '**Electromagnetic Compatibility Engineering**', *Wiley and Sons Inc. Publication*
5. W. C. Bosshart, '**PCB Design and Technology',** *Tata McGraw Hill, 1997*

.

Reference Books:

1. Oliver Cage, '**Electronic Measurements and Instrumentation**', *McGraw Hill,* (First Edition) *(1975)*
2. J. J. Carr, '**Electronic Instrumentation**', *Pearson Education,* (Third Edition) *(*2003).
3. Bouwens A.J, '**Digital Instrumentation**', *Tata McGraw Hill,* 1983

INBI 1202 Advanced Embedded Systems

Teaching scheme: **Examination Scheme:**
Lectures: 3Hrs/ Week In Semester: **50** Marks
End Semester: **50** Marks
Credits:3

Course Objectives:

1. To understand communication protocols used in industrial environment.
2. Understanding of the basic principles of Embedded Processor/Controller based design and development.
3. To Develop ability to program the ARM Processor and PIC microcontroller.
4. To design and build functional prototype for real world applications.

Course Outcomes:

1. Ability to design and build a functional prototype for real world applications.
2. To encourage the students to have a better understanding on state-of-art embedded technologies like system-on-chip design and reconfigurable embedded designs, their potential applications and their market views.
3. Ability to work in a group to design systems, solve problems and its applicability for the society.
4. Ability to transfer data by establishing communication using appropriate protocol in two systems

UNIT - I: Introduction to Communication Protocols: **(04)**
OSI reference model, Industry Network, Recent networks, Communication basics, Network Classification, Device Networks, Control Networks, Enterprise Networking, Network selection.

UNIT-II: Industry Open and proprietary Protocols: **(08)**
Proprietary and open networks: Network Architectures, Building blocks, Industry open protocols (RS232C, RS- 422, RS-485), Ethernet, Modbus, Modbus Plus, Data Highway Plus. Fieldbus: Fieldbus Trends, Hardware selection, Fieldbus design, Fieldbus advantages and limitations. Foundation Fieldbus & Profibus: Introduction, Design, Calibration

UNIT-III: HART and Wireless Protocols: **(03)**
HART: Introduction, Design. Introduction to wireless Protocols: WPAN, Wi-Fi, Bluetooth, ZigBee, Z-wave.

UNIT-IV: ARM Processor **(07)**
tures, ARM Architecture Overview, ARMv7 Architecture, Programmer's Model, Memory Systems, Floating Point Extensions, ARM System Design, Software Development Tools

UNIT-V: PIC Micro-controller PIC18FXX **(07)**
Features, Architecture, Memory, on chip peripherals, Instructions, Programming, Applications and System Development

UNIT-VI: Introduction to Raspberry Pi **(07)**
Hardware aspects, Board details, Overview of available hardware resources, Operating systems available, Raspberry Pi Configuration, Programming the Pi, Hardware Interfacing (GPIO,

LED, Buzzer, Switch interfacing, Sensors Interfacing)

Reference Books:

1. B.G. Liptak**, 'Process Software and Digital Networks'**:, *CRC Press ISA- The Instrumentation, Systems, and Automation Society* (3rd edition),(2002)
2. Romilly Bowden, **'HART Communications Protocol'**, *Fisher-Rosemount*.
3. User Manuals of Foundation Fieldbus, Profibus, Modbus, Ethernet, Device Net, Controlnet
4. Dogan Ibrahim, **'Advanced PIC Microcontroller Projects in C: From USB to RTOS with the PIC 18FXX Series**'
5. ARMv7 Architecture Reference Manual
6. Raspberry Pi Reference Manual

INBI 1203 Engineering in Medicine

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:
1. To study measurement of various physiological parameters.
2. To introduce life saving devices.
3. Learn safety aspects of medical instruments.
4. To study the signal conditioning techniques for various biosignals.

Course Outcomes:
1. Ability to use biosignal recording instruments.
2. Design and develop signal conditioning for different biosignals.
3. Know the instruments used in pathology lab.
4. Get knowledge of advanced instruments used in hospitals.

Unit – I: Life Saving Devices: **(06)**

Cardiac pacemakers: external and Implantable pacemaker, Cardiac defibrillator: DC defibrillator, implantable defibrillator and defibrillator analyzer, Heart Lung Machine
Operating Room Instrumentation: Elecrosurgical unit(ESU), Anesthesia Machine

Unit – II: Nervous system and ICU Instrumentation: **(05)**

EEG -10-20 electrode system, Lead Configuration and Recording System
Muscle Contraction Mechanism, Myoelectric voltages, Electromyography
ICU Instrumentation: Multipara meter monitor, Bedside Monitor, Drug Delivery system, Layout design

Unit – III: Clinical Lab Instrumentation: **(06)**

Introduction, medical diagnosis with chemical test, Spectrophotometer, Colorimeter - Auto analyzers, clinical flame photometer, Blood pH measurement, Blood P_{O2}, P_{CO2} measurement, Oximetry, Principle, Invitro and Invivo oximetry
Nomogram, Blood Cell Counters- Coulter, dark field method, Flow Cytometry

Unit – IV: Sensory Instrumentation: **(06)**

Ear: Hearing loss, Sound conduction system, Basic audiometer, Pure tone audiometer, Bekesy Audiometer system, Evoked response audiometer, Hearing aids.
Vision: Visual acuity, Errors in vision, slit lamp, Tonometer, Ophthalmoscope, Perimeter.

Unit – V: Respiratory and Kidney Instrumentation: **(06)**

Spirometers, Airflow measurement, oxygenators- bubble type, membrane type, Ventilator
Dialysis-basic principle of dialysis, Dialyzers: different types of dialyzers, Peritoneal dialysis,

Hemodialysis
Lithotripsy

Unit – VI: Bio Signal Conditioning Techniques: **(07)**

Amplifiers – Differential amplifiers, Instrumentation amplifier, Chopper amplifiers, Isolation amplifier. Transient Protection, Interference reduction, movement artifact circuits, Active filters, Rate Measurements, Averaging and Integrating Circuits

Patient Safety: Electric shock hazards, leakage currents, electrical safety analyzer, testing of biomedical equipments, safety codes

Text Books:

1. Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer, '**Biomedical Instrumentation and Measurements'**, Prentice Hall of India, (2011)
2. Joseph J. Carr and John M Brown, '**Introduction to Biomedical Equipment Technology'**, *Pearson Education*, (4 th edition, 2008)
3. John G. Webster, '**Medical Instrumentation Application and Design**', *Wiley,* (3 edition ,1997)
4. R. S. Khandpur '**Handbook of Bio-Medical Instrumentation'**, *Tata McGraw Hill*, (2nd Edition, 2003)
5. Ronald Pitts Crick, Pang Khaw, 'Text book of Clinical Ophthalmology', *World Scientific publication,* (2nd edition)

Reference Books:

1. Geddes L.A and Baker L.E, '**Principles of Applied Biomedical Instrumentation**', *Wiley-Interscience,* (3 edition, 1989)
2. Joseph Bronzino, '**Biomedical Engineering & Instrumentation'**, *Taylor & Francis,* (3rd edition,2006)

INBI 2101 Medical Imaging and Image Processing

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:
1. To acquire knowledge about fundamental concepts of imaging.
2. To study principle and working of various medical imaging techniques.
3. To know the applications of various imaging modalities.
4. To learn basic digital image processing techniques like enhancement and segmentation.

Course Outcomes:
1. Understand the working of various imaging techniques
2. Understand the concept of 2D and 3D imaging process.
3. To gain knowledge about the various image enhancement and segmentation techniques.
4. Ability to apply the image processing techniques to medical images for diagnosis.

Unit – I: X-Ray Imaging: (12)

Electromagnetic Spectrum, Interactions between Radiation and matters; Fundamentals of acoustic propagation; Interaction between sonic beams and matter;
X-ray tube: The generation: Electron-Target Interactions, X-ray emission spectrum: Characteristic x-ray spectrum, Bremsstrahlung x-ray spectrum, Factors affecting X-ray Emission Spectrum: Effect of mA, kVp, added filtration;
X-ray unit: generators, filters and grids; Image intensifiers; X-ray detectors: Screen film detector, Image Intensifier; Radiographic techniques, quality and exposure. Fluoroscopy and Visual Physiology,
Angiography: Arterial access, Catheters, Contrast media;
Mammography: Soft tissue radiography, Equipments: Target composition, Filtration grids, Photo timers, Image receptors;
Xero radiography; Digital radiography

Unit – II: Computed Tomography (04)

Operational modes: First generation scanners, Second, Third, Fourth, Fifth generation scanners; System components: Gantry, Collimation; High Voltage generators; Image characteristics: Image matrix, CT numbers; Image reconstruction; Image Quality: Spatial resolution, Contrast resolution, System noise, Linearity, Spatial Uniformity.

Unit – III: Ultrasound Imaging (06)

Piezoelectric effect; Ultrasonic transducers: Mechanical and Electrical matching,; The characteristics of transducer beam: Huygens principle, Beam profiles, Pulsed ultrasonic filed, Visualization and mapping of the Ultrasonic field; Doppler effect-Doppler methods; Pulse echo systems [Amplitude mode, Brightness mode, Motion mode & Constant depth mode]; Tissue characterization: velocity, Attenuation or absorption, Scattering, Color Doppler flow imaging: CW Doppler imaging device, Pulsed Doppler imaging system, 2-D echo cardiography

Unit – IV: Advances in Imaging (06)

Introduction to Magnetic Resonance Imaging, Introduction to MRI, Imaging Pulse sequence, Limitations of MRI, Radionuclide Imaging, Single Photon Emission Computed Tomography, Positron Emission Tomography. Physics of thermography

Unit – V: DIGITAL IMAGE FUNDAMENTALS and ENHANCEMENT (05)

Elements of visual perception, Image formation model, image sampling and quantization, some basic relationships between pixels, matrix and singular value representation of discrete images

Gray level transformation, Histogram processing, enhancement using arithmetic/logic operation, spatial filtering –smoothening and sharpening, filtering in frequency domain-smoothening and sharpening, frequency domain, filters- homomorphic filtering

Unit – VI: IMAGE SEGMENTATION AND FEATURE EXTRACTION (05)

Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation

Representation and description: Representation schemes, descriptors, regional descriptors, pattern and pattern classes

Text Books:

1. K. Kirk Shung, Michael B. Smith, Benjamin Tsui, '**Principles of Medical Imaging**', *Academic Press*, (First Edition,1992)
2. Stewart C. Bushong, '**Radiologic science for Technologists**', *Elseveir, (*9th Edition)
3. Gonzalez R.C.; Woods R.E.; Eddins S.L, '**Digital Image Processing with Matlab**', *Tata McGraw-Hill, (*2Nd Edition, 2010)
4. A. K. Jain, '**Fundamentals of Digital Image Processing**', *Prentice Hall of India, (First Edition, 2004)*

Reference Books:

1. Jeffery Papp, '**Quality Management: In the Imaging Sciences**', *Mosby: A Harcourt Health Sciences Company*
2. Christensens, '**Physics of Diagnostic Radiology**', *Lea & Febiger*, U.S., (4th edition, 1990)
3. David J. Dowsett, Patrick A. Kemmy, R. Eugene Jhnston, '**The Physics of Diagnostic Imaging**', *A Hodder Arnold Publication*, (2nd edition)
4. W.J. Meredith & J. B. Massey, '**Fundamental Physics of Radiology**', John Wright & Sons Ltd., (3rd.ed.) (1977)
5. Jole Pierce Jones, '**Acoustic Imaging**', *Plenum Publishing*, Vol 22, (1994)

INBI 1207 SEMINAR

Teaching Scheme:
Tutorial: 2 Hrs/Week

Examination Scheme:
Oral: 50 Marks
Credits:2

Seminar shall be on the topic relevant to latest trends in the field of Instrumentation branch, Preferably onthe topic based on the electives selected by her approved by authority. The student shall submit the seminarreport in standard format using LATEX, duly certified for satisfactory completion of the work by the concerned guide and head of the Department.

SEMESTER –1

SULLABUS

ME 2101 Engineering Thermodynamics

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisite:
1. Engineering Physics
2. Engineering Chemistry
3. Basic Mechanical Engineering

Course Objectives:
1. To state and illustrate laws of Thermodynamics.
2. To understand the concept of entropy and availability.
3. To get conversant with properties of steam, vapor processes and various steam calorimeters.
4. To analyze the performance of various Thermodynamic cycles.

Course Outcome:
1. Students will be able to apply laws of Thermodynamics to various processes.
2. Students will understand the concept of entropy and availability.
3. Students will gain the knowledge about the steam generation, properties of steam and various steam processes.
4. Students will be able to do performance calculations for various Thermodynamic cycles.

Unit 1: Laws of Thermodynamics (8 hrs)
Review of basic concepts of Thermodynamics, First law applied to closed system and open system, Second law of thermodynamics, Corollaries of Carnot theorem, Second law applied to heat engine, heat pump and refrigeration cycles.

Unit 2: Entropy (6 hrs)
Clausius Inequality, Entropy – a system property, Evaluation of entropy change for solids, liquids and ideal gases, Principle of increase of entropy- entropy generation

Unit 3: Exergy Analysis (4 hrs)
Exergy, Exergy analysis of closed system, Exergy analysis of open system, 2nd law efficiency

Unit 4: Properties of Steam (8 hrs)
Formation of steam, Properties of steam, First law applied to steam processes, Steam calorimeters

Unit 5: Thermodynamic Vapor Cycles (8 hrs)
Carnot cycle, Rankine cycle, modified Rankine cycle, Reheat and Regeneration

Unit 6: Thermodynamic Gas Cycles (6 hrs)
Otto cycle, Diesel cycle, Dual cycle and Brayton cycle.

Text Books and References:

1. Principles of Engineering Thermodynamics- Moran, Shapiro, Boettner, Baily Eighth Edition, Wiley
2. P. K. Nag, Engineering Thermodynamics, 5^{th} Edition, Tata McGraw Hill Publications
3. C.P. Arora, Engineering Thermodynamics, Tata McGraw Hill
4. S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar, Thermal Engineering, Dhanpat Rai Publishers
5. Çengel and Boles, 'Thermodynamics – An Engineering Approach', 7^{th} Edition, Tata McGraw Hill.
6. Rayner Joel, "Basic Engineering Thermodynamics", Addison Wesley Longman

ME 2102 – Materials' Technology I

Teaching Scheme
Lecture: 2 Hrs/week
Tutorials: 1 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Physics
2. Chemistry

Course Objectives:
1 To introduce material properties and behaviour that is relevant to Mechanical engineering.
2 To provide an integrated understanding of structure, properties, processing and performance

Course Outcomes:
Upon completion of this course, students will be able to:
1 Based on principles of material science and engineering, correlate the relationship between processing-structure-property-performance of materials.
2 Apply the knowledge of engineering fundamentals and material science to define and evaluate properties relevant to mechanical engineering.
3 Evaluate structure of engineering materials
4 Cite usual types of failures in materials correlate the structure of material with common failures and write their causes.

Unit 1: Properties of Engineering Materials **(8 hrs)**
Classification of various properties, expressing and computing properties relevant to mechanical engineering. Study conventional destructive and non destructive testing.

Unit 2: Structure of Crystalline solids **(8 hrs)**
Effect of making process on internal structure, structure of crystalline solids.

Unit 3: Structure of Non crystalline solids **(5 hrs)**
Polymers, composites and functionally graded materials.

Unit 4: Structure property relation **(9 hrs)**
Effect of inter-atomic distance on properties, effect of crystalline and non crystalline structure and defects on properties, effect of grain size on properties, defects, defect tolerance, slip, twinning, work hardening, failure modes.

Text Books:

1 "Callister's Material Science and Engineering", W.D. Callister, D.G.Rethwisch, Wiley, 2016,Second edition.

Reference Books:

1 "Material Science & Engineering." Raghavan V., Prentice Hall of India, New Delhi. 2003.
2 "Properties of Engineering materials", R.A. Higgins, ELBS, Edward Arnold, 1988.
3 "Engineering Metallurgy", Higgins R. A., Viva books Pvt. Ltd., 2004.
4 "Mechanical Metallurgy", Dieter, G.E., McGraw-Hill, 1988.

5 "Introduction to Physical Metallurgy", Avner, S.H., Tata McGraw-*Hill*, 1997.
6 "Material selection in mechanical design', Michael Ashby, Butterworth-Heinemann, 3/e, 2005.

INBI 1203 Engineering in Medicine

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:
1. To study measurement of various physiological parameters.
2. To introduce life saving devices.
3. Learn safety aspects of medical instruments.
4. To study the signal conditioning techniques for various biosignals.

Course Outcomes:
1. Ability to use biosignal recording instruments.
2. Design and develop signal conditioning for different biosignals.
3. Know the instruments used in pathology lab.
4. Get knowledge of advanced instruments used in hospitals.

Unit – I: Life Saving Devices: **(06)**

Cardiac pacemakers: external and Implantable pacemaker, Cardiac defibrillator: DC defibrillator, implantable defibrillator and defibrillator analyzer, Heart Lung Machine
Operating Room Instrumentation: Elecrosurgical unit(ESU), Anesthesia Machine

Unit – II: Nervous system and ICU Instrumentation: **(05)**

EEG -10-20 electrode system, Lead Configuration and Recording System
Muscle Contraction Mechanism, Myoelectric voltages, Electromyography
ICU Instrumentation: Multipara meter monitor, Bedside Monitor, Drug Delivery system, Layout design

Unit – III: Clinical Lab Instrumentation: **(06)**

Introduction, medical diagnosis with chemical test, Spectrophotometer, Colorimeter - Auto analyzers, clinical flame photometer, Blood pH measurement, Blood $P_{O2,}$ P_{CO2} measurement, Oximetry, Principle, Invitro and Invivo oximetry
Nomogram, Blood Cell Counters- Coulter, dark field method, Flow Cytometry

Unit – IV: Sensory Instrumentation: **(06)**

Ear: Hearing loss, Sound conduction system, Basic audiometer, Pure tone audiometer, Bekesy Audiometer system, Evoked response audiometer, Hearing aids.
Vision: Visual acuity, Errors in vision, slit lamp, Tonometer, Ophthalmoscope, Perimeter.

Unit – V: Respiratory and Kidney Instrumentation: **(06)**

Spirometers, Airflow measurement, oxygenators- bubble type, membrane type, Ventilator
Dialysis-basic principle of dialysis, Dialyzers: different types of dialyzers, Peritoneal dialysis,

Hemodialysis
Lithotripsy

Unit – VI: Bio Signal Conditioning Techniques: **(07)**

Amplifiers – Differential amplifiers, Instrumentation amplifier, Chopper amplifiers, Isolation amplifier. Transient Protection, Interference reduction, movement artifact circuits, Active filters, Rate Measurements, Averaging and Integrating Circuits

Patient Safety: Electric shock hazards, leakage currents, electrical safety analyzer, testing of biomedical equipments, safety codes

Text Books:

1. Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer, '**Biomedical Instrumentation and Measurements'**, Prentice Hall of India, (2011)
2. Joseph J. Carr and John M Brown, '**Introduction to Biomedical Equipment Technology'**, *Pearson Education*, (4 th edition, 2008)
3. John G. Webster, '**Medical Instrumentation Application and Design**', *Wiley,* (3 edition ,1997)
4. R. S. Khandpur '**Handbook of Bio-Medical Instrumentation'**, *Tata McGraw Hill*, (2nd Edition, 2003)
5. Ronald Pitts Crick, Pang Khaw, 'Text book of Clinical Ophthalmology', *World Scientific publication,* (2nd edition)

Reference Books:

1. Geddes L.A and Baker L.E, '**Principles of Applied Biomedical Instrumentation**', *Wiley-Interscience,* (3 edition, 1989)
2. Joseph Bronzino, '**Biomedical Engineering & Instrumentation'**, *Taylor & Francis,* (3rd edition,2006)

	ME 2104 MACHINE DRAWING	
Teaching Scheme		**Examination Scheme**
Lecture: 1 Hr/week		**In-semester Exam: 25** **Credit: 1**

Prerequisites:		
	Engineering Graphics	
Course Objectives:		
1	Students able to understand conventional representations of common features	
2	Students able to understand sectioning and dimensioning techniques	
3	Students able to understand limits, Fits and tolerance	
4	Students will able to create detail and Assembly drawing using CAD software	
Course Outcomes:		
	Students will be able to	
1	Read engineering drawings with different views, including orthographic views, hidden lines and cross sectional views.	
2	Understand the description of surface roughness, lay waviness and the representations of tolerances and surface finish on engineering drawings.	
3	Draw 2D drawing of engineering objects, engineering drawings with different views, and an assembly of the objects that make up engineered systems.	
4	Understand the use modern drafting software for creating Engineering drawings.	
Unit –I	**Conventions and Standards**	**(02)**
	Need of Graphical Language, Importance of Machine Drawing, Drafting equipment's (from Instruments to Current Software). **Principles of Drawings:** BIS Conventions, ISO standards, Importance of Title Block and Part list, Line types (Lines used in Machine Drawings). **Classification of Machine Drawings:** Assembly Drawing, Part Drawing Detailed Drawing, Catalogues Drawing, Drawing for Instruction Manuals, Schematic Representation, Patent Drawing. **Conventional Representations:** Need and types, IS conventions of Springs, Gear, Shaft, Pipe, Bar, Washers, Knurling, array of holes, Ratchet & Pawl Angle, Channel, Tee, H or Joist Sections, Rivets, Weld, Surface finishing and Machining Symbols.	
Unit –II	**Projections and Dimensioning**	**(03)**
	Projections: Designation, Relative position of views. **Sectioning:** Cutting Planes and Section, Hatching Lines, Half Sections, Aligned Sections, Offset Sections, Sectioning Revolved, Removed Sections, Local Sections, Successive Sections and Thin Sections. **Dimensioning:** Principle of Dimensioning, Dimensioning of Common Features e.g. Diameter, radii, chords, arcs, angles, Counter Sunk, Counter drilled holes, Counter bored holes, chamfered and Counter sunk holes on curved surfaces, Spot Faces, Chamfers, Tapered Features. Addition of Letters and symbols, special indications.	
Unit –III	**Screw Threads and Threaded Fasteners**	**(02)**
	Introduction –Helix Thread terms and Nomenclature, Designation, Threads Form, Form of V Threads, Form of Square Threads, Conventional representations, Threaded fasteners- Bolts, Washers, Types of Bolts, Stud.	

	Types of Nuts, Types of Screw, Designation of Bolted Joints, Stud, Types of Nut Locking Arrangements. Foundation Bolt	
Unit –IV	**Limits, Fits and Tolerance**	**(03)**
	Machining Symbols and surface structure Theory of Conventional Tolerancing, Tolerancing and limit systems, symbols for tolerances, deviations and fits, Method of tolerancing, Tolerance grade. Fits-System of fits, classification of fits, Selection of Fits, Method of indicating fits on drawing.	
Unit –V	**Geometrical Dimensioning and Tolerancing**	**(03)**
	Need of Geometrical Tolerance, Geometrical Characteristics of Symbols, Characteristics(such as Straightness, Flatness, Circularity, Cylindricity etc) Tolerances for Related Features such as Parallelism, Perpendicularity, Angularity, Concentricity, its symbols and interpretations	
Unit –VI	**Assembly drawing and details**	**(03)**
	Assembly Drawings: Introduction, Types of Assembly, Importance of BOM Assembly procedures, Assembly of Engine Parts, Assembly of Machine Tools Parts etc. **Introduction of Computer Aided Drafting:** Computer Aided Drafting and Design, Advantages of Computer Aided Drafting and Design, CAD Software.	

Text Books:	
1	N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay.
2	Gill P. S., “A Text book of Machine Drawing”, Revised Edition K. Kataria and Sons, New Delhi, 2008, ISBN 81-85749-79-5.
Reference Books:	
1	N. Sidheshwsr, P. Kannaiah and V. V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
2	R. K. Dhavan, Machine Drawing. S. Chand and Company
3	Narayana, Kannaiah and Venkatareddv, Machine Drawing, New Age International
4	N. D. Junnarkar Machine Drawing 1st print Pearson Education
5	IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
6	IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
7	IS: 2709-Guide for selection of fits, B.I.S. Publications.
8	IS:919- Recommendation for limits and fits for Engineering, B.I.S. Publications
9	IS: 8000- Part I, II. III. TV, geometrical Tolerancing of technical drawings -- B.I.S. Publications.

ME 2105 Engineering Thermodynamics Laboratory

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme:
Oral: 25
Credits: 1

Prerequisite:
1. Engineering Physics
2. Engineering Chemistry
3. Basic Mechanical Engineering

Course Objectives:
1) To study different types of calorimeters to determine calorific value of fuels.
2) To get conversant with various types of boilers.
3) To get conversant with boiler mountings and accessories.
4) To understand boiler performance calculations.

Course Outcome:
1. Students will be able to conduct trial on calorimeters to determine calorific value of various fuels.
2. Students will gain knowledge about various types of boilers.
3. Students will understand working of various boiler mountings and accessories.
4. Students will be able to do performance calculations for boiler.

List of Experiments: (Any eight)
1. Determination of calorific value using gas calorimeter.
2. Determination of calorific value using bomb calorimeter.
3. Study of various types of boilers.
4. Study of boiler mountings.
5. Study of boiler accessories.
6. Stud of various types of steam traps.
7. Determination of dryness fraction of steam.
8. Trial on boiler to determine boiler efficiency, equivalent evaporation and energy balance.
9. Industrial visit to any process industry which uses boiler and submission of detailed report.

Text Books:

1. P. L. Ballaney, Thermal Engineering: Engineering Thermodynamics and Energy Conversion Techniques, Khanna Publishers
2. S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar, Thermal Engineering, Dhanpat Rai Publisher

ME 2106 – Materials' Technology-I Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral Examination: 25 marks
Credits: 1

Course Objectives:

1 To provide firsthand experience of procedures and equipment required for measuring common mechanical properties of material that are specified in component drawings.

Course Outcomes:

Upon completion of this course, students will be able to:

1 Inspect components and measure mechanical properties of engineering materials using equipments in the laboratory.
2 Propose testing method for mechanical properties considered in design, quality assurance and servicing of engineering components.
3 Prepare reports consisting drawings, graphs, written procedures, observations, results and conclusions.
4 Identify the phases and measure grain size of the material using metallography.
5 Demonstrate an understanding of professional, ethical and social responsibility by applying codes and standard practices on material testing.

Lab work to be accomplished

1. Introduction to Lab safety.
2. Perform Tensile test.
3. Perform Hardness tests (3).
4. Failure analysis based on demonstration of Impact test.
5. Ultrasonic flaw detection.
6. Magnetic particle test.
7. Dye penetrant test.
8. Tasks/ Activity based practical.

ME 2107 Manufacturing Process Lab I

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical examination: 25 Marks
Credits: 1

Course Objectives:
1. To practice lathe operations like turning, taper turning, thread cutting etc.
2. To understand various concepts related to pattern making for casting.
3. To understand joint preparation and welding phenomenon.

Course Outcomes: Student will be able to:-
1. Plan different operations like turning, thread cutting, grooving etc. on lathe machine.
2. Analyze and estimate machining time for different operations on lathe machine.
3. Prepare pattern for sand casting.
4. Select welding joints for different applications.

Term Work:
1. One job on plain and taper turning and screw cutting.
2. Demonstration of pattern making for sand casting.
3. One simple exercise on welding – preparing a component comprising of welding joints.
4. Demo of turning operation on plastic rod to know the difference in machining of metals and plastics (Any of the commercial plastics like Nylon-6, Nylon-66, Polyster, PET etc.)

	ME 2108 MACHINE DRAWING LAB	
Teaching Scheme		**Examination Scheme**
Practical: 2Hr/week		**Practical/Oral Exam: 25** **Credit: 1**

Prerequisites:		
	Engineering Graphics	
Course Objectives:		
1.	To Understand IS conventions, dimensional techniques.	
2.	To draw assembly drawing from part drawing.	
3.	To draw the sectional view of assembly drawing with partlist.	
4.	Students use the drafting software for creating drawing	
Course Outcomes:		
	Students will be able to	
1	Use the IS Convention, dimensional techniques	
2	Create assembly drawing from part drawing.	
3	To draw the sectional view of assembly drawing.	
4	To create assembly drawing using AutoCAD	
	List of Practical	
Sheet 1	**IS conventions**	**(04)**
	A2 Sheet based on various IS conventions (Manual Drawing sheet) Use CAD software to get conversant with modern tools to develop orthographic projections of simple objects studied in Engineering Graphics.	
Sheet 2 and 3	**Assembly Drawing and Detail Drawing**	**(08)**
	Sheets based on 1 Simple Mechanical Assemblies e.g. Flange Couplings, Plummer Block, Bench Vice, Screw Jack, Foot Valve, etc. Application and working of the studied assembly, Use BOM. One Full Imperial sheet of details and assembly of this assignment should be prepared on Auto-CAD.	
Sheet 4 and 5	**Assembly Drawing and Detail Drawing**	**(08)**
	Sheet based on 1Complex Mechanical Assemblies e.g. Tail Stock, Four Jaw Chuck, Tool Head for Shaping Machine etc. Application and working of the studied assembly, Prepare BOM. One Full Imperial sheet of details and assembly of this assignment should be prepared on Auto-CAD.	
Text Books:		
1	N. D. Bhatt, Machine Drawing. Charotor Publication House, Bombay.	
2	Gill P. S., “A Text book of Machine Drawing”, Revised Edition K. Kataria and Sons, New Delhi, 2008, ISBN 81-85749-79-5.	
Reference Books:		
1	N. Sidheshwsr, P. Kannaiah and V. V. S. Sastry. Machine Drawing, Tata McGraw Hill,	

	New Delhi.
2	R. K. Dhavan, Machine Drawing. S. Chand and Company
3	Narayana, Kannaiah and Venkatareddv, Machine Drawing, New Age International
4	N. D. Junnarkar Machine Drawing 1st print Pearson Education
5	IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
6	IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
7	IS: 2709-Guide for selection of fits, B.I.S. Publications.
8	IS:919- Recommendation for limits and fits for Engineering, B.I.S. Publications
9	IS: 8000- Part I, II. III. TV, geometrical Tolerancing of technical drawings -- B.I.S. Publications.

ME 2201 : Strength of Materials

Teaching Scheme

Lecture: 3 Hrs/week

Tutorials: I Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 4

Prerequisites:

I. Engineering Mechanics

Course Objectives:

- To gain knowledge of different types of stresses, strain and deformation induced in the mechanical components due to external loads
- To study the distribution of various stresses in the mechanical elements such as beams, shafts etc.
- To study Effect of component dimensions and shape on stresses and deformations

Course Outcomes:

Upon completion of this course, students will be able to:

- Demonstrate fundamental knowledge about various types of loading and stresses induced.
- Draw SFD and BMD for different types of loads and support conditions.
- Compute and analyse stresses induced in basic mechanical components.
- Design cross section of beam for slope and deflection in beam.
- Analyse buckling and bending phenomenon in columns and beams respectively.

Unit I: Simple Stresses and Strains (7 hrs)

Concept & types of Stresses and strains, Poison's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading.

Unit 2: Shear Force and Bending Moments (9 hrs)

Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, iv) uniformly varying loads and (v) application of moments, relation between the rate of the shear force and the bending moments.

Unit 3: Bending and Shear Stresses in Beams (6 hrs)

Bending stresses in beams with derivation & application to beams of circular, rectangular, I-T and channel sections, and composite beams, shear stresses in beams with combined bending, torsion & axial loading of beams.

Unit 4: Slope and Deflection (9 hrs)

Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method. Calculations for Compound slope and deflection of (i) cantilevers and simply supported beams with or without overhang under concentrated load, uniformly distributed loads or combination of concentrated and uniformly distributed loads

Unit 5: Torsion of Circular Members (8 hrs)

Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Numerical.

Thin Cylindrical and Spherical Shells: Cylinders and Spheres due to internal pressure. Cylindrical Shell with hemispherical end.

Unit 6: Compound Stresses and Strains (6 hrs)

Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr' s circle of stresses.

Text Books:

- Strength of Materials, Subramanyam, Oxford University P ress, Editi on 2
- Mechanics of Materials, Thi n Cylindrical and Spherical Shells: B _C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, NewDelhi.

Reference Books:

- Strength of Materials, Basavarajaiah and Mahadevappa Khanna Publishers, New Delhi.
- Strength of Materials, Singer Harper and Row Publications..
- Elements of Strength of Materials, Timoshenko and Young Affiliated East West Press.
- Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning.

- Strength of Materials S. Ramamrutham, DhanpatRai Pvt. Ltd.
- Mechanics of Materials S. S. Rattan, TMH Pvt. Ltd.
- Mechanics of Structures S. B. Junnarkar, Charotar Publication.
- Strength of Materials W. Nash, Schaum's Outline Series, McGraw Hill Pub

ME2202 Fluid Mechanics

Teaching Scheme

Lecture: 3 Hrs/week

Tutorials: 1Hr/week

Examination Scheme

In semester: 25 marks

End semester: 50 marks

Credits: 3

Prerequisite:- Engineering Physics, Engineering Mathematics

Course Objectives:

- Applying the mass conservation principle, to engineering problems.
- Applying the momentum and energy equations to engineering problems.
- Evaluating head loss in pipes and conduits.
- Introduction to formation of boundary layer and drag and lift concepts associated with it

Course Outcome:

- Student will able to apply mass conservation principle for the given system
- Student will able to understand the energy conservation principle for fluid flow
- Student will able to calculate the pressure drop for given system
- Student will able to explain the boundary layer formation on the flat plate

Unit 1: Fluid Properties **(6)**

Applications of fluid mechanics, Basic tensor and vector calculus, Definition and characteristics of Fluids, Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematics Viscosity, Surface Tension, Capillarity, Compressibility, Vapor pressure. Pascal's Law, Centre of pressure, Buoyancy and flotation

Unit 2: Fluid Kinematics **(6)**

Eulerian and Lagrangian fluid description, Types of flows (One , two, three dimensional , steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational, Visualization of flow field (Stream, Path and Streak line), Fluid Acceleration and Material Derivative, vorticity in two dimensional flow, Control volume approach for solution.

Unit 3: Fluid Dynamics **(8)**

Flow Analysis using Control volume Approach, Continuity and Linear momentum Equation. Flow Analysis using differential Approach: Continuity and linear momentum equation. Euler equation of motion, Derivation Bernoulli's equation along and normal to Stream line, application of Bernoulli's equation to Pitot tube, Orifices and Venturi meter

Unit 4: Internal Flow (6)

Entrance region and fully developed flow. Pressure and Shear Stress distribution for laminar flow in a pipe and plane Poiseulle flow, Fully developed Turbulent flow, Transition from laminar to turbulent, Velocity profile of Turbulent flow, Introduction to Navier – Stokes Equation and Exact Solution to Plane Poiseulle flow

Unit 5: Flow through Pipes (6)

Energy losses through pipe, Major and Minor Darcy-Weisbach equation, Moody's diagram, Dimensional Analysis-Dimensions of physical quantities, dimensional homogeneity, Buckingham pi Theorem, important dimensionless numbers, Model analysis (Reynolds, Froude and Mach).

Unit 6: External Flow (6)

Boundary layer Structure and Thickness on Flat plate, Effect of Pressure Gradient on Boundary layer, Separation of Boundary Layer and Methods of Control, Lift and Drag concepts , Drag – Pressure and Friction, Drag Coefficient, Lift - Surface pressure Distribution and Circulation

Text Books and References:

1. Munson, Okiishi, Young, 'Fluid Mechanics', 7th Ed,Wiley, 2016.
2. Cengel, Cimbala, 'Fluid mechanics', Tata Mcgraw hill publishing
3. Gupta and Gupta, 'Fluid Mechanics', 3rd Ed, New Age publications, 2016.
4. Kundu, Cohen, Dowling, 'Fluid Mechanics', Elsevier India
5. K. Muralidhar, G. Biswas, 'Advance Fluid Mechanics', 3rd Edition, Narosa Publishing House
6. Fox, Mcdonald, 'Fluid Mechanics', 8thEdition, Wiley.

ME 2203 Manufacturing Process II

Teaching Scheme
Lectures: 3Hrs/week
Practical: 2 Hrs/week

Examination Scheme
In Sem.- I, II : 50marks
End Sem.: 50 Marks
Credits: 3

Objectives:
1. To familiarize with the basic concepts of machining science.
2. To acquaint with various single and multipoint cutting tools designing processes.
3. To make the students understand the economics of machining process.

Course Outcomes:
Students will be able to:
1. Analyze principles and working of different forming processes such as sheet metal working, forging, rolling and extrusion.
2. Evaluate cutting force, power, tool life, surface finish for machining operation.
3. Select an appropriate single or multipoint cutting tool parameter.
4. Apply features and applications of non-traditional machining process.
5. Incorporate use of different locating and clamping devices for jigs and fixture design.

Unit 1: Sheet metal working and forging:

Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working. Forging, other deformation processes related to forging; Wire and Tube drawing; Sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; defects.

Unit 2: Rolling, Extrusion, shaping process for plastic:

Rolling, extrusion, types and analysis. Plastic: types, plastic production processes, injection molding, compression and transfer molding, blow molding and rotational molding; defects.

Unit 3: Metal Cutting Theory:

Orthogonal and oblique cutting, various types of chips, Mechanics of orthogonal steady state metal cutting, shear plane and shear plane angle, Merchant's circle of forces, velocity relations. Merchant's theory & modified theory of metal cutting. Concept of specific power consumption in machining. Cutting forces measurement using dynamometers.

Surface Integrity and Cutting fluids: Measurement and specification of surface finish, Function of coolant, types of coolants and cooling system. Major tool material types. Tool life and machining economics: types of tool wear Taylor's tool life equation: Components of product cost, Optimum cutting velocity for minimum cost of production and maximum production rate.

Unit 4: Design of cutting tools:

Design of shanks, cutting tip and chip breakers for HSS.

Study of machining tool's Nomenclature: Various types such as flat form tool, tangential form tool, circular form tool, constructional details and fields of application. Profile design of flat and circular form tools. Nomenclatures of Broach, Drills, Reamers,: Taps and Milling cutters.

Unit 5: Unconventional machining processes:

Classification according to type of energy used for machining, basic principles, machines, applications of Electrical discharge machining (EDM), Electron beam machining (EBM), Plasma arc machining (PAM), Laser beam machining (LBM), Ultrasonic machining (USM), Abrasive jet machining (AJM).

Unit 6: Basic Construction of Jig & Fixture:

Degrees of freedom, redundant location, fool proofing, nesting, Material used.

Locators: types and there functions; locating & clamping Devices: Position, types of mechanisms and there functions. Component distortion under clamping and cutting forces. Design of simple Jig and Fixtures.

Text Book:

1. Fundamentals of modern manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication

Reference Books:

1. Fundamentals of Metal Machining and Machine Tools, Third Edition by Winston A. Knight, Geoffrey Boothroyd, CRC press Taylor and Francis group.
2. Metal Cutting Principles (2nd Edition), by Milton Clayton Shaw, Oxford University Press.
3. Cutting Tools, by P. H. Joshi, A. H. Wheeler Publishing Co. Ltd.
4. ASM Handbook, Vol. 16: Machining (9th Edition), by Joseph R. Davis, ASM International.
5. Fundamentals of Metal Cutting and Machine Tools (2nd Edition), by B. L. Juneja, G. S. Sekhon and Nitin Seth, New Age International Pvt. Ltd.
6. Metal Cutting Theory and Cutting Tool Design, by V. Arshinov and G. Alekseev, Mir publishers, Moscow, Mir Publishers.
7. Production Technology by HMT.
8. Jig and Fixture Design Manual, Erik K. Henriksen, Industrial Press.
9. An introduction to jig and tool Design, M.H.A. Kempster, III Ed., Pub Hodder and Stoughton.
10. Jigs and Fixture, P.H. Joshi, Tata McGraw-Hill.
11. Tool design, C. Donaldson, George H. Lecain, V.C. Goold, Tata McGraw-Hill
12. Jigs and Fixture Handbook, A.K. Goroshkin, Mir Publication.
13. Jigs and Fixture, ASTME.

ME 2204 Rigid Body Dynamics

Teaching Scheme
Lecture: 2 Hrs/week
Tutorials: Nil

Examination Scheme
In semester: 25 marks
End semester: 25 marks
Credits: 2

Prerequisites:
1. Engineering Mathematics
2. Engineering Mechanics
3. Physics

Course Objectives:
1. To present the basic principles of rigid body dynamics
2. To help develop proficiency in applying these principles to formulate and solve dynamics problems.

Course Outcomes:
Upon completion of this course, the student will be able to:
1. Apply impulse/momentum methods to kinetics problems of particles, rigid bodies, and systems
2. Analyze dependent motion of particles
3. Analyze planar rigid body kinematics problems
4. Apply Newton/Euler methods to kinetics problems
5. Apply work/energy methods to kinetics problems of rigid bodies

Unit 1: Kinetics of a Particle: Dependant Motion, Impulse and Momentum
System of Particles - Dependant Motion, Principle of Linear Impulse and Momentum, Principle of Linear Impulse and Momentum for a System of Particles, Conservation of Linear Momentum, Central Impact

Unit 2: Planar Kinematics of a Rigid Body
Planar Rigid-Body Motion, Translation, Rotation about a Fixed Axis, Absolute Motion Analysis, Relative-Motion Analysis: Velocity, Instantaneous Centre of Zero Velocity, Relative-Motion Analysis: Acceleration, Relative-Motion Analysis using Rotating Axes (Coriolis Component of Acceleration)

Unit 3: Planar Kinetics of a Rigid Body: Force and Acceleration
Moment of Inertia, Planar Kinetic Equations of Motion, Equations of Motion: Translation, Equations of Motion: Rotation about a Fixed Axis, Equations of Motion: General Plane Motion

Unit 4: Planar Kinetics of a Rigid Body: Work and Energy
Kinetic Energy, Work of a Force, Work of a Couple, Principle of Work and Energy, Conservation of Energy

Unit 5: Planar Kinetics of a Rigid Body: Impulse and Momentum
Angular Momentum, Relation Between Moment of a Force and Angular Momentum, Principle of Angular Impulse and Momentum, Linear and Angular Momentum, Principle of Impulse and Momentum, Conservation of Momentum, Eccentric Impact

Text Book:
1. Engineering Mechanics – Dynamics, R. C. Hibbeler, 12th Edition, Pearson publication https://docs.google.com/file/d/0B4FucDjPtPAedTZpWllOcWhwOGM/edit

References:

1. Engineering Mechanics – Statics and Dynamics, A Nelson, Mc Graw Hill Education
2. Vector Mechanics for Engineers-Dynamics, Beer and Johnson, Mc Graw Hill Education
3. Engineering Mechanics- S. Timosenko. DPT.young & J.V.Rao- Tata Mc Graw hill education pvt. Ltd. New Delhi.

ME 2205 – Materials' Technology II

Teaching Scheme
Lecture: 1 Hrs/week
Tutorial: 1 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 25 marks
Credits: 2

Prerequisites:
1 Materials Technology I

Course Objectives:
1 To develop an understanding on modification of material properties.
2 To do material selection.

Course Outcomes:
Upon completion of this course, students will be able to:
1 Read binary phase diagram, predict and quantify phase transformation using phase diagrams.
2 Select method for modification of properties.
3 Analyze and translate performance requirements of a component into required mechanical properties of material reaching conclusions using first principles of engineering sciences.
4 Apply available methods for selection of material for a given application.

Unit 1: Phase diagrams **(5 hrs)**
Phase diagrams, cooling curves, plotting of phase diagrams, Iron-iron carbide equilibrium diagram. Non equilibrium cooling and its effects.

Unit 2: Modification of properties **(5 hrs)**
Strengthening mechanisms; Alloying, cold working, heat treatment methods.

Unit 3: Selection of Materials **(5 hrs)**
Translation of performance requirements into properties, selection of material for given application, material indices, material selection and specification.

Text Books:

1 "Callister's Material Science and Engineering", W.D. Callister, D.G.Rethwisch, Wiley, 2016,Second edition.

Reference Books:

1 "Material Science & Engineering." Raghvan V., Prentice Hall of India, New Delhi. 2003.
2 "Properties of Engineering materials", R.A. Higgins, ELBS, Edward Arnold. 1988.
3 "Engineering Metallurgy", Higgins R. A., Viva books Pvt. Ltd., 2004).
4 "Mechanical Metallurgy", Dieter, G.E., McGraw-Hill, 1988
5 "Introduction to Physical Metallurgy", Avner, S.H., Tata McGraw-Hill, 1997
6 "Material selection in mechanical design", Michael Ashby, Butterworth-Heinemann, 3/e, 2005.

ME 2206 Fluid Mechanics Lab

Teaching Scheme
Lab: 2 Hrs/week

Examination Scheme
Oral: 25 marks
Credits: 1

Objectives:

- Introduction to the basics of experimental techniques in fluid mechanics

Course Outcome:

- Student will understand the basic experimental techniques in fluid mechanics

List of experiments

1. Measurement of Viscosity and Sp. Gravity
2. Measurement of Pressure and velocity
3. Measurement of coefficient of orifice
4. Verification of Bernoulli's theorem
5. Calibration of Venturi/Orifice meter
6. Flow visualization using Reynolds Apparatus
7. Measurement of coefficient of friction in pipe
8. Verification of momentum equation

Text Books and References:

1. Instrumentation, Measurements, and Experiments in Fluids, E. Rathakrishnan , CRC Press .
2. Fluid Mechanics Measurements Taylor & Francis Inc, Richard J. Goldstein, Taylor & Francis Inc
3. Springer Handbook of Experimental Fluid Mechanics, by Cameron Tropea (Editor), Alexander Yarin (Editor), John F. Foss (Editor)

ME 2207 Manufacturing Process II Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical Examination. 25 Marks
Credits: 1

Objectives:

1. To practice machining of flat surfaces on shaping and grinding machines.
2. To practice milling, boring and thread cutting operations.

Outcomes: Learner should be able to:-

1. Develop assembly of different manufactured components using machine tools like lathe machine, drilling machine, milling machine etc.
2. Analyze and estimate machining time for lathe machine, drilling machine, milling machine etc.
3. Express plastic molding.
4. Demonstrate machining of non-metals.

Term Work:

1. One composite job consisting of minimum four parts, employing operations on lathe, precision turning, screw cutting, boring etc. and involving the use of milling and grinding operations.
2. Demo of injection molding of plastic parts.
3. Demo on machining of Glass Fiber Reinforcement Plastic (GFRP) composite material, Drilling and edge milling operation are to be studied (Any of the commercial available GFRP/Epoxy plates are to be used).

ME 2208 Rigid Body Dynamics Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral: 25 Marks
Credits: 1

Prerequisites:
1. Engineering Mathematics
2. Engineering Mechanics
3. Physics

Course Objectives:
1. To present the basic principles of rigid body dynamics
2. To help develop proficiency in applying these principles to formulate and solve dynamics problems.

Course Outcomes:
Upon completion of this lab course, the student will be able to:
1. Apply impulse/momentum methods to kinematics and kinetics problems of particles, rigid bodies, and systems
2. Analyze planar rigid body kinematics problems
3. Apply Newton/Euler methods to kinematics and kinetics problems
4. Apply work/energy methods to kinematics and kinetics problems of rigid bodies

List of Experiments:

Expt. No.	Experiment Details	CO
1	To determine MI of a connecting rod using compound pendulum method	CO.3
2	To determine MI of a flat bar using bifilar suspension method	CO.3
3	To determine MI of a circular disk using trifilar suspension method	CO.3
4	To determine coefficient of restitution for an oblique impact	CO.1
5	To verify conservation of momentum principle for impact of two rigid bodies	CO.1
6	To find velocity and its angle using conservation of energy principle	CO2
7	Assignment to solve kinetics problem using Newton/Euler method	CO.3
8	Assignment to solve kinetics problem using work/energy method	CO.4

Text Book:

1. Engineering Mechanics – Dynamics, R. C. Hibbeler, 12th Edition, Pearson publication https://docs.google.com/file/d/0B4FucDjPtPAedTZpWllOcWhwOGM/edit

References:

1. Engineering Mechanics – Statics and Dynamics, A Nelson, Mc Graw Hill Education
2. Vector Mechanics for Engineers-Dynamics, Beer and Johnson, Mc Graw Hill Education
3. Engineering Mechanics- S. Timosenko, D.P.T. Young and J.V. Rao, Tata Mc Graw hill Education

ME 2209 – Materials' Technology-II Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral Examination: 25 marks
Credits: 1

Course Objectives:

1. To provide first-hand experience of facilities for materials property testing and treating.
2. To provide an understanding of structures in material and their relation to properties.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Identify the phases and measure grain size of the material using metallography.
2. Provide interpretation of microstructures and prepare a laboratory report.
3. Apply correlation of science, mathematics and engineering principles to material processing and modify properties of steel by modifying microstructure using different heat treatments.
4. Understand and use methods utilized for selection of materials.

Lab work to be accomplished

1. Metallurgical microscope and metallographic preparation of specimen.
2. Study and draw microstructure of steel.
3. Study and draw microstructure of Cast iron.
4. Study and draw microstructure of Non ferrous metal and alloys.
5. Task based activity to measure, predict and achieve a certain set of mechanical properties in a material. This will involve conducting test, working on feasibilities, planning heat treatment and achieving results.
6. Study of material selection methods.

ME 2210 Solid Modeling Lab

Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/week	End semester: 25 marks
	Credits: 1

Course Objectives:

1. To develop an ability to create a 3D solid model of machine components.
2. To develop an ability to create 3D assembly model of mechanical system.
3. To demonstrate the rapid prototyping technique.

Course Outcomes:

After completing the course students will be able to

1. Create 3D machine components by using a solid modeling software package.
2. Create 3D assemblies of mechanical systems.
3. Create manufacturing drawing with required tolerances.
4. Create parametric solid model of a machine component.

List of Assignments:

1. Assignment on Solid modeling of simple and intricate machine and automobile components.
2. Assignment on parametric solid modeling of a machine component using various commands and features of the software.
3. Assignment on assembly modeling.
4. Generation of production drawings of the parts and assembly with appropriate tolerances.
5. Assignment on rapid prototyping.

MED 1101 Advanced Mathematics and Numerical Techniques

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1 Hr/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 4

Course Objectives:

1. To understand the philosophy and general procedure of Linear algebra applied to complex engineering problems
2. To familiarize students with the concepts of Ordinary and Partial Differential Equations and to introduce related analytical and computer tools.
3. To provide a bridge between hand calculations based on advanced mathematics and numerical solutions for more complex states.
4. To study approximate nature of the numerical methods and convergence of results are examined.
5. To provide some experience with a commercial MATLAB code and some practical modeling exercises

Course Outcomes:

On completion of the course, students will be able to -

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Implement numerical methods in MATLAB.
5. Write efficient, well-documented MATLAB code and present numerical results in an informative way.

Unit 1: Linear Algebra **8 Hrs**

Matrices and systems of linear equations; Solution of **Ax = b** (Gauss elimination/ Gauss-Jordan elimination, Rank of matrix); Vectors in n-dimensions; Linear dependence and independence of vectors; Matrix Arithmetic; Inverse of a matrix; Jacobi and Gauss-Seidel Iterative Methods; LU decomposition; Cholesky Method; Determinants of square matrices, minors and cofactors; Adjoint of a matrix; Norm and inner product of vectors; Orthogonal vectors and matrices; Eigenvalues; Diagonalization and Quadratic forms.

Unit 2: Ordinary Differential Equations: **7 Hrs**

Introduction, Classification of ODE's, Linear differential equations of n-th order with constant coefficients (homogeneous and non-homogeneous), Solutions of systems of linear differential equations (homogeneous and non-homogeneous); Initial Value Problem -- Solution Concept, Euler's Method, Modified Euler's Method, Heun's Method, First, second, third and fourth order Runge-Kutta methods, Predictor-corrector method; Boundary Value Problem – Solution Concept for second order equation using Finite Difference Methods.

Unit 3: Partial Differential Equations: **6 Hrs**

Introduction and classification of linear partial differential equations of second order (Parabolic, Elliptic and Hyperbolic), Solutions for homogeneous forms for a variety of boundary conditions using Finite Difference Methods -- Elliptic and Parabolic equations.

Unit 4: Numerical Differentiation and Integration **6 Hrs**

<u>Numerical Differentiation</u>: Definition of derivatives, Engineering applications, basic finite difference

method, Taylor's series expansion, Difference operators, Differentiation of interpolating polynomials
Numerical Integration: Engineering Applications, Newton Cotes formulae, Simpson's, Richardson's extrapolation, Romberg integration, Gauss Quadrature for double and triple integration, Integration in two and three dimensional domains

Unit 5: Curve Fitting and Interpolation 5 Hrs

Introduction, Engineering applications, Collocation polynomial fit, Interpolation using Splines (Step, Linear, Quadratic, Cubic), Least-Squares regression (Linear, Polynomial, Non-Linear, Linearization)

Unit 6: Transforms: 6 Hrs

Concept of transforms, Fourier transforms, Applications to partial differential equations, Laplace transforms and its inverse, Laplace transform of special functions: Unit step, Unit impulse, Periodic and Error. Applications to initial value problem and wave equation using transform techniques.

Books:

1. S.S.Rao, *Applied Numerical Methods for Engineers and Scientists,* Prentice Hall, 2002
2. Steven C. Chapra, *Applied Numerical Methods with MATLAB for Engineers and Scientists,* TATA McGRAW-HILL, 3rd Edition, 2012
3. Erwin Kreyszig, *Advanced Engineering Mathematics,* Wiley Eastern Ltd., 10th Edition, 2004.
4. Peter V. O' Neil, *Advanced Engineering Mathematics*, Thomson Brooks Cole, Singapore, 5th ed.

MED 1102 Design of Experiments and Research Methodology

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/week	In semester: 50 marks
Tutorial: 01 Hr/Week	End semester: 50 marks
	Credits: 4

Prerequisite: Technical Seminar, Mini/Minor Project and Major/Final year B.E./BTech. Projects.

Course Objectives: Students are expected to –

1. Understand Phases of Research, Types of Research,
2. Understand concept and application of Research Methodologies and Statistical Techniques used in research.
3. Understand concept and application of System Engineering
4. Understand of the key elements of Systems Engineering
5. Understand systems engineering processes, requirements analysis, interface definition and management, system models, and design validation techniques

Course Outcome:

1. Students will be capable to do critical literature review and formulate the research problem.
2. Students will be capable to do select appropriate Research Method(s) and Statistical Techniques used in research.
3. Students will be able to analyse the major activities of the systems engineering process.
4. Students will be able to apply the system engineering.

Course Description:

- Research Methodology component of this course is designed to impart education in the foundational methods and techniques of research. Research scholars would examine and be practically exposed to the main components of a research process and framework i.e., literature review, problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, students would be well placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.
- Systems engineering component of this course is designed to impart an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and reliability improvement while considering the complete problem including operations, performance, test, manufacturing, cost and schedule. This course emphasizes the links of systems engineering to fundamentals of decision theory, statistics, and optimization. The course also introduces the most current, commercially successful techniques for systems engineering.

Unit 1: Research Problem definition and research methodologies **6**

- Introduction to research: Definitions and characteristics of research; Types of research; Main components of any research work. Scope and objectives of research problem. Criteria / Characteristics of a good research problem, Errors in selecting a research problem.

- Literature review and Problem identification: Purpose of literature review; Source of information; Organization of information, Identifying gap areas from literature review and formulating the problem statement.
- Research design and Work Plan: – Research design – Basic Principles- Need of research design Features of good design – Important concepts relating to research design; Work Plan
- Writing a research report: Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student.

Unit 2: Data Collection, Analysis and Applied Statistics **6**

- Study of : Population; Variables; Sampling; Sample size determination; Plan for data collection; Methods of data collection; Plan for data processing and analysis; Ethical considerations.
- Co-relation analysis, Regression analysis, Parameter estimation, Multivariate statistics.

Unit 3: Introduction to Mathematical Modeling and Design of Experiment **6**

- Mathematical Modeling : Introduction, Modeling methods, examples from engineering
- Design of Experiment : Introduction to: Full Factorial Method Taguchi DoE, Response Surface Method

Unit 4: Systems Engineering in New Product Development **6**

- What is SE? - Origin and evolution - Definitions of systems - Need of Systems Engineering - Objectives of SE –Importance - Relation of SE to architecture
- Introduction to the Systems Engineering Process - SE relationship to the generic Product Development (PD) Process – Systems Engineering & Program Management

Unit 5: Requirements Development and Management **7**

- Requirement Development Process - Requirement Elicitation - Sources of Requirements
- Quality Functional Deployment (QFD)
- Requirements Attributes – Rationale - Conditions of operation – How to write good requirements – Requirement Validation
- Boundary diagrams - Interface definition and management - Managing changes to Requirements

Unit 6: System Design, Analysis, Verification and Validation **7**

- Concept Selection - Managing System Interactions – Design Structure Matrix (DSM) - System Architecture - System integration – Design for X - Design Optimization - Design reviews
- Risk/uncertainty management – Design Failure Modes and Effects Analysis (DFMEA) - Technical Performance Measure (TPM) – Critical Parameter Management (CPM)
- Verifying process capability - Design verification and validation plan – Execution – Interpretation - Reliability

Text Books:

1. Research methodology: an introduction for science & engineering students', by Stuart Melville and Wayne Goddard
2. 'Research Methodology: A Step by Step Guide for Beginners', by Ranjit Kumar, 2nd Edition
3. 'Research Methodology: Methods and Trends', by Dr. C. R. Kothari.
4. Systems Engineering Principles and Practice, 2nd Edition, A. Kossiakoff, W. Sweet, and S. Biemer, Wiley Series in Systems Engineering and Management, Wiley Interscience, 2011.

References:

1. Creswell, J. W. Research design: Qualitative, Quantitative and Mixed Methods Approaches. 4th Ed. Thousand Oaks, CA: Sage, 2014.
2. ‘Research Methodology: An Introduction’ by Wayne Goddard and Stuart Melville
3. System Engineering Management, Benjamin Blanchard, Wiley & Sons, Inc., 2008
4. The Engineering Design of Systems: Models and Methods, Dennis M. Buede, John Wiley & Sons, Inc., 2000.
5. Customer – Centered Products, Amacom, IvyF Hooks and Kristin A Farry
6. Systems Engineering Handbook: A ‘What to’ Guide for All SE Practitioners, INCOSE-TP-2003-016-02, Version 2a, 1 June 2004 http://www.incose.org/ProductsPublications/sehandbook.

MED1103 ADVANCE MECHANICS OF MATERIALS

Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/week	**Theory: 25+25+50**
	Credit: 3

Prerequisites

Applied Mechanics, Strength of Materials, Engineering Materials

Course Objectives

Introduce students to

1 basics of theory of elasticity
2 basics of theory of plasticity
3 fracture mechanics and fatigue behavior of material
4 nature and behavior of composite materials

Course Outcomes

Students will be able to

1 solve the problems on theory of elasticity
2 solve the problems on theory of plasticity
3 understand the fracture mechanics and fatigue failure of the material
4 understand the composite material and its failure criteria

Unit 1 Theory of Elasticity **(10)**

Analysis of stress and strain, Stress–Strain Relations for Linearly Elastic Solids, Yield Criteria and Introduction to ideally Plastic Solid.

Unit2 Theory of Plasticity **(10)**

Non-linear material response, Yield criteria: maximum principal stress criteria, maximum principal strain criteria, strain-energy density criteria, alternative yield criteria, general yielding.

Unit3 Introduction to fatigue and fracture mechanics **(10)**

Stress life: S-N diagram, Mean stress effect, modifying factors, Strain-life: material behavior, strain-life curve, fatigue properties, mean stress effect, Brittle Fracture, Stress Intensity Factor, Fracture Toughness, Fracture Conditions, Fracture Modes, Plane Stress and Plane Strain, Plastic Collapse at a Notch, Experimental Determination of K_Ic, Strain-Energy Release Rate, Meaning of Energy Criterion, Design Consideration.

Unit4 Mechanics of Composite Materials **(10)**

Stress–Strain Relations, Basic Cases of Elastic Symmetry, Laminates, Ply Stress and Ply Strain, Failure Criteria of Composite Materials, Micromechanics of Composites.

References

1 Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw-Hill
2 Advanced Mechanics of Materials, A. P. Boresi, Wiley
3 Theory of Elasticity, S. P. Timoshenko, Mc Graw Hill
4 Fundamentals of metal Fatigue, J. A. Bannantine, Prentice Hall
5 Mechanics of Composite Materials, A. K. Kaw, CRC Press

MED1104 DESIGN OF TRIBOSYSTEMS

Teaching Scheme
Lecture : 3 Hrs/week

Examination Scheme
In semester : 50 marks
End semester : 50 marks
Credits : 3

Course Objectives:

1. To understand and system level functioning of a frictional process and lubrication system
2. To learn contact stress analysis of a frictional processes
3. To study material properties for a bearings
4. To understand design process of tribological systems

Course Outcomes:

Students will be able to:

1. Identify the system model of a lubrication system
2. Perform contact stress analysis of a frictional process
3. Select materials for bearings and lubricant oil specifications
4. Design a lubrication system for a mechanical system

UNIT I : System Concept for Tribosystems

Application of system concepts to tribology, Function of Tribomechanical systems, Structure of Tribo-mechanical systems, Tribological interaction, Functional plane, mechanical work plane, thermal plane and material plane.

UNIT II: Friction and Wear Process

Role of tribo processes in mechanical systems, Wear as a system property. Contact Mechanics, number of bodies taking part in contact process, macro geometry of bodies, Deformation mode; elastic , plastic and elastic-plastic, Types of relative motion; static contact, rolling contact, sliding contact, contact physics and geometry, contamination layer, absorbed gas layer, oxide layer, work hardened layer, metal substrate.

UNIT III: Bearing Materials

Materials for various tribo-components, materials for plane bearing, materials for gear, materials for brakes, clutches, materials for Internal combustion engines, ceramics and special alloys, cermets, polymer materials, selection considerations in design.

UNIT IV: Design of Tribological Systems

Design of various tribo-elements; such as: Plane bearing, Gear, Seals, Piston and cylinder, Friction devices, cutting tools, chains. Design of lubrication systems.

Text Book:

1. Czichos, H., "Tribology: A system approach to the science & technology of friction, lubrication and wear,"– Tribology Series 1, Elsevier Scientific Publishing Company, Amsterdam, Netherland, 1978.

Reference Books:

1. Peterson, M. B., Winer, W. O., "Wear Control Handbook," ASME, N. Y., 1992.
2. Glaeser, W. A., "Tribology: Materials for Tribology," –Tribology series – Vol. 20, Elsevier,N. Y. 1992.
3. Stolarski, T., "Tribology in Machine Design", Butterworth-Heinemann, N. Y., 1990

MED1105 DESIGN OF TRIBOSYSTEMS LAB

Teaching Scheme	**Examination Scheme**
Lecture : 2Hrs/week	End semester : 50 marks
	Credit/s : 1

Course Objectives:

1. To learn experimental methods to determine coefficient of friction
2. To demonstrate rolling failure of wear of materials
3. To study material properties for lubricants and bearings
4. To understand design process of tribological systems

Course Outcomes:

Students will be able to:

1. Determine coefficient of friction experimentally for various materials
2. Determine wear rate experimentally for various materials and dynamic conditions
3. Select materials for bearings and lubricant oil specification
4. Analyse and simulate friction and wear processes

List of Experiments: (Any 5)

1. Determine the coefficient of friction for different conditions and different material pairs.
2. Experiments on wear measurement.
3. Study effect of lubricants and their properties on friction and wear.
4. Study effect of additives on lubricant performance.
5. Experiment on gas lubricated bearing.
6. Experimental study on Journal bearing performance.
7. Simulation of friction and wear mechanisms

Assignment:

Design of **Any one** tribo-element; such as: Plane bearing, Gear, Seals, Piston and cylinder

MED1106ADVANCE MECHANICS OF MATERIALS LAB

Teaching Scheme	**Examination Scheme**
Practical: 2Hrs/week	**Oral Exam: 25 M**
	Credit: 1

Course Objectives

	Introduce students to
1	details of fracture testing
2	basics of physical property testing
3	mechanical property testing
4	FEA of machine element

Course Outcomes

	Students will be able to
1	Test and interpret the results of fracture testing
2	Test and interpret the results of physical property testing
3	Test and interpret the results mechanical property testing
4	Perform the FEA of machine element and interpret the results

Assignments

1 Testing of Fracture toughness of Single Edge Notch Bend specimen.
2 Fatigue life estimation of the test specimen.
3 Physical properties of polymer matrix composites.
4 Testing of Mechanical properties of polymer matrix composite (Tensile/Flexural/Impact).
5 FEA of machine member by using commercial software for stress distribution, stress concentration.

(MED 1103) Automation and Control Technology

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/week	T1 + T2 = 50 Marks
Total Credit =3	End Sem= 50 Marks

Objective:
1) Study of an Automation System elements and types of Automation systems.
2) Understanding the Principles of Operations of Sensors, Transducers and Actuators.
3) Study of a Complete Mechatronics System design through various case studies.
4) Implementation of an Automatic Control technology through PLC, SCADA & HMI
5) Study of System Modelling, Stability concept and various modes of Controllers.

Outcomes:
1) At the end of the course the student will be able to correlate manufacturing and Electronics interfaces for automation of the systems.
2) Student will understand the working principle and apply the knowledge of sensors and Actuators through measurement, Signal conditioning for Automatic control systems.
3) Students will be able to identify the elements of Mechatronics and Automation Systems.
4) Students can apply the knowledge of Mechatronics System Design for automation of any Production line.
5) Students can remember and analyse the Mathematical Model for any Mechanical system.

Unit I : Introduction to Automation technology **(7)**

Automation & Its Importance, Mechanisation Vs Automation, Automation Applications, Social Issues of automation, Elements of automated systems, advanced automation functions, levels of automation, types of automation, Fixed, programmable, flexible, Hard & soft automation, Fundamentals of automated production lines, material handling in automated systems, Group technology.
Automated guided vehicle (AGV) systems: types, guiding techniques, AGV system design, Inspection techniques in automation.

Unit II: Automatic Control System **(5)**

Control System Definition, Open loop and closed loop Control system, Examples, Feedback and Feed Forward Control System, Transfer Function. Block diagram reduction techniques, Signal flow Graphs-Mason's Gain Formula

Unit III: Transducers and Actuators **(7)**
Introduction and Elements of Mechatronics sytem, Measurement system,
Sensors and Transducers: Potentiometers, LVDT, Position Sensors, Optical Encoders, Proximity Sensor, Temperature Sensor, Strain Guage, Flow Sensors, Level and Pressure switch.
Actuators: Piezo and Shape Memory Alloy actuators, Stepper Motor, Servomotor, Solenoid Valve Interfacing of various sensors and transducers using suitable kit.

Unit IV: Mechatronics System Design **(7)**

Traditional and Mechatronics design concepts. Mechatronics design process. Mechatronics Control in Automated Manufacturing, Signal Conditioning, D/A & A/D Conversion

Case Studies of Mechatronics system design- Car Engine Management System, Washing Machine, Pick and Place Robot, Conveyor based Material Handling System, PC based CNC Drilling Machine.

Unit V: Programmable Logic Controllers (PLC's) **(7)**

Introduction-Basic Structure, PLC operating Cycle, Specifications, Advantage of PLC over Relay system, Input and Output devices, Selection of PLC, Ladder Programming-Mnemonics-Timers, Counters, SCADA,MTU and RTU Functions, HMI.

Unit VI: System Modelling &Controller Modes **(6)**

System Models, Mathematical Model. Modelling of physical system-Mechanical, Thermal, Hydraulic system and Electrical Analogy.

Stability, Relative Stability, Poles and Zeros of System, Time domain Response.

Controller Modes: On-Off Modes, Proportional Control Mode, Integral Control Mode, Derivative Control Mode, Composite Control Mode: PI,PD and PID Controller.

Text Books:

1) M.P.Groover, Automation, Production systems and Computer Integrated Manufacturing, PHI learning Pvt. Ltd.
2) Industrial Automation: W.P. David, John Wiley and Sons.
3) Ogata K., “Modern Control Engineering” Prentice Hall of India
4) Nagrath I.J., & Gopal M, “Control system Engineering.” Wiley Eastern Reprint
5) Michael B. Histand and David G. Alciatore : Introduction to Mechatronics and Measurement Systems, McGraw-Hill International Edition.
6) W. Bolton: Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Third Edition, Pearson Education (Low Price Edition).

Reference Books:

1) Devdas Shetty and Richard A. Kolk: Mechatronics System Design, PWS Publishing Company (An International Thomson Publishing Company).
2) C D Johnson, “Process Control Instrumentation Technology”, Prentice Hall of India, New Delhi. ISBN: 8120309871
3) Nagrath and Gopal “Mathematical Modelling, Simulation and Analysis”, MGH Pub.
4) Gary Dunning, “Introduction to Programmable Logic controller”, Thomas Learning, edition, 2001.
5) Handbook of design, manufacturing and Automation: R.C. Dorf, John Wiley and Sons

MED 1202 VIBARTION AND ACOUSTICS

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 Marks
End semester: 50 Marks
Credit: 3

Prerequisite: Higher Engineering Mathematics, Applied Physics, Mechanical Vibrations

Course Objectives: Students should be able to,

1. To know the fundamentals of vibration through the complex problems with mathematical approach.
2. To know and able to determine the natural frequency of the multi degree freedom system.
3. To know the fundamentals of continuous and random vibrations.
4. To know the fundamentals of acoustics and India standards of Noise.
5. To know the sound absorbing materials and its practical application.
6. To know the measurement and control techniques of vibration and noise.

Course Outcome: Students will be able to,

1. An ability to solve the complex problems in vibration
2. An ability to measure the vibration and noise of machines/engines
3. An ability to do the modal analysis of beams
4. An ability to understand the lifelong learning through industry visit

Unit 1: Fundamentals of Vibration: 6

Introduction, Definition, Types of vibration, Phenomenon of beats, Harmonic motion representation by vector method, complex number method, complex algebra method, Harmonic analysis by Fourier Series Expansion, Complex Fourier Series, Time and Frequency domain, Even and Odd function, Half-Range function.

Unit 2: Two Degree of Freedom System 6

Introduction, Free and Forced- undamped and damped vibrations- equation of motion, Generalised coordinates and coordinate coupling, Natural Frequencies and Mode shapes (Eigenvalues and Eigenvectors) Modal Analysis of free and forced undamped and damped vibrations, Matrix iteration method.

Unit 3: Multi Degree of Freedom Systems 6

Introduction, Free and Forced- undamped and damped vibrations- equation of motion, Influence coefficients, Generalised coordinates and coordinate coupling, Natural Frequencies and Mode shapes (Eigenvalues and Eigenvectors) Orthogonal properties of normal modes, Modal analysis of free and forced undamped and damped vibrations, Matrix iteration method.

Unit 3: Introduction to Random Vibration 4

Introduction, Functions of Random variables, Random processes in time domain and frequency domain, Correlation Function of a Random Process, Power Spectral Density, Wide band and Narrow band processes.

Unit 4: Fundamentals of Acoustic **6**

Basic physics of sound, decibels, sound pressure level, sound intensity, sound fields, sound reflection, Logarithmic addition, subtraction and averaging, sound absorption and transmission , concept and governing equation with co-relation of each other, Noise Limits in India, Resonators and Filters.

Unit 5: **Acoustic of Rooms, Partitions, Enclosures and Barriers** 7

Sound absorbing materials, Sound insulation, Sound in rooms, Reverberation room, Sound proof room, Partition, Enclosures and Barriers, Mufflers and Silencers, Transmission and insertion loss in silencers and mufflers.

Unit 6: Measurement and Control Vibration and Noise- **6**

Vibration Noun graph and Acceptable vibration levels, Transducers and pickups for measurement of vibration and nosie, FFT Analyzer, Impact Hammer, Vibration Exciter, Sound level meter, Vibration isolation, Isolator design for fixed base systems, Dynamic Vibrations Absorber, Active Vibration Control, Nosie source control, path control, noise control at the receiver, Impact noise control.

References:

1. Mechanical Vibrations, S S Rao, Pearson Education.
2. Mechanical Vibrations, Rao V Dukkipati, Narosa Publisher, New Delhi.
3. Random Vibration, Zach Liang and George C Lee, CRC Press Taylor & Francis Group
4. Random Vibrations, Loren D Lutes and Shahram Sarkani, Elsevier B-H UK
5. Noise and Vibration Control, M L Munjal IISc Press, World Scientific
6. Acoustics of Ducts and Mufflers. M L Munjal John Wiley and sons, New York
7. Mechanical Vibrations and Industrial Noise Control. Lasithan L G PHI Learning P Ltd. New Delhi.

MED1203 Finite Element Analysis

Teaching Scheme **Examination Scheme**

Lecture: 3 Hrs/week
Tutorials: Nil

In semester: 25 marks
End semester: 50 marks
Credits: 3

Pre-Requisites:

Advanced Mathematics and Numerical Techniques

Course Objectives:

1. To understand the philosophy and general procedure of Finite Element Method as applied to solid mechanics and thermal analysis problems.
2. To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.
3. To provide a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
4. To study approximate nature of the finite element method and convergence of results are examined.
5. To provide some experience with a commercial FEM code and some practical modeling exercises

Course Outcome:

On completion of the course, students will be able to -

1. understand the different techniques used to solve mechanical engineering problems.
2. derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.
3. apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.
4. explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.
5. use commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer.
6. interpret the results of finite element analyses and make an assessment of the results in terms of modeling (physics assumptions) errors, discretization (mesh density and refinement toward convergence) errors, and numerical (round-off) errors.

Unit 1: Introduction to Finite Element Method

Finite element method, brief history, basic steps, advantages and disadvantages, weak formulation, variational methods of approximation – Rayleigh-Ritz methods, Methods of Weighted Residuals (Galerkin, Least-squares & Collocation methods), Variational formulation of 1D bar and beam elements (Euler Bernoulli and Timoshenko beam) – governing equation, domain discretization, elemental equations, assembly and element connectivity, application of boundary condition, solution of equations, post processing of the results.

Unit 2: Iso-parametric Elements and Formulation of Plane Elasticity Problems

Introduction, shape functions – linear & quadratic, displacement function – criteria for the choice of the displacement function, polynomial displacement functions, displacement function in terms of nodal parameters, strain-nodal parameter relationship, stress-strain relationship, element stiffness matrix, convergence of iso-parametric elements, numerical integration – Trapezoidal rule, Simpson's 1/3 rule, Newton-Cotes Formula, Gauss Quadrature formula, Gauss Quadrature in two and three dimensions

Unit 3: Nonlinear Problems – Geometric, Material and Contact Problems
Introduction to non-linear analysis, formulation for geometrical, material and contact nonlinear problems, Nonlinear equation solving procedure - direct iteration, Newton-Raphson method, modified Newton-Raphson method, incremental techniques

Unit 4: Dynamic Problems – Eigen value and Time Dependent Problems
Formulation of dynamic problems, consistent and lumped mass matrices
Solution of eigenvalue problems – transformation methods, Jacobi method, Vector Iteration methods, subspace iteration method
Forced vibration – steady state and transient vibration analysis, modelling of damping, the mode superposition scheme, direct integration methods – implicit and explicit numerical integration

Unit 5: Special Topics
Linear buckling analysis, Three-Dimensional Stress Analysis, Thermal Stress Analysis, adaptive finite element technique, error estimation, h & p refinements, symmetry – mirror/plane, axial, cyclic & repetitive, submodelling and substructuing,

Unit 6: Practical Considerations in Modelling
Pre processing: model definition – nodal coordinates, element connectivity, material and element type and property definitions, type of analysis (static/modal), loading and boundary conditions.
Meshing techniques: free and mapped meshing, Quality checks – aspect ratio, warp angle, skew, Jacobian, distortion, stretch, included angle, taper
Processing: Element level calculations, Equation assembly, Equation solver (sparse solvers, factorization, numerical/computational issues)
Post Processing: strain and stress recovery (integration and nodal points), interpretation of results (results validation and data interpretation) and design modification

Books:

1. Daryl Logan, First Course in the Finite Element Method, Cengage Learning India Pvt. Ltd.
2. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., Practical Finite Element Analysis, Finite to Infinite, Pune
3. Seshu P., "Text book of Finite Element Analysis", PHI Learning Private Ltd., New Delhi, 2010.
4. Reddy, J. N., "An Introduction to The Finite Element Method", Tata McGraw Hill, 2003.
5. Cook R. D., "Finite Element Modeling for Stress Analysis", John Wiley and Sons Inc, 1995
6. Mukhopadhyay M and Sheikh A. H., "Matrix and Finite Element Analyses of Structures", Anne Books Pvt. Ltd., 2009.
7. Bathe K. J., "Finite Element Procedures", Prentice-Hall of India (P) Ltd., New Delhi.
8. Chandrupatla T. R. and Belegunda A. D., "Introduction to Finite Elements in Engineering", Prentice Hall India.
9. Liu G. R. and Quek S. S. "The Finite Element Method – A Practical Course", Butterworth-Heinemann, 2003.

MED1204 – Design & Optimization

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Course Objectives:

1	To introduce to the students optimization problems and various solution techniques ,
2	To impart knowledge of various classical and modern optimization technigues
3	To make students aware about industrial optimization problems
4	To expose students to numerical techniues to solve optimization problems

Course Outcomes:

Upon completion of this course, the student will be able to:

1	formulate objective functions and constraint equations for a given classical problem,
2	apply classical and modern method of optimization to standard problems
3	solve realistic and industrial design problems
4	use computational tools such as MATLAB/OCTAVE to get solutions

Unit 1: Introduction to Optimization **5 Hrs.**
Engineering Applications of Optimization, Statement of an Optimization Problem, Classification of Optimization Problems, Graphical Optimization Techniques

Unit 2: Classical Optimization Techniques **9 Hrs.**
Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints: Solution by Direct Substitution, Solution by the Method of Constrained Variation, Solution by the Method of Lagrange Multipliers, Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Conditions, Constraint Qualification, Convex Programming Problem

Unit 3: Linear Programming: Simplex Method **6 Hrs.**
Applications of Linear Programming,Standard Form of a Linear Programming Problem, Simplex Algorithm, Two Phases of the Simplex Method

Unit 4: Nonlinear Programming **8 Hrs.**

Introduction, Unrestricted Search, Interval Halving Method, Golden Section Method, Quadratic Interpolation Method, Newton Method, Practical Considerations,

Unit 5: Special Optimization Methods **8 Hrs.**
Geometric Programming, Dynamic Programming, Integer Programming, Optimal Control

Unit 6: Modern Methods of Optimization **8 Hrs.**
Genetic Algorithms, Simulated Annealing, Particle Swarm Optimization, Neural-Network-Based Optimization, Practical Aspects of Optimization

Suggested Texts and Reference Materials:

1. Engineering Optimization -Theory and Practice/ Singerusu S. Rao/ New Age.

2. Optimum Design of Mechanical elements/ Johnson Ray C/ Wiley, John & Sons

3. Genetic Algorithms in search, Optimization and Machine/ Goldberg D. E. Addison/Wesley /

NewYork

4. Optimization for Engineering Design Algorithms and Examples/ Kalyanamoy Deb/Prentice Hall of India

MED 1205 Automation and Control Technology Laboratory

Teaching Scheme: **Examination Scheme:**

Practical: 02 Hrs / week **Oral = 25 Marks**

Total Credit =01

Objective:

1) Hands-on Automation system components and types of Automation system
2) Understanding the Principles of Operations of Sensors, Transducers and Actuators.
3) Design of a typical Mechatronics System through various case studies.
4) Practical Implementation of an Automatic Control technology through PLC using Automation Studio software

Outcomes:

1) At the end of the course the student will be able to identify and differentiate between the various Components of Automation system.
2) Student will understand the working principle and apply the knowledge of sensors and Actuators through measurement, Signal conditioning for Automatic control systems.
3) Students will be able to design a simple Mechatronics system and Automation Systems.
4) Students can apply the knowledge of Automation in Design of Automated Production line.

List of the Experiments (Expt. No.6 is Compulsory & Any 3 from remaining) :

1) Demonstration of Bottle Filling plant using a Automation Studio simulation software

2) Design of Automatic Traffic Control System

3) Study of Automatic control in Car Engine Management System.

4) Industrial Visit to study the different types of Automation on Production line.

5) Demonstration on Pick and Place Robot for implementation of Automation on production line.

6) Design of Real time system by interfacing various sensors and actuators.

Assignments: (Any 2)

1) Report based on Industrial visit where students can find the applications of PLC,SCADA & HMI.
2) Case Study: Mechatronics system design of any system.
3) Study of Modelling and Analysis of typical Mechanical System.

Reference Books:

1) Devdas Shetty and Richard A. Kolk: Mechatronics System Design, PWS Publishing Company (An International Thomson Publishing Company).
2) C D Johnson, “Process Control Instrumentation Technology”, Prentice Hall of India, New Delhi. ISBN: 8120309871
3) Nagrath and Gopal “Mathematical Modelling, Simulation and Analysis”, MGH Pub.
4) Gary Dunning, “Introduction to Programmable Logic controller”, Thomas Learning, edition, 2001.
5) Handbook of design, manufacturing and Automation: R.C. Dorf, John Wiley and Sons

MED 1206: VIBARTION AND ACOUSTICS LABORATORY

Teaching Scheme	**Examination Scheme**
Lecture: 2 Hrs/week	Oral: 25 Marks
	Credit: 1

Prerequisite: Higher Engineering Mathematics, Applied Physics, Mechanical Vibrations

Course Objectives: Students should be able to,

1. To know the fundamentals of vibration through the complex problems with mathematical approach.
2. To know and able to determine the natural frequency of the multi degree freedom system.
3. To know the fundamentals of continuous and random vibrations.
4. To know the fundamentals of acoustics and India standards of Noise.
5. To know the sound absorbing materials and its practical application.

To know the measurement and control techniques of vibration and noise.

Course Outcome: Students will be able to,

1. An ability to solve the complex problems in vibration
2. An ability to measure the vibration and noise of machines/engines
3. An ability to do the modal analysis of beams
4. An ability to understand the life long learning through industry visit

A] Assignments:

The following SIX assignments are mandatory to the students

1. Unit 1 (2 nos)
2. Unit 2 and Unit 3 (Each one)
3. Unit 5 on Environmental Impact Assessment (1 No)
4. Unit 6 (1 No)

B] Experiments: (Any Three)

1. Experiment on forced damped vibratory system
2. Experimental measurement and analysis of Vibration and Noise spectrum of Machine or Engine
3. Experiment on Shock Absorber Test Rig
4. Experimental Modal Analysis of metal beam and composite beam
5. Experiment Modal Analysis by sine sweep on Vibration Shaker.
6. Experiment on Vibration Absorber
7. Experimental measurement of Transmission Loss of reactive muffler

C] Industrial Visits: (Minimum One)

1. Engine Manufacturer
2. Engine Testing and NVH Laboratory

The Industry visit report should be enclosed in the lab journal.

References:

1. Mechanical Vibrations, S S Rao, Pearson Education

2. Mechanical Vibrations, Rao V Dukkipati, Narosa Publisher, New Delhi
3. Random Vibration, Zach Liang and George C. Lee, CRC Press Taylor & Francis Group
4. Random Vibrations, Loren D Lutes and Shahram sarkari, Elsevier B-H, UK
5. Noise and Vibration Control, M L Munjal, IISc Press, World Scientific
6. Mechanical Vibrations and Industrial Noise Control, Lasithan L.G. PHI Learning P Ltd, New Delhi.

MED1207 Finite Element Analysis Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral: 25 Marks
Credits: 1

Pre-Requisites:

Advanced Mathematics and Numerical Techniques

Course Objectives:

1. To understand the philosophy and general procedure of Finite Element Method as applied to solid mechanics and thermal analysis problems.
2. To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.
3. To provide a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
4. To study approximate nature of the finite element method and convergence of results are examined.
5. To provide some experience with a commercial FEM code and some practical modeling exercises

Course Outcome:

On completion of the course, students will be able to -

1. understand the different techniques used to solve mechanical engineering problems.
2. derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.
3. apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.
4. explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.
5. use commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer.
6. interpret the results of finite element analyses and make an assessment of the results in terms of modeling (physics assumptions) errors, discretization (mesh density and refinement toward convergence) errors, and numerical (round-off) errors.

List of experiments:

1. Introduction to Software Tools used for Finite Element Analysis -- MATLAB and ANSYS
2. Write 4 computer programs using Finite Element Analysis in MATLAB
3. Analyze 4 real life problems using ANSYS modeling and write a short report

List of Assignments:

Two assignments based on the theory topics will be given during the semester.

Books:

1. Daryl Logan, First Course in the Finite Element Method, Cengage Learning India Pvt. Ltd.
2. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., Practical Finite Element Analysis, Finite to Infinite, Pune
3. Seshu P., “Text book of Finite Element Analysis”, PHI Learning Private Ltd., New Delhi, 2010.

4. Reddy, J. N., “An Introduction to The Finite Element Method”, Tata McGraw Hill, 2003.
5. Cook R. D., “Finite Element Modeling for Stress Analysis”, John Wiley and Sons Inc, 1995
6. Mukhopadhyay M and Sheikh A. H., “Matrix and Finite Element Analyses of Structures”, Anne Books Pvt. Ltd., 2009.
7. Bathe K. J., “Finite Element Procedures”, Prentice-Hall of India (P) Ltd., New Delhi.
8. Chandrupatla T. R. and Belegunda A. D., “Introduction to Finite Elements in Engineering”, Prentice Hall India.
9. Liu G. R. and Quek S. S. “The Finite Element Method – A Practical Course”, Butterworth-Heinemann, 2003.

MED1208 Seminar

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral: 50 Marks
Credits: 2

Course Objectives:

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well-organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presentation.

Course Outcome: With this seminar report and presentation, the student will be able to

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well-organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presentation.

Course Contents:

The evaluation of the seminar report is proposed with the two stages.

- **InSem Review** In this stage the student is expected to deliver the Topic selection, Literature review, State of the art related to the topic of interest, Problem statement, Methodology, Scope and objectives.
- **Final review:** In this stage the student is expected to deliver the Quantification of results, concluding remarks or summary, Seminar report, final presentation/viva.

The contents of the seminar report and presentation are expected to include the following: Abstract/Summary, Introduction: Scope and Methodology, Literature review (The review should be conducted from recent research papers), Case study and References.

The final presentation/viva will be assessed by an internal panel. The internal panel will consist of the seminar guide and a subject expert, approved by the HOD.

References:

1. Technical Communication, Mike Markel, Bedford/St. Martin's; Ninth edition, 2009
2. Technical Writing, Basu, Prentice Hall India Learning Private Limited, 1st Edition, 2007
3. Technical Writing, O.N. Pandey, S.K. Kataria & Sons; 2014th edition
4. The Insider's Guide to Technical Writing, Kristaa Vaan Lann, XML Press, 2012
5. LaTeX Beginner's Guide, Stefan Kottwitz, Packt Publishing; 2nd edition

ECSP1204 Biomedical Signal Processing

Teaching Scheme:

Lectures: 3Hrs/Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To understand the basic bio-signals.
2. To study origins and characteristics of some of the most commonly used biomedical signals, especially ECG, EEG, and EMG.
3. To understand sources and characteristics of noise and artefacts in bio signals. 4. To understand use of bio signals in diagnosis, patient monitoring and physiological investigations.
5. To explore research domain in biomedical signal processing.
6. To explore applications of established engineering solutions to complex biomedical signal problems.

Course Outcomes:

1. Apply various methods of acquiring bio signals.
2. Reveal various sources of bio signal distortions and its remedial techniques.
3. Analyze ECG and EEG signal with characteristic feature points.
4. Apply various Image processing techniques for biomedical image analysis.

Unit – I : Introduction to bio-medical signals and their acquisition: (06)

Origin of bio-signal, action potential, nerve and muscle cells and their electrical activity, electrical activity of the heart, genesis of ECG, ECG lead systems, electrical activity of the brain, EEG signal and its acquisition, EMG signals and its acquisition. Sources of contamination and variation of bio signals.

Unit – II: Analog signal processing of bio-signals: (07)

Biomedical instrumentation systems, biomedical transducers, electrodes and their characteristics, instrumentation amplifier, isolation amplifier, active filters(commonly used topologies), ADC, aliasing effect, anti-aliasing filters, grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding with reference to Biomedical equipment.

Unit – III: Digital Signal processing of bio-signals (13)

Review of FIR, IIR Filters, Weiner filters, adaptive filters. Model-based spectral analysis, AR, Eigen analysis spectral analysis, Time-frequency methods: Spectrogram, Wigner-Ville and other methods, Principal Component Analysis, Independent Component Analysis, Continuous Wavelet Transform, and Discrete Wavelet transform, Electrocardiogram: Signal analysis of event related potentials, morphological analysis of ECG waves, Envelope extraction and analysis of activity, application- Normal and Ectopic ECG beats, Phonocardiography

Unit – IV: Diagnostic Biomedical Imaging: (10) Types of Medical Images, CT, PET, and SPECT, MRI, Functional MRI, ultrasonic diagnostic imaging. Feature extraction, analysis and classification. Introduction to soft computing approaches for biomedical signal and image diagnostics: Artificial Neural networks, (Multilayer perceptron, Radial basis function networks) as classifiers.

Reference Books:

1. J. Malmivuo & Robert Plonsey, „**Bioelectromagnetism - Principles and Applications of Bioelectric and Biomagnetic Fields**‟, *Oxford University Press*, *New York*, (1995). **2.** J. L. Semmlow, „**Signals and Systems for Bioengineers: A MATLAB-Based Introduction**‟, *Academic Press*, (2nd Edition), (2011).

3. J. L. Semmlow, „**Biosignal and Biomedical Image Processing MATLAB-Based Applications**‟, *Marcel Dekker*, (2nd Edition), (2008).

4. W. J. Tompkins, „**Biomedical Signal Processing**‟, *ED*, *Prentice – Hall*, (1993). **5.** E. N. Bruce, „**Biomedical Signal Processing and Signal Modelling**‟, *John Wiley & Sons*, (2000).

6. R. M. Rangayyan, „**Biomedical Signal Analysis A case study approach**‟, *John Wiley & Sons*, (2002).

7. R. M. Rangayyan, „**Biomedical Image Analysis**‟, *CRC Press*, (2005).

OEHS 2101: Entrepreneurship and IP Strategy (NPTEL)

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	ISE: 50 Marks
	ESE: 50 Marks
	Credits: 3

Course Objectives:

1. To discuss intellectual property strategy to protect inventions and innovations of new ventures.
2. To develop skills of commercial appreciation by allocating knowledge about substantive aspects of management, strategy and legal literature.
3. The course will make participants appreciate the nature, scope and differences of IP, its different utilities and approaches
4. The course will make participants manage and strategize IP lifecycle effectively throughout the journey of start-up, in a time when it is aspired highly by the economy and society.
5. Participants will learn the fundamentals and advanced strategies of IP. They will be given the opportunity for understand the same in the MSME sector. They will finally be provided brief exposure about the valuation techniques and audits of IP.

Course Outcomes:

After completion of the course, students will be able to

CO1 Illustrate the importance of securing intellectual property to protect inventions and innovations of new ventures

CO2 Appreciate the scope, nature, protection process and infringement of Trademarks and Patents as an entrepreneur

CO3 Appreciate the scope, nature, protection process and infringement of Copyrights and Industrial Design as an entrepreneur

CO4 Apply various concepts of IP and Entrepreneurship in strategic valuation and audit of IP management at MSMEs

Unit I: Introduction to entrepreneurship and intellectual property: Definition, concepts (05)

1. Introduction, 2. What is entrepreneurship? 3. What do you understand by IP?, 4. Whether entrepreneurship and IP related? What is the role of IP strategy in entrepreneurship? 5. Case study I – IT industry

Unit II: **Innovation and entrepreneurship:** **(05)**

1.Innovation, invention and creativity, 2. Types of innovation, 3. Innovation, market and IP, 4. Open innovation and IP, 5. Case Study II - Biotechnology

Unit III: **IPR: Trademark and entrepreneurship:** **(05)**

1. Trademark-Definition, 2. Trademark-Types, 3. Trademark-Registration, 4. Trademark infringement, 5. Case study III - Textile industry

Unit IV: **IPR: Patent and entrepreneurship:** **(05)**

1. Patent-introduction, 2. Patent infringement, 3. Patent strategies- I, 4. Patent strategies- II
5. Capsule version

Unit V: **IPR: Copyright and entrepreneurship:** **(05)**

1. Copyright – Definition and subject matter, 2. Copyright and related rights, 3. Copyright registration and entrepreneurship, 4. Copyright infringement, 5. Case study IV – Film industry

Unit VI: **IPR: Industrial design and entrepreneurship:** **(05)**

1. Industrial Design- Definition, concept, 2. Industrial Designs Act - Key features, 3. Industrial Design-Business, 4. Industrial Design infringement, 5. Case study V - Automobile industry

Unit VII: **IP strategy & entrepreneurship** **(05)**

1. IP strategy for start-up and MSME, 2. IP transaction – introduction, 3. IP valuation, bank loan, insurance, 4. Success story and business model of a few start-ups, 5. Case Study VI – Pharma industry and Agriculture.

Unit VIII: **Entrepreneurship & IP - Government initiates:** **(05)**

1.Incubators, research parks, 2.Various Government policies, 3.Integrative approach – Entrepreneurship & IP strategy, 4.Capsule revision, 5.Am I ready to venture my start up? (Course applicability)

Books and References:

1. Ove Granstrand, "**The Economic and management of Intellectual Property**", (1999)
2. Narayanan, V. K., "**Managing technology and innovation for competitive advantage**", first edition, Pearson education, New Delhi, (2006)
3. Idris, K. (2003), "**Intellectual property: a power tool for economic growth**", 2nd edition, WIPO publication no. 888, Switzerland
4. Bosworth D. & Webster E, "**The Management of Intellectual Property**", Edward Elgar.
5. Berman, "**Ideas to Assets**", Wiley publications
6. Richard Dorf & Thomas Byers, "**Technology ventures from idea to enterprise**", 2nd edition.
7. Neeraj Padey, Khushdeep Dharni "Intellectual Property Rights", 1st Edition, August 2014

Online Resources:

1. NPTEL Course: **"Entrepreneurship and IP Strategy"**
   https://onlinecourses.nptel.ac.in/noc22_hs110/preview
2. **WIPO: Global Forum for Intellectual Property**
3. http://www.wipo.int/portal/en/index.html
4. **Intellectual Property India**
   http://www.ipindia.nic.in/

An Autonomous Programme Structure of

M. Tech. Electronics and Telecommunication Engineering

Specialization: Signal Processing

PEECSP1101 Mixed Signal Processing System and Design

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50**Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. To learn digital CMOS logic design.
2. To nurture students with CMOS analog circuit designs.
3. To explore the architecture and design of switched capacitor based circuits.
4. To explain designs of different types of data converters and their performance parameters.

Course Outcomes:

After completion of the course, students will be able to

1. Design analog and digital CMOS circuits for specified applications
2. Analyze and design switched capacitor circuits.
3. Compare performance of analog to digital converter and digital to analog converter.
4. Design circuits for data conversion to meet the desired specifications.

Unit – I: Properties of Basic CMOS Cells and CMOS Circuit Fabrication (10)

CMOS Transistor Characteristics, Circuits composed of MOS Transistor : Voltage controlled resistor, Diode connected transistor, Current source, switch, inverter, Current mirror, Amplifier stage, Differential stage, CMOS Circuit Fabrication: Wafer preparation, Oxidation, Deposition, Lithography, Etching, Epitaxy, Diffusion and Ion Implantation, Contacts and Interconnects, Masks and Design rules.

Unit – II: Digital Techniques (10)

Static Logic Circuits: NAND and NOR Gates, General CMOS Logic Gates, Pseudo-nMOS and Pseudo-pMOS Logic, Dynamic Logic: Dynamic Inverter, Dynamic Logic Gates.

Unit – III: Analog VLSI Circuits **(10)**

Passive and Active Circuit Elements, Switched current techniques, Switched capacitor techniques, Low Power and Low Voltage Techniques.

Unit – IV Data converters **(08)**

Basics of data converters, types of data converters, Types of ADCs like Successive approximation, dual slope, Flash type, pipelined ADCs, hybrid ADCs, high resolution ADCs, parallel path ADCs like time-interleaved and multi-channel converters.

Types of DACs like Current scaling, Voltage scaling, Charge scaling, their architectures, Combination of differently scaled DAC Performance metrics of data converters, SNR, SFDR, SNDR. Background and foreground techniques to improve performance of data converters.

Reference Books

1. R. J. Baker, **'CMOS mixed signal circuit design',** *Prentice Hall, IEEE press*, (2^{nd} Edition),(2008).
2. A. Handkiewicz, **'Mixed Signal System- a guide to CMOS circuit design',** *IEEE Press,* (1^{st} Edition),*(2002)*
3. W. Kester, **'Mixed Signal and DSP design techniques',** *Engineering Analog Devices Inc published by Newnes Elsevier,*(1^{st} Edition),(2002)

PEECSP1202 Computer Vision

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: 50Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:

1. To understand Image acquisition concepts.
2. To understand mapping from 3D word to 2D word.
3. Hands on Camera calibration techniques and basics of stereo imaging.
4. Feature analysis and extraction techniques such as Corner detector, Scale Invariant Feature Transform.
5. Understand and compare different object tracking algorithms such as Optical flow, Kalman filter, Mean Shift etc.
6. Applications of Computer Vision such as Surveillance system, Tomography, Tomography, Surveillance, Industrial robot vision, 3D Reconstruction, etc.

Course Outcomes:

1. **Understand and analyze image formation and working of camera as image sensor.**
2. **Analyze procedure of camera calibration.**
3. **Analyze of stereo imaging formation and its applications and challenges.**
4. **Apply computer vision algorithms for motion tracking.**
5. **Express the basic concept of infrared imaging**
6. **Development of different video and computer vision based applications.**

Unit – I: Image Formation **(08)**
Introduction: Purpose, state of the art
Image Formation: CMOS CCD image sensors, projection, color image camera.

Unit – II: Camera Calibration and Stereo Imaging **(08)**

Camera calibration: camera parameters, camera calibration.
Stereo imaging: Epipolar geometry, rectification, correspondence, triangulation, RANSAC algorithm, Dynamic programming.

Unit – III: Feature detection and tracking **(14)**

Corner detector, Edge Detector, Histogram of Gradient, Scale Invariant Feature Transform, Background Subtraction Techniques, Optical flow, mean shift tracking, Kalman filter, Object Tracking, Condensation.

Unit – V: Applications **(06)**

Non-visible-light Imagery: infrared and thermal imaging, applications,
Applications of computer vision: Tomography, Surveillance, Industrial robot vision, 3D reconstruction.

Reference Books :

1. D. A. Forsyth, J. Ponce, „Computer Vision, A Modern Approach‟, Prentice Hall, (2003).
2. R. Szeliski, „Computer vision algorithms and applications‟, Springer-Verlag, (2010).
3. M. Shah, „Fundamentals of Computer Vision‟, Online book (1997).
4. L. G. Shapiro, George C. Stockman, „Computer Vision‟, Prentice Hall (2001).
5. E. Trucco, A. Verri, „Introductory Techniques for 3-D Computer Vision‟ Prentice Hall (1998).
6. D. H. Ballard, C. M. Brown, „Computer Vision‟, Prentice Hall (1982).
7. M. Sonka, V. Hlavac, R. Boyle, „Image Processing, Analysis, and Machine Vision‟ Thomson (2011).

PEINBI 1101 A) Bio-Signal Processing

Teaching Scheme: | **Examination Scheme:**

Lectures: 3 Hrs/Week

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 3

Course Objectives:

1. To learn the frequency domain characteristics of biomedical signals and systems.
2. To design digital filtering techniques to biomedical signals.
3. To design adaptive filtering algorithms to biomedical signals.
4. To design multirate filters to biomedical signals.

Course Outcomes:

1. To compute the response of discrete-time systems to various biomedical signals.
2. To evaluate and analyse the frequency domain characteristics of various biomedical signals.
3. To implement and apply digital FIR and IIR filtering techniques to remove noise in biomedical signals.
4. To implement and apply adaptive and multirate filtering algorithms in biomedical systems.

Unit – I: Introduction to biomedical signals and systems **(06)**

Biomedical signals: origin or source, types and characteristics. Biomedical signal conversion: Sampling, signal conversion systems, sampling requirements for biomedical signals. ECG, EEG, EMG, etc. signal characteristics, representation in discrete-time domain. Biomedical signal processing systems: properties, representation and response of systems.

Unit – II: Frequency analysis of biomedical signals **(06)**

Frequency response analysis of biomedical signals, Fourier Transform, Discrete Fourier Transform (DFT), DFT properties, circular convolution, Fast Fourier Transform (FFT) algorithms.

Unit – III: Digital filtering in biomedical signals **(06)**

Digital filters, elements of digital filter, types of digital filters, linear filtering of biomedical signals, pole-zero analysis, characteristics and realizations of finite impulse response (FIR) and Infinite impulse response (IIR) filters, FIR filter design methods, window techniques, frequency sampling. Smoothening or moving average filters for per-processing of biomedical signals.Applications of FIR filters to bio-signals, removal of noise, motion artifacts from ECG signal, and removal of baseline drift in ECG using different FIR filters.

Unit – IV: IIR filters for biomedical signals **(06)**

Conversion of analog filters to digital filters, impulse invariance, bilinear transformation methods, IIR filter design methods, Butterworth approximation, Chebyshev approximation, Applications of IIR filters to bio-signals, removal of high frequency noise and periodic events using different IIR filters.

Unit – V: Adaptive filters **(06)**

Noise Canceler model in biomedical signals, Adaptive filtering algorithms, least mean square (LMS), Recursive least square (RLS) algorithm, applications of adaptive filtering: Maternal ECG in fetal ECG, Cardiogenic artifacts, detection of ventrycular fibrillation and tachycardia, etc.

Unit – VI: Multirate signal processing **(06)**

Decimation, interpolation, sampling rate conversion by a rational factor, implementation, polyphase structures, applications of multirate filtering in biomedical field, subband coding of speech signal, subband coding of ECG signal, subbands of EEG signal.

Text Books:

1. W. J. Tompkins, '**Biomedical digital signal processing**', *Prentice Hall of India,* (1993)

Reference Books:

1. J. G. Proakis , D.G. Manolakis, **'Digital signal processing',** *Prentice Hall of India,* (Fourth edition),(2013)
2. S. K Mitra, **'Digital signal processing',** *Tata Mcgraw-Hill Education*, (Fourth edition),(2013)
3. Oppenheim, Schafer, 'Discrete-time **signal processing',** *Pearson Education* (Third edition), (2010)
4. R. Panneerselvam, **'Research Methodology'**, *PHI Learning* (2nd edition**),** (2014)
5. S. Gupta, **'Research Methodology and Statistical Techniques'**, *Deep and Deep* (2005)
6. N.J. Rajagopalan, **'Research Methodology'**, *Depiti Civil* (Rev. Edition),(1994)
7. D. Buchala, W. Mclachlan, **'Applied Electronic Instrumentation and Measurement'**, *PHI*, (1992)
8. J.P. Holman, **'Experimental Methods for Engineers'**, *McGraw Hill* (7th Edition), (2001)

PEINBI 1202 B) Advanced Digital Signal Processing

Teaching Scheme: Lectures: 3 Hrs/Week

Examination Scheme: In-Semester: **50**Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. To learn the basic concepts and properties of multi-rate DSP
2. To learn the basic concepts and properties of wavelet transform
3. To learn the characteristics of signal modelling
4. To study the linear prediction algorithms, power spectrum estimation and adaptive filters

Course Outcomes:

1. To understand the concepts of multi-rate DSP and wavelets
2. To evaluate and analyse the random process
3. To design and implement prediction, power estimation and adaptive filters

Unit – I: Stochastic Processes **(06)**

Introduction, WSS signals and linear systems, spectral factorization, models of stochastic processes, vector processes.

Unit – II: Linear Prediction **(06)**

Innovations representation of a stationary random process, forward and backward linear prediction, solutions of the normal equations. Properties of linear prediction-error filters, AR and ARMA lattice filters, Wiener filters and predictions, Applications of linear predictions to biomedical signals.

Unit – III: Spectral Estimation **(06)**

Periodogramm-based nonparametric methods: Periodogram, Bartlett's method, Welch's method, Blackman-Tukey method . Parametric methods for power spectrum estimation: ARMA modeling, Yule- Walker equation and solution.

Unit – IV: Time-frequency analysis **(04)**

Time frequency analysis, the need for time frequency analysis, Time frequency distribution, Short time Fourier Transform, introduction to wavelets.

Unit-V:MRA & CWT: **(07)**

Definition of Multi Resolution Analysis (MRA), Haar Basis, Construction of General Orthonormal MRA, Continuous Time MRA, Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian), Tiling of Time – Scale Plane for CWT, CWT as a correlation, CWT as an operator, Inverse CWT.

Unit – VI:DWT: **(07)**

Wavelets derived from iterated filter banks, Wavelet Filters – Inverse DWT, Choice of Wavelet Function Coefficients, Derivations of Daubechies Wavelets, Mallat's Algorithm for DWT, Decomposition and Reconstruction filters, examples of orthogonal basis generating wavelets, filter bank implementation of two dimensional wavelet transform. Applications of Wavelet Transform to biomedical signals.

Text Books:

1. J. Proakis , Charles M. Rader, Fuyun Ling, Christopher L. Nikias, **'Advanced Digital Signal Processing'**, *Macmillan Coll Div,* (1992)
2. Leon Cohen, '**Time Frequency Analysis',** *Prentice Hall*, (1995)
3. K P Soman and K I Ramachandran, **'Insight into wavelets: From theory to Practice',** *Prentice Hall of India.*

Reference Books:

1. Glenn Zelniker, Fred J. Taylor, **'Advanced Digital Signal Processing'**, *CRC Press.* (1994)
2. A.V.Oppenheim, R.W.Schafer, **'Discrete time Signal Processing'**, *Prentice Hall,* (1992)
3. P.P. Vaidyanathan, **'Multirate systems and Filter banks'**, *Prentice Hall,* (1993)
4. J C Goswamy, A K Chan, **'Fundamentals of Wavelets: Thory, Algorithms and Applications'**
5. G Strang, T Q Nguyen, **'Wavelets and filter banks'**, *Wellesley Cambridge Press*, (1998).
6. Steven M . Kay , **'Modern Spectrum Estimation'**, *Prentice Hall, (*1988)

INBI 1206 B) Advanced Digital Signal Processing Laboratory

Teaching Scheme: Lectures: 2 Hrs/Week

Examination Scheme: In-Semester: **25** Marks

Credits: 1

List of Experiments:

1. Power spectral analysis of an ECG using parametric methods.
2. Power spectral analysis of an ECG using non-parametric methods.
3. Implementation of linear prediction filtering algorithms.
4. Frequency analysis of stationary and non-stationary signals using FT.
5. Time frequency analysis of Gaussian Function.
6. Implementation of DWT for 1D signal and verify using the direct MATLAB command.
7. Introduction to Wavelet Toolbox
8. Applications Demo using Wavelet Toolbox

M. Tech. Mechanical Engineering Design (AY: 2017-2018)

SEMESTER I

Transport Phenomena

(PEMED1101, Elective I)

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisites:
1. Engineering Physics
2. Engineering mathematics
3. Fluid Mechanics

Course Objectives:

1 To Interpret the mathematical and physical foundations of the continuum mechanics of fluids,
2 To apply the conservation laws to viscous, inviscid, incompressible flows; and boundary layer flows
3 Be able to apply the principles of fluid mechanics to solve engineering problems and to design systems or components to meet desired needs
4 To derive the generic form of N-S equation and able to deduce an analytical solution for simple fluid mechanics and mass transfer problemsproblems.

Course Outcomes:

Upon completion of this course, the student will be able to:

1 Student will be able understand the concepts of continuum mechanics of fluids,
2 Student will be relate the conservation laws to different types of fluid flow conditions
3 Student will produce the solution for complex fluid mechanics problems and to design system using fundamental principles.
4 Student will derive the generic form of N-S equations and illustrate the analytical solution for simple flow and mass transfer problems

Unit 1:
Introduction to transport phenomena, momentume trnasfer, heat transfer and mass transfer.
(4 hrs)

Unit 2:
Description of fluid flow motion, conservation of mass, momentum equation, energy equation (Integral and differential approcah)
(10 hrs)

Unit 3: Inviscid and viscous fluid flow, boundary layers

(8 hrs)

Unit 4: Differential equation of heat transfer, steady state conduction, convective heat transfer and radiation heat transfer

(8 hrs)

Unit 5: Fundamentals of mass transfer, differential equation of mass transfer, steady statte mass diffussion, convestive mass transfer

(8 hrs)

Unit 6: Applications: Fluid machinery, heat and mass transfer equipments

(6 hrs)

Suggested Texts and Reference Materials:

1. Introduction to Fluid Mechanics R. Fox and A. MacDonald, John Wiley and Sons
2. Introduction to Fluid Mechanics and Fluid Machines: S. K. Som, Gautam Biswas and Suman Chakraborty, McGraw-Hill Education
3. Fluid Mechanics and its Applications, Vijay Gupta Santosh Gupta New Age international
4. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen, David R Dowling, Academic
5. Transport Phenomena, R. B. Bird, W. Stuart, Press Wiley; Second edition (1 January 2006)

PEMED1101C PROGRAME ELECTIVE-I POWER TRAIN DESIGN

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 Marks
End semester: 50 Marks
Credit: 3

Prerequisite: Theory of Machines, Machine Design, I/C Engines

Course Objectives: Students should be able to,

1. Acquire the knowledge of vehicle power train design.
2. Know the design of engine components and engine performance.
3. Know the design of transmission systems of vehicle.
4. Understand the dynamics of driveline.
5. Know the systems of hybrid electric vehicle.

Course Outcome: Students will be able to,

1. Apply the vehicle power train concepts
2. Design engine components and analyze the engine performance
3. Apply knowledge to compute the vehicle longitudinal dynamics
4. Design and analyze the transmission systems and dynamics of driveline of the vehicle

Unit 1: Vehicle Power Train Concepts
Introduction to Powertrain systems, Powertrain components, Power generation characteristics of SI and CI Engines, Engine Kinematics, Engine Torque, output characteristics.

Unit 2: Design of Internal Combustion Engines
Introduction, Design of cylinder and its components, Design of Piston and its components, Design of connecting rod, crankshafts and valve mechanisms and its component, Engine Torque speed characteristics, Multi cylinder engines firing order and its performance, Net Output Power.

Unit 3: Vehicle Longitudinal Dynamics
Introduction, Torque Generators, Tractive Force, Resistive Forces, Vehicle Constant Power Performance (CPP), Constant Torque Performance (CTP), Fixed Throttle Performance (FTP), Throttle Pedal Cycle Performance (PCP), Effect of Rotating Masses, Tyre Slip, Performance on slope, Vehicle Coast Down, Driveline Losses.

Unit 4: Design of Transmission System
Introduction, The need for a Gearbox, Design of Gearbox Ration, Gearbox Kinematics and Tooth Numbers, Manual Transmissions, Automatic Transmission, Conventional Automatics, CVTs Classification, Friction CVTs, Ratcheting CVTs, Non Mechanical CVTs, Idling and Launch.

Unit 5: Driveline Dynamics
Introduction, Modeling Driveline Dynamics, Bond Graph Models of Driveline Components Driveline Models, Analysis: Effect of Clutch Compliance, Effect of Driveshaft Compliance, Effect of Clutch and driveshaft Compliances, Frequency Responses and Improvements.

Unit 6: Introduction to Hybrid Electric Vehicles

Introduction, types of hybrid electric vehicles, power split devices, HEV component characteristics HEV performance analysis, HEV component sizing, and Power management.

References:

1. Vehicle Powertrain Systems by Behrooz Mashadi, David Crolla, A John Wiley & Sons Ltd
2. Automobiles Power Train and Automobiles Dynamics by, David Crolla, A John Wiley & Sons Ltd
3. Automotive Engineering Powertrain, Chassis Systems and Vehicle Body by David Crolla, Elsevier BH New York, London, Oxford.

PEMED 1102 Transport Phenomeno Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End sem: 25 Marks
Credits: 1

Prerequisites:

1. Engineering Mathematics
2. Engineering Physics
3. Fluid Mechanics

Course Objectives:

1. To understand fluid flow and mass transfer characteristics experimentally
2. To study and find temperature distribution in conduction heat transfer
3. To calculate heat transfer coeffcient
4. To understand the simulation and analysis of flow and mass transfer

Course Outcomes:

Upon completion of this lab course, the student will be able to:

1. measure flow characteristics of laminar flow throgh pipe
2. determine temperature distribution in conduction heat transfer
3. determine heat tranfer coefficient in convective heat transfer
4. analyse and simulate flow and mass transfer

List of Experiments:

1.	Flow characteristics of laminar flow through a pipe
2.	Tempretaure distribution in conduction heat transfer trough cylinder and shpere
3.	Heat transfer coefficient in convective heat trtansfer
4.	Radiation Heat Transfer_shape factor analysis
5.	Demonstrtion of mass diffussion
6.	Numerical code on fluid flow and heat transfer

PEMED1102C: PE-I POWER TRAIN DESIGN LABORATORY

Teaching Scheme
Lecture: 2 Hrs/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Prerequisite: Theory of Machines, Machine Design, I/C Engines

Course Objectives: Students should be able to,
1. Acquire the knowledge of vehicle power train design.
2. Know the design of engine components and engine performance.
3. Know the design of transmission systems of vehicle.
4. Understand the dynamics of driveline.
5. Know the systems of hybrid electric vehicle.

Course Outcome: Students will be able to,
1. Apply the vehicle power train concepts
2. Design engine components and analyze the engine performance
3. Apply knowledge to compute the vehicle longitudinal dynamics
4. Design and analyze the transmission systems and dynamics of driveline of the vehicle

Assignments:
1. Determination of Power generation characteristics of IC Engines using programming
2. Determination of engine torque and power verses speed using programming
3. Determination of engine power loss with altitude using programming
4. Plot the variation of speed, vehicle acceleration, speed and distance travel with time,
5. Determination of effect of rotating masses on the performance of vehicle in terms of gear shift.

Project on full imperial size drawing sheet for the following
Design and Draw the of IC engine components details and its assembly

References:

1. Vehicle Powertrain Systems by Behrooz Mashadi, David Crolla, A John Wiley & Sons Ltd
2. Automobiles Power Train and Automobiles Dynamics by, David Crolla, A John Wiley & Sons Ltd
3. Automotive Engineering Powertrain, Chassis Systems and Vehicle Body by David Crolla, Elsevier BH New York, London, Oxford.

PEMED1201 A Computational Fluid Dynamics

Teaching Scheme:	**Examination Scheme:**
Theory: 3 Hrs/week	**In Sem: 25+25 Marks**
Credit: 3	**End Sem: 50 Marks**

Prerequisites

Fluid dynamics, Heat transfer, Numerical methods

Course Objectives

To introduce students to,

1. Finite volume method (FVM) of discretization for differential equations
2. Development of solution of discretized equations using various methods
3. Development of numerical codes for diffusion and convection problems
4. CFD techniques to fluid dynamics and heat transfer problem

Course Outcomes

Students will be able to

1. Discretize a given differential equation with FVM
2. Write a numerical code for diffusion and convection problems
3. Develop a Navier-Stokes equation solver
4. Apply CFD techniques to real life industrial problems

Unit 1 Introduction to CFD:

Governing equations: the continuity equation, momentum equation and energy equations, convective forms of the equations and general description, Reynolds transport theorem. Classification of partial differential equations; physical examples of elliptic, parabolic and hyperbolic equations. Mathematical nature of the flow equations& their boundary conditions.

Unit 2 Discretization Methods:

Discretization Methods: The discretization concept, the structure of discretization equations, methods of deriving the discretization equations. Finite volume methods; approximation of surface and volume Integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem. Concept of consistency, accuracy, stability and Convergence.

Unit 3 Solution of Discretization Equations

Tri-Diagonal Matrix Algorithm (TDMA), Application of TDMA Method to Two dimensional Problem, Application of TDMA Method to Three Dimensional Problem

Unit 4 Finite Volume Method for Diffusion Problems:

Finite Volume Method for Diffusion Problems:

Finite Volume Method for one dimensional steady state Diffusion, Worked Example – One dimensional steady state Diffusion, Finite Volume Method for Two Dimensional Diffusion Problem, Finite Volume Method for Three Dimensional Diffusion Problem

Unit 5 **Finite Volume Method for Convection-Diffusion Problem:**

Finite Volume Method for Convection-Diffusion Problem: Steady one dimensional convection and Diffusion, Central Differencing Scheme, Properties of Discretization Schemes, Assessment of Central Differencing Schemes for Convection Diffusion Problem, Upwind Differencing Scheme
Hybrid Differencing Scheme

Unit 6 **Solution Algorithms:**

Solution Algorithms for Pressure-Velocity Coupling Steady Flow, Staggered Grid, Momentum Equations, Simple Algorithm, Assembly of Complete Method.

Programming Assignments:

1. Development of FVM code for conduction problem
2. Development of FVM code for convection problem
3. Development of FVM code for Convection-Diffusion Problem
4. Lid Driven Cavity using SIMPLE algorithm

Visiting Lectures: Visiting lectures will conducted by the professionals from Industries/Research labs etc.

References

1 S. V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill.

2 John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor &Francis

3 Versteeg, H. K. and Malalasekara, W. (2008). Introduction to Computational Fluid Dynamics: The Finite Volume Method. Second Edition (Indian Reprint) Pearson Education.

4 4. Anderson, J.D. Computational Fluid Dynamics, McGraw Hill, 1995.

PEMED 1201B Design for Manufacturing and Assembly

Teaching Scheme
Lecture : 3 Hrs/week

Examination Scheme
In semester : 50 marks
End semester : 50 marks
Credits : 3

Prerequisite: Manufacturing process, Machine shop, Machine Design I & II, CAMD, Mini / Final year B.E./B.Tech. Projects

Course Objectives:
1. To introduce the DFMA concepts general guidelines for selection of material and manufacturing processes.
2. To acquaint students with various design rules and recommendations for optimum design based on different manufacturing process and material used to manufacture the parts.
3. To make students understand the design factors and processes along customer desires for manufacturing.
4. To develop thinking in the mind of students about the process of cost saving by knowing method to use DFMA concepts for avoid scrap and minimize reworks, design iterations between design and manufacturing / vendors.

Course Outcome:
After learning the course the students should be able to –
1. Identify the design factors and processes along customer needs for manufacturing.
2. Apply various techniques of DFMA for product design and assembly.
3. Apply GD&T guidelines for DFMA processes.
4. Identify the design factors for design for additive manufacture and for environment.

Course Description:
- To introduce the basic concepts and design guidelines of different manufacturing processes.
- It is also equally important that students should understand the concepts of design for assembly to reduce number of parts and to optimize design without compromising function.
- Also, to introduce current global trends, requirements of environmental design and DFMA tools.

Unit 1: Introduction to DFMA and general requirements (4 Hrs.)

- **Introduction:** Design for Manufacture and Assembly, History of DFMA, DFMA during product design, advantages, DFMA case studies,
- **Classification and Selection:** Introduction to Manufacturing processes, Introduction to Materials, Selection of Manufacturing processes and materials for product design.

Unit 2: Design for Assembly **(6 Hrs.)**

- **Design for Assembly:** The assembly process, Characteristics and applications, General taxonomies of assembly operation and systems, Examples of common assemblies;
- **DFA for design consideration and design recommendation for Part Handling**- Insertion, Fasteners [e.g. for manual assembly, high-speed automatic assembly and robot assembly],
- **DFA analysis** (evaluating assembly): Assembly Metrics, Example of worksheet;

Unit 3: Design for Machining **(7 Hrs.)**

- **Introduction:** Material removing/machining processes; recommended materials for machinability;
- Design for **Turning, Milling, Round-Holes Machining, Planning, Shaping and Slotting, Broaching, Grinding** [Process description; Typical characteristics and applications; Suitable materials; Dimensional factors and tolerances];
- **Design recommendations for Jigs & Fixtures** for manufacturing and measurement parts.

Unit 4: Design for Forming and Joining Processes **(7 hrs.)**

- Design for **Castings, Injection Molding, Forging, Sheet-metal stamping Welding Extrusion and Powder Metal Processing** [Process steps, Typical characteristics and applications; Defects; Suitable materials; Design consideration and recommendations for selected process].

Unit 5: Design for Additive Manufacturing and Environment **(5 Hrs.)**

- **Additive Manufacturing:** Brief introduction, comparison between Additive Manufacturing (AM) and traditional manufacturing methods; Typical characteristics (w.r.to supports, overhangs, rounds etc.) and application; Rapid Prototyping.
- **Design for the Environment:** Introduction, objectives, Design guidelines, Techniques to reduce environmental impact, Design for: Recyclability/remanufacture, energy efficiency, sustainability, Design to regulations and standards.

Unit 6: G D & T for DFMA and DFMA Tools **(7 Hrs.)**

- **G D & T Considerations for DFMA:** Tolerances, Limits and Fits (IS and ASME Y 14.5 standard), tolerance Chains and identification of functionally important dimensions. Geometric tolerancing for manufacture: Tolerance stack up calculations; Review of relationship between attainable tolerance grades and different machining.
- **DFMA Tools:** DFA index, Introduction to DFX Software, DFMA case studies.

- **Assessment Methods:**

  1. Assignment Based evaluation: T1- 25 Marks (5 Marks per assignment)

  ❖ Four assignments of case studies, based on visiting any manufacturing and assembly industry related to units no. 2, 3, 4 and 5.

  ❖ Case study base assignment using software (to understand automated DFM process).

  2. Paper Pen Tests: T2 - 25 Marks and ESE – 50 Marks.

- **Text Books:**

1. G. Boothroyd, P. Dewhurst, W. A. Knight, Product Design for Manufacture and Assembly, CRC Press.
2. K. T. Ulrich and S. D. Eppinger, Product Design and Development, McGraw-Hill Higher Education.
3. Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill.
4. G E Dieter, Engineering Design - A Material Processing Approach, McGraw Hill.
5. B. R. Fischer, Mechanical Tolerance stackup and analysis, CRC Press.
6. D E Whitney, Mechanical assemblies: their design, manufacture, and role in product development, Oxford Press.

- **References**:

1. J. Lesko, (1999) Industrial Design, Materials and Manufacture Guide, John Willy and Sons, Inc.
2. George E. Dieter and Linda C. Schmidt (2009), Engineering Design, Fourth edition, McGraw-Hill companies, New York, USA
3. Geoffrey Boothroyd, Peter Dewhurst and Winston Knight (2002) Product Design for Manufacture and Assembly, Third Edition, CRC press, Taylor & Francis, Florida, USA
4. O. Molloy, S. Tilley and E.A. Warman (1998) Design for Manufacturing and assembly, First Edition, Chapman &Hall, London, UK.
5. D. E. Whitney, (2004) Mechanical Assemblies: Their Design, Manufacture, and Role inProduct Development, Oxford University Press, New York
6. A.K. Chitale and R.C. Gupta, (1999) Product design and Manufacturing, Prentice Hall of India, New Delhi.
7. James G. Bralla (1998) Design for Manufacturability Handbook, Second Edition,McGraw-Hill companies, New York, USA
8. Geoffrey Boothroyd (2005) Assembly Automation and Product Design, SecondEdition, CRC press, Taylor & Francis, Florida, USA
9. G. Q. Huang (1996) Design for X, Concurrent Engineering Imperatives, First Edition, Chapman &Hall, London, UK.

Audit Course (AC3101) : Employability Skill Development

Teaching Scheme: Lectures: 2 Hrs/2Week

Course Objectives:
1. To enhance the analytic and problem solving ability of students.
2. To develop English language proficiency .
3. To make them aware of communication skills necessary for getting employed and being successful in a profession.

Course Outcomes:
After successful completion of the course, students will be :
1. Able to solve Numerical ability questions without using calculators.
2. Equipped with essential language skills (written, verbal and non-verbal)
3. Able to exhibit their presentation skill and be ready for facing interviews.

Section A: Quantitative Analysis:
1. Divisibility, Remainder Theorem
2. Surds & Indices
3. LCM & HCF
4. Percentage
5. Average
6. Ratio Proportion
7. Profit Loss
8. Set Theory (Venn Diagram)
9. Alligation
10. Time & Work
11. Speed Distance Time
12. Boats & Trains
13. Equations
14. No. Series, AP GP HP
15. Simple & Compound Interest
16. Clocks
17. Calenders
18. Relations & Age
19. Permutation & Combination
20. Probability
21. Verbal & Non Verbal Reasoning
22. Data Interpretation

Section B - Communication Skill
[Speaking Skills – Public Speaking, Presentation skills, Group discussion]
1. Self introduction-Elevator pitch, SWOT analysis,Resume Preparation as per College format.
2. Mock interviews (individual)
3. Group Discussion on current issues.
4. Presentation skills on Seminar /Mini Project, Mad ads
5. Public Speaking : Book/ Movie review, Extempore, Debates
6. Essay writing

Books for references:

1. Basic Managerial Skills for all E. H. McGrath, Eastern Economy Edition, Prentice hall India.
2. Personality Development and Group Discussions,Barun K. Mitra, Oxford University Press
3. Group Dissussions and Interview Skills : Priyadarshi Patnaik, Foundation Books :

Cambridge University Press
4. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success: Gopalaswamy Ramesh, Mahadevan Ramesh
5. Abhijeet Guha, “Quantitative Aptitude for competitive exams”, McGraw-Hill Education

Reference Website:

1. *https://www.indiabix.com/*
2. *https://www.aptitude-test.com/*
3. https://www.careerride.com/
4. https://www.freshersworld.com/

20AC 01 Soft Skills and Business Communication

Teaching Scheme: Practical: 2 Hrs/Week Examination Scheme: In-Semester: Nil

End-Semester: Nil

Credits: Nil

Course Objectives:

1. To develop team spirit, leadership and professionalism.

2. To focus on over all personality development.

3. To develop right attitudinal and behavioral aspects, and build the same through

activities. 4. Possess right professional and social ethical values.

5. To make student confident in communicating in Business environment.

6. Improve their fluency in English language.

Course Outcomes:

After completion of the course, students will be able to

1. Communicate, interact and present his ideas to other professionals.

2. Explain role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.

3. Develop right attitudinal and behavioral aspects, and build the same through activities.

4. Develop right professional and social ethical values.

5. Overcome apprehension of communicating in professional environment.

6. Language proficiency will enable student to present ideas, applications and reports effectively in oral and written communication.

Unit I: Self-Awareness & self-Development (03)

Self Assessment, Self Appraisal, SWOT, Goal setting -Personal &career-Self-Assessment, Self Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting. b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

Unit II: Communication Skill (06) Importance of communication, types, barriers of communication, effective communication.

Speaking Skills– Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening.

Group Discussion- characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

Presentation skills- planning, preparation, organization, delivery.

Written Skills– Formal & Informal letter writing, Report writing, Resume writing- Sentence structure, sentence coherence, emphasis. Paragraph writing, Letter writing skills-form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Unit III: Corporate/ Business Etiquettes. (02)

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting Understand the importance of professional behavior at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit IV: Interpersonal relationship (03)

Team work, Team effectiveness, Group discussion, Decision making - Team Communication Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity. Unit V: Leadership skills (01) Leaders‟ role, responsibilities and skill required- Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about

Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

Unit VI: Other skill (03)

Time management-The Time management matrix, apply the Pareto Principle (80/20Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say “no” to time wasters, develop your own individual plan of action.

Stress management- understanding the stress & its impact, techniques of handling stress

Problem solving skill, Confidence building Problem solving skill, Confidence building.

Reference Books:

1. S. Kumar, S.Pushpalata, „Communication Skills‟, Oxford University Press, (1 st Edition), (2011)

2. K. Mohan, M. Banerji, „Developing Communication Skill‟ , McMillan India Ltd, (1 st Edition), (2011)

3. S. Sweeney, „English for Business Communication‟ Cambridge University Press,(1st Edition), (2013)

4. B. K. Mitra, „Personality Development and Group Discussions‟, Oxford University Press, (1st Edition),(2010)

5. S. Napoleon Hill „Think and Grow Rich‟, Ebury Publishing,(1 st Edition), (1937)

CE 3101 COMPUTER NETWORKS

Teaching Scheme
Lecture: 3 Hrs./week
Tutorial: 1 Hrs / week

Examination Scheme
In Semester Exam : 50 Marks
End semester: 50 Marks
Credits: 4

Prerequisite: Fundamental of Computer Networks (CE 2202)

Forward Linkage:
- Wireless and Mobile Communication (PECE 3201 Elective III)

Course Objectives:
Facilitate the learners to:-
1. Apply and distinguish the fundamental concepts of networking standards, protocols and technologies.
2. Identify role of protocols at various layers in the protocol stack.
3. Select and Compare the appropriate network by understanding the given requirerments for a given system.
4. Identify fundamental concepts of wireless network, mobile network and network security.

Course Outcome:
By taking this course, the learner will be able to–
1. Analyze data flow between two communicating hosts using various protocols at Application, Transport and Network Layer.
2. Identify appropriate computer networking protocol for a given application.
3. Analyze the requirements for a given system to select an appropriate network.
4. Identify technologies and characteristics in mobile network , wireless network and network security.

Unit-1: Network Layer (07)
Design Issues, Routing Algorithms: Dijkstra's, Distance vector Routing, Link State Routing, Network Layer Protocols: Address Resolution Protocol, Reverse Address Resolution Protocol, Internet Control Messaging Protocol, Routing Protocols: Routing Information Protocol, Open Shortest Path First , Boarder Gateway Protocol, Unicast Routing Protocols, Multicast Routing Protocols.

Unit-2: The Network Layer in the Internet (07)
IP Protocol addressing: IPV4 address classes, Public and private IP addresses. IP sub-netting, IP super-netting, classless inter domain routing (CIDR), Overview of IPv6, IPV4 Vs IPV6.

Unit-3: Transport Layer **(08)**

Transport layer design issues, Protocol Overview, Header Structure, Transmission Control Protocol (TCP) functions such as Connection Management, Error control, Flow control, Congestion control, User Datagram Protocol (UDP) overview, typical applications support, TCP Vs UDP, introduction to Socket Programming, TCP and UDP Socket Primitives. Quality of Service (Quality of Service): Differentiated Service

Unit-4: Application Layer **(07)**

Hyper Text Transport Protocol (HTTP): Overview, header structure, connections, request and response messages, persistence and non-persistence HTTP. Cookies, Simple Mail Transport Protocol (SMTP): Overview and Working of MIME, POP3, File Transfer Protocol (FTP): Overview and Working, identifying protocols for given application with example.

Unit-5: Network Servers **(06)**

Client-Server Architecture, Peer -to- Peer Architecture, Introduction to various Types of Servers, Dynamic Host Configuration Protocol (DHCP): Header, Working, DHCP Server Configuration, Domain Name Server(DNS) : Working, Proxy Server : Need and Significance, working, configuration, Introduction to virtualization: Server Visualization, creating network and providing internet connectivity.

Unit-6: Wireless and Mobile Networks **(07)**

Introduction to wireless LAN, Introduction to mobile communication: 1G,2G,3G,4G,features, limitations of mobile computing, Introduction to Network Security: Security mechanism and Services, Introduction of cryptography, Network Perimeter Security concept: Firewall.

Text Books:

1. Andrew S Tanenbaum, David J Wetherall,**'Computer Networks'**, *Pearson,* (5th Edition), (2014).

2. Forouzan B **'Data Communication and Networking'**, *Tata McGraw Hill,* (5th Edition), (2013).

Reference Books:

1. Kurose, Ross **'Computer Networking a Top Down Approach Featuring the Internet'** *Pearson,* (6th Edition) , (2014).

2. Stallings W **'Data and Computer Communications'** *Prentice Hall Pvt.Ltd*. (8th Edition), (2009).

3. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff **'Unix Network Programming Volume 1'**, *Addison-Wesley Publication*, (3rd Edition), (2003).

4. Geoffrey C. Fox, Jack Dongarra, and Kai Hwang,**'Distributed and Cloud Computing'** Morgan Kaufmann, (1st Edition),(2011).

5. Stallings W,**'Cryptography and Network Security: Principles and Practice'**, *Pearson*, (6th Edition), (2014).

CE 3102 DATABASE MANAGEMENT SYSTEMS

Teaching Scheme	**Examination Scheme**
Lecture : 3 Hrs/week	In semester : 50 marks
Tutorials: 1 Hr/week	End semester : 50 marks
	Credits : 4

Prerequisite: Data Structures and Algorithms II(CE 2201)

Forward Course Linkages:
- Data Mining Data Warehousing (PECE 3202)
- Big Data Analytics (PECE 4101)
- Business Intelligence(OE 4201)
- E-Business (OE 4202)

Course Objectives:
To facilitate the learners to-
1. Design database schema using an entity relationship diagram (ERD) and normalization.
2. Design queries using Structured Query Language (SQL) to retrieve the required data from the database.
3. Understand Transaction management in a Database management System.
4. Understand NoSQL Databases to handle unstructured data.
5. To introduce advanced database topics such as Special purpose databases, Distributed database systems, Big data, Data mining and Data Warehousing etc.

Course Outcomes
With successful completion of the course, the students will be able to–
1. Design the Entity Relationship diagram for the system / application considering its constraints and design issues.
2. Apply the knowledge of SQL to retrieve the required data from the database.
3. Make use of various Transaction management algorithms for scheduling concurrent transactions.
4. Apply the knowledge of NoSQL databases to handle unstructured data.
5. Survey advanced database topics such as Special purpose databases, Distributed databases, Big data, Data mining and Data Warehousing.

Unit 1 : Introduction to Database Management Systems (06)
Introduction to database management systems, Advantages of a Database Management Systems over file-processing systems, Data abstraction, Data Independence, Relational Model, Architecture
Introduction to NoSQL databases. Special purpose databases- e.g. Temporal, Spatial, In-memory, Multimedia databases etc.

Unit 2 : Database design and Structured Query Language (08)
Data Modeling: Entity Relationship Diagram (ERD), Components and conventions (entity, attributes, relationships) Primary key, Converting Entity Relationship Diagram into tables, Foreign key and other Integrity constraints. Extended Entity Relationship Diagram features.
Structured Query Language:
SQL - Data Definition Language (DDL) : SQL Data Types, Null values and Literals, Creating, Modifying and Deleting tables. Views and Indexes.
SQL - Data Manipulation Language (DML) : Insert, Update, Delete, Select (all clauses), Set Operations, Joins, Tuple Variables, Nested sub-queries, Query Processing.

SQL - Transaction Control Language (TCL) : Commit, Savepoint, Rollback
SQL - Data Control Language (DCL) : Grant, Revoke
PL/SQL (Programming Language SQL) : Stored Procedures and Functions, Cursors, Triggers.

Unit 3 : Normalization **(06)**

Converting ERD to tables (Weak entity set, multivalued attributes,EER features).
Normalization, Purpose of Normalization, Data Redundancy and Anomalies (Insert / Delete / Update), Normal Forms: 1NF, Functional dependency, decomposition of tables using Functional Dependency :Second Normal Form (2NF), Third Normal Form (3NF), Boyce Codd Normal Form (BCNF)

Unit 4 : Transaction management **(08)**

Transactions, ACID Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability : Conflict serializability, View serializability, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Need, Locking Methods, Deadlocks,Timestamping methods. Recovery methods : Shadow-Paging and Log-Based Recovery, Checkpoints

Unit 5 : NoSQL Databases **(08)**

Structured and unstructured data, NoSQL- Comparative study of SQL and NoSQL databases, Big data. BASE Properties, Types of NoSQL databases- Key-value store – JSON, Document Store - MongoDB, Column store - HBase and Graph based, MongoDB- MongoDB shell, Create, Retrieve, Update and Delete (CRUD) Operations, Indexing, Aggregation and MapReduce in MongoDB

Unit 6 : Advances in Databases **(06)**

Data warehousing: Data warehouse Architecture, schemas, data marts, Extract, Transform and Load (ETL) process
Data mining – Descriptive and predictive Data mining techniques
Introduction Business intelligence

Text Books:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, **'Database System Concepts'**, *McGraw Hill*, (6th edition), (2013)
2. Jiawei Han, Micheline Kamber and Jian Pei, **'Data Mining – Concepts and Techniques'**, *Morgan Kaufmann Publishers*,(3rd Edition), (2012)
3. Kristina Chodorow, Michael Dirolf, **'MongoDB: The Definitive Guide'** , *O'Reilly*, (2nd Edition), (2013)
4. Ramez Elmasri and Shamkant B. Navathe, **'Database Systems'**,*Pearson*, (6th Edition), (2013)

References:

1. Raghu Ramakrishnan and Johannes Gehrke, **'Database Management Systems'**, *McGraw Hill*, (3rd Edition), (2003)
2. C. J. Date, **'An Introduction to Database Systems'**, *Pearson*, (8th Edition), (2006)
3. Thomas Connally, Carolyn Begg, **'Database Systems'**, *Pearson*, (4th Edition), (2012)

Tutorials

The tutorials aim to strengthen the database designing and query writing skills of the learners.

Example Assignments for Tutorials:

1. Design an Entity Relationship diagram (ERD) for a given system.
2. Convert the ERD to tables and Normalize the tables up to Third Normal Form (3NF).
3. Write Structured Query Language Data Definition Language (SQL DDL) commands for Creating the tables with appropriate integrity constraints, Altering the tables and Deleting/ Dropping the tables.
4. Write SQL queries for retrieving the required data from the tables using SELECT, GROUP BY and ORDER BY clauses.
5. Write SQL queries using different JOINs.
6. Write SQL queries using UNION, INTERSECTION, EXCEPT and SUBQUERIES.
7. Write SQL commands to create Database VIEWS and INDEX.
8. Write a Stored Procedure (using explicit cursor) for the given requirements.
9. Write MongoDB Queries using different variations of the FIND() function.
10. Write Queries using the aggregation framework of MongoDB.
11. Define the dimensions and measures for the given database to build the star schema for the given database.
12. Define data mining query for the given database.

CE 3103

Design and Analysis of Algorithms

Teaching Scheme:
Teaching: 3 Hrs/Week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credits: 3

Prerequisite:
1. Data Structures and Algorithms II (CE 2201)

Course Objectives:
To facilitate the learners :-
1. Understand and apply methods of analysis of algorithms.
2. Learn and apply strategies for designing the algorithms.
3. Learn and apply the concept of computational complexity classes for the given problem.
4. Get acquainted to the concept of abstract algorithms design.

Course Outcomes:
By taking this course, the learner will be able to :–
1. Apply the knowledge of analyzing the algorithm.
2. Evaluate algorithm design techniques for solution of a problem.
3. Perceive the given problem solution from computational complexity classes point of view.
4. Build knowledge to understand the design requirements of abstract algorithms.

UNIT I: **Introduction** [7]
Basic steps to solve the problems, Performance analysis of recursive and non-recursive algorithms, Recurrences: substitution method, recursion-tree method, master method.

UNIT II: **Divide and Conquer & Greedy Strategy** [7]
Divide and Conquer: General Strategy, Control Abstraction, min/max problem, Binary Search, Quick Sort and Merge Sort.
Greedy Method: General strategy, control abstraction, Knapsack problem, Job sequencing with Deadlines, Minimal Spanning Tree algorithms.

UNIT III: **Dynamic Programming** [7]

Dynamic programming: General Strategy, Multi stage graphs, Optimal Binary Search Tree problem(OBST), 0/1 Knapsack problem, Travelling Salesperson Problem.

UNIT IV: **Backtracking and Branch and Bound** [7]

Backtracking: General Strategy, Implicit and Explicit constraints, DFS State space tree formulation, Sum of subsets, 8 Queens problem, Hamiltonian Cycle problem, Maze problem.

Branch and Bound: General Strategy, BFS state space tree formulation, Traveling Salesperson Problem.

UNIT V: **Computational Complexity Classes** [7]

Basic Concepts of complexity classes, Non deterministic algorithms, The classes P and NP, NP Complete and NP Hard.

Decision problems: Clique Decision problem, Node cover Decision problem,Directed Hamiltonian Cycle Problem, Satisfiability problem, Travelling salesman problem, NP Hard problems

UNIT VI: **Abstract Algorithms** [7]

Introduction to Parallel Algorithms, Evolutionary algorithm: Genetic Algorithms and Tabu search

Text Books:

1. Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2nd edition. Galgotia publication,, 2008, ISBN: 978 81 7371 6126

2. Gilles Brassard and Paul Bartley, "Fundamental of Algorithm.", PHI, 2010, ISBN-9788120311312 New Delhi

3. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm", 3rd edition, 2009,PHI

Reference Books:

1.Fayez Gebali, “Algorithms and Parallel Computing”, Willy, 2015, ISBN 9788126553891

2.Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 2014, Pearson Education

3.A. V. Aho and J.D. Ullman, "Design and Analysis of Algorithms", Pearson Education, 2006, ISBN: 978 81 317 0205 5

4.Parag Himanshu Dave, Himanshu Bhalchandra Dave, “ Design And Analysis of Algorithms”, PEARSON Education, ISBN 81-7758-595-9

PECE 3101 Cloud Computing

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits: 3

Prerequisites: Operating Systems (CE 2203)

Course Objectives:
To facilitate the learner to-
1. Understand the basic concepts related to cloud computing.
2. Analyze the underlying principles of different cloud service models.
3. Understand and apply the security techniques in cloud computing.
4. Get exposure to emerging trends in cloud computing.

Course Outcomes:
By taking this course, the learner will be able to-
1. Apply cloud computing concepts and the emerging trends to cloud based systems.
2. Analyze the cloud services and models.
3. Analyze various cloud platforms and tools for realization of different services.
4. Apply security concepts to the cloud environment.

Unit 1: Introduction (06)
Introduction to Cloud Computing, Cloud Economics, National Institute of Standards and Technology (NIST) Definition of Cloud Computing, Cloud Characteristics, Cloud Service Models, Cloud Deployment Models, Benefits, Challenges and Risks.

Unit 2: Infrastructure-as-a-Service (IaaS) (08)
Introduction to Infrastructure-as-a-Service (IaaS), NIST Cloud Computing Reference Architecture, Virtualization – Introduction, Taxonomy, Characteristics, Pros and Cons, Types of Service Level Agreement (SLA), Hypervisors - Xen, Kernel Virtual Machine (KVM), VMware, Containers, Case Study- Amazon Web Services (AWS).

Unit 3: Platform-as-a-Service (PaaS) (07)
Introduction to Platform-as-a-Service (PaaS), Data in Cloud: Relational Databases, NoSQL Databases, Big Data, Cloud File System: Hadoop Distributed File System (HDFS), HBase, Map-Reduce Model, Case Study- Google App Engine (GAE).

Unit 4: Recent Trends (06)
Inter-cloud / Federated Cloud, Internet of Things (IoT) and Cloud Computing, Mobile and Cloud Computing, Data Centers- Introduction, Cloud Applications.

Unit 5: Software-as-a-Service (SaaS) (08)

Introduction to Software-as-a-Service (SaaS), Multi-tenancy, Mashups, Service Oriented Architecture (SOA), Web Services based on Simple Object Access Protocol (SOAP) and REpresentational State Transfer (REST), SaaS Applications, Case Study- Salesforce.com.

Unit 6: Cloud Security (07)

Cloud Security Fundamentals, Cloud Security Challenges and Risks, Virtualization Security, Identity Management and Access Control, Secure Execution Environment and Communication.

Text books:

1. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, '**Mastering Cloud computing**', *McGraw Hill Education*, (2013), ISBN 978-1-25-902995-0.
2. Gautam Shroff, '**Enterprise Cloud Computing**', *Cambridge University Press*, (2010), ISBN 978-0-521-13735-5.
3. Ronald Krutz and Russell Dean Vines, '**Cloud Security**', *Wiley India Pvt. Ltd.*, (2010), ISBN 978-81-265-2809-7.
4. Kailash Jayaswal, Jagannath Kallakurchi, Donald Houde, Dr. Deven Shah, '**Cloud Computing Black Book**', *DreamTech Press*, (2015), ISBN 978-93-5119-418-7.

Reference books:

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, '**Cloud Computing Concepts, Technology and Architecture**', *Prentice Hall*, (2013), ISBN 978-01-333-8751-3.
2. Barrie Sosinsky, '**Cloud Computing Bible**', *Wiley India Pvt. Ltd.*, (2015), ISBN 978-81-265-2980-3.
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, '**Cloud Computing Principles and Paradigms**', *Wiley India Pvt. Ltd.*, (2015), ISBN 978-81-265-4125-6.
4. Dr. Kumar Saurabh, '**Cloud Computing**', *Wiley India Pvt. Ltd.*, (2011), ISBN 978-81-265-2883-7.
5. Tim Mather, Subra Kumaraswamy, Shahed Latif, '**Cloud Security and Privacy**', *O'Reilly*, (2011), ISBN 13:978-81-8404-815-5.
6. A. Srinivasan, J. Suresh, '**Cloud Computing: A Practical Approach for Learning and Implementation**', *Pearson*, (2014), ISBN 978-81-317-7651-3.

Web References:

1. http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-291r2.pdf
2. https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf
3. http://searchdatacenter.techtarget.com/definition/data-center
4. http://www.sapdatacenter.com/article/data_center_functionality/
5. https://www.salesforce.com

Maharshi Karve Stree Shikshan Samstha's
Cummins College of Engineering for Women, Pune
(An autonomous Institute affiliated to Savitribai Phule Pune University)
Department of Computer Engineering

Elective II- PECE 3101
Statistics for Computer Science

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hr/Week	In Semester : 50 Marks
	End Semester : 50 Marks
	Credits : 3

Course Objectives

To facilitate the learners :-

1. To utilize fundamentals of statistics and descriptive statistics concepts.
2. To analyse multivariate data using multivariate, correlation and regression analysis.
3. To select and apply statistical quality control techniques using different statistical quality control charts.
4. To apply statistical inference techniques for dealing with uncertainty in decision making.

Course Outcomes

By taking this course, the learner will be able to –

1. Apply the methods of statistics on data and types of data.
2. Experiment with statistical multivariate analysis using variance, correlation and regression.
3. Apply statistical quality control techniques for given data.
4. Use sample statistics to draw inference.

Unit 1: Basic statistics (6 hrs)

Definition,collection and type of data, processing of data, classification,tabulation and graphical representation of data, limitation of statistics.
Types of averages: arithmetic mean, median, mode, geometric mean, harmonic mean, relationship among averages, variation, merits and limitations of variation, standard deviation

Unit 2 : Correlation and Regression (8 hrs)

Introduction, types of correlation, methods of studying correlation : scatter diagram, graphic method, Karl Pearson's coefficient of correlation, Rank correlation coefficient
Regression analysis : Introduction, uses of regression analysis, difference between correlation and regression analysis. Regression lines, regression equations, regression coefficient and it's properties.

Unit 3: Multivariate Analysis **(8 hrs)**

Partial regression, partial correlation, multiple correlation, multivariate regression, principal component analysis (PCA), introduction to cluster analysis.

Unit 4: Statistical Inference -Test of Hypothesis **(8 hrs)**

Introduction, procedure of testing hypothesis, types of hypothesis, two types of error in testing of hypothesis, two-tailed and one-tailed test

t-test, chi-square test, F-test, degrees of freedom, relation between t-test,chi-square and F-test.

Unit 5: Analysis of Variance **(6 hrs)**

Introduction, assumptions and techniques of analysis of variance, One-Factor analysis of variance, Two factor analysis of variance:Parameter estimation and testing hypotheses

Unit 6 : Statistical Quality Control **(6 hrs)**

Introduction, control charts : X chart, σ chart, R chart, role of acceptance sampling, OC curve

Case study : Educational and Psychological statistics.

Text Books:

1) "Statistical Methods", S.P. Gupta, 41st Edition, 2011, ISBN :978-81-8054-862-8, Sultan Chand and Sons publication.

2) "Basic statistics", B.L. Agarwal, 9th Edition, 2011, ISBN:978-81-224-2472-0, New Age publication.

3) "Statistics in Nutshell", Sarah Boslaugh and Paul Andrew Watters, 2008, ISBN : 978-81-8404-568-0, SPD O'Reilly publication.

Reference Books:

1) "Statistical Data analytic" by Piegorsch W.W., Wiley publication, 2017

2) "Introduction to Statistical Quality Control" by D.C Montgomery, 4th ed.,Publication John Wiley & Sons, 2007.

3) "Introductory statistics", Sheldon M. Ross, 2nd Edition, 2006, ISBN : 81312-00485, Elsevier publication.

4) "Applied multivariate statistical analysis", Richard A. Johnson, Dean W. Wichern, 6th edition, 2012, ISBN-978-81-203-4587-4, PHI Learning

CE 3104 DATABASE MANAGEMENT SYSTEMS LABORATORY

Teaching Scheme
Practical : 02 Hours/Week

Examination Scheme
Practical: 25 Marks
Credits : 1

Course Objectives:
To facilitate learners to-

1. Implement/Execute Structured Query Language (SQL) queries.
2. Implement/Execute PL/SQL stored procedures and functions.
3. Implement/Execute MongoDB queries.
4. Develop 2tier database applications.

Course Outcomes:
On completion of the course, student will be able to–

1. Apply the knowledge of Structured Query Language (SQL) clauses to query the relational database.
2. Apply the knowledge of PL/SQL to solve the given business problem.
3. Apply the knowledge of NoSQL databases to query semi structured documents.
4. Solve the given database problem using database programming skills.

Example Assignments for Laboratory

Assignments Group A (Mandatory)

1. Design and Execute SQL Data Definition Language (DDL) statements to create tables and insert data into the tables. Make use of the Sequence feature.
2. Design and Execute at least 15 SQL queries for suitable database application using SQL Data Manipulation Language (DML) statements: Insert, Select, Update and Delete.
3. Design and execute at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.
4. Create a 2 tier application using Java Database Connectivity (JDBC).
5. Create a MongoDB collection and Execute the MongoDB Queries using the find() function, SAVE method, logical operators.

Assignments Group B (Any 4)

1. Design and execute a Programming Language/ Structured Query Language (PL/SQL) stored procedure for returning a book in a library system. The procedure should calculate a fine as follows: Check the number of days (from date of issue), - If days are between 15 to 30 then fine amount will be Rs 5 per day. - If no. of days>30, per day fine will be Rs 50 per day & for days > 30, Rs. 5 per day. After submitting the book, status will change from I to R.
2. Write a PL/SQL stored procedure for calculating the income tax of employees of the company.
3. Write a PL/SQL stored procedure for populating the class secured by every student in the class.
4. Write a PL/SQL block of code that will merge the data from the old_Books table to the new Books table. If the data in the first table already exist in the second table then that data should be skipped.

5. Write a database trigger which will ensure that when data is inserted in the EMPLOYEE table, the department name is always in Upper case.
6. Write a database trigger which will ensure that when data in the Accounts table is updated, the old copy is preserved in the Transaction_Log table along with the date and userID.
7. Write a database trigger which will ensure that when data in the EMPLOYEE table is deleted, it is first copied in the Ex-employees table along with the date of deletion.
8. Write a PL/SQL function to calculate the number of distinction holders, first class holders, second class holders in the class.
9. Create a 2tier application using MongoDB as back end and Java as front end.
10. Implement aggregation and indexing with suitable example using MongoDB.
11. Implement Map reduce operation with suitable example using MongoDB.

Books/ Web references:

1. https://downloads.mysql.com/docs
2. Kristina Chodorow, Michael Dirolf, **'MongoDB: The Definitive Guide'** , *O'Reilly*, (2nd Edition)
3. http://docs.mongodb.org/manual/

CE 3105 Computer Networks Laboratory

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme:
Practical : 25 Marks
Credits: 1

Course Objectives:
1. Configure the computing nodes with understanding of protocols and technologies.
2. To learn network programming.
3. Use modern tools for network traffic analysis and various networking configurations.
4. Learn Fundamental concepts of Virtualization.

Course Outcomes:
On completion of the course, student will be able to -
1. Configure switches and routers.
2. Demonstrate LAN and WAN protocol behavior using Modern Tools.
3. Analyze data flow between two communicating hosts using various protocols at Application, Transport and Network Layer.
4. Develop Client-Server Application.

Example List of Assignments:

Group A: (Mandatory)

1. Design an IP scheme for a WAN network (minimum 3 networks) using Cisco Packet Tracer tool.
2. Simulation of routing in the above network using Routing Information Protocol (RIP), by using CISCO packet tracer tool.
3. Write a program to analyze following packet formats captured through Wireshark for wired network. 1. Ethernet 2. IP 3.TCP 4.UDP (using Python).

Group B: (Any Four)

1. Installing and configuring DHCP server (windows server).
2. Write a program using TCP socket for wired network for following (using JAVA/ C)
   a. Say Hello to Each other b. File transfer
3. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines. (using JAVA / C).
4. Configuring Ftp server for file upload /download using Cisco Packet Tracer.
5. Write a program to demonstrate subnetting and find the subnet masks.(JAVA /Python).
6. Write a program for DNS lookup. Given an IP address input, it should return URL and vice-versa. (JAVA / Python).
7. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol (JAVA).

Group C:

1. Creation and configuration of Virtual Machines- Create 2 local virtual machines on host and ping the Virtual Machine.

CE 3106 PROGRAMMING SKILL DEVELOPMENT LABORATORY-I

Teaching Scheme
Practical : 4 Hrs/week

Examination Scheme
Oral : 50 Marks
Credits: 2

Prerequisites:

- Principles of Programming Languages Laboratory (CE2105)
- Data Structures and Algorithms-II (CE2202)

Course Objectives:

To facilitate the learners to

1. Explore Android tools.
2. Learn to develop mobile applications.
3. Create data-driven applications.
4. Design small system using Python or Android

Course Outcomes:

By taking this course, the learner will be able to

1. Analyze problems and select suitable Android development tools
2. Create mobile applications using basic components from Android Studio
3. Create data-driven mobile applications
4. Design python Application to handle the Data

Example list of Assignments

Group A (Mandatory)

1. Download, install and configure android development tools, plugins and SDK / Studio.
2. Design simple calculator using UI Widgets – button, textview, editview etc.
3. Develop an application that uses Layout Managers and event listeners.
4. Develop an application that change text formatting.
5. Design an application in Python using classes and objects.
6. Write python code that loads any dataset and perform basic operations, and plot the graph.

Group B (Any Three)

1. Write a mobile application that draws basic graphical primitives on the screen.
2. Develop a mobile application that makes use of database.
3. Develop a native mobile application that uses GPS location information.
4. Implement a mobile application that creates an alert upon receiving a message.
5. Write a mobile application that creates alarm clock.
6. Write a mobile application for multimedia Application.
7. Write a mobile application for Image transformation.
8. Implement MySQL/Oracle database connectivity using python and implement Database navigation operations (add, delete, edit,) using ODBC/JDBC.
9. Write a program for Socket programming using python .

Group C

1. Micro Project.

PECE 3102 Cloud Computing Laboratory

Teaching Scheme	**Evaluation Scheme**
Practical: 2 Hrs/week	In Semester: 25 Marks
	Credits: 1

Course Objectives:
To facilitate the learners to-

1. Explore the underlying principles of Infrastructure-as-a-Service (IaaS), virtualization and containers.
2. Understand the use of Map-Reduce programming model of the Hadoop ecosystem.
3. Get exposure to the use of cloud Application Programming Interfaces (APIs) for developing sample application(s).
4. Study different cloud platforms and tools for various cloud service models.

Course Outcomes:
By taking this course, the learner will be able to-

1. Apply the hypervisor and container-based virtualization.
2. Experiment with Map-Reduce programming model by implementing sample programs.
3. Make use of CloudSim framework for understanding cloud computing infrastructure and services.
4. Choose relevant social networking and cloud Application Programming Interfaces (APIs), services.
5. Analyze the use of different cloud platforms and tools for various cloud service models.

Example list of assignments:

Teachers will appropriately adopt assignments on similar lines as the examples shown here.

Assignments Group A (Mandatory)

1. Explore the CloudSim platform for Cloud Modelling. For example: Create a data centre with one host and run one cloudlet on it using CloudSim.
2. Demonstrate the use of Docker container by exploring its related commands. Also, show the use of Fedora/Ubuntu images over the docker engine.
3. Using Hadoop ecosystem, implement Map-Reduce word count program for the given sample data.
4. Create a virtual machine using Kernel Virtual Machine (KVM) and explore commands for virtualization.

Assignments Group B (Any 4)

1. Explore the CloudSim platform for Cloud Modelling. For example: Create and configure the data centre and user base to show response time, request servicing time and data centre loading.
2. Demonstrate the use of MySQL image over the Docker engine.
3. Frame Python scripts to perform operations (for e.g. start/pause/stop) on the Virtual Machine using Libvirt and Operating System (OS) calls for virtualization.
4. Using Hadoop ecosystem, implement Map-Reduce program for the given log file data.
5. Demonstrate the use of Hive query language (HQL) for Map-Reduce to process the data using Hadoop ecosystem.
6. Explore and configure the Xen hypervisor or equivalent open source hypervisor.

7. Explore the use of API for cloud storage application (for e.g. DropBox API) with the Linux command line interface and Python script.
8. Create an application using Force.com API.
9. For a sample application, implement and consume web service using social networking APIs with Simple Object Access Protocol (SOAP).
10. For a sample application, implement and consume web service using cloud APIs with REpresentational State Transfer (REST).

Assignments Group C (Any 1)

1. Installation and configuration of an open source cloud platform.
2. Study of different cloud platforms such as GoogleApp Engine (GAE), Amazon Platform Services, Microsoft Azure services, Openstack and Rackspace.

PECE 3102 : Statistics for Computer Science Laboratory

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In Semester: 25 Marks
Credits: 1

Course Objectives:

To facilitate the learners to -
1. Implement and analyze the basic and descriptive statistical operations for given problem.
2. Apply data representation knowledge for given data points.
3. Apply correlation, regression model, principal component analysis(PCA) model.
4. Design the solution for real life problems using the techniques of statistics.

Course Outcome:

By taking this course, the learner will be able to -
1. Implement basic and descriptive statistical operations on given data.
2. Apply different data representation methods for interpretation of given data.
3. Apply various models of regression, correlation, PCA on given data.
4. Develop small statistical application using different techniques.

Example list of Assignments:
Assignments can be done using open source tool and technology like R , Python or using Matlab

Group A: (Mandatory)
1.Getting started with software, installation, its objects and data types
2..Graphical presentation of data in different plot forms/diagrams.
3.Apply basic statistical operations, measure of location (Arithmetic mean, harmonic mean,geometric mean, median, mode).
4.Perform measure of dispersion , standard deviation, quartile deviation etc

Group B: (Any four)

1.Plot the diagram for the given data, develop the regression model that best describes the data, also predict output for the given value.

2.Perform correlation analysis (positive negative, zero) that describes the degree to which variables are linearly related to each other.

3.Perform test of hypothesis, one sample t-test, paired t-test, chi-squared goodness of fit test, on given data and see how to use them for statistical inference.

4.Perform data dimensionality reduction using principal component analysis.

5. Perform Cluster analysis on given data.

6. Perform analysis of variance (ANOVA) on data for evaluating hypothesis.

Group C: (Any one)

1.Study software tool to understand how to construct charts related to quality control.

2.Data analysis case study for readily available data set using the statistical techniques studied.

CE 3202 Artificial Intelligence and Machine Learning

Teaching Scheme	Examination Scheme
Lectures: 3 Hr/Week	In Semester : 50 Marks
	End Semester : 50 Marks
	Credits : 3

Course Objectives:
To facilitate the learners to-
1. Learn overview of classic Artificial Intelligence and basics of machine learning.
2. Understand various intelligent searches and knowledge representation.
3. Understand types of learning as well as machine learning.
4. Study applications in Artificial Intelligence and Machine Learning.

Course Outcomes:
By taking this course, the learner will be able to –
1. Build fundamental knowledge of AI, its applications and solve classical AI problems using different AI Techniques
2. Apply intelligent search algorithms on AI problems.
3. Make use of Knowledge Management techniques of AI for reasoning.
4. Apply the appropriate supervised / unsupervised Machine Learning (ML) method to solve the given problem.
5. Examine different topics with various methods of expert system, pattern recognition, natural language processing, nature inspired computing.

Unit 1: Introduction to AI **(07)**
Definitions of Artificial Intelligence, Artificial Intelligence Problems, Topics of Artificial Intelligence: Learning Systems, Knowledge Representation and Reasoning, Planning, Knowledge Acquisition, Intelligent Search, Logic Programming, Soft Computing, Management of Imprecision and Uncertainty, Production Systems: Traveling Salesman Problem, Water-Jug Problem, State Space Representation, State Space Search, Tic-Tac-Toe as a State Space, Branches of Artificial Intelligence.

Unit 2: Heuristic Search Techniques **(07)**
Generate-and-Test, Search Techniques: Depth First Search, Breadth First Search, Best First Search Algorithm, Hill Climbing, Simulated Annealing, A* Algorithm, Problem Reduction, AND–OR Graphs, The AO* Algorithm, Towers of Hanoi Problem, Constraints Satisfaction: crypt-arithmetic problem, mini-max algorithm.

Unit 3: Knowledge Management **(07)**
Knowledge Management, Types of Knowledge: Declarative Knowledge, Procedural Knowledge, Knowledge Representation, Approaches to Knowledge Representation, Issues in Knowledge Representation, First-order Logic: Basic Predicate Representations, Conversion of WFF to Clause Form, Resolution, Unification, Resolution Examples, Reasoning, monotonic and non-monotonic reasoning, Truth Maintenance Systems.

Unit 4: Learning **(07)**

Types of Learning: Rote Learning, Learning by General Problem Solving, Concept Learning, Learning by Analogy, Learning problems and designing the learning systems, Machine Learning: Types of Problems in Machine Learning, Aspects of Inputs to Training, Learning Systems, Intelligent Agents.

Unit 5: Machine Learning methods and models **(07)**

Introduction to Supervised, Unsupervised, semi-supervised Learning, Ensemble Learning, discovery based Learning, Learning by problem solving, Reinforcement Learning, Support vector Machine, Artificial Neural Network : Perceptron, multi-layer perceptron, back propagation Neural Network, Self-organizing map.

Unit 6: Applications in Artificial Intelligence and Machine Learning **(07)**

Game Playing, Expert Systems, Natural Language Processing, Image Understanding & Computer Vision, Pattern Recognition, Virtual Reality, Nature Inspired Computing.

Text Books:

1. Vinod Chandra S. S., Anand Hareendran S., 'Artificial Intelligence and machine learning', PHI, (2014), ISBN 978-81-203-4934-6.
2. Kulkarni P., Joshi P., 'Artificial Intelligence: Building Intelligent Systems', PHI Learning, (2015), ISBN 978-81-203-5046-5.

Reference Books:

1. Peter, Norvig, 'Artificial Intelligence: A Modern Approach', Pearson, (3 rd edition), (2014), ISBN-0-13-103805-2.
2. Elaine Rich, Kevin Knight and Nair, 'Artificial Intelligence’, Tata McGraw – Hill, (3rd edition), (2012), ISBN-978-0-07-008770-5.
3. Bratko I., 'Prolog Programming for Artificial Intelligence', Pearson Education, (3rd edition), (2004).
4. Tom M. Michell, 'Machine Learning', McGraw Hill Education, Indian edition (2013), ISBN-13: 978-1-25-909695-2.
5. Ethem Alpaydin, 'Introduction to Machine Learning', PHI, (2006), ISBN-81-203-2791-8.

CE 3203 Software Design And Architecture

Teaching Scheme
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits: 4

Prerequisite: Data structures and Algorithms II (CE 2201)

Course Objectives:
To facilitate the learner to -

1. Develop familiarity with the basic concepts of software architecture and quality attributes of a system.
2. Model the software requirements of a system using Unified Modeling Language (UML) to understand the architectural, structural and behavioral aspects of the system.
3. Understand and apply various design patterns in creating an object oriented design.
4. Get exposure to the various software testing techniques and methods.

Course Outcomes:
By taking this course, the learner will be able to -

1. Analyze the concepts of software architecture and quality attributes to realize the solution of a system.
2. Build structural and behavioral models using Unified Modeling Language (UML).
3. Apply various design patterns to understand reusability in object oriented design.
4. Apply various software testing techniques at unit level, suitable to different problem areas.

Unit 1: Introduction to Software Architecture (06)
Software Development Life Cycle (SDLC), Software Requirement Specification (SRS), What is Software Architecture, Why Software Architecture is important.

Unit 2: Design Using Unified Modeling Language (UML) (08)
Importance of modeling, Use case Diagrams, Activity Diagrams, Class Diagrams, Sequence Diagrams.

Unit 3: Quality Attributes (08)
Understanding Quality Attributes, Quality Attribute Scenarios and Tactics - Performance, Security, Usability.

Unit 4: Creational and Structural Design Patterns **(07)**

What is Design Pattern, Classification of Design Patterns, Elements of Design Pattern, Creational Design Patterns - Singleton, Factory Method, Structural Design Patterns - Proxy, Adapter.

Unit 5: Behavioral Design Patterns **(06)**

Observer, Iterator, Model View Controller (MVC), Mediator.

Unit 6: Software Testing **(07)**

Introduction, Verification and Validation, White Box testing - Structural Testing – Unit / Code functional testing, Code coverage testing, Code complexity testing, Black Box testing - Equivalence Class Partitioning, Boundary Value Analysis.

Text books:

1. Len Bass, Paul Clements, Rick Kazman, **'Software Architecture in Practice'**, *Pearson Education,* (3rd Edition)(2013).
2. Grady Booch, James Rumbaugh, Ivar Jacobson, **'The Unified Modeling Language User Guide'**, *Pearson Education,* (2nd edition)(2008).
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, '**Design Patterns-Elements of Reusable Object-Oriented Software',** *Pearson Education,* (2002).
4. Srinivasan Desikan, Gopalaswamy Ramesh, '**Software Testing Principles and Practices**', *Pearson Education,* ISBN 81-7758-121-X (2013).

Reference books:

1. Len Bass, Paul Clements, Rick Kazman, **'Software Architecture in Practice'**, *Pearson Education,* (2nd Edition) (2006).
2. Mary Shaw and David Garlan, **'Software Architecture – Perspectives on an Emerging Discipline'**, *Prentice Hall of India,* (1996).
3. Richard N. Taylor, Nenad M. and Eric M. Dashofy, **'Software Architecture: Foundations, Theory and Practice'**, *Wiley,* (2006).
4. Jim Arlow and Ila Neustadt, **'UML 2 and the Unified Process –Practical Object-Oriented Analysis and Design',** *Pearson Education,* (2nd edition) (2006).
5. Iien Burnstein, '**Practical Software Testing',** *Springer (India) private limited,* (2005).

Example List of Tutorials:

1. Study architectural styles and submit a report on these styles.
2. A case study of any website or any other large system and its architecture for quality attributes requirements such as Performance, Security, Usability and Availability.
3. Design a Software Requirement Specification (SRS) document for a given system.
4. Draw Use case diagrams for capturing and representing requirements of a given system.
5. Draw Activity diagrams to display the business flows for a given system.
6. Draw Class diagrams to identify and describe key concepts like classes, relationships and other classifiers like interfaces.
7. Draw Sequence diagrams to show message exchanges in a given system.
8. Identify suitable design patterns for a given application.
9. Apply various Black Box testing methods for unit testing of a sample application.
10. Apply various White Box testing methods for unit testing of a sample application.

PECE 3201 Software Testing And Quality Assurance

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits: 3

Prerequisites: -

Course Objectives:
To facilitate the learner to -

1. Develop familiarity with the fundamental concepts and the process of software testing.
2. Understand need and concept of black box testing and White Box Testing
3. Understand the testing strategies and system testing
4. Understand Testing Metrics and Quality Assurance measures
5. Understand Recent Trends and Automated Testing

Course Outcomes:
By taking this course, the learner will be able to -

1. Apply the fundamental concepts and the process of software testing.
2. Make use of the concepts of black box testing and White Box Testing methods
3. Make use of the testing strategies and system testing
4. Make use of Testing Metrics and Quality Assurance measures and compare techniques of automated testing and modern testing tools for testing various types of applications.

Unit 1: Introduction (06)
Need of testing, Basics of Software Testing, Testing Principles, Goals, Software Testing Life Cycle, Defects, Defect management, Verification and validation, Test Plan.

Unit 2: Black Box Testing (08)
Introduction, Need of black box testing, Testing Methods - Requirements based testing, Positive and negative testing, Equivalence Class Partitioning, Boundary value analysis, Decision table / Cause effect graphing, State based testing, Domain testing, Examples of Black-Box testing.

Unit 3: Testing Strategies and System Testing **(07)**

Unit, Integration, System, Acceptance testing, Usability testing, Regression testing, Scenario testing, Adhoc testing, Functional, Performance testing, Stress testing, Security testing, Alpha-Beta testing.

Unit 4: Testing Metrics and Quality Assurance **(07)**

Testing Metrics and measurements, Types of metrics – Project, Progress, Productivity, Software quality, Quality control and assurance, Quality factors, Software Quality Assurance (SQA) Model - Six Sigma, Ishikawa's Seven Basic Tools.

Unit 5: White Box Testing **(07)**

Introduction, Need of white box testing, Testing types, Static testing, Structural Testing – Unit / Code functional testing, Code coverage testing, Code complexity testing, Challenges in White box testing, Examples of White-Box testing.

Unit 6: Recent Trends and Automated Testing **(07)**

Agile Testing, Model based testing, Need for Automation, Keyword driven automation, Data driven automation, Manual testing versus Automated testing, Automated Testing Tools, Selection of tool, Study of Testing tools and frameworks (such as Selenium, JUnit, Bugzilla).

Text books:

1. Iien Burnstein, '**Practical Software Testing',** *Springer (India) private limited* (2005).
2. Srinivasan Desikan,Gopalaswamy Ramesh, **Software Testing Principle and Practices'**, *Pearson Education*, ISBN 81-7758-121-X (2013).
3. Nageshwar Rao Pusuluri, '**Software Testing Concepts and Tools',** *Dreamtech press*, ISBN 81-7722-712-2 (2008).

Reference books:

1. Ron Patton, **'Software Testing',** *Pearson Education,* ISBN-13: 978-0-672-32798-8 (Second Edition) (2013).
2. Stephen H Kan, '**Metric and Model in Software Quality Engineering'**, *Pearson Education* ISBN 81-297-0175-8 (Second Edition) (2006).
3. William Perry, **'Effective Methods for Software Testing'**, *Wiley Publication*, ISBN 81-265-0893-0 (Third Edition) (2006).

4. Dr. K.V.K.K. Prasad, '**Software Testing Tools'**, *Dreamtech Press* ISBN: 10:81-7722-532-4 (2008).
5. Naresh Chauhan, '**Software Testing Principles and Practices'**, Oxford *University Press*, ISBN 0-19-806184-6 (2011).

Web References

1. http://www.seleniumeasy.com/selenium-tutorials
2. https://www.tutorialspoint.com/junit
3. https://www.bugzilla.org

PECE 3201 Human Computer Interaction

Teaching Scheme
Lectures: 3 Hrs /week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits: 3

Course Objectives:
To facilitate the learner to-
1. Identify the main modes of human computer interaction.
2. Identify the common pitfalls in data analysis, interpretation and presentation.
3. Understanding the use of prototyping and evaluation in design.
4. Understand the advanced techniques of Human Computer Interaction.

Course Outcomes:
By taking this course, the learner will be able to:
1. Apply the concepts of HCI to enhance the user experience.
2. Select the appropriate data gathering techniques and establish the requirements for the good design.
3. Apply the fundamental aspects of designing and evaluating the interfaces.
4. Compare the advanced techniques of Human Computer Interaction.

Unit 1: Introcuction to Interactive Design (08)
What is HCI – design, models, evaluation, Need to understand people, computers and methods.
Humans – Memory, Attention Span, Visual Perception, psychology, ergonomics.
Computers – speed, interfaces, widgets, and effects on interaction.
Understanding Users, Universal Design, User-centered design.

Unit 2: Design Process and Interaction Styles (08)
HCI in the Software Process, HCI design principles and rules, Shneiderman's golden rules, Normans seven principles, Nielsens ten heuristics with example of its use.
Interaction Styles, Direct Manipulation - Menu selection, Form Fill-in and Dialog Boxes

Unit 3: Establishing Requirements (07)
Understanding importance of identifying the requirements, Different kinds of requirements, Data gathering for requirements, Data analysis, Data interpretation and presentation, Task description and analysis.

Unit 4: Design, Prototyping, and Construction (06)
Prototyping and construction, Conceptual design, Physical design, User Persona, Using scenarios in design, Using prototypes in design and support for design, Handling errors and designing help.

Unit 5: Evaluation Approaches (06)
Importance of evaluation, Evaluation approaches and methods, Evaluation case studies, Determine, Explore, Choose, Identify, Decide, Evaluate (DECIDE): A Framework to guide evaluation.

Unit 6: New Interaction Technologies (07)
Explicit and Implicit Human Computer Interaction, User Interfaces and Interaction for Four Widely Used Devices, Hidden User Interface via Basic smart Devices, Hidden User Interface via Wearable and Implanted Devices.

Text books:

1. Rogers, Sharp, Preece, 'Interaction Design', Wiley Publications (India), (Third edition), (2014).
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, 'Designing the User Interface: Strategies for Effective Human-Computer Interaction', Pearson Education Limited (India),(2010).
3. Stefan Poslad, 'Ubiquitous Computing', Wiley Publications (India), (2014).

Reference Books:

1.Alan Dix, 'Human Computer Interaction', Pearson Education Limited (Third edition), (2004).
2.Wilbert O. Galitz, 'The Essential Guide to User Interface Design', Wiley Publications (Second edition), (2003).
3.John M. Carroll, 'Human-Computer Interaction', Pearson Education Limited, (2002).
4.Don Norman, 'The Design of Everyday Things', Basic Books, A member of the Perseus Books Group, (2013).

PECE 3201 – Multimedia Systems

Teaching Scheme:
Lectures: 3Hrs/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

To facilitate the learners to -

- Understand basics of Multimedia Systems.
- Understand various file formats.
- Learn Multimedia editing tools.
- Analyze various compression techniques.
- Learn advances in multimedia.

Course Outcomes:

By taking this course, the learner will be able to

- Build the knowledge of multimedia systems and its characteristics.
- Utilize text and audio file formats and compression techniques in multimedia applications.
- Apply digital image and video processing techniques useful in multimedia applications.
- Build the knowledge of animation and Virtual reality concepts.
- List and analyse advances in multimedia.

Unit – I: Introduction to Multimedia **(06)**

What is Multimedia? (Text, Graphics, Audio, Video, Animation), Multimedia presentation and production, Multimedia Authoring Tools (Various tools for creation and editing of Multimedia Projects), Hardware and Software requirement for Multimedia, Multimedia Applications

Unit – II: Text and Audio **(08)**

Text - Introduction, About Fonts and Faces, Using Text in Multimedia, Font Editing and Design Tools, Text Compression (HUFFMAN, LZ, LZW), File Formats (TXT, DOC, RTF, PDF, PS), Hypertext and Hypermedia.

Audio – Introduction, Characteristics of Sound, Elements of Sound System, Digital Audio, Synthesizer, MIDI, Audio File Formats (WAV, VOC, MP3) , Audio Processing Softwares.

Unit – III: Images **(07)**

Digital Image, Basic steps for image processing, Image file formats (BMP, TIFF), Image Compression (RLE, JPEG), Image Manipulation, Image processing softwares.

Unit – IV: Video **(07)**

Types of Video Signals, Analog Video, Digital Video, Video File Formats and CODEC (AVI, MPEG), Video Editing Softwares.

Unit – V: Animation and Virtual Reality A ni

mation- Introduction, Uses, Types, Principles, Animation on Web, 3D animation, Rendering, Animation Softwares **(07)**
Virtual reality - Introduction, Forms, Applications, Software Requirements, Devices, VRML

Unit VI: Introduction to Advances in Multimedia

Introduction, Challenges of Multimedia Information processing, Watermarking, Organization, Storage and retrieval Issues, Neural Networks for multimedia processing, Multimedia Processors **(07)**

Text Books:

1. Ranjan Parekh, **'Principles of Multimedia'**, *McGraw Hills education*, (2nd edition), (2013)
2. Ralf Steinmetz, Klara Nahrstedt, **'Multimedia: Computing, Communications and Applications'**, *Pearson*, (8th Impression 2011)
3. Nigel Chapman & Jenny Chapman, **'Digital Multimedia',** *Wiley Publications*, (2nd edition) (2004)

Reference Books:

1. Ze-Nian Li, Marks S. Drew, **'Fundamentals of Multimedia'**, *Pearson Education,* (2005)
2. Tay Vaughan , **'Multimedia: Making it work'**, *Tata McGraw-Hill, (*8th edition), (2011)
3. Judith Jeffcoate, **'Multimedia in Practice'**, *Prentice Hall of India*, (2003)

PECE 3201 THE JOY OF COMPUTING USING PYTHON

Teaching Scheme
Lecture: 3 Hrs./week

Examination Scheme
In Semester Exam : 50 Marks
End semester: 50 Marks
Credits: 3

Course Objectives:
The course brings programming to student's desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, student will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, there is introduction to some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

Course Outcomes:
By taking this course, the learner will be able to–
1. Apply the programming logic in general and use Python data model to write programs
2. Choose and apply appropriate data structures and control structures of Python language to arrive at a solution for a given problem
3. Choose appropriate modules of Python language to solve a given problem
4. Develop programs to demonstrate some of the current advances in computing with Python as a language

This course is based on Joy of Computing using Python, a NPTEL course offered (https://nptel.ac.in/courses/106/106/106106182/).

Course Contents:

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip

- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What’s the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don’t measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let’s play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works

PECE 3202 Data Mining and Data Warehousing (Elective-IV)

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
In Semester : 25 Marks
End semester : 50 marks
Credits : 3

Prerequisite : Database Management Systems (CE 3102)

Course Objectives

To facilitate the learners to -

1. Understand the concepts and techniques of data mining and data warehousing
2. Apply various data pre-processing and visualization techniques
3. Design and model a data warehouse and its components
4. Compare and analyse various Data Mining algorithms based on performance parameters
5. Understand advances in the field of Data Mining

Course Outcomes

By taking this course, students will be able to –

1. Explore the concepts of data warehousing and data mining for modern day BI
2. Apply appropriate pre-processing techniques to make data ready to be used for various data mining algorithms
3. Design a Data warehouse model by using appropriate data modelling schema
4. Evaluate various data mining algorithms based on their outcomes for the given dataset
5. Understand the advances in the field of Data Mining

Unit 1: Introduction to Data Mining and Data Warehousing (05)

Introduction to data warehousing and data mining, Evolution of decision support systems, operational data Vs. historical data (data warehouse data), Importance of data preparation for data mining, types of data mining techniques, various data mining functionalities, Data mining task primitives, Integration of operational systems and data warehousing system

Unit 2: Data Pre-processing (07)

Introduction / overview of data pre-processing, Descriptive data summarization – Measuring central tendency, dispersion, range, quartiles, variance and standard deviation of data, Graphical displays of descriptive data summaries, Data cleaning, Data Integration, Data Transformation, Data Reduction

Unit 3: Data Warehouse and OLAP Technology (06)

3-tier Data Warehouse architecture, data warehouse design process, Modelling subject(s), dimensions and measures, Multidimensional data modelling using star schema, snowflake schema and fact constellation schema; Introduction to OLAP, OLAP operations, Data cube generation, Concept hierarchy generation; Case study on designing a Data warehouse for a given application

Unit 4 : Unsupervised Learning **(06)**

Data mining process, Types of Data Mining Systems, Cluster Analysis - Types of Data in Cluster Analysis, Categorization of Major Clustering Methods, K-means clustering, Density based Clustering

Unit 5 : Supervised Learning **(07)**

Classification and Regression, Decision Tree Induction, Bayesian Classification, Nearest neighbour approach, Mining frequent patterns and Association Rules – Apriori Algorithm

Unit 6 : Advances in Data Mining **(05)**

Information Retrieval, Text mining, multimedia data mining, Graph mining, Mining World Wide Web, stream, time series and sequence data mining

References

Text Books

1. Han, J., Kamber, M., "Data Mining: Concepts and Techniques", 3rd Ed.,Morgan Kaufmann, 2006

2. Tan P.N., Steinbach M., Kumar V., "Introduction to Data Mining", Addison Wesley, 2006

Reference Books

1. W. H. Inmon, "Building the Data Warehouse", 4th edition, Wiley

2. Alex Berson, Stephen J, "Data Warehousing, Data Mining, & OLAP", Tata McGraw- Hill, 2004

3. Dunham M.H., "Data Mining: Introductory and Advanced Topics", Prentice Hall, 3

4. Miller T. W., "Data and Text Mining - A Business Applications Approach", Pearson education-08

5. Maimon O., Rokach L., "Data Mining And Knowledge Discovery Handbook", Springer 2009

6. Pujari A K, "Data Mining Techniques", Universities Press, 2010

Web Resources :

1. www.autonlab.org/tutorials : Statistical Data mining Tutorials

2. www-db.standford.edu/ullman/mining/mining.html : Data mining lecture notes

3. ocw.mit.edu/ocwweb/slon-School-of-management/15-062Data-MiningSpring2003/course home/index.htm : MIT Data mining open course ware

4. www.kdnuggets.com : Data mining resources

Web links of similar courses offered at other universities

1. Purdue University : Introduction to Data mining : www.cs.purdue.edu/homes/clifton/cs490d/

2. University of New South Wales : Data warehousing and Data mining www.cse.unsw.edu.au/~cs9318/

3. York University: Data mining www.cs.yorku.ca/course-archieve/2005-06/w/4412/

4. IIT- Madras : Data Mining www.iitm.ernet.in/~cs672/

5. New York University: Data warehousing/mining www.cs.nyu.edu/courses/spring03/G22.3033-015

6. NPTEL Data Warehousing Data Mining Web course - http://nptel.ac.in/syllabus/syllabus_pdf/106106105.pdf

Journals

IEEE Transactions on Knowledge and Data Engineering

PECE 3202 Elective–IV EMBEDDED AND REAL TIME SYSTEMS

Teaching Scheme
Lecture : 3 Hrs/week

Examination Scheme
In semester : 25 marks
End semester : 50 marks
Credits : 3

Prerequisite:
- Microprocessor Architecture (CE 2204)

Forward Linkages :
- Internet of Things (CE 4201)

Course Objectives:
To facilitate the learners :-
1. To understand processors, its components use for embedded product.
2. To implement use of system hardware in various embedded designs.
3. To differentiate between use of embedded communications protocols and its interfacing to memory and processor.
4. To execute smaller codes written for embedded system programming using different languages.
5. To Understanding real time operating systems and compare different scheduling algorithms.

Course Outcome:
By taking this course, the learner will be able to :–
1. Summarize embedded systems with different components and design process.
2. Design an embedded system for a given application using system hardware components.
3. Analyze processor, memory, input/output and communication protocols requirement for a given embedded system.
4. Develop skills for embedded system programming.
5. Summarize the RTOS and exemplary operating system used for various embedded applications.

Unit 1: Introduction to Embedded Systems **(06)**
Components of Embedded System & its Classification, Characteristic of embedded system. Structural Units of Processor, Comparision of Microprocessors & Microcontrollers(8051 block diagram).
Introduction to embedded processor, Digital Signal Processor, Application Specific System Processor, Multiprocessor systems using General Purpose Processor. Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer(RISC) Processor architectures.
Design Process in Embedded System, Design metrics, Steps in design process. Challenges in Embedded System design, Embedded System Examples.

Unit 2: System Hardware (08)

Advanced RISC Machines (ARM7) Processor - Architecture, Register set, Modes of operation, Interrupt Structure and ARM family and their applications**.** Comparison with ARM9. Details of Components of Embedded Systems-Management of Power Supply, Clocking Unit, Real Time Clock and Timers, Reset Circuitry and Watchdog Timer.
Memory Map Of Embedded System, Interfacing Processors with design examples.

Unit 3: Memory and I/O interfacing and Communication Buses (07)

Processor and Memory Selection, I/O devices, sensors - temperature, IR, ADC / DAC, Optical Devices such as LED / LCD Display devices, Opto-Isolator, Relay & stepper motor, Timers/Counters.
Parallel v/s serial communication. Parallel ports their uses in device interfacing.
Different serial communication Protocols- RS232C, RS 485, CAN, & USB – Protocol Architecture, topology, different Packets, Communication Cycle, Arbitration, few Applications.

Unit 4 : Programming concepts, Embedded System Programming (07)

Programming in Assembly labuage using ARM processor, Use of High level Language – C and Python for Embedded System Applications, Selection of data strcutures, Micro, function, statement, loops etc, Embedded system programming using Developent boards, Development tools – Simulator / emulator / debugger.

Unit 5: Real time Operating System (07)

Operating Systems Concepts, Real-Time Systems, Real-Time Tasks, Types of Real-Time Tasks, Real-Time Operating Systems, Scheduling Algorithms – Pre-emptive, non preemptive, Real time

Unit 6: Exemplary Operating Systems and Representative Embedded System (07)

Examples of Real Time OS, embedded System OS and Handheld OS. Representative Embedded Systems – Digital Thermometer, smart card Design Examples and case study of - Automatic Vending machine / Automatic Cruise control System their Block diagram, class diagrams.

Text Books:

1. Rajkamal, **'Embedded System Architecture Programming Design'** *Tata Graw Hill Publication (Second Edition)*, (2008).
2. Dr. K. V. K. K. Prasad '**Embedded / real time System : Concepts, Design, & Programming – Black Book'** *Dreamtech Press Publication, (2003).*
3. Lyla B. Das, '**Embedded Systems: An Integrated Approach'**, *Pearson Education*, (2012).

References:

1. Dr. K. V. K. K. Prasad, Gupta Dass, Verma, **'Programming for Embedded system'** *Wiley – Dreamtech India Pvt. Ltd.*
2. ARM 7 Manual.
3. CAN Specification Version 2.0 Protocol Standard.
4. USB Specification Version 2.0 Protocol Standard.
5. I2C Specification Protocol Standard.

PECE 3202 LINUX INTERNALS

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In Semester: 25 marks
End Semester: 50 marks
Credits: 3

Prerequisites: Operating Systems (CE 2203)

Course Objectives:
To facilitate learners -

1. To understand basic concepts of Unix Operating System
2. To understand Linux kernel and environment.
3. To understand process and memory management in Linux
4. To learn basics of Inter process communication w.r.t. Unix/Linux.

Course Outcomes:
The learner will be able to -

1. Recall basic knowledge about Unix operating system.
2. Understand Unix and Linux environment.
3. Understand basics in process, thread management.
4. Explain concepts inter-process communication.

Unit I: Foundation of Unix operating system (07)
Introduction, Kernel architecture, types of kernel,Operating system: Booting process, Grub I, Grub II,Representation of files, systems call File system,Concept of Buffer management in Unix/Linux.

Unit II: Process and threads in Linux (08)
Process states and transitions, layout of system memory,Context of a process, saving the context of a process ,Concept of threads, Linux processes and thread management, introduction to threads (advantages and implementation),Process management and Linux scheduler.

UNIT III: Swapping and Demand paging (07)
Swapping, Demand Paging, A hybrid system with swapping and demand paging, Linux memory management.

UNIT IV: Inter-process Communication in Linux (07)
Process tracing, system V IPC, Network communication, sockets, Multiprocessor systems : problem with multiprocessor systems, solution with master slave processes, Linux Inter process communication: User level IPC mechanism, Kernel synchronization, socket programming

UNIT V: MAKE and AWK (07)
Search and Sort tools: grep, egrep, fgrep, MAKE tool: When to use MAKE, Macros, abstractions and shortcuts, make, nmake, cmake. Awk tool: AWK syntax, AWK grammar, awk scripting

Unit VI: Variants in Linux (06)
Hand-held systems: requirements, Linux as hand-held operating system, Linux for distributed systems,

technology overview, Case study: Google Android

Text books:

1. Maurice J. Bach , **'The Design of the Unix Operating System'** , Third Edition,2013, Pearson , ISBN 978-81-203-0516-8.
2. Pramod Chandra P. Bhatt, **'An introduction to Operating Systems: Concepts and Practice(GNU/Linux)'** , PHI, (Fourth edition), (2014), ISBN-978-81-203-4836-3.

Reference books:

1. Evi Nemeth, Garth Snyder, Tren Hein, Ben Whaley, **'Unix and Linux System Administration Handbook'** , Pearson , (Fourth Edition), (2014), ISBN: 978-81-317-6177-2011.
2. William Stallings, **'Operating System-Internals and Design Principles' ,** Prentice Hall India, ISBN-81-297-0 1 094-3.
3. David Rusling, **'The Linux Kernel'** , Addison Wesley, (Second edition), ISBN 978-0201770605.
4. Sumitabha Das, **'UNIX Concepts and Applications'**, ISBN 0-07-053475-6.

PECE 3202 Elective III Image Processing

Teaching Scheme
Lecture : 3 Hrs/week

Examination Scheme
In semester : 50 marks
End semester : 50 marks
Credits : 3

Prerequisite:
"-"

Forward course linkages:
Pattern Recognition And Machine Learning (PECE 4101)
Bio medical Image Processing (OE 4101)

Course Objectives:

To facilitate the learner to-

1. Understand basic concepts of digital image processing.
2. Learn and apply image enhancement and Image Segmentation techniques.
3. Understand object Recognition, Image Restoration and reconstructions.
4. Learn and apply image compression techniques and Understand image processing applications.

Course Outcome:

By taking this course, the learner will be able to -

1. Apply basic steps of digital image processing on given images
2. Select the image enhancement techniques
3. Make use of Image Restoration, reconstructions techniques. Choose Image Segmentation techniques for given images.
4. Identify the image compression techniques.

Unit 1: Introduction to Image Processing (07)

Introduction to digital image processing: Origin, usage and application of image processing, Fundamental steps and component of image processing system,representation of digital images. Elements of matrix theory,Arithmetic Operations,introduction to Human Visual System,Image sensing and acquisition,Basic concepts in sampling and quantization

Unit 2: Image Enhancement Techniques (08)

Basic image preprocessing (contrast enhancement, simple noise reduction, color balancing), some basic gray level transformations,Histogram Processing,Spatial filtering, Smoothing and Sharpening Spatial filters

Unit 3: Image Compression (07)

Introduction to Image Compression and its need, Coding Redundancy,Classification of Compression Techniques (Lossy and Losless - JPEG,RLE, Huffman, Shannon fano), Scalar & Vector Quantization.

Unit 4: Image Restoration & Reconstruction. (06)

Model of Image degradation, Noise Models,Classification of image restoration techniques,Inverse filtering, Wiener filtering,Blind-deconvolution techniques

Unit 5:

Image Segmentation, Analysis and Object Recognition. (08)

Introduction to feature extraction: Edges, Lines & corners detection,Texture & shape measures.

Segmentation & thresholding, region extraction, edge (Canny) and region based approach, use of motion in segmentation.

Introduction to Object Recognition, Object Representation(Signatures, Boundary Skeleton), Simple Boundary Descriptors, Regional descriptors (Texture).

Unit 6: Advances in Image processing Applications (06)

Medical Image Processing, Face detection, Iris Recognition, Remote Sensing, Synthetic-aperture radar (SAR) Image Processing

Text Books:

1. R.C. Gonzalez, R.R. Woods, '**Digital Image Processing'**, ISBN 978-81-317-2695-2,*Person (*Third Edition) ,(2011)(62 copies)
2. Sridhar S. '**Digital Image Processing',** *Oxford University Press, (Second Edition),(2016)*
3. S.Jayaraman, S. Esakkirajan,T. Veerakumar , **'Digital Image processing',**ISBN 978-0-07-014479-8, *Mcgraw Hills Publication (Tenth reprint),(2013)*

References:

1. Sonka, Hlavac, Boyle, '**Digital Image Processing and Computer Vision',** ISBN 978-81-315-0555-7,*Cenage Learning* (Sixth Indian Reprint) ,(2011)
2. B. Chanda, D.Datta Mujumdar '**Digital Image Processing And Analysis',** *PHI*, ISBN 978- 81-203- 4325-2, (Second Edition),(2013)
3. Anil Jain, '**Fundamentals of Digital Image Processing'**, *PHI*, ISBN-81-203-0929-4 (Indian Reprint) ,(1995)
4. Basudeb Bhatta **' Remote Sensing and GIS'** *Oxford University Press*, ISBN 978-0-19-807239-3 (Second Edition)(2014)

Web Reference

1 https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6504845

CE 3204 SEMINAR

Teaching Scheme
Practical : 4 Hrs./week

Examination Scheme
In semester : 25 marks
Oral : 25 marks
Credits : 2

Course Objectives:
To facilitate the learners :-

1. To identify the topic based on current engineering trends/ social problems/ new technologies.
2. To explore the basic principles of communication (verbal and non verbal) and active, empathetic listening, speaking and writing techniques.
3. To produce relevant technical documents by following best practices of technical writing.
4. To understand the basic principles of presentation, technical writing techniques for seminar.

Course Outcome:
By taking this course, the learner will be able to :

1. Select appropriate/reserach topic and write a technical report and present it to audience.
2. Be familiar and use the basic technical writing concepts and terms such as audience analysis, jargon, format, visuals and presentation.
3. Improve skills to read, understand and interpret material on technology.
4. To enhance technical communication and presentation skills.

General Guidelines for Seminar:

- Seminar is an individual student activity.
- The area/domain must be selected under the guidance of institute guide.
- Each student will select a topic in the current/new trends of Computer Engineering and Technology beyond the scope of syllabus avoiding the repetition in consecutive years.
- Student should do - literature survey based on IEEE/ACM/Springer/Digital Library papers or technical Magazines/books, specify knowledge area, brief technical knowledge about the topic.
- Each student will make a seminar presentation based on the domain topic using audio/video aids for a duration of 20-25 minutes.
- Student have to submit the technical seminar report in the department.

Guidelines for assessment:

- Internal guide will evaluate students on understanding of topic, punctuality and Timely Completion of Report, Paper presentation/Publication and Attendance.
- An external examiner(s) panel will be assessing the seminar work based on these parameters - Understanding of Topic, flow of Contents, Presentation, report, Paper presentation/Publication, Question and Answers, Active Participation.

References:

1. Research papers from reputed journals/transactions- references necessary for the Project.
2. Reference books/Magazines for conceptual technical support.

CE 3205 Artificial Intelligence and Machine Learning Laboratory

Teaching Scheme
Practical: 4 Hr/Week

Examination Scheme
Practical: 50 Marks
Credits : 2

Course Objectives:
To facilitate the learners to-
1. Experiment Artificial Intelligence and machine learning concepts from syllabus.
2. Experiment AI searches like A*, Min-max algorithm.
3. Understand monotonic and non-monotonic knowledge representation.
4. Experiment classification and clustering algorithms.

Course Outcomes:
By taking this course, the learner will be able to-
1. Implement various intelligent searching techniques.
2. Apply Knowledge Management techniques to implement truth maintenance system / Expert system.
3. Choose the appropriate supervised Machine Learning (ML) method and solve the given problem.
4. Choose the appropriate Unsupervised ML method and solve the given problem.

Example list of Assignments:

Assignments Group A (Mandatory)
1. Study: Learning simple statements in Prolog
2. Implement DFS/BFS for simple water jug problem
3. Implement A* algorithm for 8 puzzle problem
4. Implement Unification algorithm
5. Represent knowledge using Prolog by implementing small expert system
6. Implement Best first search algorithm

Assignments Group B (Any 3)
1. Write a program to implement Min-max algorithm for game playing
2. Write a program to implement Perceptron in artificial neural network
3. Write a program to implement SOM
4. Write a program to implement SVM/backpropagation learning algorithm

Assignment Group C
Develop any one machine learning tool for application: character/sign classification

PECE 3203 Data Mining and Data Warehousing Laboratory

Teaching Scheme
Practical: 2 Hrs / week

Examination Scheme
Oral: 25 marks
Credit: 1

Course Objectives:
To facilitate the learners to -

1. Model and build a data mart / data warehouse.
2. Study and analyze various open source data sets to pre-process them using open source data mining tools.
3. Implement data mining algorithms to discover interesting patterns.
4. Analyze results of data mining algorithms

Course Outcome:
By taking this course, the learner will be able to –

1. Model a data warehouse, using appropriate schema for the given application
2. Apply various pre-processing techniques on the given dataset
3. Analyze various data mining algorithms on real time data
4. Practice advanced Data Mining functionalities such as Text Mining and Mining unstructured data.

Example List of Assignments

Assignments Group A (Mandatory)

1. Explore WEKA Data Mining / Machine Learning Toolkit and perform the following operations : Understand the features of WEKA toolkit, Study the arff file format, explore the available data sets in WEKA.
2. Load any one dataset in Weka and observe the following : List the attribute names and their types, Number of records in each dataset, class attribute (if any), Plot Histogram, Determine the number of records for each class, Visualize the data in various dimensions; Apply various pre-processing tasks; Apply classification OR clustering algorithms on the chosen dataset and observe the results
3. Implement K-means clustering algorithm using a programming language that you are familiar with such as Java / Python. Compare the performance of your algorithm on the dataset, used in Weka, on different parameters such as accuracy, scalability, efficiency etc. by changing input parameter value such as K.

Assignments Group B (Any 2)

1. Implement DBSCAN clustering algorithm. Compare the performance of your algorithm on the dataset, used in Weka, on different parameters such as accuracy, scalability, efficiency etc.
2. Implement a decision tree classification algorithm. Compare the performance of your algorithm on the dataset, used in Weka, on different parameters such as accuracy, scalability, efficiency etc.
3. Implement Apriori, a Frequent Pattern Analysis algorithm. Assume suitable data. Compare the performance of your algorithm on the dataset, used in Weka, ondifferent parameters such as accuracy, scalability, efficiency etc.
4. Implement Information Retrieval using TF / IDF algorithm. Assume suitable data.

Assignments Group C (Any 1)

1. Build a Data Warehouse / Data Mart (using open source tools like Pentaho or other data warehouse tools like Microsoft - SSIS etc.) Identify source tables and populate sample data Analyze which multidimensional model (Star, snowflake and Fact constellation) will be best suited for the given application and design the schema (Example Applications can be Banking, Insurance, Finance, Health care, Manufacturing, Automobile, etc.)
2. Study any of the existing data warehouse / data repository / ... and prepare your report based on data / model / tools and techniques / software used etc.
3. Download, install and study the features of any open source data mining compare its features with Weka.

PECE 3203 Embedded Systems and Real time Operating Systems Laboratory

Practical : 02 Hours/Week

Examination Scheme:
Oral : 25 Marks
Credit : 1

Course Objectives:
By taking this course the student will learn to-

1. Understand various embedded development boards.
2. Implement different components of embedded systems on development boards.
3. Implement using assembly level language or high level language.
4. Develop mini applications based on embedded systems knowledge with proper design process.

Course Outcomes:
On completion of the course, student will be able to–

1. To apply the knowledge of embedded system to real time applications.
2. To apply the knowledge of various components to interface with embedded develoment boards.
3. To apply the knowledge of embedded programming for solving the given problem.
4. To apply the knowledge of design process to implement smaller applications.

List of Laboratory Assignments

SrNo	Assignment
1	Study of Operating System based Evaluation/development Board (16 or 32 bit Microcontroller based) – Hardware & IDE Software.
2	Write a Program to read input from the switches and display on LED using Microcontroller development board.
3	Write a Program in C language to read key press from keypad and display the key ID on LED or LCD.
4	Write a program in C to control the relay operation as per switch position and to indicate its status on LEDs.
5	Write program in C language for Data Acquisition System to Acquire data from ADC Channel , Convert it into Digital Format & transmit to PC.
6	Write a Program in C language to perform serial communication, Which Generates Packets of 32 Bits, where First bit of packet indicates whether the packet is control packet or data packet.
7	Write a Program in C language to communicate with PC serially.
8	Implement process control application/s using the peripherals such as LED/LCD, Keyboard, ADC, Relays, Switches etc.
9	Write a Shell Script that display the no. of readable, writable & executable files in specified Directory.
10	Write a C Program that takes string input from keyboard & Displays the Length of string - use Multi Threading for message Que or Shared Memory.
11	Write a program that demonstrates the communication between two Processes.
12	1. Study of ***Compiling the Embedded Linux kernel*** 2. selecting the kernel source 3. configuring the kernel 4. compiling or building the kernel modules 5. installing the kernel modules 6.

	7. ***Building the File System*** 8. basic structure of the root file system 9. kernel modules 10. kernel images 11. device files 12. BusyBox 13. Selecting a file system 14. RAMdisk 15. 16. ***Building the Toolchain*** 17. binutils 18. gcc glibc

PECE 3203 Linux Internal Laboratory

Teaching Scheme
2Hrs/week

Examination Scheme
Oral – 25 Mark
Credits: 1

Course Objectives:

To facilitate learners -

1. To understand basic commands of Unix Operating System
2. To understand and write shell script for a given problem statement.
3. To apply socket programming concepts
4. To learn basics of awk programming.
5. To apply Inter process communication concepts for solving a problem

Course Outcomes:

The learner will be able to -

1. recall basic knowledge about Unix operating system.
2. understand and write shell script for a given problem statement.
3. understand and apply socket programming concepts .
4. apply awk scripting basics to write programs.

Group A (Mandatory)

1. Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
2. Write a shell script to find factorial of a given integer.
3. Implement in Java (modular programming) the following UNIX commands using System calls
   A. cat
   B.ls
   C.mv
4.Write an IPC program using pipe. Process A accepts a character string and Process B inverses the string. Pipe is used to establish communication between A and B processes using Python or Java
5. grep,Make, nmake commands

Group B (Any 4)

1.Write an awk script to count the number of lines in a file that do not contain vowels.
2.Write client and server programs (using Java) for interaction between

server and client processes using Unix Domain sockets.
3.Write a python program for creating virtual file system on Linux environment.
4. Write a program in Java/Python to create a RAMDRIVE and associate an acyclic directory structure to it.
5.Write a Java program to create a Zombie process.
6.Write a Java/Python program that illustrates two processes communicating using shared memory

Group C (Any one)

1. Make tool (dependency file structure)

PECE 3203 III Image Processing Laboratory

Teaching Scheme	**Examination Scheme**
Practical: 2Hrs/week	Oral : 25 Marks
Credits: 1	

Course Objectives:

To facilitate the learners to -

1. Learn Basics Image Processing operations like image Read, Write, add, subtract.
2. Understand and apply algorithms used for image enhancement, edge detection.
3. Design Image Processing application using various techniques.
4. Learn and use different Image Processing Tools.

Course Outcome:

By taking this course, the learner will be able to –

1. Apply basic operations on the given image.
2. Apply algorithms used for image enhancement ,edge detection
3. Develop small image processing application using various techniques
4. Use Image Processing Tools

Example list of Assignments:

Group A: (Mandatory)

1. Write a program to create a simple image file in .tiff format, and display it .
2. Write a program to perform Intensity Transformation techniques on given image.
3. Write a program for image enhancement techniques.

Group B: (Any Three)

1. Write a program using derivative filtering techniques for edge detection .
2. Write a program to illustrate Morphological transformation using Dilation.
3. Write a program to illustrate Morphological transformation using Erosion.
4. Write a program to illustrate Image Restoration techniques.

Group C: (Any One)

Develop any one of the Image processing application using MATLAB/OpenCV (in Limited Scope).

1. Medical Image Processing
2. Face detection
3. Iris Recognition
4. Fingerprint detection

HSEL2101 Fundamentals of Disaster Management

Teaching Scheme:

Lectures: 3 Hrs/Week In-Semester: 75Marks

Tutorial: 1 Hr/Week End-Semester: 50 Marks

Credits: 4

Course Objectives:

1.To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences

2. To increase the knowledge and understanding of the International Strategy for Disaster reduction and to increase skills and abilities for implementing the Disaster Risk Reduction Strategy.

3. To ensure skills and ability to design, implement and evaluate research on disasters.

Course Outcomes:

1. Integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

2. Describe, analyse and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

3. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.

4. Manage the Public Health aspects of the disasters.

5. Obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them

Unit – I: Introduction :Concepts and definitions (06)

Disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility Authority.

Unit-II: Disaster Impacts **(**06)

Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit-III : Disaster Risk Reduction (DRR) (06)

Disaster management cycle its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. P. Sahni, ‘Disaster Risk Reduction in South Asia’, Prentice Hall. (2004)

4. B. K. Singh, ‘Handbook of Disaster Management: techniques & Guidelines’, Rajat Publication, (2008)

5. G. K. Ghosh, ‘Disaster Management’, APH Publishing Corporation, (2006)

OE2101 Architecture for Signal Processing Algorithms

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **50** Marks
	End-Semester: **50** Marks
	Credits: 3

Course Objectives:

1. To understand the methodologies needed to design custom or semi-custom VLSI circuits for DSP applications.

2. To design efficient architectures, algorithms and circuits which can be operated with low power or high speed with low area utilization.

3. To compute iteration bound using efficient algorithms.

To understand the concepts of retiming, unfolding, systolic architecture and its methodology.

Course Outcomes:

1. Represent DSP algorithms in graphical forms.
2. Design power and area efficient architectures for DSP algorithms using pipelining and parallel processing approaches.
3. Identify the techniques, to be applied to optimize the implementations for speed, power and area.
4. Make use of retiming techniques, folding and register minimization path problems.

Unit – I: Review of DSP algorithms **(08)**

Discrete Fourier Transform, Decimation in time and decimation in frequency FFT, Representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph, Challenges in designing architectures for DSP algorithms, DSP application demands and CMOS technologies.

Unit – II: Iteration Bound **(08)**

Data flow graph representations, loop bound and iteration bound, algorithms for computing iteration bound, iteration bound of Multirate data flow graphs.

Unit – III: Architecture Design **(09)**

Pipelining and parallel processing of FIR digital filters, combined pipelining and parallel processing, Fast Convolution- Cook-Toom algorithm, Algorithm-Architecture transformation.

Unit – IV: Retiming, Unfolding and Folding **(10)**

Retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodology.

Reference Books:

1. K. K. Parhi, **'VLSI Digital Signal Processing Systems, Design and Implementation'**, *John-Wiley and sons*, (2008)
2. U. Meyer-Baese, **'Digital Signal Processing with Field Programmable Gate Arrays'**, *Springer,* (2nd edition), (2004)
3. J. G. Proakis, Dimitris G. Manolakis, **'Digital Signal Processing-Principles, algorithms and applications'**, *PHI*, (1997)
4. M. S. Moonen, Francky Catthoo, **'Algorithms and Parallel VLSI architectures'**, *Elsevier,* (1995)

   K. J. Ray Liu, **'High Performance VLSI-signal Processing: Algorithms, architectures and applications'**, *IEEE Press,* (1998)

EC 3101 DIGITAL COMMUNICATION

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	In Semester: 50 Marks
Tutorial: 1 Hours / Week	End Semester: 50 Marks
	Credits: 4

Course Objectives:

1. Explain the functional block of Digital Communication System
2. Analyze PCM, DPCM, DM, ADM source coding techniques
3. Explain conversion of digital data to digital signal and ISI for reliable baseband transmission
4. Classify random processes
5. Describe binary and M-ary digital modulation techniques
6. Explain the optimum filter, correlation receiver and response of matched filter receiver in presence of noise
7. Describe the principle of spread spectrum modulation including pseudo – noise sequence

Course Outcomes:

After completion of the course, students will be able to

1. Describe waveform coding technique and evaluate bitrate, bandwidth and signal-to- noise ratio
2. Describe and interpret data formats, multiplexing, synchronization and Intersymbol interference for reliable baseband Transmission
3. Classify random processes in terms of mean, variance and autocorrelation
4. Describe and analyze bandpass modulation techniques along with their performance measure - bit period, bandwidth, signal space representation and Euclidian distance
5. Analyze the error probability of digital modulation techniques with matched filter and correlator
6. Illustrate the concept of Direct sequence and Frequency hopped spread spectrum

Unit I: Digital Transmission of Analog Signal (08)

Comparison between analog and digital communication, Block diagram of digital communication system, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, and Delta Sigma Modulation.

Unit II: Baseband Digital Transmission (08)

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization, Inter-symbol interference, Equalization, Eye diagram.

Unit III: Random Processes (05)

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation & Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process.

Unit IV: Bandpass digital Techniques (09)

Binary phase shift keying, Differential phase shift keying, Differentially Encoded PSK, Quadrature phase shift keying, M-ary PSK, Quadrature Amplitude shift keying, Binary frequency shift keying, M -Ary FSK, Minimum shift keying (MSK), and GMSK.

Unit V: Optimal reception of digital signal (06)

Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver. Calculation of error probability for BASK, BPSK and BFSK.

Unit VI: Spread Spectrum techniques (06)

Pseudo noise sequences, spread spectrum, Direct sequence spread spectrum with coherent BPSK, Frequency hop spread spectrum and types, Processing gain.

Text Books:

1. Simon Haykin, Michael Moher, "**Communication Systems**", *Wiley*, (5th Edition), (2009).
2. Bernard Sklar, "**Digital Communications fundamentals and Applications"**, *Prentice Hall P T R*, (2nd Edition), (2009).

Reference Books:

1. Donald L. Schilling, Goutam Saha, Herbert Taub, "**Principles of Communication system**", T*ata McGraw-Hill Education Pvt. Ltd,* (4th Edition), (2015).
2. A. B. *Carlson* and P. B. Crilly, "**Communication Systems**", *McGraw-Hill*, (5th Edition), (2002).
3. T. L. Singal, "**Analog and Digital Communication**", *Tata McGraw-Hill,* (1st Edition), (2012).
4. K. Sam Shanmugam, "**Digital and analog communication systems**", *Wiley Publication*, (1stEdition), (1996).

Online Resources:

1. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Dig%20Comm/New_index1.html
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/

EC 3102 MICROCONTROLLERS

Teaching Scheme			**Examination Scheme**
Lectures: 3 Hours / Week			In Semester: 50 Marks
			End Semester: 50 Marks
			Credits: 3

Course Objectives:

1. Explain the applications of microprocessors and microcontrollers
2. Introduce the architecture and features of typical microcontrollers
3. Learn the interfacing of real world I/O devices
4. Learn hardware and software development tools

Course Outcomes:

After completion of the course, students will be able to

1. Compare architectures for microprocessors and microcontrollers
2. Describe architecture of 8051 and PIC 18F microcontroller
3. Write assembly language codes for 8051 microcontroller
4. Write assembly language codes for interfacing on-chip peripherals viz. I/O ports, Timers, Serial communication of 8051 microcontroller
5. Write C language programs for interfacing peripherals viz. LCD and DC motor using PIC 18F

Unit I:	**Introduction to Microprocessor/Microcontrollers Architecture**	**(08)**

Microprocessors and Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Architecture of a Microcontroller, Family members. Microcontroller Application Development tools: Simulator, Emulator, ISP, Cross assembler, Concept of RS 232 C, RS485, SPI bus and I2C bus standards.

Unit II:	**8051 Architecture**	**(06)**

MCS-51 architecture, Pin description, PSW, Internal and external memories, Counters and Timers, Serial communication, Stack and Stack Pointer, Port Structure, Interrupts.

Unit III:	**MCS-51 Addressing modes and Instructions**	**(06)**

8051 Addressing modes, MCS-51 Instruction set and simple assembly language programs.

Unit IV:	**Real World Interfacing**	**(09)**
Interfacing ADC, DAC, memory, Interfacing 8051 to LED, Interfacing 8051 to LCD, Interfacing 8051 to keypad, Interfacing 8051 to Stepper motor.		
Unit V:	**PIC MICROCONTROLLER**	**(06)**
Architecture of PIC 18X series, registers, memory organization, Interrupts, Timers, I/O port, Power down modes, Configuration bit settings.		
Unit VI:	**Real world interfacing with PIC**	**(07)**
Interfacing PIC 18F with Keypad, LCD, CCP, DC Motor (PWM), I2C bus for peripheral chip access, A/D converter, UART.		

Text Books:

1.	Mohammad Mazidi, Janice Mazidi and Rolin McKinlay, " **The 8051 Microcontroller and Embedded Systems using Assembly and C"**, *Pearson Education*, (2nd Edition), (2014).
2.	Mazidi, Mckinley, Causey, "**PIC Microcontrollers and Embedded Systems",** *Pearson Education*, (1st Edition), (2013).

Reference Books:

1.	Myke Predko, "**Programming and customizing the 8051 microcontroller"**, *Tata McGraw Hill.* (2nd Edition), (2014).
2.	Kenneth Ayala "**The 8051- Architecture, Programming and Applications",** *West Publishing Company*, (3nd Edition), (2014).

OnOnline Resources:

1.	www.intel.com
2.	www.microchip.com

PEEC 3101 MECHATRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Discuss the concepts and key elements of Mechatronics system
2. Explain principles and characteristics of Sensors and Transducers
3. Describe working principle of Hydraulic and Pneumatic systems and its applications
4. Give example of applications of Mechatronics Systems

Course Outcomes:
After completion of the course, students will be able to
1. Identify key elements of Mechatronics System and its representation in terms of block diagram
2. Classify Sensors and Transducers according to their applications
3. Design Signal Conditioning circuit for given Sensors/Transducers
4. Explain working principle and applications of Hydraulic and Pneumatic Systems
5. Apply concept to Interface Hydraulic/Pneumatic System components for given task
6. Develop Mechatronics systems for automation

Unit I: Elements of Mechatronics Systems **(06)**
Introduction to Mechatronics, key element/components, level of Mechatronics system design, phases of Mechatronics design process, integrated design approach, Advantages, and disadvantages of Mechatronics systems, Mechanical components: cam, gears, gear-train, servomechanism, and its application

Unit II: Sensors and Transducers **(10)**
Overview of Sensors and Transducers, classification, and their Characteristics. Temperature: Thermistor, RTD, semiconductor (AD590, LM35, LM75), IR sensor, Force: strain gauge, Load Cell, Pressure: Strain gauge, Piezoelectric, Displacement/Position: potentiometer, LVDT, proximity, optical encoder, Ultrasonic transducer, Level and Flow: ultrasonic transducer, Vibration and acceleration: piezoelectric accelerometer

Unit III: Signal Conditioning and Data Acquisition Systems **(06)**
Signal conditioning: its necessity, Amplification, filtering and Impedance Matching, protection, 4-20 mA Transmitters, Data Acquisition system: its necessity, components of DAQ, data conversion, and data signal transmission and its representation.

Unit IV: Hydraulic and Pneumatic Actuating System **(08)**
Introduction to Hydraulic Actuating system, Physical Components of Hydraulic systems, types of Hydraulic actuators and their applications. Introduction to Pneumatic Actuators systems, Physical Components of a Pneumatic Systems, types of Pneumatic Actuators/Cylinders and its applications. Comparison of hydraulic and pneumatic actuators.**Valves:** Pressure relief, Pressure regulator and directional Control Valve (3/2 Valves, 4/2 Valves, 5/3 Valves)

Unit V: Introduction to Electrical Actuators and Electro-Mechanical Actuators (06)

Selection criteria and specifications of stepper motors, servomotors, solenoid valves, Solid State relays and Electromechanical relays. Electro-Pneumatic: Physical Components of Electro-Pneumatic systems.

Unit VI: Mechatronics Systems Applications (06)

Mechatronics Systems in Automobile, Engine Management systems, Antilock Brake systems (ABS), washing machine, pick and place robot, introduction to CNC Machines.

Text Books:

1. Bolton W., **"Mechatronics Electronic systems in Mechanical and Electrical engineering"**, *Pearson Educatio Ltd.*, (6th Edition), (2016).
2. K. P. Ramachandran, G. K. Vijayaraghavan and M.S. Balasundaram, **"Mechatronics-Integrated Mechanical Electronic Systems"**, *Wiley Publication*, (1st Edition), (2008).
3. David Alciatore and MaichaelB Histand, **"Introduction to Mechatronics and Measurement Systems"**, *Tata McGraw Hill*, (4th Edition), (2013).

Reference Books:

1. Doeblin E.O., **"Measurement System-Application and Design",** *TMH, New Delhi*, (4th Edition), (2004)
2. Mahalik N. P., **"Mechatronics - Principles, Concepts and Applications",** *TMH, New Delhi*, (2nd Edition), (2014)
3. Devdas Shetty and Richard A. Kolk, **"Mechatronics System Design",** *Thomson India Edition*, (1st Edition), (2007).

Online Recources:

1. http://nptel.ac.in/courses/112103174/

PEEC 3101 POWER ELECTRONICS

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credits: 3

Course Objectives:

1. Explain the power devices structure and characteristics
2. Elaborate the line synchronization and isolation circuit/techniques
3. Compare the output voltage waveforms of power converters for R and R-L loads
4. Calculate the performance parameters of power converters
5. Explain power converter applications
6. Explain the protection circuits for the power devices

Course Outcomes:

After completion of the course, students will be able to

1. Explain the need of power devices, their structure and characteristics
2. Design gate drive circuits for Power Devices
3. Analyze power converters for output voltage, Output current, Reactive power
4. Determine the power converter performance parameters
5. Describe power converter applications
6. Design protection circuits for power devices

Unit I: Power Devices **(06)**

SCR- Construction, turn on mechanism, Static and Dynamic Characteristics, Specifications, Gate-cathode characteristic , Firing circuits, Isolation Techniques, Power MOSFET, IGBT-Construction and Gate Drive Circuits.

Unit II: Phase Controlled Rectifiers **(10)**

Concept of Line and Forced Commutation, Introduction to Forced Commutation circuits for SCR (No Derivations only operation and waveforms), Analysis of Single phase Semi converters and Full Converters for R and R-L load, Effect of Freewheeling Diode, Working of Three phases Converters for R load.

Unit III: AC Voltage Controllers **(05)**

Single Phase AC voltage Controller for R and R-L load, Three Phase AC voltage Controller for R load, Light dimmer, resistance welding, induction heating.

Unit IV: Inverters **(08)**

Working principle of Single phase Half Bridge and Full Bridge inverters for R and R-L load, Analysis of Performance parameters, Three phase Bridge inverters for R load (120° and 180° mode Operation), PWM Inverters, Working of ON Line and Off Line UPS.

Unit V: Choppers **(08)**

Circuit Diagram, waveforms and operation of Step Down chopper for R and R-L load, Different Control Strategies for the output voltage control, Step up chopper, 2-quadrant and Four Quadrant Choppers, flyback Converters, Block diagram and working of SMPS.

Unit VI: Protection Circuits for Power Devices **(05)**

Over current, over Voltage protection for power devices, Snubbed circuit for SCR, Cooling mechanism for power devices.

Text Books:

1. M. H. Rashid, **"Power Electronics Circuit, Device and Application"** *PHI New Delhi*, (3rd Edition), (2009).
2. M. D. Singh and K. B. Khanchandani, **"Power Electronics"** *TMH, New Delhi*, (2nd Edition), (2008).
3. Ned Mohan, T. M.Undeland, and W.P. Robbins, **"Power Electronics Converter Application and Design"** *John Wiley and Sons*, (3rd Edition), (2009).

Reference Books:

1. M. S. Jamil Asghar, **"Power Electronics"**, *PHI*, *New Delhi*, (1st Edition), (2011).
2. P. C. Sen, **"Power Electronics"**, *John Wiley and Sons*, (1st Edition), (2008).

Online Recourses:

1. www.nptelvideos.in/2012/11/power-electronics.htm

PEEC 3101 SYSTEM PROGRAMMING AND OPERATING SYSTEM

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective

1. Explain the fundamentals of system programming
2. Introduce the algorithmic design aspects of assembler, macro processor and compiler
3. Explain the concept of linkers and loaders
4. Explain the steps in software development along with the software tools and the code optimization techniques
5. Explain the types and functions of Operating system

Course Outcomes:
After completion of the course, the student will be able to
1. Explain the language processors: assembler, macro processor, compiler, linkers and loaders
2. Analyze the program development steps using software tools and interpret code optimization techniques
3. Describe the operating system concepts and functions
4. Analyze and evaluate the memory management techniques
5. Explain the file system concepts and mobile OS

Unit I : Basics of system programming and Macroprocessor (06)
Language processors: Language processors and processing activities
Data structures for language processing: Search data structure, Allocation data structures.
Macro Processor: Macro definition and call, macro expansion, Nested macro calls, advanced macro facilities, Design of macro pre processor.

Unit II : : Translators : Assembler, Compilers and Interpreters (08)
Assembler: Assembly language programming, simple assembly scheme, pass structure of assembler, design of two pass assembler
Compilers and Interpreters : Phases of compilation, memory allocation, code of optimization, Interpreters and comparison with compilers

Unit III : Linkers and Loaders and Software tools (06)
Linkers and Loaders: Basic loaders functions, absolute loaders, relocation loader, direct linking loader, dynamic linking and loading
Software tools: Software tools for program development, editors, debuggers, programming environment, user interfaces

Unit IV : Introduction to Operating System (OS), Process Management and Deadlocks (10)

Operating System: OS services, system calls and its types, UNIX operating system structure

Process Management: Process states, process control block, processes scheduling and scheduling algorithms

Threads: Single and multi threaded processes, types of threads, multithreading models, comparison of threads with process

Inter process communication: Shared memory and message passing mechanism, direct and indirect communication

Process synchronization: Critical section, semaphores, classic problems of syncronization namely bounded buffer problem, reader-writer problem and dining philosophers problem

Deadlocks: Necessary conditions for deadlock, deadlock prevention, deadlock avoidance, Banker's algorithm, recovery from deadlock

Introduction to mobile OS, comparison of various mobile OS and comparison of mobile OS with the UNIX based OS

Unit V : Memory Management (06)

Basics of memory management, swapping, memory allocation, paging, segmentation, virtual memory, demand paging, page replacement, page replacement algorithms namely First In First Out(FIFO) and Least Recently Used (LRU)

Unit VI: File System and implementation (06)

File System : file attributes, file operations, file types, file access methods, file directories, file protection, file system structure, file system implementation, free space management

Text Books:

1. D.M. Dhamdhere, **"Systems Programming and Operating System"**, *Tata McGraw Hill,* (2nd Edition), (2009).
2. Siberschatz A; Galvin P.B; Gagne G, **"Operating System Concepts"**, *Wiley India Pvt. Ltd.,* (8th Edition), (2010).
3. P. K. Dixit, **"Android",** *Vikas Publishing*, (1st Edition), 2014

Reference Books:

1. J. J. Donovan, **"Systems Programming"**, *Tata McGraw Hill,* (1st Edition), (1991).
2. Andrew S. Tanenbaum, **"Modern Operating System"**, *Pearson,* (4th Edition), (2015).
3. Alfred Aho, Ravi Sethi & Jeffrey D. Ullman, **"Compilers – Principles, techniques and tools",** *Pearson Education India Ltd.***,** (2nd Edition), (2007).

Online Resources:

1. Assemblers : http://slideplayer.com/slide/7276157/
2. System Calls and its types: https://youtu.be/x6XTxhY1jZQ
3. Compiler, Interpreter, Assembler, Linker and Loaders : https://youtu.be/4sPWotthkgw
4. How OS works : https://www.youtube.com/watch?v=85_XLP1CKYs

PEEC 3101D: PROBABILITY AND STATISTICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain Axioms, rules in Probability and Distributions
2. Solve numerical on various Statistical Measures
3. Evaluation and interpretation of descriptive Statistics
4. Design and Analysis of Experiments
5. Explain Hypothesis tests

Course Outcomes:
After completion of the course, students will be able to
1. Solved problems based on Probability and Bayes Theorem
2. Identify Distributions in Data
3. Calculate Mean, Variation, Regression, Correlation on given data
4. Design and Analyze experiments and apply hypothesis tests
5. Draw inferences from statistical analysis of data
6. Describe Principle Component Analysis and Independent Component Analysis and their applications

Unit I: Probability (06)
Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, Probability distribution.

Unit II: Review of Basic Statistical Measure (08)
Introduction, Measures of Central Tendency: Arithmetic Mean, Weighted Arithmetic Mean, Median, Geometric and Harmonic Mean. Measurement of Variation: Quartile, Average and Standard Deviations, Coefficient Variation. Measurement of Skewness.

Unit III: Design and Analysis of Experiment (08)
Introduction, ANOVA, Completely Randomized design, Latin Square design, Duncan's Multiple Range Test.

Unit IV: Tests of Hypotheses (10)
Introduction, Tests of Hypothesis Concerning Means, Hypothesis Concerning Proportions, Hypothesis Concerning Variations (Chi-square and F-Tests), Chi-square Test for checking Independent of Categorized Data, Goodness of Fit Test

Unit V: Multivariate Analysis (10)
Introduction, Correlation Analysis, MANOVA, Forecasting, Linear Regression, Discrimination Analysis, Factor Analysis, Principle Component Analysis and Independent Component Analysis.

Text Books:

1. R. Panneerselvam**, “Research Methodology”,** *PHI Learning Private Limited,* (2nd Edition), (2014).
2. P. Z. Peebles***, “Probability, Random Variables and Random Signal Principles”,*** *Tata McGraw-Hill****,*** (4th Edition), (2013)**.**
3. A. Papoulis, S. U. Pillai, ***“Probability, Random Variables and Stochastic Processes”,*** *Tata McGraw-Hill****,*** (4th Edition), (2002).

Reference Books:

1. S. M. Ross, **“Introduction to Probability and Statistics for Engineers and Scientists”***,* *Elsevier Publication,* (5th Edition), (2014).
2. Jay I. Devore*,* **“Probability and Statistics for Engineers and Scientists”**, *Elsevier Publication,* (5th Edition), (2014).
3. E. Rukmangadchari, E. K. Reddy, “**Probability and Statistics”,** *Pearson India Pvt. Ltd,* (1st Edition)*,* (2015).
4. Rohatgi A. K., Md. E. Saleh, **“Introduction to Probability and Statistics”**, *Wiley Publication Pvt. Ltd*., (3rd Edition), (2015).

Online Recourses:

1. http://nptel.ac.in/courses/111/105/111105041/

EC 3104 DIGITAL COMMUNICATION LAB

Teaching Scheme

Lectures: 2 Hours / Week

Examination Scheme

Practical: 25 Marks

Credits: 1

Course Objective

1. Explain pulse code modulation techniques and companding
2. Explain Delta modulation and Adaptive delta modulation
3. Analyze data format and their spectral analyses
4. Verify shift keying techniques such as FSK, PSK and QPSK experimentally.
5. Verify properties of PN-Sequence

Course Outcome

After completion of the course, students will be able to

1. Compare bit-rate, signal-to-noise ratio, Quantization error and design implementation for waveform coding techniques
2. Interpret the data format for bit pattern and explain Inter Symbol Interference
3. Compare and measure bandwidth and bit-rate of digital modulation techniques
4. Illustrate balance and run-length property of PN-sequence

List of Experiments:

1. To measure Bit-rate, Signal to noise ratio and Quantization error for PCM.
2. To measure and plot slope overload and Grannular noise in Delta modulation.
3. To measure and plot slope overload and Grannular noise in Adaptive Delta modulation.
4. To interpret line codes (NRZ, RZ, Polar RZ, Bipolar (AMI), Manchester) and interpret spectral analysis for a given bit pattern
5. To observe BFSK waveform in presence of noise and measure bandwidth.
6. To observe BPSK and QPSK waveforms, compare and measure its bit rate and bandwidth.
7. Write program for calculation and plotting the error probability of BPSK, QPSK and QAM.
8. To observe and verify properties of PN-sequence.
9. Analyze parameters of codec IC's OR Design and implement PCM Modulator.

EC 3105 MICROCONTROLLERS LAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
Practical : 50 Marks
Credits: 2

Course Objectives:

1. Explore software development tools for 8051 and PIC 18F Microcontrollers
2. Assembly language programming
3. Interfacing of real world I/O devices with 8051 microcontroller
4. Interfacing of real world I/O devices with PIC 18F microcontroller

Course Outcomes:
After completion of the course, students will be able to

1. Write assembly language codes using instructions of 8051 microcontroller
2. Write assembly language codes for interfacing on-chip peripherals viz. I/O ports, Timers, Serial communication of 8051 microcontroller
3. Write assembly language codes for interfacing external peripherals viz., LED, DAC ,7-segment display
4. Write assembly language codes for interfacing external peripherals viz., LCD, Keypad, and stepper motor
5. Write C language programs for interfacing peripherals viz. LCD and DC motor using PIC 18F

List of Experiments:

1. Write programs for Mathematical Calculator/ Temperature Conversion/Smaller-Greater numbers, Factorial of a number.
2. Program for Data transfer from Internal to Internal / Internal to External Memory.
3. Program to sort the numbers in ascending /descending order.
4. Different programs to interface LEDS — (flashing in different patterns, BCD Counter)
5. Generation of various waveforms using DAC interface to 8051.
6. Interfacing of Multiplexed 7-segment display (counting application)
7. Interfacing of LCD to 8051 (4 bit and 8 bit modes)
8. Interfacing of Stepper motor to 8051 using Timer delay
9. Interfacing 4X4 keypad to 8051 and displaying key pressed on LCD
10. Interfacing serial port of 8051 to PC.
11. Write a program for interfacing switch, LED, relay & buzzer with PIC.
12. Generation of PWM signal for DC Motor control using PIC.

13*. Simulation of interfacing switch, LED, relay & buzzer with PIC using Proteus.

14*. Interface analog voltage 0-5V to internal ADC of PIC and display the value on LCD.

Note: * Higher difficulty level Programs

EC 3106 ELECTRONIC DESIGN LAB

Teaching Scheme	Examination Scheme
Lectures: 2 Hours / Week	Oral : 25 Marks
	Credits: 1

Course Objectives:

1. Apply fundamental concepts of electronics to design electronic systems.
2. Inculcate circuit designing skills and to use modern design tools.
3. Highlight the importance and significance of customer specification/requirements.
4. To learn electronics circuit function verification with EDA tools.

Course Outcomes:

After completion of the course, students will be able to

1. Apply the fundamental concepts and working principles of electronic devices to design electronic systems
2. Interpret data sheets and thus select appropriate components and devices
3. Design an electronic system/subsystem in the area of regulated power supplies and validate its performance
4. Select appropriate transducer and signal conditioning circuit to design prototype of Data Acquisition System and validate its performance by simulating the same with EDA tools
5. Design, Develop, Built, Test and Demonstrate Linear Power Supply
6. Write and submit a report on the Linear Power Supply

1. Linear Regulated Power Supply: (04)

Design, Built and Test Linear Power Supply for Laboratory use should be selected from any one type given below:

a. Single Polarity (Variable/Fixed)
b. Dual Polarity (Variable/Fixed)
c. Dual Tracking (Variable/Fixed)

Scope of Design :

1. Proper selection of transformer, rectifier and filter, with its appropriate ratings.
2. Justify selection and design of regulator circuits.
3. Current boosting using external pass/parallel transistors.
4. Over current/ short-circuit, over voltage, thermal protection.
5. Indication of voltage, current and mode of operation on panel by meter or display.
6. Indicators for over voltage and over current.
7. Thermal considerations- Heat Sink calculations.
8. Component list in the form of bill of material.
9. Performance analysis

2. Data Acquisition system (DAS) (04)

Design and simulate Data Acquisition systems in the field of Instrumentation, Automotive

Electronics, Bio-medical, etc. It should have at least two-channel input.

Scope of Design:

1. Selection of appropriate signal sensing scheme.
2. Design of signal conditioning circuit.
3. Selection of suitable A to D converter
4. Selection of Microcontroller with appropriate interfacing circuit
5. Indication of parameters using LED/LCD Display.
6. Component list in the form of Bill of Material.
7. Simulation to verify the performance of DAS

3. Build and Test Electronic hardware for assignment 1 and Simulation of assignment 2 with the EDA tool **(04)**

Build a working model of the design and prepare a report for Linear Power Supply.

References:

Data and Application Manuals and Application Notes from:

1. RS Component Catalog.
2. National Semiconductor regulator design manual.
3. Analog Devices Data Manual.
4. Motorola, "Linear / Switch mode power supplies".
5. Motorola Power Transistors and Thyristors data hand book.
6. BEL Transistor Manual
7. Tower's Data Manual.
8. "PIC 16XX data book"
9. Texas instruments, "Linear interface and applications circuit design"
10. "ATMEL microcontroller data book"
11. Intel Peripheral Manual.

Reference Books:

1. Paul Horowitz, **"Art of Electronics",** *Cambridge University Press*, (2nd Edition), (2008).
2. B. S. Sonde, **"Power Supplies",** *McGraw-Hill Education,* (1st Edition), (1980).
3. B. S. Sonde, **"Introduction to System Design Using Integrated circuits",** *New Age Publication (P) Ltd.*, (2nd Edition), (2003).
4. Sergio Franco, **"Design with Operational amplifiers and analog Integrated circuits**", , *McGraw-Hill Education*, (3rd Edition), (2003).
5. Muhammad Ali Mazidi and Janice Gillispie Mazidi, **"The 8051 Microcontroller and Embedded Systems"**, *Pearson Education Asia*, (2nd Edition), (2009).
6. Muhammad Ali Mazidi , **"PIC Microcontroller and Embedded System"**, *Pearsion Education,* (3rd Edition), (2008).
7. Irving M. Gotlib, **"Power Supply Design"**, *McGraw-Hill Education,* (4th Edition),

PEEC 3102 MECHATRONICS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Practical : 25 Marks
Credits: 1

Course Objectives:

1. Measure of displacement, velocity, liquid level, liquid flow
2. Identify and interface components of electro-hydraulic/electro-pneumatic and hydraulic/pneumatic systems
3. Study of data acquisition system

Course Outcomes:
After completion of the course, students will be able to
1. Measure load, velocity, flow and level using analog and digital sensors
2. Interface sensor with data acquisition system and monitor data trending
3. Interface components of electro-hydraulic/electro-pneumatic and hydraulic/pneumatic to build circuits.
4. Develop and demonstrate application of Mechatronics system using suitable hardware.

List of Experiments:
1. Weight measurement using Load Cell.
2. Velocity measurement using optical encoder.
3. Liquid flow measurement using Turbine flow sensor.
4. Liquid level measurement using capacitance sensor.
5. Interfacing any two sensor with Data Acquisition System and observe data trending.
6. Interface hydraulic/ electro - hydraulic system component to actuate single acting and double acting actuator.
7. Interface pneumatic/ electro-pneumatic system component to actuate single acting and double acting cylinders.
8. Design and implement Mechatronics system for any application.

PEEC 3102 POWER ELECTRONICS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Practical : 25 Marks
Credits: 1

Course Objectives:

1. Demonstrate V-I characteristics of power devices
2. Analyze gate drive circuits of the power devices
3. Observe and analyze the output voltage of power converters for R and R-L loads
4. Demonstrate the applications of power converters
5. Examine the power converter using simulation tool

Course Outcome
After completion of the course, students will be able to
1. Measure the important parameters of power devices
2. Test synchronization at every stage in the gate driving circuits
3. Compare the theoretical and practical values of output voltage of the power converters for R and R-L loads with different values of firing angles.
4. Analyze waveforms at different stages of gate drive circuits and at the output of power conversion circuits
5. Analyze the power converter performance using simulation tool

Tools and Platforms: Power Electronics experimental kits , Multisim

List of Experiments:
1. To plot static characteristic of SCR for various gate current values. Measure holding current and Latching current for the SCR used.
2. a) Examine the output of single phase fully controlled bridge rectifier for R, R-L load and R-L with fly wheel diode.
   b) Demonstration of single phase half controlled bridge rectifier for R and R-L load.
3. To plot transfer characteristic and output characteristic of MOSFET.
4. To inspect and analyze different waveforms of single phase full bridge Inverter
5. To test the gate drive circuit and analyze the output of Step down chopper.
6. To observe the waveforms of the triggering circuit and measure the output voltage of AC Voltage controller.
7. To perform converter based DC drive for Permanent magnet DC Motor
8. To test the performance of any one power converter using Multisim.

PEEC 3102 SYSTEM PROGRAMMING AND OPERATING SYSTEM LAB

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours / Week	Practical : 25 Marks
	Credits: 1

Course Objectives:

1. Implementation of language processors.
2. Introduction to Linux / Ubuntu OS and implementation of algorithms of OS functions

Course Outcome

After completion of the course, students will be able to

1. Use basic Linux/ Ubuntu OS commands and demonstrate the steps in Andriod OS application development
2. Implement and analyze stages of compilation of a C language program
3. Implement, analyze and evaluate the OS functions
4. Implement, analyze and compare memory management techniques

Tools and Platforms: C Language on Ubuntu OS

List of Experiments:

1. Implement basic Linux/ Ubuntu Commands
2. Write a shell script on Linux/ Ubuntu OS
3. Implement and analyze stages of compilation in C program
4. Write C Program to implement Lexical Analyzer for simple arithmetic operation to create output tables.(a. Identifier Table b. Literal Table c. Symbol Table d. Arithmetic table e. Keyword table)
5. Implement process scheduling algorithms First Come First Serve (FCFS) and Shortest Job First (SJF)
6. Implement Bankers Algorithm for deadlock detection and avoidance
7. Implementation of page replacement algorithm First In First Out (FIFO) / Least Recently Used (LRU)
8. Develop an application based on Android OS

PEEC 3102D: PROBABILITY AND STATISTICS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Practical: 25 Marks
Credits: 1

Course Objectives:

1. Execute program on probability and statistical methods.
2. Evaluating and Interpolation of data.

Course Outcome
After completion of the course, students will be able to
1. Compute Probability of an event
2. Find and plot distribution on a given data
3. Calculate the measure of central tendency for set of data
4. Perform ANOVA test
5. Execute PCA on given data

Tools and Platforms: MATLAB/ R-Programming
List of Experiments:
1. Determine Probability of an event.
2. Plot CDF and PDF for set of data.
3. Calculate measures of Central Tendency for set of data.
4. Calculations of Variance for set of data.
5. ANOVA test for set of data.
6. To apply Chi Square test to given data.
7. To perform Regression analysis given set of data.
8. Analysis of multivariate data using PCA/ICA.

EC 3201 DIGITAL SIGNAL PROCESSING

Teaching Scheme			Examination Scheme
Lectures: 3 Hours / Week			In Semester: 50 Marks
Tutorial: 1 Hours / Week			End Semester: 50 Marks
			Credits: 4

Course Objectives

1. To discuss basics of Digital Signal Processing and analog to digital signal conversion.
2. To apply transform techniques for the analysis of discrete time LTI signals and systems.
3. To compare analog and digital filters, design digital filters and realize using block diagrams.
4. To describe practical DSP systems and relate it to DSP fundamentals.

Course Outcomes

After completion of the course, students will be able to

1. Explain basic elements of Digital Signal Processing
2. Choose an appropriate sampling frequency and apply the sampling theorem to determine discrete time signal from continuous time signal and vice versa
3. Apply the transform techniques such as Z-transform and Discrete Fourier transform on discrete time signals, interpret its frequency domain representation and compare the computational complexities of DFT and FFT algorithms
4. Analyze a given system function in Z-domain to test for system stability and causality from the inspection of the pole-zero plot
5. Design FIR and IIR digital filters for given specifications, assess performance of the digital filters and build the filter structures
6. Explain the real-life applications of Digital Signal Processing

Unit I:	**Introduction to DSP**	**(06)**

Basic elements of Digital Signal Processing, Advantages of Digital over Analog signal processing, Sampling of analog signals, Sampling theorem in time domain, Recovery of analog signals, Mapping between analog frequencies to digital frequency.

Unit II:	**Z-Transform**	**(06)**

Need of transform, Definition of bilateral and unilateral Z-Transform, Properties of ROC, Properties of Z-Transform, Pole-zero plot, Pole locations and time domain behavior, Inverse Z-Transform, Analysis of LTI DT systems, Stability and causality considerations for LTI systems.

Unit III:	**Discrete Fourier Transform**	**(08)**

DTFT- Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, Computation of linear convolution using circular convolution, FFT algorithms-decimation in time and decimation in frequency using Radix-2 FFT algorithm, Butterfly diagram, Computational complexity of FFT algorithms, Bit-reversal, In-place computation.

Unit IV:	**FIR Filter Design**	**(08)**

Ideal filter requirements, Comparison of analog and digital filters, Frequency response of Linear phase FIR filters, Types of FIR filter, Design of linear phase FIR filter using windows method, characteristics and comparison of different window functions, FIR filters realization using direct and cascade forms.		
Unit V:	**IIR Filter Design**	**(08)**
Characteristics of practical frequency selective filters, Comparison of characteristics of-Butterworth, Chebyshev and elliptic filters, Design of IIR filters from analog filters, IIR filter design by impulse invariance method, bilinear transformation, Frequency warping effect, IIR filter realization using direct form, cascade form and parallel form.		
Unit VI:	**Applications of DSP**	**(06)**
Overview of DSP in real world applications, Applications of DSP in- Audio Systems, Telecommunication Systems, Biomedical, Image Processing.		

Text Books:

1.	John G. Proakis, D. G. Manolakis, **"Digital Signal Processing"**, *Pearson Prentice Hall*, (4rd Edition), (1997).
2.	Emmanuel C. Ifeachor, B. W. Jervis, **"Digital Signal Processing- A practical approach"**, *Pearson Education*, (2nd Edition), (2002).
3.	S. Salivahanan, A. Vallavraj, C. Gnanpriya, **"Digital Signal Processing"**, *McGraw Hill*, (3rd Edition), (2011).

Reference Books:

1.	S. K. Mitra, **"Digital Signal Processing- A Computer Based Approach"**, *McGraw Hill*, (4th Edition), (2013).
2.	A. Nagoor Kani, **"Digital Signal Processing"**, *Tata McGraw-Hill Education Pvt. Ltd.*, (2nd Edition), (2012).
3.	Alan V. Oppenheim, **"Discrete-Time Signal Processing"**, *Pearson Education India,* 3rd Edition), (2013).
4.	Vinay K. Ingale, John G. Proakis, **"Digital Signal Processing using MATLAB"**, *Cengage Learning, (*3rd Edition), (2009).
5.	S. D. Apte, **"Digital Signal Processing"**, *Wiley India Publication*, (2nd Edition), (2011).

Online Resources:

1.	http://freevideolectures.com/Course/2317/Digital-Signal-Processing-IIT-Delhi
2.	https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/
3.	http://www.dspguide.com/

EC 3202 ADVANCED PROCESSOR

Teaching Scheme
Lectures: 3 Hours /Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50Marks
Credits: 3

Course Objectives:

1. Explain the architecture of ARM 7 and ARM-cortex series microprocessor
2. Describe features of on chip peripherals of ARM 7 processor
3. Interfacing real world input and output devices to ARM 7
4. Explain the need of Operating system for embedded systems
5. Describe features of cortex based Raspberry PI board

CourseOutcomes:
After completion of the course, students will be able to

1. Describe the ARM microprocessor family architecture and features
2. Write algorithm / C language program for ARM 7 on chip peripheral
3. Interface external peripherals to ARM 7 and write algorithm/ C program
4. Describe features of Raspberry pi ARM-cortex board and explain concepts of Real Time Operating System

Unit I:	**Introduction to ARM 7 processor – LPC 2148**	**(07)**

Introduction to ARM processor – LPC 2148. LPC2148: Features, GPIO, Pin Connect Block, serial communication programming for transmission and reception from computer, programming for UART, Internal register set, CPSR, SPSR. Interface LED to GPIO.

Unit II:	**Real world Interfacing - I**	**(06)**

Introduce GSM AT commands, Interface GSM to LPC 2148 (Hardware / algorithm), Introduce GPS module and interface to LPC 2148, Memory Map.

Unit III:	**Real world Interfacing - II**	**(08)**

Architecture and pin configuration of LCD/GLCD and interface to LPC

2148, On chip ADC registers (algorithm), on chip DAC for waveform generation, interface EEPROM using I2C protocol, Programming examples Using timers of LPC2148 to generate delay.

Unit IV: ARM 7 Core **(08)**

ARM7 data flow model, programmers model, modes of operations. ARM7 Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), timer, Interrupt structure of LPC2148, Interfacing with KEYPAD, ARM versions: ARM7, ARM9 and ARM11 feature comparison.

Unit V: ARM CORTEX **(08)**

Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Firmware development using CMSIS standard for ARM Cortex.

Unit VI: Introduction of Raspberry-Pi **(05)**

Introduction of Raspberry-Pi – Features, processor. Different OS of Raspberry Pi board. Installation procedure of OS. Booting sequence. Introducing GCC compiler, writing Hello world program.

Text Books:

1. Rajkamal, **"Embedded System Architecture Programming Design",** *Tata Graw Hill Publication,* (2nd Edition), (2008).
2. Dr. K. V. K. K. Prasad **"Embedded / real time System: Concepts, Design, &Programming"***Black Book Dreamtech Press Publication.(*2003)
3. Andrew N. Sloss, DomiicSymes, Chris Wright, **"ARM System Developer's Guide-Designing and Optimizing Software"**, *Elsevier Publication,* (2004).
4. Joseph Yiu, **"The Definitive Guide to the ARM Cortex-M"**, *Newnes, ELSEVIER,* (2007)

Reference Books:

1. Tammy Noergaard, **"Embedded Systems Architecture"** Elsevier, (2nd Edition), (2004).
2. Dr. K. V. K. K. Prasad, Gupta Dass, Verma, **"Programming for embedded system",***Wiley – Dreamtech India Pvt. Ltd*.
3. I2C Specification Protocol Standard.
4. ARM7/TDMI (ReV4) – Technical Ref Manual

Online Resources:

1. LPC 214x User manual (UM10139) :- www.nxp.com
2. LPC 17xx User manual (UM10360) :- www.nxp.com
3. ARM architecture reference manual : - www.arm.com

EC 3203 CONTROL SYSTEMS

Teaching Scheme

Lectures: 3 Hours / Week

Tutorial:1 Hour / Week

Examination Scheme

In Semester: 50 Marks

End Semester: 50 Marks

Credits: 4

Course Objectives:

1. Explain the need of Laplace transform and develop the ability to analyze the system in s domain
2. Explain the components and types of control systems
3. Find response of first order and second order systems using standard input signals
4. To analyze feedback control system stability in time domain using Routh-Hurwitz criterion and Root Locus technique
5. Analyze feedback control system stability in frequency domain using Bode and Nyquist plot
6. Explain state space approach for control system analysis

Course Outcomes:

After completion of the course, students will be able to

1. Find the Laplace transform of signals and determine the transfer function of the system in s domain
2. Classify and explain different systems, interpret transfer function of physical components and construct system transfer function
3. Determine and analyze system response to find time and frequency domain specifications and steady state error
4. Examine system stability in time domain and in frequency domain
5. Examine the stability of system by plotting Root Locus, Bode and Nyquist plots
6. Analyze control system using state space approach

Unit I: Laplace Transform and its Applications (05)

Definition of Laplace Transform (LT), need of Laplace transform, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform(ILT), stability considerations in s domain, application of Laplace transforms to the LTI system analysis.

Unit II: Basics of Control Systems (08)

Introduction, types of control systems: open loop and closed loop, feedback control system, effect of feedback, concept of transfer function, characteristics equation, poles and zeros, block diagram algebra, signal flow graph, Mason's gain formula.

Unit III: Time Domain Analysis **(07)**

Type and order of the control systems, types of standard inputs, response of first order system to step, ramp and parabolic inputs, response of second order system to standard input signals, time domain specifications of second order systems, steady state error and error coefficients.

Unit IV: Stability **(07)**

Concept of stability, absolute, relative, marginal and unstable system in s plane, dominant poles and zeros, Routh-Hurwitz criterion, concept of Root Locus**.**

Unit V: Frequency Domain Analysis **(09)**

Need of frequency domain analysis, correlation between time and frequency domain, frequency domain specifications, Bode plot, construction of Bode plot, gain and phase margin, determination of relative stability, Nyquist stability criterion.

Unit VI: State Space Analysis **(06)**

Advantages of state space analysis over classical control, concept of state, state variables and state model, state space representation using state model, state transition matrix and its properties, solution of state equations for LTI system, concept of controllability and observability**.**

Text Books:

1. I. J. Nagrath, M. Gopal, "**Control Systems Engineering**", *New Age International Publishers, New Delhi*, (5th Edition), (2007).
2. Katsuhiko Ogata, "**Modern Control Engineering"**, *PHI Learning Private Limited, New Delhi,(*5th Edition), (2010).
3. Barry Van Veen, Simon Haykin**, "Signals and Systems",** *Wiley,* (2nd Edition), (2007).

Reference Books:

1. B. C. Kuo, "**Digital Control Systems",** Oxford *University Press, New York*, (2nd Edition), (1992).
2. Richard C. Drof, Robert N. Bishop, "**Modern Control Systems"**, *Addison Wesley Pub. Company*, (1st Edition), (2001).

Online Resources:

1. http://nptel.ac.in/courses/108101037/1
2. https://www.tutorialspoint.com/control_systems/index.htm
3. https://www.youtube.com/watch?v=s8rsR_TStaA&list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO

PEEC 3201 BIOMEDICAL ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective

1. Analysis of biomedical signals, its origin and classification of biosignals
2. Explain characteristics of biosignals and their Acquisition
3. Enhance the students ability in analysis for biomedical signals
4. Explain the functionality of biomedical electronic instruments

Course Outcome
After completion of the course, students will be able to
1. Explain anatomy of cardiovascular and nervous system
2. Describe sources, signal conditioning and processing techniques of biosignals
3. Analyze ECG and EEG signals using transform techniques
4. Design digital filter for removal of artifact and noises from biosignals
5. Explain biomedical instruments for diagnosis with consideration of patient safety

Unit: I Human Anatomy and Biomedical Electronic System (08)
Cell, Nerve cell, Human Anatomy: Body Skeleton, Muscles, Heart, Respiratory System, Nervous System, Introduction to Biomedical Electronics, its advantages and applications.

Unit: II Bioelectric Signals and Recording System (07)
Action Potential, Classification of Biomedical Signals. Bioelectric Signals: ECG, EEG, EMG, EOG, MEG. Sources and Contamination of Noise in Bioelectric signals. Recording Electrodes, Skin impedance measurement, Bio-Amplifiers, Isolation amplifiers, Filtering and Patient safety.

Unit: III Cardiovascular System (06)
Electrical Activity of the Heart, Lead Configuration to measure ECG, Einthoven Triangle, Normal and Abnormal ECG, ECG Machine, Heart Sounds and Blood Pressure Measurement.

Unit: IV Central Nervous System (06)
Electroencephalogram(EEG) – Types and Significance of EEG Signal, 10-20 Electrode Placement, Evoked potential, EEG Machine, EEG amplifier and filters, EEG applications: Epilepsy, sleep disorder and Human Brain Computer Interface.

Unit: V Biosignal Processing (07)
Removal of artifact and noise using digital filter, time frequency analysis of biosignals, event detection of ECG and EEG, cancellation of maternal ECG from fetal ECG using Adaptive filter.

Unit: VI Medical Instruments and Measurements (08)
Blood Flow Measurement, Finger Plethesmography, Echocardiography, Bedside Monitors, Central Monitoring System, X Ray properties, Generation of X Rays, block diagram of

X Ray machine image intensifier, Drawbacks of X Ray imaging, CT Scan and MRI
Life Saving Devices: Pacemakers, Defibrillators, Ventilators.

Text Books:

1. Joseph J. Carr and John M. Brown, **"Introduction to Biomedical Equipment Technology",** *Prentice Hall India,* (4th Edition), (2000).
2. R. Rangayan, **"Biomedical Signal Analysis",** *Wiley India Pvt. Limited,* **(**1st Edition), (2002).
3. R. S. Khandpur, **"Handbook of Biomedical Instrumentation"**, *Tata McGraw Hill New Delhi*, (2nd Edition), (2003).

Reference Books:

1. D. C. Reddy **"Biomedical Signal Processing: Principles and techniques",** *Tata McGraw Hill New Delhi*,(1st Edition), (2005).
2. Bruce**, "Biomedical Signal Processing & Signal Modeling**," *Wiley India Pvt. Limited,* (Wiley student edition), (2009).
3. John L Semmlow**, "Bio-signal and Medical Image Processing",** *CRC Press,* (2nd Edition), (2009).

online Resources:

1. http://nptelonlinecourses.iitm.ac.in/
2. https://onlinecourses.nptel.ac.in/noc18_ec02/preview

PEEC 3201 Artificial Intelligence

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective

1. To explain the basics of Artificial Intelligence (AI)
2. To introduce various types of algorithms useful in AI
3. To explain the concepts of machine learning, pattern recognition, and natural language processing.
4. To explain the numerous applications and huge possibilities in the field of AI

Course Outcomes:
After completion of the course, the student will be able to
1. Explain the components of intelligent agents and expert systems.
2. Apply knowledge representation techniques and problem solving strategies to AI applications.
3. Explain and analyze the search and learning algorithms
4. Describe the AI techniques in Expert/intelligent system development

Unit I : Basics of AI and Problem Solving (06)
Categories of AI, applications of AI, intelligent agents, agents and environments, good behavior, the nature of environments, structure of agents, problem solving, problem solving agents, searching for solutions, uninformed search strategies.

Unit II : Problem Solving : Beyond Classical Search, Adversarial Search And Constraint Satisfaction Problems (08)
Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments,
Games: optimal decisions in games, Alpha- Beta Pruning, imperfect real-time decision, games that include an element of chance. Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP.

Unit III : Knowledge Representation (08)
Logic, Propositional logic, First order logic, Knowledge engineering in first order logic, inference in first order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, resolution, knowledge representation, uncertainty and methods,Bayesian probability and belief network, probabilistic reasoning, Bayesian networks, inferences in Bayesian networks.

Unit IV : Learning (07)
Learning from observations: forms of learning, Inductive learning, Learning decision trees,

Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement learning.

Unit V : Expert Systems (07)

Introduction to Expert System, Architecture and functionality, Examples of Expert system Visual perception-Waltz's algorithm,Basic steps of pattern recognition system, Feature Extraction- Principal Component Analysis, Linear Discriminant Analysis, Object Recognition-Template Matching theory, Prototype Matching Theory, Pattern Mining,Robotics, robot hardware, robotic software architecture, applications.

Unit VI: Natural Language Processing (06)

Language Models, text classification, formal grammar for a fragment of English, syntactic analysis, augmented grammars, semantic interpretation, ambiguity and disambiguation, discourse understanding, grammar induction, probabilistic language processing, probabilistic language models.

Text Books:

1. Stuart Russell, Peter Norvig, **"Artificial Intelligence, A Modern Approach"**, *Pearson Education/Prentice Hall of India,* (3rd Edition), (2010).
2. Elaine Rich, Kevin Knight and Shivshankar Nair, **"Artificial Intelligence"**, *Tata McGraw Hill,* (3rd Edition), (2009).

Reference Books:

1. Nils J. Nilsson, **"Artificial Intelligence: A new Synthesis"**, *Morgan Kaufmann Publishers,* (1th Edition), (1998).
2. George F. Luger, **"Artificial Intelligence: Structures and Strategies for Complex Problem Solving"**, *Pearson Education*, (6th Edition) (2008)

Online Resources:

1. NPTEL Lectures on AI : http://nptel.ac.in/courses/106105077/

PEEC 3201E DATABASE MANAGEMENT SYSTEMS

(Swayam Course)

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credits: 3

Course Objectives:

1. Understand data models, database languages.
2. Learn the components of database management systems.
3. Understand the basics of SQL

Course Outcomes:

After completion of course, students will be able to:

1. Make use of the database concepts and conventions to be able to apply in the design and applications of databases.
2. Apply the concepts of SQL and its usage in database management.
3. Make use of the database design principles and Entity-Relationship diagrams to arrive at schemas and relations.
4. Cognizance of the practical aspects of design and usage of databases from within application programs.

Unit I: Introduction **(06)**

Database-System Applications. Purpose of Database systems. View of Data. Database languages. Relational databases. Database Design. Data Storage and Querying. Transaction Management. Database Architecture.

Unit II: Introduction to the Relational Model **(06)**

Structure of Relational Databases. Database Schema. Keys. Schema Diagrams. Relational Query Languages. Relational Operations.

Unit III: Structured Query Language (SQL) **(07)**

Introduction to SQL - Overview, SQL data definition. Basic structure of SQL queries. Set operations. Null values. Aggregate functions. Nested sub queries.
Join expressions, views, and transactions. Integrity constraints, SQL data types and schemas. Authorization. Accessing SQL from a programming language.

Unit IV: Database Design, E-R Model and User Interfaces (07)
Overview of the design process. The Entity-Relationship Model and its constraints. Removing redundant attributes in Entity sets. E-R Diagrams. Reduction to Relational Schemas. E-R design issues. Extended E-R features. Alternative notations for Modeling Data. Application programs and User Interfaces. Web fundamentals. Servlets and JSP. Application architectures. Application performance and security.

Unit V: Data Storage and Querying (07)
Overview of Physical Storage Media, magnetic disk and flash storage, RAID, Tertiary storage, file organization. Query Processing: Overview, measures of Query Cost. Selection operation, sorting, join operation, evaluation of expressions. Transformation of relational expressions.

Unit VI: Transactions, Concurrency Control and Recovery System (07)
Transaction concept, simple transaction model, storage structure, transaction atomicity, durability and isolation, serializability. Transactions as SQL statements. Lock-based protocols, deadlock handling. Failure classification, storage, recovery And atomicity, recovery algorithms.

Text Books:

1. Silberschatz, Korth, Sudarshan, "Database Systems Concepts", McGraw Hill Education (India) Pvt Ltd, 6th edition.
2. C. J. Date, "An Introduction to Database Systems", Narosa Publication, 3rd edition.

Reference books:

1. Elmasari and Navathe, "Fundamentals of Database Systems", Benjamin Publication, 2nd edition.

2. Hansen and Hansen, "Database Management and Design", Prentice Hall, 2nd edition.

PEEC 3202 EMBEDDED DESIGN AND RTOS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks

End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain embedded system design challenges
2. Discuss Operating system (OS) requirement for embedded systems
3. Describe real time operating system concepts
4. Discuss features of Linux OS
5. Interface real world input and output devices

Course Outcomes:
After completion of the course, students will be able to
1. Describe design metrics of embedded systems to design real time applications to match recent trends in technology.
2. Identify appropriate software development model for a given application
3. Apply real time systems concepts for developing embedded system
4. Explain need of open source OS with General Public License (GPL)
5. Explain kernel configuration and boot loader

Unit I : Introduction to Embedded Systems (07)
Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. Embedded processor technology - IC technology, Design technology. Software development life cycle (SDLC) models like waterfall, spiral, V , Rapid Prototyping models and comparison,

Unit II: Structure of μCOS –II - Part - I (07)
Kernel Structure: Foreground and background systems, Pre-emptive and non-preemptive. Starting the OS. Tasks, Task States, TCB, Ready list, Task Scheduling, Task Level, Multitasking , Context Switching, , Idle Task, Statistics Task, Task Management: Creating/Deleting and Suspending/Resuming Task, Task Stacks and checking, Changing Task's Priority.

Unit III : Synchronization in μCOS-II (07)
Critical Session, Shared resources, Inter task communication, Mutual exclusion, Semaphore Management: Creation/Deletion, Pending/Posting/Acceptance/Query. Mutual Exclusion Semaphores: Creation/Deletion, ending/Posting/Acceptance/Query. Event Flag

Management: Internals, Creation/ Deletion of Event Flag groups, Waiting/Setting/Clearing/Looking for/Querying an Event Flag Group.

Unit IV: Structure of µCOS –II **(07)**

Static and Dynamic Priorities, Priority inversion, Synchronization, mechanisms, Interrupts: Latency, Response and Recovery, Clock Tick, Memory requirements. Schedulers, Locking and unlocking of scheduler, Interrupts, Clock Tick, Initialization, Time Management: Delaying/Resuming task, System Time

Unit V: Communication in µCOS-II **(07)**

Message Mailbox Management: Creating/Deleting a Mailbox, Waiting/ Sending /Getting without waiting a Message from Mailbox, Status of Mailbox, Alternate uses of Mailbox. Message Queue Management: Creating/Deleting/ Flushing a Message Queue, Waiting/Sending/Getting without waiting a Message from Queue, Status and Alternate use of Message Queue. Memory Management: MCB, Creating a partition, Obtaining /Returning/Waiting for a memory Block, Partition Status. Porting of µCOS-II: Development tools, Directories and Files, Configuration and testing of Port.

Unit VI: Linux Kernel Construction **(07)**

Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS Versus Boot loader Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration. Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das U-Boot. Porting U-Boot.

Text Books:

1. Jean J. Labrosse, **"MicroC OS II,The Real-Time Kernel",** *CMP Books*, (2nd Edition), (2011).
2. Christopher Hallinan, **"Embedded Linux Primer - A Practical, Real-World Approach",** *Prentice Hall Pvt.,* (2nd Edition), (2010)
3. Raj Kamal, **"Embedded Systems –Architecture, Programming and Design",** *McGraw Hill*, (2nd Edition), (2008).

Reference Books:

1. Dr. K. V. K. K. Prasad **"Embedded / real time System: Concepts, Design, & Programming -Black Book"**.*Dreamtech Press Publication.*(2nd Edition),(2003).
2. Frank Vahid and Tony Givargis, **"Embedded System Design – A Unified hardware/ Software introduction"**, *Wiley Publication*, (3rd Edition),(2006).

PEEC 3202 DIGITAL IMAGE PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Basic concepts of image processing like relations between pixels, distance measures, statistical parameters, colour models and noise models and operations on images
2. Different image enhancement, segmentation, representation and classifier techniques
3. Image analysis in spatial and transform domain for image compression and filtering
4. Different applications of Image processing

Course Outcomes:
After completion of the course, students will be able to
1. Explain basic concepts of image processing, Compute distance measures and perform arithmetic, logical, geometric, set and spatial transformation operations on images
2. Apply spatial domain image enhancement, filtering and grey scale transformation techniques on image
3. Analyze, apply and explain image processing in frequency domain for image filtering and compression
4. Apply morphological image processing on an image and apply image representation and description techniques
5. Apply image representation and description techniques and explain image segmentation and classification
6. Select different image processing modules to develop an image processing application

Unit I : Digital Image Fundamentals (08)
Components of Image Processing System, Element of Visual Perception, Image sensing and acquisition, A Simple Image Model, Sampling and Quantization, Relationship between pixels and Distance Measures, Statistical parameters. Basic operations on images.

Unit II: Image Enhancement (08)
Image Enhancement in Spatial Domain, Basic Gray Level transformations, Histogram processing, Equalization, Local Enhancement, Basics of Spatial Filtering, Smoothing, Mean filter, Ordered Statistic Filter, Sharpening. Image Enhancement in Frequency Domain, Basics of Filtering in Frequency Domain Filters, Low pass, High pass, Correspondence between Filtering in Spatial and Frequency Domain, Homomorphic Filtering.

Unit III : Image Transforms and Colour Models (08)
Color Image Processing, Color Fundamentals, Color Models, Pseudo color Image processing, Converting Colors to different models.2-D Discrete Fourier Transform, Discrete Cosine Transform, Redundancies, Image Compression Model, Lossy and Lossless Predictive Coding, block diagram of JPEG

Unit IV: Image Segmentation, Representation and Classification (10)

Image analysis, Detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, image representation- chain codes, boundary representation by chain codes, Fourier descriptors, Shape number, Signatures.Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier.

Unit V: Morphological Image Processing and Applications of Image processing (08)

Introduction to Logical Operations on Binary Images, Dilation and Erosion, Opening and Closing, Applications on image processing, remote sensing, fingerprint recognition, character recognition, face recognition, medical applications, CBIR etc

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "**Digital Image Processing**", *Pearson Education*, (2nd Edition), (2012).
2. S. Jayaraman, Esakkirajan, Veerakumar, **"Digital Image Processing"**, *McGraw Hill Education*, (1st Edition,), (2012).

Reference Books:

1. Anil K. Jain, **"Fundamentals of Digital Image Processing"**, *Prentice Hall*, (1st Edition), (1989).
2. Pratt W. K., "**Digital Image Processing**", *John Wiley*, (2nd Edition), (2001).

PEEC 3202 ROBOTICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain fundamentals of robotic system
2. Introduce kinematics, dynamics and control for robotics systems
3. Introduce trajectory planning for motion
4. Describe application of robots in automation

Course Outcomes:
After completion of the course, students will be able to
1. Explain and classify different components used in developing robotic system
2. Select sensors, actuators and grippers for developing robot.
3. Apply formulations to obtain kinematics, dynamics and trajectory planning of manipulator
4. Explain path planning program for robotic system
5. Develop robot for automation

Unit I: Introduction to Robotics (06)
Definition of robotics, components of Robot system-(manipulator, controller, sensors, power conversion unit etc.), Classification of robots based on co-ordinate systems, Robot Architecture, Degrees of freedom, links and joints, progressive advancements in robots, Present trends and future trends in robotics.

Unit II: Robotic Sensors, Actuators and End Effectors (10)

Classification of sensors, internal and external sensors, position, acceleration sensors, proximity, velocity sensors, force sensors, tactile sensor, camera and robot vision.
Overview of actuators: electric, pneumatic and hydraulic actuators,
Classification of end effectors, Different types of grippers: vacuum and other methods of gripping.

Unit III: Transforms and Kinematics (08)
Pose of rigid body, Position and orientation description, Coordinate transforms, Homogeneous transform, Denavit and Hartenberg (DH) parameters, forward and inverse kinematic analysis.

Unit IV: Dynamics and Trajectory (08)
Dynamics and inverse Dynamics of robots, link inertia tensor and manipulator inertia tensor, Newton – Eller formulation. Trajectory planning, joint space planning, Cartesian space planning and position and orientation trajectories.

Unit V: Programming methods (04)
Robot language classification, Robot language structure, elements and its functions. Simple programs on Sensing distance and direction, Line Following Algorithms, Feedback Systems

Other topics on advance robotic techniques

Unit VI: Application of Robot in Automation **(06)**

Application in Manufacturing: Material Transfer, Material handling, loading and unloading processing, spot and continuous arc welding & spray painting, Assembly Inspection, Robot application in Medical, Industrial Automation, and Security

Text Books:

1. S.K. Saha, "Introduction to Robotics", Tata McGraw Hill, (2nd Edition), (2014).
2. R. K. Mittal, I. J. Nagrath**, "Robotics and Control" ,** *Tata McGraw Hill, New Delhi "* **,** (1st Edition), (2003).
3. K.S. Fu, R.C .Gonzalez, C.S.G.Lee ,"**Robotics Control ,Sensing ,Vision and Intelligence" ,** *Tata McGraw Hill* **,** (2nd Edition), (2008).

Reference Books:

1. Robert schilling, **"Fundaments of Robotics: Analysis and Control",** *PHI. New Delhi*, (1st Edition), (2003).
2. S. R. Deb**, "Robotics Technology and Flexible Automation",** S. Deb, Tata McGraw Hill, (1st Edition), (2010).
3. Robert J. Schilling, **"Fundamentals of Robotics- Analysis and Control",** Prentices Hall India, (1st Edition), (2008).

Online Resources:

1. https://nptel.ac.in/downloads/112101098/
2. https://nptel.ac.in/courses/112103174/module7/lec6/6.html

EC 3204 DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral: 25 Marks

Credits: 1

Course Objectives

1. To get familiar with the simulation software and build programming skills for simulating key Digital signal processing operations
2. To apply different sampling frequencies to verify sampling theorem
3. To compare the characteristics of LTI systems from pole-zero plot
4. To discuss frequency domain representation of discrete time signals
5. To verify digital filter design

Course Outcomes
After completion of the course, students will be able to
1. Select appropriate sampling frequency for the given signal to avoid aliasing
2. Simulate and verify the transform (ZT, DFT, FFT) techniques and filter design
3. Analyze LTI system characteristics- pole-zero plot, stability, causality
4. Interpret spectral representation of discrete time signals
5. Design and evaluate performance of digital filters

List of Experiments
1. To write a program to verify the sampling theorem and aliasing effects with various sampling frequencies.
2. To analyze LTI system using pole zero plot, study stability of different transfer functions.
3. To solve the difference equation and find the system response using Z transform.
4. To write a function to find DFT.
5. To write a program to verify DFT properties.
6. To compare the characteristics of different window functions.
7. To design FIR filter for the given specifications using windowing method and interpret the effect of different windows on FIR filter response.
8. To design Butterworth filter using Bilinear transformation method.
9. Design a digital filter to eliminate noise from real life signals, Example: speech or biomedical signals.

EC 3205 ADVANCED PROCESSORLAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
Practical : 50 Marks
Credits: 2

Course Objectives:

1. Explain on chip peripherals of LPC 2148 processor
2. Interfacing real world input and output devices to LPC2148
3. Use of Operating system in embedded systems

Course Outcomes:
After completion of the course, students will be able to

1. Write assembly or C language program for LPC2148 on chip peripheral
2. Interface external peripherals to LPC2148 and write C code
3. Install OS on Raspberry pi

List of Experiments:

1. Using UART of LPC2148 for serial reception and transmission from/to computer.
2. Interfacing GSM with LPC2148 for sending and receiving message and voice call.
3. Interfacing GPS with LPC2148 for finding current location latitude and longitude values.
4. Interfacing LPC2148 with GLCD to display image on it.
5. Using built-in ADC of LPC2148 for displaying its values (Programming built-in ADC with interrupt and without interrupt) OR Programming of onchip ADC and displaying converted digital values.
6. Generate waveform using DAC of LPC2148.
7. Interfacing EEPROM to LPC2148 using I2C protocol.
8. Write Program for generating delays using timer/counter.
9. Installing OS in Raspberry Pi.
10. Write program in Raspberry pi to display 'hello world' and compile using GCC.

PEEC 3203 EMBEDDED SYSTEM AND RTOS LAB

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours / Week	In Semester: 25Marks
	Credits: 1

Course Objectives:

1. Interface real world input and output devices
2. Discuss use of µCOS-II RTOS functions in programming
3. Explain porting of Linux OS

Course Outcomes:

After completion of the course, students will be able to

1. Interface real world input and output devices
2. Apply RTOS concepts to external peripheral devices
3. Write C program using RTOS functions
4. Port Linux OS in embedded system

List of Experiments:

1. Port µCOS-II RTOS on ARM-7.
2. Multitasking in µCOS-II RTOS using min 4 tasks on ARM7
3. Semaphore as signaling and Synchronizing on ARM7.
4. Mailbox implementation for message passing on ARM7.
5. Implement MUTEX on ARM 7
6. Use OS service(s) to accept keyboard input and display/transmit
7. Building tool chain for embedded Linux and porting Kernel on ARM9 target board.
8. Write a program 'Hello world; using embedded Linux on ARM9.

PEEC 3203 DIGITAL IMAGE PROCESSING LAB

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours / Week	In Semester: 25Marks
	Credits: 1

Course Objectives:

1. Perform operations of Digital Image
2. Digital image enhancement and filtering techniques
3. Transform domain operations to achieve image compression and filtering
4. Image segmentation and representation techniques

Course Outcomes:

After completion of the course, students will be able to

1. Perform logical, set, arithmetic and geometric operations on images
2. Implement algorithms for image enhancement, filtering in spatial domain and transform domain
3. Develop an algorithm for image segmentation, compression and colour model conversions
4. Perform morphological operations on images

List of Experiments:

1. To read a BMP file and display its information using C.
2. To perform image segmentation using pseudo colouring using C.
3. To create a digital image and to perform basic operations on images.
4. To perform conversion between colour spaces.
5. To perform power law and gamma corrections.
6. To perform image filtering in spatial domain and frequency domain.
7. To perform image compression using DCT transform.
8. To perform edge detection using masks.
9. To apply morphological operators on an image.
10. Demonstration of installation of Open CV platform.
11. To perform digital image processing using Open CV and Python.

PEEC 3203 ROBOTIC LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25Marks
Credits: 1

Course Objectives:

1. Demonstrate robot working and degree of freedom using physical components
2. Demonstrate robot functioning using simulation software
3. Design microcontroller based robotic system for specific task

Course Outcomes:
After completion of the course, students will be able to
1. Describe mechanical configuration of robot manipulation
2. Describe sensors and actuators used in robot manipulation
3. Apply concept to simulate to obtain work space, kinematics, and trajectory path of robot manipulator
4. Develop robots for specified task

List of Experiments:
1. Velocity and Position measurement using optical encoder.
2. Interface Pneumatic system component to actuate single acting and double acting cylinders.
3. Plot of work space of 2-link planer arm using simulation software.
4. Simulation of Forward Kinematics and Inverse Kinematic of
    1. 3-Link Robot
    2. PUMA 560 Robots.
5. Simulation of Trajectory path of :
    1. 3-Link Robot
    2. PUMA 560 Robots.
6. Design and implement Robotics system for any application..

EC3206 MINI PROJECT AND SEMINAR

TeachingScheme	**Examination Scheme**
Practical: 2Hours/Week	Oral : 25 Marks
	Credits: 1

Course Objectives:

1. Undertake and execute a Mini Project through a group of students
2. Explain the Product Development Cycle through Mini Project
3. Inculcate electronic hardware implementation skills by :
   a. PCB artwork design using an appropriate EDA tool
   b. Imbibing good soldering and effective trouble-shooting practices
   c. Knowing the significance of aesthetics and ergonomics while designing electronic product.
4. Identify the importance of technical documentation of mini project work

Course Outcomes:

After completion of the course, students will be able to

1. Select, plan and cost-estimation of the project
2. Design and simulate the project by using EDA tools
3. Test the project circuit for intended output on bread board or general purpose board
4. Develop the art work and layout of the circuit using PCB design software
5. Test the mini project for intended output
6. Compose a technical report and demonstrate the project

Guidelines:

1. Project group shall consist of not more than 3 students per group.
2. Project design ideas should be adopted from recent issues of electronic design magazines,
3. Application notes from well known component manufacturers may also be referred.
4. Hardware component is mandatory.
5. Layout versus schematic verification is mandatory.

Domains for projects may be from the following, but not limited to:

- Electronic Communication Systems
- Power Electronics
- Biomedical Electronics
- Audio , Video Systems
- Mechatronics Systems
- Embedded Systems
- Instrumentation and Control Systems

Note:

1. Microcontroller based projects should preferably use Microchip PIC controllers/ATmega controller/AVR microcontrollers.

Reference books:

1. Meenakshi Raman, Sangeeta Sharma**, " Technical Communication, Principles and Practice",** *Oxford University Press,* (2nd Edition), (2012).
2. M. Ashraf Rizvi,**" Effective Technical Communication"**, *Tata McGraw Hill Education Pvt. Ltd.* (1st Edition), (2005).

3. C.Muralikrishna, Sunita Mishra,**“ Communication Skills for Engineers”,** *Pearson Education India,* (2nd Edition), (2011) .
4. Thomas C Hayes, Paul Horowitz, **“The Art of Electronics”,** *Cambridge University Press,* (3rd Edition), (2015).
5. Jim Williams, **“Analog Circuit Design: Art, Science and Personalities”,** *Elsevier EDN series for Design Engineers,* (1st Edition), (2013).

OEHS 3101 **ENTREPRENEURSHIP DEVELOPMENT**

Teaching Scheme Examination Scheme Lectures: 3 Hours / Week In Semester: 50 Mark Credits: 3 End Semester: 50 Marks

Course Objectives:

Students will be able to

1. Understand the fit between individual entrepreneurial ambitions
2. Select a problem worth solving
3. Identify customers
4. Develop a solution for your customers' problems and problem solution
5. Build and demonstrate an MVP (Minimum Viable product)
6. Structure a business model around the problem, customer, and solution and present Business Model Canvas

Course Outcomes:

This course will give the students the foundational experience of the entire cycle of entrepreneurship, through a combination of theory and practice.

At the end of the course, the students shall be able to:

1. Describe what it takes to be an entrepreneur
2. Analyze business opportunities and the basics to create, launch and manage new businesses
3. Develop Business Model for their Idea/Problem
4. Create MVP (Minimum Viable Product)

Module 1: Introduction (3) Discover yourself, Principles of Effectuation, Identify your entrepreneurial style

Module 2: Problem Identification and Idea generation (4) Identify Problems worth Solving, Introduction to Design Thinking, Generate ideas that are potential solutions to the problem identified

Module 3: Customer Segmentation (7) Customer identification, Market, Creative solution, Unique Value proposition

Module 4: Business Model Canvas (4) Types of business models, Business Plan documentation, Risk identification

Module 5: Validation (9) Identification of MVP, Solution development, Building

products/services, Build-measure-learn loop for development, Market fit of solution
Module 6: Money (5) Revenue streams, Pricing and cost, Venture financing, Investor expectations

Module 7: Team building (3) Shared leadership, role of good team, Collaboration tools and techniques

Module 8: Marketing and sales (3) Positioning, Channels and strategies, Sales planning

Module 9: Support (4) Project management, Planning and tracking, Business Regulation

Course contents available at: https://staging.learnwise.org/ - Through a Cloud Technology Platform – WF Learn Wise Platform

PDF documents can be downloaded from the website for the distribution to students.

<u>Sample References:</u>

1) **Effectuation: <u>https://necrophone.com/2014/01/20/effectuation-the-best-theory-of entrepreneurship-you-actually-follow-whether-youve-heard-of-it-or-not/</u>**

2) **Value Proposition: https://www.youtube.com/watch?v=jZN6CUieuOQ&list=PLw540Wq5kay866m6A6xI7KOwE_Ah7is4m**

3) **The Lean BMC: https://www.youtube.com/watch?v=FjB_e7UO1hc**

4) **Define your MVP: <u>https://startups.fb.com/en-in/categories/development/</u> 5) Designing**

Experiments: https://www.youtube.com/watch?v=WiMZWCg1Hu8&t=111s 6) Beating

the Competition: https://www.youtube.com/watch?v=46uP6vOj5G0 7) Google : Think

branding: https://www.youtube.com/watch?v=1l2CUjkg0ug

OEHS3101 Introduction to Digital Marketing

Teaching Scheme	**Examination Scheme**
Lectures: 3	In Semester: 50 marks
	End Semester: 50 marks
	Credits:3

Course Objective:

1. Interpret Digital marketing campaign strategy
2. Explain social media and its role in marketing strategy through various channels which it operates
3. Explore search engine optimization
4. Explain concepts related to mobile marketing

Course Outcome:

After successfully completing the course students will be able to

1. Explore methods to illustrate website and webhosting concepts
2. Develop a marketing plan for product or service by integrating social media platforms to generate leads
3. Examine mobile marketing strategies to connect with customers
4. Demonstrate importance of organic ranking through SEO

Unit: I Overview of Digital Marketing (08)

Introduction to Digital Marketing,Understand customer needs, Benefits of Digital marketing, Digital marketing platforms and Strategies, Comparing Digital with Traditional Marketing,Latest Digital marketing trends, What is Domain Name, Types of Domain, Web Hosting Concepts, Domain/Hosting Business,introduction to wordpress

Unit: II Digital Advertising with Google AdWords (08)

Introduction to Paid Marketing, Google Account setup, Account Structure, Campaigns settings, AdGroup setup, Keyword Match Types, Keyword Research Tools, Understanding Ad Auction, What is Quality Score, My Client Centre, Google AdWords Editor Tool,
Interface Tour and BillingSettings

Unit: III Social Media Marketing (08)

Introduction to Social Media, Integrating Social Media with Other Disciplines, Facebook Marketing, Facebook account setup, Personal account properties, Facebook marketing strategy, Facebook business page setup, Types of Business pages, Cover photo designing, Page management options, twitter and Instagram marketing

Unit: IV Mobile Marketing (06)

Introduction to Mobile Marketing and m-commerce, create mobile app,case study:market potential of mobile commerce.

Unit: V Search Engine Optimization (06)

Introduction to Search Engines, On-Page Optimization, Off-Site Optimization, Social media monitoring Tool

Unit: VI Case study and Future Trends in Digital marketing (06)

Text Books:

Seema Gupta, "Digital Marketing", *McGraw-Hill Publication*, (1st Edition), 2018.

Benjamin Mangold, "Google Adwords and Google Analytics", *loves data* , (1st Edition), 2018.

Richard stokes, "Pay per click", *Entrepreneur Press*,(2nd Edition),2014.

Eric Enge, "The Art of SEO", *O'Reily Media*,(3rd Edition),2015.
Reference Books:

Vandana Ahuja, Digital Marketing, *Oxford University Press,* (1st Edition*),*2015.

Reference Books:

1.Ian Dodson, **The Art of Digital Marketing:** *Wiley,Apr 2016*

2.Sira. R Bowden **Beginners Guide Digital Marketing Part 2:** *Mobile Marketing, BookRix, 2016*

websites:

1. https://www.searchenginejournal.com/seo-guide/panda-penguin-hummingbird/
2. https://www.lynda.com/Analytics-tutorials/Online-Marketing-Fundamentals/188429-2.html

20OEHS501B Intellectual Property Rights			
Teaching Scheme			**Examination Scheme**
Lectures: 3 Hours / Week			ISE: 50 Marks
			ESE: 50 Marks
			Credits: 3

Prerequisite : No pre-requisite

Course Objectives:
To facilitate learners to,

1.	Overview of Intellectual Properties (IP) regime in India and International arrangements
2.	Introduce the types of IP as Patents, Copyrights, Trade Secrets etc.
3.	Understand the process and steps involved in filing Intellectual Properties
4.	Understand intricacies involved in drafting patent applications

Course Outcomes:

After completion of the course, students will be able to

CO1	Demonstrate the concepts of Intellectual Property Rights, patents and other forms of IP
CO2	Apply appropriate type of IP for the Intellectual property
CO3	Analyze the patentability of inventive step by searching patents
CO4	Construct patent drafts for given Patent specification
CO5	Understand the advances in patent law, in national and international scenario

Unit I:	**Introduction**	**(06)**

Intellectual Property (IP) Vs. Physical property, History of IP in India, Importance of IP, Patentable inventions / art, types of IPR-Patents, Copyright, Industrial Design, Trade Marks etc., Basic principles of IPR, Economic Importance of Intellectual Property Rights, IPR-ownership, morality, public order, traditional knowledge

Unit II:	**Patents**	**(08)**

20OEHS501B Intellectual Property Rights			
Teaching Scheme			**Examination Scheme**
Lectures: 3 Hours / Week			ISE: 50 Marks
			ESE: 50 Marks
			Credits: 3

Introduction to Patents, Patentable Inventions as per the Indian Patent Act, Patent searching, types of Patent applications, Procedure for filing application (National and International), Patents offices, Register of Patents, Rights and obligations of patentee, Term of patent, Patent of Addition

Unit III:	**Drafting of patent applications**	**(08)**

Fundamentals of drafting, structure of the patent specification-Field of invention, prior art, patent classifiations, technical advance, Invention Disclosure Form, problem solution statement, claims, preamble, body, summary

Unit IV:	**Transfer and Infringement of Patent Rights**	**(06)**

Working of patents, compulsory licensing, Revocation of patents, Transfer of Patent Rights-Assignment, License; Concept of infringement, Infringement of Patents Rights, Infringement of Patents rights

Unit V:	**Introduction to other types of IPs**	**(08)**

Copyright, Trade Marks, Geographical Indications, Industrial Designs, Trade Secrets, Layout designs of Integrated Circuits : Introduction, Work protected by, ownership and infringement, Application process

Unit VI : Advances in IPR **(06)**

International Patenting, Patent Co-operation Treaty (PCT), Commercialization of Patents, Advances in IPR

Text Books:

1.	Niraja Pandey, Khushdeep Dharni, “Intellectual Property Rights”, PHI
2.	N. S. Rathore, “Intellectual Propoerty Rights: Drafting,Interpretation of Patents Specification and Claims” , New India Publishing Agency

20OEHS501B Intellectual Property Rights			
Teaching Scheme			**Examination Scheme**
Lectures: 3 Hours / Week			ISE: 50 Marks
			ESE: 50 Marks
			Credits: 3

Reference Books:	
1.	Venkataraman M., “An introduction to Intellectual property Rights”, Venkataraman M.
2.	Mishra, “An introduction to Intellectual property Rights”, Central Law Publications
3.	R Anita, V. Bhanoji Rao, “Intellectual property Rights, - A Primer”, Eastern book Company
4.	R Puri, “Practical approach to intellectual propert Rights”
5	P Ganguly, “IPR unlisting the knowlege economy”
Online Resources:	
1.	NPTEL course material on “Patent Drafting for Biginners” - https://onlinecourses.nptel.ac.in/noc18_hs17/preview
2.	IP India : www.ipindia.nic.in/
3.	WIPO, World Intellectual property Organization - www.wipo.int/
4.	Intellectual Property (IP) Policy | USPTO - https://www.uspto.gov/intellectualproperty-ip-policy

OEHS3101 PROJECT MANAGEMENT			
Teaching Scheme			**Examination Scheme**
Lectures: 3 Hours / Week			ISE: 50 Marks
Tutorial : 1 Hour/ Week			ESE: 50 Marks
			Credits: 3

Prerequisite:

Course Objectives:

1.	To introduce concepts of Project management
2.	To discuss life cycle of real life projects and activities involved in projects
3.	To understand risks involved in a project

Course Outcomes:

After completion of the course, students will be able to

CO1	Identify scope of a project and lifecycle of a project
CO2	Develop a plan for a project
CO3	Determine schedule of a project
CO4	Assess risks involved in a project
CO5	Estimate budget of a project
CO6	Adapt project management tools and techniques

Unit I:	**Introduction**	**(07)**

Definition of project, Objectives of Project Management, Classification of projects, Life cycle phases of the project. Project management and Project manager, Role and responsibilities of the project manager, Stakeholder Identification, team building

Unit II:	**Project Planning**	**(07)**

Project Planning: Introduction and basic requirements, establishing project objectives, Statement of work (SOW), project specifications, Work Breakdown structure (WBS).

Unit III:	**Project Scheduling**	**(07)**

Project scheduling: Introduction and basic requirements, milestone scheduling, Network Scheduling techniques: PERT(Program Evaluation Review Technique), CPM(Critical Path Method), GANNT chart, Schedule control

Unit IV:	**Risk Assessment and Management:**	**(07)**

Risk Management Planning, Risk identification, Qualitative Risk analysis, Quantitative Risk analysis, Risk response planning, Risk monitoring and controlling

Unit V:	**Project Cost Estimation**	**(07)**
Resource Planning, Cost Estimating, Cost Budgeting, Budget control, Earned Value Analysis, Project Audits, Project closure		
Unit VI:	**Tools and Techniques for Project Management**	**(07)**
Project Management tools, International Project Management, Collaborative development, Planning Quality Management, Quality metrics, Techniques for Quality Control (statistical control, six sigma, ISO)		

Text Books:

1.	1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), PMI.
2.	PROJECT MANAGEMENT A Managerial Approach, Jack R. Meredith, John Wiley & Sons

Reference Books:

1.	Morris, P. W. G., Pinto, J. K., The Wiley Guide to Managing Projects, 2004, John Wiley & Sons
2.	Phillips, J.PMP Project Management Professional Study Guide, McGraw-Hill, 2003.

Online Resources:

1.	http://www.pmi.org
2.	https://www.ipma.world

INBI 1204 Advanced Embedded Systems Laboratory

Teaching scheme:	**Examination Scheme:**
Practicals: 2Hrs/ Week	Practical: **25** Marks
	Credit:1

8 Experiments / Practicals are to be performed on any two processors mentioned in the syllabus.

1. MODBUS communication between two systems.
2. Signal Transmission using Zigbee
3. Study of comparison between CISC and RISC processors.
4. Basic Programs: Arithmetic logical operations, Code Conversions using embedded processor.
5. Basic Programs: Counting/Looping, Stack operations using embedded processor.
6. Square wave generation using timer/counter of using embedded processor.
7. Simulation of sine/square/triangular waveform using embedded processor.
8. Interfacing of LCD display to embedded processor.
9. Interfacing of Keyboard to embedded processor.

INBI 1205 Engineering in Medicine Laboratory

Teaching Scheme: **Examination Scheme:**

Lectures: 2 Hrs/Week Oral: **25** Marks

Credits: 1

List of Experiments:

1. To design ECG calibrator.
2. Design of ECG amplifier using op-amp.
3. To design notch filter for line frequency and a band pass filter.
4. To design and develop Heart Rate Meter.
5. EEG Recording using EEG machine.
6. To study and acquire Real time ECG using Bedside Monitor.
7. To design and develop thermistor based flow spirometer / Demo of Turbine spirometer.
8. To perform the hearing test using audiometer.
9. Study of ophthalmic instrument- Visit to Eye Care Clinic.

Hospital Visit and report submission- Dialysis Unit and Pathology lab

HSEL2101 C) Fundamentals of Disaster Management

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: **75**Marks
Tutorial: 1 Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences
2. To increase the knowledge and understanding of the International Strategy for Disaster reduction and to increase skills and abilities for implementing the Disaster Risk Reduction Strategy.
3. To ensure skills and ability to design, implement and evaluate research on disasters.

Course Outcomes:

1. Integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2. Describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
3. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
4. Manage the Public Health aspects of the disasters.
5. Obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them

Unit – I: Introduction :Concepts and definitions (06)

Disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility Authority.

Unit-II: Disaster Impacts (06)

Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit-III : Disaster Risk Reduction (DRR) (06)

Disaster management cycle its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of HomeAffairs).
3. P. Sahni, **"Disaster Risk Reduction in South Asia",** *Prentice Hall.* 1st edition, (2004)
4. K. Singh, **"Handbook of Disaster Management: techniques & Guidelines",** *RajatPublication,* 1st edition, (2008)
5. G. K. Ghosh**, "Disaster Management"**, *APH Publishing Corporation,* 1st edition, (2006)

OE2101 C) Bioinformatics

Teaching Scheme: | **Examination Scheme:**

Lectures: 3 Hrs/Week

In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. To develop a**dvanced skills to critically analyze and solve problems in biotechnology.**
2. To be enable to evaluate data using bioinformatics.
3. To be able to identify potential uses and opportunities of this data.
4. To be able to understand the recent developments in a specialized area of biotechnology.

Course Outcomes:

1. Ability to explain the basic principles that underpin Bioinformatics analyses.
2. Ability to apply the Bioinformatics principles in analyzing biological data.
3. Ability to synthesize information and analyze biological data using a variety of Bioinformatics tools.
4. Ability to interpret correctly the outputs from tools used to analyze biological data and Make meaningful predictions from these outputs.

(06)

Unit – I: Introduction and Resources

Information on various databases and bioinformatics tools available. For eg; nucleic acid sequence database (GenBank, EMBL, DDBJ), protein sequence databases (SWISS-PROT, TrEMBL, PIR, PPB)

Unit – II: Machine learning and bioinformatics **(07)**

Introduction to various machine learning techniques and their applications in bioinformatics. Genetic algorithm, Support Vector Machine, Neural Network and their practical applications towards the development of new models, methods and tools for bioinformatics

Unit – III: Sequence Analysis **(07)**

Various file formats for biomolecular sequences - genbank, fasta, gcg, msf, nbrf-pir, etc
Basic concepts of sequence similarity, identity and homology, paralogues.
Sequence based database searches - BLAST and FASTA algorithms

Unit – IV: Sequence Alignment **(07)**

Pair wise and Multiple Sequence Alignments (MSA). Basic concept of sequence alignment, Pair wise alignment (Needleman and Wunsch, Smith and Waterman algorithms), MSA (Progressive and Hierarchical algorithms). Their use for analysis of Nucleic acid and protein sequences and interpretation of results

Unit – V: Markov Chains and Hidden Markov Models(HMM) **(07)**

Introduction to Markov Chains and HMM using Markov chains for discrimination of biological sequences. Forward and Backward algorithms

Unit – VI: Phylogeny **(06)**

Phylogeny analysis, definition and description of phylogenetic trees and its types. Various computational methods in phylogenetic and molecular evolutionary analysis

Text Books:

1. Hooman Rashidi, Lukas K. Buehler, '**Bioinformatics Basics: Applications in Biological Science and Medicine'** (2nd Edition) (May 2005)
2. Des Higgins (Ed),Willie Taylor (Ed), **'Bioinformatics: Sequence, Structure and Databanks - A practical approach'** (1st Edition) (October 2000)
3. 3. N.J. Chikhale and Virendra Gomase, **'Bioinformatics- Theory and Practice'** (1st Edition)(July 2007)

INBI 2201 Project Phase-II

Teaching Scheme:
Practical: 28 Hrs/Week

Examination Scheme:
In-Semester: 150 Marks
Oral :100 Marks
Credits: 14

In Project Work Stage – II, the student shall complete the remaining part of the project which will consist of the fabrication of set up required for the project, work station, conducting experiments and taking results, analysis & validation of results and conclusions. The student shall prepare the duly certified final report of project work in standard format using LATEX for satisfactory completion of the work by the concerned guide and Head of the Department.

IN3201: Process Loop Components

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Sensors and transducers, op amp circuits, control system components

Course Objectives:
1. To understand the basics of process control
2. To explain the need, construction, working, types of process control components like transmitters, controllers, converters, control valves
3. To demonstrate PLC programming skill for industrial application

Course Outcomes: The student will be able to
1. develop and represent process control loops using standard symbols and notations by comprehending the fundamentals of process control
2. compare and analyze the working of different process loop components
3. select, configure and calibrate process control components like transmitters, convertors etc
4. develop control logic for various industrial applications

Unit 1: Fundamentals of Process Control (06)

Elements of process control loop, types of process variables, representation of process loop components using standard symbols (basics with reference to control loop), P & ID for temperature, flow, level, pressure process loops. Process Characteristics like process load, plant lags, dead time, capacity and regulation

Unit 2: Transmitters and Converters (06)

Need of transmitter (concept of field area & control room area), Need for standardization of signals current, voltage, and pneumatic signal standards Concept of live & dead zero. Types of transmitters (Two and four wire transmitters). Types, mounting (Installation), manifold, calibration setup, of electronic Differential Pressure Transmitter (DPT). DPT for Level measurement, zero elevation, zero suppression, square root extractor. Block schematic and calibration of Smart transmitter. Comparison of SMART with conventional transmitter. Difference between converter and transmitter. Converters like Current to pressure converter and Pressure to current converter

Unit 3: Controllers (08)

Discontinuous (Two position, time-proportional) and Continuous controllers (Proportional, Integral, Derivative, Proportional-Integral, Proportional- Derivative, Proportional- Integral-Derivative (PID)). Reset windup, Anti reset windup, Rate before reset, Bump less transfer, Effect of process characteristics on PID combination ,Tuning of controllers. Block schematic and face plate of digital controllers

Unit 4: Programmable Logic Controller (PLC) (08)

Continuous versus Discrete Process Control, Limitations of relay based system, architecture of PLC, types of Input & Output modules (AI, DI, DO, AO), wiring diagram, Fixed & Modular PLC (Rack, slot, grouping), Interfacing pneumatic & hydraulic systems to PLC, PLC specifications, PLC manufacturers, PLC Basic instructions, Timers (ON delay, OFF delay & Retentive) & Counters with timing diagrams, ladder programming for process applications

Unit 5: Control Valves (06)

Comparison of control valve with other final control element, parts of pneumatic control valve and control valve terminologies like range-ability, turndown, valve capacity, fail-safe conditions Inherent and Installed control valve characteristics. Construction, advantages, disadvantages and applications of types of control valve (globe, 3-way, diaphragm, ball, butterfly)

Unit 6: Control Valve Accessories and Actuators **(06)**Control advantages, disadvantages and applications of different types of actuators (spring and diaphragm, piston cylinder (power cylinder), electric, electro-hydraulic and smart actuators.

Text Books:

1. C. D. Johnson, "Process control and Instrument technology", Tata McGraw Hill Publications
2. B. G. Liptak, "Process Control", Instrument Engineering Hand book CRC Press.
3. N.A. Anderson, Boca Ratan, "Instrumentation for Process measurement and control" CRCPress, Third ed., 1980.
4. Frank Petruzella, "Programmable Logic Controllers" McGraw-Hill, 2011
5. Gary Dunning, "Introduction to Programmable Logic Controller", Cengage Learning India Pvt.Ltd., Third ed., 2006.

Reference Books:

1. Armando B. Corripio,"Tuning of industrial control systems", ISA.
3. James W. Hutchinson, "Control valve Handbook", ISA
4. E. B. Jones, "Instrument Technology", Butterworth's, Forth ed., 1985
5. William Andrews, "Applied Instrumentation in Process Industries", Gulf, Second ed., 1979.

IN3202: Digital Signal Processing

Teaching Scheme
Lecture: 3 Hr/Week
Tutorial: 1 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Prerequisite: Fourier Transform, Z-transforms and their properties, Continuous time system.

Course Objectives:
1. To provide better understanding of discrete and digital signals and systems in time and frequency domains.
2. To provide knowledge to analyze linear systems with difference equations
3. To study the characteristics to identify the correct type of filter required for a given problem and be able to demonstrate the design and implementation of a digital filter.

Course Outcomes: The student will be able to
1. list and define different time and frequency domain parameters in the given signal.
2. apply difference equations to analyze the given linear system.
3. design and implement FIR and IIR filters with different structures.
4. compare and select appropriate digital filter for the given application.

Unit 1: Introduction, Signals and Systems **(08)**
Introduction to Digital Signal Processing (DSP): Basic elements, advantages Classification of Signals:
Discrete Time Signals: sampling process / theorem, aliasing effect and reconstruction
Discrete Time Systems: input-output description of systems, block diagram representation

Unit 2: Analysis of Discrete-LTI Systems **(08)**
Linear convolution, causality and stability of discrete time systems, autocorrelation, cross correlation.
Z-transform and its properties, solving difference equations and analysis of discrete-time systems in z-domain.
Transfer function, pole-zero plot.

Unit 3: Frequency Analysis of Discrete-Time Signals **(08)**
The Discrete Time Fourier Transform (DTFT): symmetry properties and theorems of DTFT. Energy density spectrum and power density spectrum.
Discrete Fourier Transform (DFT): DFT, properties of DFT, symmetry properties, circular convolution, Frequency analysis of signals using DFT, Efficient computation of DFT.
Fast Fourier Transform (FFT) algorithms: radix-2 decimation-in-time (DIT) and decimation-in-frequency (DIF) FFT algorithms.

Unit 4: Digital Filter: FIR **(06)**
Frequency selective filters characteristics / response
Design of FIR filters: Introduction to FIR filters, linear phase filters, symmetric and anti-symmetric filters, FIR design methods.
Realizations of FIR Filters.

Unit 5: Digital Filter: IIR **(06)**

Design of digital IIR filters from analog filters

Introduction to analog IIR filters, Butterworth approximation, Chebyshev approximation.

Design of Digital IIR filter: impulse invariance method, bilinear transformation, approximation derivative method. Frequency transformations in analog and digital domain.

Realizations of IIR Filters.

Unit 6: DSP Applications **(06)**

Applications of Convolutions, Auto-correlation, Cross-correlations, DFT, Digital filters.

Text Books:

1. A. V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Pearson Education.
2. Salivahanan, A Vallaraj, C. Gnanapriya, “Digital Signal Processing”, Tata McGraw-Hill Publishing Company Limited.
3. P. Ramesh Babu, “Digital Signal Processing”, Sci-Tech Publications.
4. S. K. Mitra, “Digital Signal Processing-A Computer Based Approach”, MGH

Reference Books:

1. J. G. Proakis and D. J. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, PHI, 2000.
3. Rabiner, Gold, “Theory and Applications of Digital Signal Processing”, TMH.
4. E. C. Ifeachor and B. W. Jervis, “Digital Signal Processing-A practical Approach”, Addison-Wesley publication

List of Tutorials:

1. Case study on different applications based on analog and digital signals to understand the advantages of DSP over ASP.
2. To reconstruct digital signal with various sampling frequency and understand the concept of Nyquist Criteria.
3. To solve real time problems based on linear convolution.
4. To solve problems based on D.E.
5. To prove numerically the properties of DFT.
6. FIR filter design problems
7. IIR filter design problems
8. Case study on real time DSP applications.

IN3203: Unit Operations

Teaching Scheme
Lecture: 3 Hr/week
Tutorial: 1 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Prerequisites: Sensors and transducers, fluid properties

Course Objectives:

1. To learn various Unit Operations used in Industry.
2. To describe various equipments involved in various unit operations.
3. To understand different renewable and non-renewable energy sources

Course Outcomes: The student will be able to

1. disseminate various Unit Operations used in industry
2. select Unit Operations and related Instrumentation for the given application
3. compare and analyze renewable and non-renewable energy sources
4. apply various performance enhancement methods for boilers

Unit 1: Unit Operations and Fluid Transportation (07)

A. Introduction, Flow of incompressible fluids through pipes, transportation and metering of fluids, Pipes, Fittings, Valves, Pumps, Fans, Blowers, Compressors, Feeders, Dampers

B. Fluids filtration, solids fluidization

Unit 2: Unit Operations in Chemical Engineering (07)

A. Gas absorption and liquefaction, refrigeration

B. Mechanical processes, including solids transportation, crushing and pulverization, screening and sieving

C. Separation and mixing of fluids

Unit 3: Heat Transfer Operations (07)

A. Principles of heat flow in fluids, Heat transfer to fluids without phase change, Heat Transfer to fluids with phase change

B. Heat Exchange Equipment: Heat Exchangers, Condensers, Boilers and Calandria, Evaporators, Chillers, Cooling towers

Unit 4: Mass Transfer Operations and Introduction to Energy Sources (07)

A. Distillation: Flash and Continuous, Multi component Distillation, Leaching and Extraction

B. Drying of Solids and liquids, Crystallization

C. Introduction to Power generation

D. Energy Sources and their classification

Renewable: Small Hydro, modern biomass, wind power, solar, geothermal and bio-fuels.
Nonrenewable: fossil fuels (coal, oil and natural gas) and nuclear power.
Unit 5: Boiler Ancillaries (07)
A. Types of boilers like FBC, CFBC, DIPC, Fluidized Bed, boiler safety parameters
B. Instrumentation for Boiler, water treatment, electro-static precipitator, soot blower, economizer, de-aerator, super heater, chemical dosing systems, air pre-heater, coal and ash handling systems, fuel storage and distribution, Bag House Filters.

Unit 6: Unit Operations in Process Industry (07)
Study of Processes and Unit Operations applied to process industry, viz. sugar, paper and pulp, Dairy, Pharmaceutical, and Fertilizer

Text Books:
1. Unit Operations in Chemical Engineering by McCabe, W.L., Smith, J.C., and Harriot P., McGraw-Hill VII Edn. 2004.
2. Perry, “Chemical Engineer’s Handbook”, McGraw Hill, 1984.
3. Non-conventional energy resources by B. H. Khan, McGraw Hill, New Delhi.
4. Renewable energy Technology. Chetan Singh Solanki, Prentice Hall Publication.
Reference Books:
1. Process Control, B.G. Liptak
2. Solar Energy, by S. P. Sukhatme, Tata McGraw Hill, New Delhi.
3. Nonconventional Energy Sources. G. D. Rai, Khanna Publication.
4. M. G. Rao and Misting, “Outline of Chemical Technology”, Second Edition, East West, 1973.
5. Leverspel O., “Chemical Reaction Engineering”, Second Edition Willey Eastern Pvt Ltd.
List of Tutorials:
1. Numericals on Pumps, related to developed head, Power requirement, NPSH and efficiency
2. Numericals on Fans and Compressors
3. Study of Refrigeration process plant
4. Numericals on Enthalpy balances for Single Effect Evaporators
5. Material Balance in Plate column of Distillation Column
6. Numericals on McCabe Thiele Method
7. Study of Boiler Ancillaries
8. Study of SWAS
9. Renewable and Nonrenewable Energy Sources comparison

PEIN3201 (A): Environmental Instrumentation

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
In-Sem: 25 Marks
End-Sem: 50 Marks
Credit: 3

Prerequisite: Sensor & Transducer, Analytical Instrumentation

Course Objectives:
1. To learn necessity of Instrumentation in Environmental Engineering.
2. To describe various components in Environmental Instrumentation.
3. To understand different types of Pollutions and various control strategies.

Course Outcomes: The students will be able to
1. Explain Instrumentation and control related with the Environmental Instrumentation.
2. To apply knowledge & understanding of various Environmental Instrumentation.
3. Compare renewable and non-renewable energy sources
4. To justify the selection of proper instrument used for development of desired

Unit 1: Sensors, Detectors, Analyzers for Environmental Instrumentation (06)
Necessity of instrumentation & control for environment, sensor requirement for environment, Instrumentation methodologies: Detectors & Analyzer

Unit 2: Disaster Management (08)
Concepts of Hazard, Types of Disaster, Impact of Disasters, Human resettlement and rehabilitation issues during and after disaster

Unit 3: ICT- Automatic Weather Station (08)
Instruments in Weather station like Barometer, Rain gauge, Ceilometer etc. Global environmental analysis, Virtual Instruments in Environmental Engineering Laboratory, Rover Environmental Monitoring Station (REMS).

Unit 4: Sustainable Development (06)
Ecological stability, Ecosystem services, Environmental degradation

Unit 5: Water Quality Parameters & Water Treatment (07)
Standards of raw & treated water, sources of water & their natural quality, effects of water quality, Water quality parameters & their application, conductivity analyzers & their application, Water treatment

Unit 6: Air Pollution and Sound Monitoring Systems (07)
Definitions, energy environment relationship, importance of air pollution, Air sampling methods &equipment, analytical methods for air pollution studies. Control of air pollution. Sound pollution: basics of sound pollution, its effect to environment. Acoustic noise measurement & monitoring

Text Books:

1. ‘Water treatment technology’ by Walter J. Weber.
2. ‘Air pollution engineering’ by M. N. Rao & H. V. N. Rao.
3. ‘Air pollution control technology’ by Wark & Warner.
4. ‘Environmental Engineering’ by Peany Howard S, Donal R Rowe and George TachoBanoylous Teddy

Reference Books:

1. Environmental Instrumentation & Analysis Handbook by Randy D. Down.
2. Environmental Instrumentation & Analysis Handbook, by Randy D. Down & Jay H. Lehr, Wiley.
3. ‘Environmental noise pollution’ by Patrick F. Cunniff, Wiley, May 1977
4. ‘Environmental Engineering and Science’ by Gilber M Masters, Pearson Education (1997)

T.Y.B.Tech Instrumentation & Control
AY (2020-21) Semester II
Subject: PEIN3201 (A) Environmental Instrumentation
Teaching Plan

Online Lecture Link: https://meet.google.com/odc-negi-iac?authuser=0
Moodle Site: https://in20ampccew.gnomio.com/

Lecture	Teaching plan
Lec-1	Introduction to Environmental Issues, Causes and types of Pollution, Role of Engineers in handling Environmental issues, Introduction to Course Contents
Lec-2	What is Environment? Classify Various Issues, Causes and Effects of that, Pollution Process, types and their effects, Why and where instrumentation is requires, Objectives, Sampling, Analysis
Lec-3	
Lec-4	
Lec-5	
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Lec-30	
Lec-31	

PEIN3201C: Micro Electro Mechanical System (MEMS)

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Conventional sensors and materials, application of sensors

Course Objectives:
1. To introduce emerging MEMS field and importance of micro scaling to students
2. To provide knowledge of advanced materials, sensors and actuators
3. To learn advance micro fabrication techniques
4. To know advancement in instrumentation field of bio, automotive, aerospace field

Course Outcomes: The student will be able to,
1. compare smart material based on their characteristics
2. select the appropriate micro sensor and micro actuator for different application.
3. identify and define variuos phases of micro scaling and micro fabrication process.
4. develop application using MEMS devices.

Unit 1: Introduction to MEMS (07)
Introduction to MEMS, Introduction to micro sensors, Evaluation of MEMS, Micro sensors, Market Survey, Application of MEMS

Unit 2: Smart Material and Applications (07)
Shape memory Materials, Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, Rheological Materials, Electro chromic Materials, Self-healing Material, Conducting polymer

Unit 3: Micro Sensor (06)
Silicon Capacitive Accelerometer, Piezoresistive Pressure Sensor, Conductometric Gas Sensor, Fiber-Optic Sensors, Electrostatic Comb-Drive

Unit 4: Micro Actuator (06)
Magnetic Micro relay, Microsystems at Radio Frequencies, Piezoelectric Inkjet Print Head, Portable Blood Analyzer, Micro mirror Array for Video Projection Micro-PCR Systems

Unit 5: Micro Fabrication (07)
Study of Silicon as a Material for Micro machining, Thin-film Deposition –Evaporation, Sputtering, Chemical Vapor Deposition, Epitaxial Growth of Silicon Thermal Oxidation, Lithography, Doping the Silicon Wafer: Diffusion and Ion, Implantation of Dopant, Etching. Dry Etching, Silicon Micro machining Bulk Micro machining, Surface Micro machining

Unit 6: MEMS –Electronics, Packaging and Applications (07)
Wafer Bonding & Packaging of MEMS Interface Electronics for MEMS, MEMS for Biomedical Applications (Bio-MEMS)

Text Books:

1. Micro And Smart Systems by G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Atre : Wiley, India (2010).

Reference Books:

1. Vijay, K., Varadan K., Vinoy J. Gopalakrisham S.: Smart Material Systems and MEMS: Designand Development Methodologies, Willey 2006
2. Addington, M. ,Schodek, Daniel L.: Smart materials and new technologies, Architectural Press,2005.
3. Brain Culshaw – Smart Structure and Materials Artech House – Borton. London 1996
4. Srinivasan A.V., Michael McFarland D., Smart Structure analysis and design,Cambridge University Press, 2001

PEIN 3201 (D): Internet of Things

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Basics of sensors and actuators, networks, logic building ability

Course Objectives:
1. To study latest trends in Instrumentation.
2. To study various connectivity technologies for IoT.
3. To study wireless communication and protocols.

Course Outcomes: The student will be able to
1. apply suitable techniques for sensor networking.
2. compare different connectivity technologies for IoT.
3. select and justify the protocols for typical applications.
4. verify wireless sensor networks for typical applications.

Unit 1: Introduction to IoT **(07)**
IoT Basics, Components, architecture, Interdependencies, categories, gateways, associated technologies, Challenges, Considerations, Scalability
Role of sensors, actuators and networks in IoT
Connectivity technologies: Introduction, Features, Working principle, addressing, Routing and Applications of 6LoWPAN, RFID

Unit 2: IoT Networking **(07)**
Introduction, features, components, methods, variants, communication, Response models, message types and applications of MQTT, CoAP, XMPP, AMQP

Unit 3: Communication Protocols in IoT (Part I) **(07)**
Introduction, features, components, methods, variants, communication, topologies, Response models, message types and applications of IEEE802.15.4, Zigbee, HART and Wireless HART

Unit 4: Communication Protocols in IoT (Part II) **(07)**
Introduction, features, components, methods, variants, communication, topologies, Response models, message types and applications of Z wave, ISA100.11.A and NFC

Unit 5: Wireless Sensor Networks **(07)**
Introduction, features, components, multihop paths, challenges of WSN.
Sensor Web, Entanglement, Co-operation in WSN, Security challenges, Node behavior and dynamic misbehavior
Detection and Connectivity, Event Aware topology management, Information theoretic self-management of WSN
Introduction and Applications of Wireless Multimedia Sensor Networks

Unit 6: Paradigms of IoT **(07)**
UAV networks, Machine to machine communication in IoT, Interoperability in IoT.
Introduction to Cloud Computing and Fog Computing. Role of Microcontrollers in IoT

Text Books:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).
2. "Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti (Universities Press)

Reference Books:

1. “Architecting the Internet of Things”, by Dieter Uckelmann, Mark Harrison, Florian, Springer
2. “The Internet of Things: Key Applications and Protocols”, by Olivier Hersent, David Boswarthick, Elloumi, Wiley

PEIN3202A: Embedded Product Design

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50Marks
Credit: 3

Prerequisites: Embedded system design, Knowledge of Assembly and C programming, Electronic instrumentation and system design

Course Objectives:
1. To give knowledge of interfacing analog and digital input devices to microcontrollers.
2. To give knowledge of interfacing analog and digital output devices to microcontrollers.
3. To implement different power optimization techniques for low power systems.
4. To give overview of product design with case study.

Course Outcomes: Students will be able to
1. To apply different methodologies to interface different sensors and devices to microcontroller.
2. To apply different methodologies to interface different actuators to microcontroller.
3. To compare and select proper power optimization techniques.
4. To design and test performance of system designed for practical application.

Unit 1: Programming and Interfacing Analog Input Devices (07)
Load cell, Temperature sensor, 2-wire transmitters, potentiometric sensors, LVDT, Linear opto-isolator IL300

Unit 2: Programming and Interfacing Analog Output Devices (08)
Linear opto IL300, PWM based DAC, serial DAC, Voltage to current converter, Lamp/indicator, miniature DC motor,

Unit 3: Programming and Interfacing Digital Input Devices (08)
Key board, Proximity switch, incremental Encoders, Ultrasonic sensors, serial ADC, RTC-1307, Opto coupler MCT2E

Unit 4: Programming and Interfacing Digital Output Devices (08)
Alpha-numeric LCD, 7-Segment LED display, serial memories, Opto coupler MCT2E, printer, Stepper motor, relays (SSR and Electro-mechanical)

Unit 5: Power Efficient System and Communication Design (06)
Design considerations for battery powered systems, communication based on RS-232, RS-485, Bluetooth and USB drives

Unit 6: Small System Design with Case Study (05)
Embedded system design for Temperature data logger, Burglar alarm, Fire alarm, WSN based system, RFID based access control

Text Books:

1. Microcontrollers: Theory & Applications by Dr. A. V. Deshmukh, Tata McGraw Hill, Publications
2. Programming and Customizing the AVR Microcontroller by Dhananjay V. Gadre, Tata McGraw Hill Publishing Company Limited, 2003.
3. AVR microcontroller & Embedded System by A. Mazidi , Prentice Hall

Reference Books:

1. Internet resources for AVR:
   a. Atmel AVR Page: http://www.atmel.com/images/doc2502.pdf
   b. http://www.atmel.in/Images/doc0856.pdf
   c. Datasheets of ATmega 8535, ATtiny2313
   c. Datasheets of IL300, RTC1307, MCT 2E, serial ADCs, DACs

PEIN3202B: Advanced Biomedical Instrumentation

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Physiology of human body organs and basics of monitoring equipments

Course Objectives:

1. To study diagnostic and operating instruments
2. To study life saving devices
3. Get the knowledge of laser technology
4. To learn various instruments used for checking performance of sensory organs

Course Outcomes: Students will be able to,

1. identify functionalities of various advanced biomedical instruments
2. compare and select the suitable biomedical instrument for appropriate diagnosis.
3. demonstrate the operation of biomedical instruments.
4. develop biomedical instrument system for various application.

Unit 1: Cardiovascular Instrumentation **(07)**
Pacemaker, Types of pacemakers: External and Internal, Programmable Pacemaker
Defibrillators: AC and DC Defibrillator, Implantable defibrillator, Heart Lung Machine

Unit 2: Clinical Lab Instrumentation **(07)**
Blood and its composition and function, Blood Cell Counters, Pulse Oximetry- principle, Invitro and Invivo Oximeter, Colorimeter, Spectrophotometer, Clinical flame photometer, Auto analyzers.
Telemetry- Time division and Frequency division multiplexing, Telemedicine

Unit 3: Respiratory and Kidney Instrumentation

(07) Spiro meters- volume and flow type, airflow measurement, Ventilators, Oxygenators-Bubble Type, Membrane Type
Dialysis System- Hemodialysis and Peritoneal dialysis, Artificial Kidney-types (Coil type, parallel plate type), Lithotripsy

Unit 4: Laser Applications and Rehabilitation Engineering **(06)**
Types of lasers, Properties of laser, Interaction of lasers with tissues- thermal and non thermal, Basic Endoscopes system and its characteristics, Laser applications in ophthalmology- Diabetic Retinopathy, glaucoma and Retinal hole and detachment treatment, Dermatology- Tattoo, port wine treatment.

Orthrotics & Prosthetic devices, overview of various orthotics and prosthetic devices along with its materials. Wheelchair types, material used in wheelchair

Unit 5: ICU and Operating Room Instrumentation **(07)**
Drug Delivery System, Infusion Pump
ICU layout, organization, Bedside monitor.

Operating room instrumentation: Electro surgical Unit - modes, electrode configuration, front panel controls and safety aspects, Anesthesia Machine

Unit 6: Sensory Instrumentation **(06)**

Basic Audiometer; Pure tone audiometer; Audiometer system Bekesy; Evoked response Audiometer system, Hearing Aids, Visual acuity, Slit Lamp, Tonometer, Ophthalmoscope, Perimeter

Text Books:

1. Medicine and Clinical Engineering by Jacobsons & Webster, PHI
2. Introduction to Biomedical Equipment Technology ByCarr & Brown
3. Biomedical Instrumentation and Measurements by Cromwell, PHI
4. Handbook of Biomedical Instrumentation by R. S. Khandpur, TMH

Reference Books:

1. The Biomedical Engineering Handbook, Bronzino, IEEE Press
2. Applied Chemical Engineering Feenberg,
3. Principles of Medical Imaging.-By: K. Kirk Shung, Michael B. Smith, Benjamin Tsui.-Pub: Academic Press.
4. Medical Laser Applications -By Carruth
5 .Biomedical Instrumentation and Measurement, R.Anandanatarajan

PEIN 3202 (C): Computer Organization

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisite: Basic computer skills and logic development skills

Course Objectives:
1. To provide better understanding of functions of different operating systems.
2. To provide knowledge of software testing and communication protocols
3. To understand the software development life cycle.

Course Outcomes: Students will be able
1. To list and define functionalities of operating system
2. Compare various standards related to computer communication
3. Develop Queries for Data Base Management Systems
4. Classify and compare software testing methodologies

Unit 1: Operating System Overview (08)
Concepts of Operating System and its services, Types of operating systems
Process Management: Concept, scheduling, operations on process
CPU scheduling: Basic concepts, CPU scheduling algorithms
Deadlocks: Characterization, Handling, Recovery Disk scheduling algorithms

Unit 2: Memory and File Management (08)
Memory Management: Address Binding, Overlays, Swapping, Contiguous memory allocation, Paging, Segmentation
Virtual memory: Concept, Demand paging, Preparing, Page size considerations, Page replacement algorithms, Thrashing
File system management: Concept, file access methods, directory structures, file allocation methods

Unit 3: RTOS, Parallel Computers (08)
Real Time & embedded System OS: Concepts, Types, their differences, Handheld Operating Systems. Interrupt Routines in RTOS environment, RTOS Tasks and their Scheduling models, Strategy for synchronization between the processes,
Parallel Computers: Basic concepts, Types of parallelism, Intertask dependencies, classification of parallel computers, vector computers, Array processors, Systolic Arrays
Data Compression, Encryption and decryption

Unit 4: Computer Communication (06)
Computer Communication: ISO-OSI Seven Layer model, The TCP/IP reference model Introduction to LAN, LAN topologies, IEEE standards for networking- IEEE 802.3, IEEE 802.4, IEEE 802.5, Circuit switching and Packet switching networks, Features and capabilities of TCP/IP, Industrial Ethernet, Introduction to IEEE 1394, IEEE 488(GPIB), its configuration and advantages.

Unit 5: Database Management System (04)
Introduction to DBMS, Disadvantages of File Processing System, characteristics of DBMS
Data Model, SQL Programming.

Unit 6: Software Testing **(06)**

Software Development Life Cycle and its models:

a. Linear Sequential

b. Rapid development

c. Incremental

d. Component based Software Analysis, Software Design, Software Implementation

Software Testing: fundamentals, white box, black box testing, control structure testing, specific environment testing, comparison testing, orthogonal testing, strategic approach to testing, unit testing, integrated testing, validation testing, system testing, CASE tools

Software debugging: Standard guidelines, debugging techniques- use of break points, test macros, output files for sampled inputs, instruction set simulation, laboratory tools

Software maintenance: Preventive, Corrective, Adaptive, Enhancement, System Re-engineering

Text Books:

1. Operating System Concepts by Silberschatz, Galvin, Gagne
2. Parallel Computer architecture and programming by V. Rajaraman, C. SivaRam Murthy, PHI
3. Computer Networks by Andrew Tanenbaum, Prentice Hall.
4. Introduction To Data Compression by Khalid Sayood, Morgan Kaufmann Publishers, Inc.
5. Software Engineering by Ian Somerville, 4th edition, Addison Wesley publication

Reference Books:

1. Computer Architecture and Parallel processing by Kai Hwang, Faye Briggs, McGraw Hill International Editions
2. Computer Networks Protocols, Standards and Interfaces by Uyless Black, PHI
3. High Speed Networks TCP/IP and ATM design principles by William Stallings.
4. Introduction to Data Compression by Khalid Sayood, Morgan Kaufmann Publishers, Inc.

IN3204: Process Loop Components Lab

Teaching Scheme **Examination**
Scheme
Practical: 2 Hr/week **Practical: 25**
Marks

Credit: 1

Course Outcomes: The student will be able to
1. calibrate various process control components like transmitter, converter by selecting proper testand measuring instruments
2. characterize performance of various process control components like transmitter, converter,control valve etc.
3. configure, test and tune various process control components like transmitter, controller, controlvalve by proper analysis of given application
4. develop and Implement PLC programs for the given application

List of Experiments:
Students are expected to perform Minimum 8 Experiments
1. Plotting the characteristics of two wire transmitter
2. Calibration and plotting the characteristics of Current to Pneumatic converter
3. Plotting the characteristics of Square root extractor
4. Calibration and plotting the characteristics of conventional differential pressure transmitter
5. Calibration of Smart differential pressure transmitter flow measurement using smart DPT
6. Plotting the step response of electronic controllers
7. Tuning of controllers
8. Study of PLC
9. PLC programming
10. Interfacing PLC to pneumatic circuit
11. Identifying parts of control valves by using cut sections of different types
12. Plotting control valve characteristics

IN3205: Digital Signal Processing Lab

Teaching Scheme **Examination**
Scheme
Practical: 2 Hr/Week **Practical: 25**
Marks

Credit: 1

Course Outcomes: The student will be able to
1. Solve the mathematical problem using programming skills.
2. Select and implement appropriate signal processing operation for the given application.
3. Analyze discrete and digital signals and systems in time and frequency domains.
4. Design the signal processing filtering operation for specific application.

List of Experiments:
Students are expected to perform at least eight experiments using MATLAB or equivalent software:
1. Write a Program to generate the basic signals.
2. Write a Program to implement the basic DSP operations on the given signals.
3. Write a Program to implement Linear Convolution of the two given sequences.
4. Write a Program to obtain the auto-correlation and Cross-correlations of the given sequences.
5. Write a Program to obtain the transfer function and plot is pole-zero plot
6. Write a Program to find the DFT of the given sequences. Plot its magnitude and phase plot.Also find its IDFT to obtain the original sequence.
7. Write a Program to obtain the linear convolution using circular convolution of two givensequences.
8. Write a Program to obtain the DFT of the given sequences and plot its magnitude and phasespectrum.
9. Write a Program to design and implement FIR filters using difference windowing methods.

Write a Program to design and implement IIR filters (Using Butterworth or Chebyshev approximations).

PEIN3203B: Advanced Biomedical Instrumentation

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcome: The student will be able to
1. list the various parts of advanced biomedical instruments
2. identify various control of advanced biomedical instruments
3. record the response of human sensory organs
4. analyze and interpret the recorded data

List of Experiments: (minimum 8 experiments)
1. Study of various types of Pacemakers and its specifications
2. Study of specifications and applications of AC and DC Defibrillators.
3. Study of various equipments and their working in Clinical Lab.
4. Study principle and operation of electrosurgical machine.
5. Study of Basic telemetry system: ECG telemetry system
6. Study of instrumentation and various interlocks in the Dialysis equipment.
7. Recording and analysis of audiogram for different subjects using audiometer.
8. Study of various ophthalmic instruments
9. Study of dermatological laser treatments
10. Study of various Rehabilitation equipments, instrumentation involved and their applications.
11. Hospital visit Report

PEIN3203 (C): Computer Organization Lab

Teaching Scheme
Practical: 2 hrs/Week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: Students will be able to,
1. Develop logic for operating system functionalities
2. Apply database management concepts for handling database
3. Create their own test plan as a part of software development life cycle
4. Compare standard communication protocols

List of Experiments:
Students are expected to perform at least eight experiments using MATLAB or equivalent software:
1. CPU scheduling algorithms.
2. Program on parallel computing
3. PC to PC Communication.
4. Introduction to SQL Programming
5. Create a database for any DBMS.
6. Applying logic for sorting DB in SQL
7. Generate a test plan format for an application as a case study
8. Theoretical Study of the software testing guidelines
9. Case study on Communication Protocols

IN 3206 : Seminar on Mini Project

Teaching Scheme :
Practical: 4 Hr/Week

Examination Scheme:
In Semester: 25 Marks
Practical: 25 Marks
Credits: 2

The students will present a seminar on the mini-project done by them. The students will work in a group of 2/3 per group.

IN 3101: Embedded System Design

Teaching Scheme
Lecture: 3 Hr/week
Tutorial: 1 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Prerequisites:
1. Concepts of Digital Electronics
2. Hexadecimal number systems and their arithmetic/ logical operations
3. Basics of C programming

Course Objectives:
1. To provide an understanding of hardware and software design and integration for embedded system development
2. To provide the use of on-chip functionalities that can be used in developing embedded systems.
3. To review and develop an embedded system with AVR micro controller.

Course Outcomes: The students will be able to
1. decipher the features and on-chip peripherals of AVR micro controller
2. develop niche skills in programming.
3. configure peripherals for a specified application
4. design and develop an embedded systems.

Unit 1: Introduction to Embedded Systems (AVR ATMega8535) (07)
Overview and Features of AVR ATMega8535, Concepts of Memory (RAM and ROM), Buses, System Clock and Clock Options, Reset Sources, Power Saving Modes

Unit 2: AVR Architecture and Programming (07)
A. AVR architecture, Instruction Set, Programming techniques for ATMega8535, writing loops and subroutines in assembly and C
B. AVR Port Structure, Alternate Port Functions, I/O configurations

Unit 3: AVR On chip Timers (07)
B. 8 bit Timer/ Counter 0 with PWM, Modes, Prescaling and Programming
C. 16 bit Timer/ Counter 1, Modes, Prescaling and Programming
D. Watch Dog Timer, concepts, Configuring and Programming

Unit 4: AVR Interrupts and ADC (06)
A. External and Internal Interrupts, Programming, Configuring and Priority
B. ADC Features, Operation, Programming and Configuring

Unit 5: On chip serial interfaces: SPI, I^2C and USART (07)
Concepts, Features, Configuration Registers and Programming the AVR for serial interfaces
Introduction to RS232, RS485 and Wireless communication

Unit 6: AVR based System Development (06)
A. Introduction to Arduino systems
Arduino physical board and libraries and the integrated development environment.
Software libraries and shields for interfacing to the Arduino board. Programming the Arduino.
Introduction to ATMega328P as the processor on Arduino systems
B. Interfacing of external devices

a. LED, Keyboard, LCD display Interfacing to AVR
b. Application examples with Firmware details

Text Books:

1. 'The AVR microcontroller and Embedded Systems Using Assembly and C', Mazidi, Naimi, Naimi, Prentice Hall
2. 'Arduino, the complete beginners guide', Bryon Francis
3. 'Embedded Systems, Architecture Programming and Applications', Raj Kamal, McGraw Hill

Reference Books:

1. Datasheet of AVR ATMega8535
2. Datasheet of ATMega328P

List of Tutorials:

1. Arithmetic and logical operations with Hexadecimal numbers
2. Implementing at least four data transfer instructions using simulator
3. Study the timing details and calculation of time for software delays
4. Study the Stack pointer and Program counter in Branch and Call Instructions
5. Calculation of timer register values for timer 0/1
6. Calculation of timer values for different modes of timer 0/1
7. Calculations for configuration of ADC
8. Understanding configuration registers for interrupts and configuration for the given problem statement
9. Calculation of register values for various baud rates
10. Case study using Arduino system

IN-3102: Control Systems II

Teachinh Scheme:
Lectures: 3hrs/week
Tutorial: 1hr/week
Practical: 2hrs/week

Examination Scheme:
In-sem: 50 Marks
End-sem: 50 Marks
Practical: 25 Marks
Credits: 5

Prerequisite: Control systems–I (IN-2204)

Course Objectives:
1. Apply the basic concepts of control system-I to analyze the system requirements in time and frequency domain.
2. To know the basics of compensators, its types and electrical network.
3. To know how to choose and design the compensator.
4. To learn PID control actions, its requirement, constraints and tuning procedures analytically, numerically and experimentally.
5. To learn design methods of controllers using modern control theory.
6. To analyze the performance of designed controllers.

Course Outcomes:
After successful completion of the course with minimum grade, the student will be able to
1. Interpret and investigate the system requirements both in time and frequency domain.
2. Classify, compare and choose the suitable compensator.
3. Compare, choose the control structure and determine the controller tuning parameters.
4. Apply, analyze and validate the design based on modern control theory.

Fundamentals of Compensators and compensator design by Root locus approach:
Need of compensators, types of compensators (series, feedback and feed forward), Types of series compensators (lead, lag, lag-lead) and their transfer functions, Electrical lead, lag and lag- lead compensating networks, lead, lag and lag-lead. Effects of addition of zeros, addition of poles.
Compensator design:
Compensator design using root locus approach. Frequency response of lag, lead and lag-lead compensating networks. Compensator design using Bode plot approach.
Basics of Control actions and Controller tuning:
Control actions: ON/OFF, Proportion, Proportional + Integral, Proportion plus integral plus derivative. Controller tuning methods.
Controller Design analytical approach:
Design of PI/PD/PID using root locus and Bode plot approaches, Direct synthesis of controller, controller design for systems with and without dead time through controller synthesis formula.
Analysis of control system in state space:
State transition matrix, concept of controllability: definition, derivation for the necessary and sufficiency condition for complete state controllability, controllability matrix, concept of observability: definition, derivation for the necessary and sufficiency condition for complete state observability, observability matrix.
Design concepts in state space:
State variable feedback, control system design via pole placement, State observer, quadratic optimal control systems, design of optimal state regulator using reduced matrix Riccati equation. concept of performance indices.

Tutorials:
1. Effect of addition of poles and zeros on system's transient and steady state performance. (CO1)
2. Mathematical modeling of electrical lag, lead and lag-lead compensator. (CO2)
3. Analysis of effect of proportional, Integral and derivate control actions. (CO3)
4. Design of PI, PD and PID controllers using root locus and frequency response approach. (CO3)
5. Design of controller using direct synthesis approach for system with and without dead time. (CO3)
6. Computing complete state controllability and complete state observability for given system. (CO3)
7. Computation of State feedback controller via pole placement. (CO4)
8. Computation of full order state observer. (CO4)
9. Design of optimal state regulator for minimizing given performance index using reduced matrix Riccati equation. (CO4)

Laboratory Outcomes:
After successful completion of the Laboratory sessions, the student will be able to
1. Interpret and investigate the system requirements both in time and frequency domain.
2. Design the compensators in time and frequency domain
3. Design, Compare, choose the control structure and determine the controller tuning parameters.
4. Apply the concepts of modern control theory for the analysis of system requirements and controller design

Laboratory Work:
1. Introduction to soft computing tools for design and analysis of compensators/controllers. [CO1]
2. Design and performance analysis of lead / lag compensator using root locus approach. [CO2]
3. Design and performance analysis of lead / lag compensator using Bode plot approach.[CO2]
4. Tuning (Ziegler-Nicholas closed loop method) and performance analysis of P, PI and PID controllers for for given plant transfer function.[CO3]Tuning (Ziegler-Nicholas and Cohen-Coon open loop method) and performance analysis[CO3]
5. Tuning (Ziegler-Nicholas and Cohen-Coon open loop method) and performance analysis of P, PI and PID controllers for given plant transfer function.[CO3]
6.Simulation and performance analysis of a state feedback controller. [CO4]
7.Simulation and performance analysis of full order state observer. [CO4]
8.Case study of design, simulation and Real-time implementation of controller. [CO1-CO4]

List of text books:

1. B. S. Manke, "Control System Design", Khanna Publishers, New Delhi.
2. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers.

List of reference books:

1.K. Ogata, "Modern Control Engineering", PHI, New Delhi.
2.Norman S. Nise, "Control System Engineering", John Wiley and Sons.
3.B. C. Kuo, "Automatic Control Systems", PHI New Delhi.
4.Graham C. Goodwin, Stefan F. Graebe and M. E. Salgado, "Control system Design", PHI, New Delhi.

IN3103: Control System Components

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Sensors and transducers, pneumatic flapper nozzle system

Course Objectives:
1. To select different electrical control system components like AC motor, relays, switches and develop sequencing and interlocking circuits
2. To analyse the working of electrical, hydraulic, pneumatic components and auxiliary components
3. To develop pneumatic circuits for given application using various pneumatic components
4. To develop hydraulic circuits for given application using various hydraulic components

Course Outcomes: The student will be able to
1. Delineate working of different types of ac motors, electrical, pneumatic and hydraulic components
2. Compare and A nalyse the working of different types of ac motors, electrical, pneumatic andhydraulic components and systems
3. select electrical, hydraulic and pneumatic components to solve a given problem
4. develop various electrical wiring diagram and hydraulic, pneumatic circuits for the given application

Unit 1: AC Motors **(08)**
Comparison of electrical systems and other systems. Types, construction, working, characteristics, applications of single phase motors and three phase induction motor. Need of starters, types of starters, Direction reversal, speed control methods

Unit 2: Special Purpose Motors **(04)**
Types, construction, working, characteristics, applications of special purpose motors like stepper motor and servomotors. AC and DC position and speed control. Synchros for error detector, position measurement and control.

Unit 3: Industrial Devices **(06)**
Types, construction, working, application, and symbolic representation of switches (toggle switch, slide switch, DIP switch, rotary switch, thumbwheel switch, selector switch, push button, limit switch, Drum switch, process switches), relays (EMR, Reed relay, Solid state relays), and contactors. Specifications/selection criteria and applications. Comparison between relay & contactor.

Unit 4: Motor Control Circuits **(06)**
Concept of sequencing & Interlocking. Standard symbols used for Electrical Wiring Diagram, Electrical wiring diagram in relation to motors for Starting, Stopping, Emergency shutdown starters. Motor protection circuits (short circuit protection, over load protection, low/under voltage protection, phase reversal protection, over temperature protection). Circuits for reversing direction of rotation, braking, starting with variable speeds. ,jogging/Inching. Motor control center: concept and wiring diagrams.

Unit 5: Pneumatics **(08)**

Comparison of pneumatic systems and other systems. Pneumatic supply, pneumatic componentslike pneumatic relay, Actuators (Single acting & double acting cylinder , special cylinders, air motors), Filter Regulator Lubricator (FRL), pneumatic valves (direction controlled valves, flow control etc) , special types of valves like relief valve, pressure reducing etc. ,time delay valve.

Standard Symbols used for developing pneumatic circuits ,sequence diagram (step-displacement) for implementing pneumatic circuits, different pneumatic circuits(reciprocating, sequencing, anti- cycle repetition, block transfer, speed regulation etc)

Unit 6: Hydraulics and Auxiliary Components **(08)**Compar

Hydraulic Circuits (Meter in, Meter out, Reciprocating, speed control, sequencing of cylinders, direction control etc). Construction, working & applicationsof: auxiliary components like Alarm annunciator, High/low selectors, Flow totalizer, Computing relays, Seals, Snubber, Circuit Breaker

Text Books:

1. B. L. Theraja, “Electrical Technology”, S. Chand and Company.
2. Petruzella, “Industrial Electronics”, McGraw-Hill
3. Majumdhar, “Pneumatic Instrumentation”, TMH
4. Andrew Parr, “Hydraulics and pneumatics : A Technician's and Engineer's guide”, ButterworthHeinemann Ltd
5. B.G. Liptak, “Process Control, Instrument Engineering Hand book”, Butterworth-Heinemann Ltd

Reference Books:

1. Pneumatics, Festo Didactic
2. Hydraulics, Festo Didactic

PEIN3101B: Fundamentals of Biomedical Instrumentation

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50Marks
Credit: 3

Prerequisites: Human Anatomy and Physiology

Course Objectives:

1. To know functioning of various body organs
2. To understand the characteristics of signals generated during the functioning of the organ.
3. To learn bio signal acquisition and measurement techniques
4. To study safety aspects of biomedical instruments

Course Outcomes: The student will be able to

1. identify various anatomical structures and state their functioning.
2. compare and select sensor for capturing the physiological signals.
3. use of biomedical instruments to record and analyze bio signals.
4. implement safety aspects during product designing.

Unit 1: Cell Anatomy **(08)**

Structure and function of Cell, Nernst and Goldman equation. Generation and Conduction of Bio-potential, Homeostasis, Sensors: Study of Bio transducers, Biochemical Sensors (Glucose, pH, Po_2, Pco_2), Electrode as sensor, Types of electrodes, Electrode circuit model

Unit 2: Cardiovascular System **(08)**

Function of heart as Pump, electro conduction system, Basics of ECG, Einthoven triangle, 12 lead configuration & Electrocardiograph, Types of ECG monitors, Analysis of ECG signal. Correlation of Blood Pressure, Heart Sounds, Blood Flow with ECG

Unit 3: Cardiovascular Measurement and Musculo-Skeletal System (08)

Phonocardiography, Plethysmography Pulse transit time, Pulse wave Velocity, Blood pressure measurement- Manual and Automatic, Blood Flow meters- Electromagnetic, Ultrasound and Dye dilution

Structure of Skeletal Muscle, Types of Muscles, EMG Signal, Electromyography

Unit 4: Nervous and Sensory System **(06)**

Structure and function of Neurons, brain anatomy, 10-20 electrode system, EEG basics, Electroencephalography, EEG Analysis

Sensory Organs: Structure and function of Eye, Ear- Mechanism of Hearing, Auditory pathway Special sensors: tongue-test, nose-smell, skin-touch, temperature regulation

Unit 5: Urinary and Respiratory System **(04)**

Structure and function of kidneys and Nephron, Mechanism of Urine formation, regulation of water and electrolyte balance.

Respiratory system: lungs anatomy, Regulation of Respiration. Pulmonary function test: lungs volume and capacities, Artificial respiration

Unit 6: Bioelectric Signal Conditioning Techniques (06)

S/N Ratio, Filters like Notch, Band pass, Instrumentation Amplifier, Isolation Amplifier, Transient Protection, Electrical Safety: Significance of Electrical Danger, Physiological Effect of Current, Micro-shock and Macro-shock.

Text Books:

1. Introduction to Biomedical Equipment Technology by Carr & Brown
2. Biomedical Instrumentation and Measurements by Cromwell, 2nd edition, Pearson Education.
3. Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH
4. Biomedical Instrumentation, Arumugam
5. Text book of clinical Ophthalmology- Ronald Pitts Crick, Pang Khaw, 2nd Edition, World Scientific publication. ISBN 981-238-128-7
6. Biomedical Instrumentation and measurement, R. Anandanatarajan

Reference Books:

1. Human Physiology- The Mechanism of Body Function by Vander, Sherman, TMH Ed.1981
2. Medical Instrumentation, John G Webster

PEIN3101C: Power Electronics and Drives

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Linear Integrated Circuits and Digital Electronics

Course Objectives:
1. To understand and analyze different power electronic devices.
2. To study of different special purpose integrated circuits.
3. To use different control methodologies based on different applications.
4. To use the knowledge to understand and solve practical problems.

Course Outcomes: The student will be able to
1. list and define characteristics of different power devices.
2. compare and select various power circuits and motors for suitable applications.
3. develop controlling circuits for various design stages.
4. design and construct the suitable controlling circuit for given applications.

Unit 1: Introduction to Power Devices **(07)**
Construction, Working, Characteristics, Specifications and applications of SCR, TRIAC, DIAC, Power MOSFET, and UJT, SCR gate triggering and commutation circuits , Series and Parallel connection of SCR and its triggering arrangement

Unit 2: Converters **(06)**
Converters: Single Phase and Three Phase controlled rectifiers, (Half wave, full wave and bridge Configuration) with resistive and inductive load with freewheeling diode.

Unit 3: Choppers and Inverters **(08)**
Choppers: Principle, Working, Classification, Thyristor choppers- Jones Chopper, Morgan Chopper, Chopper controlling strategies.
Inverters: Classification, Single Phase half bridge and full bridge Inverters, PWM Inverters
Uninterrupted Power Supply (UPS): Principle, Construction, Working, Types, Application

Unit 4: DC Motors **(07)**
Principle, Construction, Working, Types, Characteristics and Applications of DC Motors, Permanent-Magnet DC Motors (PMDC), Position Servo, Miniature DC Motors, Brushless DC Motor, Drivers for DC Motor

Unit 5: Stepper Motors **(08)**
Principle, Construction, Working, Types, Characteristics and Applications of Stepper motors, L298 H-Bridge Drive, L297 Stepper motor sequencer and drive, Half step and Full step method of stepper motor drive, Chopper drive, Speed and direction control

Unit 6: Controllers for AC Loads **(04)**
Solid state relays, Firing angle control, AC Synchronous motor drive, Variable frequency drive (VFD), Controllers for Lamps, Heaters

Text Books:

1. M.D. Singh, K. B. Khanchandani, 'Power Electronics', 2ndedition, McGraw Hill Company
2. B. L. Theraja and A. K. Theraja, S. Chand &Sons, "A textbook of Electrical Technology", Volume-II, AC & DC Machines

Reference Books:

1. P. C. Sen,' Power Electronics', TMH, 2007
2. Mohamad Rashid,' Power Electronics', PHI, 2ndedition, 2004
3. G.K.Dubey, Power semiconductor controlled drives, Prentice Hall- 1989
4. Bhag S. Guru, Huseyin P. Hiziroglu,"Electric Machinery and Transformers", Third Edition, Oxford University Press
5. Krishnan, Electrical Motor Drives, PHI-2003

IN 3104: Embedded System Design lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Practical: 25 Marks
Credit: 1

Course Outcomes: The student will be able to
1. exemplify the different instructions of the micro controller
2. implement loops, subroutines using programming skills
3. select appropriate peripheral for given application
4. differentiate between the modes and configurations of on chip peripherals

List of Experiments: (any 8)

1. Introduction and familiarization with programming environment of AVR
2. Arithmetic and Logical Operations in AVR
3. Accessing memory and exchanging data within memory addresses
4. Introduction to C programming and sorting of numbers in C
5. Square wave generation using software delay
6. Square wave generation using hardware delays, with polling and interrupts
7. Frequency counter
8. Interfacing of LCD display
9. Introduction to Arduino system Programming
10. Interfacing LED to Arduino System

IN-3105: Control Systems II Lab

Teaching Scheme:
Practical: 2hrs/week

Examination Scheme:
Practical: 25 Marks
Credits: 1

Laboratory Outcomes:

After successful completion of the Laboratory sessions, the student will be able to

1. Interpret and investigate the system requirements both in time and frequency domain.
2. Design the compensators in time and frequency domain
3. Design, Compare, choose the control structure and determine the controller tuning parameters.
4. Apply the concepts of modern control theory for the analysis of system requirements and controller design

List of Experiments:

1. Introduction to soft computing tools for design and analysis of compensators/controllers. [CO1]
2. Design and performance analysis of lead / lag compensator using root locus approach.[CO2]
3. Design and performance analysis of lead / lag compensator using Bode plot approach.[CO2]
4. Tuning (Ziegler-Nicholas closed loop method) and performance analysis of P, PI and PID controllers for for given plant transfer function.[CO3]Tuning (Ziegler-Nicholas and Cohen-Coon open loop method) and performance analysis[CO3]
5. Tuning (Ziegler-Nicholas and Cohen-Coon open loop method) and performance analysis of P, PI and PID controllers for given plant transfer function.[CO3]
6. Simulation and performance analysis of a state feedback controller. [CO4]
7. Simulation and performance analysis of full order state observer. [CO4]
8. Case study of design, simulation and Real-time implementation of controller. [CO1-CO4]

IN3106: Control System Components Lab

Teaching Scheme | **Examination Scheme**
Practical: 2 Hr/week | **In Semester: 25 Marks**
Credit: 1

Course Outcomes: The student will be able to

1. characterize performance of motors and various electrical, hydraulic, pneumatic components.
2. select electrical, hydraulic and pneumatic components to solve a given problem.
3. develop various electrical wiring diagram and hydraulic, pneumatic circuits for the givenapplication by proper analysis.
4. implement electrical and hydraulic, pneumatic circuits for given application.

List of Experiments:

Students are expected to perform Minimum 8 Experiments:

1. Characteristics of motor
2. Study of stepper motor
3. Implementation of logic gates using relays.
4. Protection/sequencing and interlocking circuits for motor
5. Study of various pneumatic and hydraulic power supplies.
6. Study of various pneumatic and hydraulic components
7. Implementation and testing of pneumatic circuits.
8. Implementation and testing of hydraulic circuits.
9. Study of Synchro transmitter and receiver system.
10. Study of Pressure/temperature/level/flow switches.
11. Demonstration & study of auxiliary components like alarm annunciation.

PEIN 3102B: Fundamentals of Biomedical Instrumentation Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to
1. use biomedical instruments to record and analyze bio-signals.
2. demonstrate working of various biomedical instruments.
3. design and implement various signal conditioning circuits for bio signal processing
4. use modern hardware and software tools for biosignal acquisition and analysis.

List of Experiments:
Students are expected to perform minimum 8 experiments:

1. To study principles and design concept of bio transducers and their applications in biomedical field.
2. To measure systolic and diastolic Blood Pressure using Sphygmomanometer and automatic BP apparatus for different subjects.
3. To study 12 lead configuration and details of ECG waveform using ECG recorder and calculate heart rate.
4. To study standard amplitude and frequency of EEG signal and to learn frequencies of alpha, beta, delta, theta waves of EEG signal.
5. To learn and record various lung capacities of Respiratory system using Power lab.
6. To study structure and function of various parts of kidney.
7. Study of anatomy and function of each part of eye and ear (Sensory Organ).
8. To design a Notch Reject Filter for Power Line Frequency. To record the frequency response of notch filter.
9. To design and implement an Instrumentation/ ECG Amplifier for displaying ECG on DSO.
10. To design and implement an analog and digital Heart Rate Meter to measure the Heart rate.
11. To study and check specifications of an ECG Recorder.
12. To record heart sounds and ECG using Power lab and study correlation of ECG and PCG.
13. To monitor plethysmograph sensor output using Power lab and calculate pulse rate.
14. To design and implement the photo-plethysmography Sensor for Pulse Rate Measurement.

PEIN3102C: Power Electronics and Drives Lab

Teaching Scheme	**Examination Scheme**
Practical: 2 Hr/week	**Oral: 25 Marks**
	Credit: 1

Course Outcomes: The student will be able to

1. find characteristics of different power devices.
2. select and develop control circuits using power devices for the given application.
3. design the circuits for control of various motors.
4. implement and test the designed control circuit for various applications.

List of Experiments: (Eight experiments from the following list)

1. UJT Relaxation oscillator.
2. SCR characteristics.
3. Triac characteristics.
4. Single phase half wave controlled Rectifiers.
5. Single phase fully controlled Rectifiers.
6. Study of DC to DC converter
7. Design and testing of PWM controller for miniature servo
8. D.C. motor control using L293
9. Stepper motor control using L298 and sequencer
10. A.C. load control using Solid state relay

IN3107 Lab Practice-II

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
In Semester: 25 Marks
Credit: 1

Prerequisite: C/C++/MatLab/Octave/SciLab

Course Objectives:
1. Apply the knowledge of C/C++/Matlab to solve the numerical methods.
2. To understand fundamental methods required for scientific data analysis.

Course Outcomes: The student will be able to
1. solve non linear and differential equation using modern computer languages.
2. apply numerical integration methods to solve problems
3. apply numerical differentiation methods to solve problems
4. able to develop the algorithm to implement mathematical solutions of any engineering problem.

Write and execute a program using C/C++/MatLab with algorithm and flow chart.
1. To find the roots of nonlinear equation using Bisection method & Newton's method.
2. To fit the curve by least square approximation.
3. To solve the system of linear equations using Gauss Elimination method.
4. To integrate numerically using Trapezoidal rule.
5. To Integrate numerically using Simpson's rules.
6. To find numerical solution of ordinary differential equations by Euler's method.
7. To find numerical solution of ordinary differential equations by Runge Kutta Method
8. To find the largest Eigen value of a matrix by power method.

PEIN3203A: Embedded Product Design Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to
1. develop, implement and test analog interfacing circuits for sensors and actuators.
2. develop, implement and test digital interfacing circuits for sensors and actuators.
3. develop power optimization techniques for battery powered instruments.
4. analyze and justify the design stages of industrial product.

List of Experiments:
Students are expected to perform 1st and any 4 Experiments from remaining list
1. Interfacing of Keyboard and LCD
2. Interfacing of temperature sensor LM35
3. Interfacing of 2-wire transmitter
4. Programmable voltage to current converter
5. Interfacing of miniature DC motor, Lamp/Power LED
6. Interfacing of proximity switch and relay using MCT 2E opto coupler
7. Interfacing of ultrasonic sensor HC-SR04
8. Design of up-down counter and Interfacing of 7-segment LED display
9. Design and testing of an application based on power down mode of microcontroller

IT 4101 Software Architecture and Design Patterns

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Object Oriented Paradigms, Software Engineering
Course Objectives:
Familiarize students with
1. Concepts of software architecture
2. Different types of software architectural styles
3. Concepts and applications of design patterns.
4. Different types of design patterns

Course Outcomes:
Students should be able to
1. Analyze and suggest architecture design for an application
2. Apply design patterns to software design
3. Evaluate and select appropriate design pattern for a situation
4. Compare the performance of the software on inclusion of various design patterns.

Unit – I: Software Architecture (07)

Overview of software Architecture, What drives software architecture, Quality attributes, Architecture design, Architecture documentation

Unit – II: Architectural Patterns (07)

Client server multitier architectural pattern, Even driven architectural pattern, Service Oriented Architectures, Component based architecture

Unit – III: Role of design patterns in architecture design (07)

Introduction to architecture design, introduction to design patterns, Types of design patterns Abstract factory, builder, factory method, singleton design patterns

Unit – IV: Creational Design Patterns (07)

Abstract factory, builder, factory method, singleton design patterns with case study

Unit – V: Structural Design Patterns **(07)**

Adapter, bridge, composite, facade, decorator, chain of responsibility with case study

Unit – VI: Behavioral Design Patterns **(07)**

State, Observer, Strategy, template method with case study

Text Books:

1. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition, ISBN: 9780130925695.
2. Elizabeth Freeman, Kathy Seirra, Head first design patterns O'Reilly Media ISBN 0596007124

Reference Books:

1. Len Bass, Paul Clements, Rick Kazman Software Architecture in Practice, Pearson Education, ISBN: 978-81-7758-996-2
2. Eric Gamma and other authors Design Patterns Elements of reusable object oriented software Addison Wesley Professional Series ISBN 0-202-63361-2

IT 4102 Cloud Computing

Teaching Scheme:
Lectures: **3** hours/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Operating Systems and Computer Networks

Course Objectives:
Familiarize students with
1. Distributed Systems and its ecosystem.
2. Basics of virtualization and its importance.
3. In-depth analysis of cloud computing capabilities.
4. Overview of cloud programming and services.

Course Outcomes:
Students should be able to
1. Recognize need of cloud based solutions.
2. Justify the importance of distributed systems.
3. Determine effective techniques to program cloud systems.
4. Evaluate current challenges and trade-offs in cloud computing.

Unit – I Introduction to Distributed Systems (07)
Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security, and Energy Efficiency

Unit – II Computer Clusters for Scalable Parallel Computing (07)
Clustering for Massive Parallelism, Computer Clusters and MPP Architectures, Design Principles of Computer Clusters, Cluster Job and Resource Management, Case Study: Top Supercomputer Systems

Unit – III Virtual Machines and Virtualization of Clusters and Data Centers (07)
Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation

Unit – IV Cloud Platform Architecture over Virtualized Data Centers (07)
Cloud Computing and Service Models, Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure, Inter-cloud Resource Management, Cloud Security and Trust Management

Unit – V Cloud Programming and Software Environments (07)

Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments,

Unit – VI Grids, P2P, and the Future Internet (07)

Grid Architecture and Service Modeling, Grid Projects and Grid Systems Built, Peer-to-Peer Computing Systems, Cloud Trends in Supporting Ubiquitous Computing, Enabling Technologies for the Internet of Things

Text Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, First Edition

Reference Books

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, First Edition
2. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, First Edition
3. A. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, First Edition
4. Anthony T. Velte, Cloud Computing: Practical Approach, McGraw Hill, and First Edition
5. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, First Edition

IT 2101 Discrete Structures

Teaching Scheme:

Lectures: **3** Hrs/Week

Tutorial: **1** Hr/Week

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 4

Course Objectives:
1. Learn the concepts of propositions and propositional logic
2. Learn the concepts of sets operations and functions
3. Learn the fundamentals of counting, permutations and combinations
4. Learn the relations, its representations and properties
5. Learn the concepts of graph, its terminology, representation, connectivity, and its Applications.
6. Learn the concepts of tree, tree traversals and applications

Course Outcomes:
By the end of the course, students should be able to

1. Solve real world problem using sets and functions
2. Use proposition and propositional logic for drawing conclusions
3. Demonstrate the application of discrete structures using relations
4. Apply graphs as models to variety of domains
5. Apply trees in simple applications of computation
6. Evaluate the combinatorial problems

Unit – I: Sets and Functions **(07)**

Sets: Introduction to Power set, Cartesian products ; Set Operations: Introduction, Generalized union and intersection, Computer representation of sets; Functions: Introduction, One-to-One and Onto Functions, Inverse function and Composition of Functions

Unit – II: Propositional Logic **(06)**

Propositional Logic: Introduction, Proposition, Conditional Statements, Truth tables of compound proposition; Propositional equivalences: Introduction, Logical Equivalences, Constructing new logical equivalences; Preliminaries of predicates and quantifiers: Introduction, Predicates, Quantifiers, Negating quantified expressions

Unit – III: Relations **(08)**

Relations and Their Properties: Introduction, functions as relation, relations on set, Properties of relations, combining relations; n-ary Relations and Their Applications: Introduction, n-ary relations, operations on n-ary relations; Representing Relations: Representing relations using matrices, Representing relations using digraph; Closures of Relations: Introduction, Closures, paths in directed graph, transitive closure, Warshall's algorithm; Equivalence Relations: Introduction, Equivalence relation, Equivalence classes and partition; Partial Orderings: Introduction, Hasse Diagrams, Maximal and Minimal elements, Lattices, discrete numeric functions

Unit – IV: Graphs **(06)**

Graphs and Graph Models , Graph Terminology and Special Types of graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths , Shortest-Path Problems, Planar Graphs, Graph Coloring

Unit – V: Trees **(06)**

Introduction to Trees, Applications of Trees: Introduction, Binary search trees, Prefix codes, Tree Traversal: Preorder, in-order and post-order traversals , Minimum Spanning Trees: Introduction, Prim's algorithm, Kruskal's algorithm

Unit – VI: Counting **(07)**

The Basics of Counting: Introduction, Basic counting principles, Inclusion exclusion principle; The Pigeonhole Principle: Introduction, Generalized pigeonhole principle; Permutations and Combinations: Introduction, permutations, combinations; Binomial

Coefficients and Identities; Generalized Permutations and Combinations: permutation with repetition, combination with repetition; Generating Permutations and Combinations: Generating permutations, generating combinations

Text Books:

1. Kenneth H. Rosen, **"Discrete Mathematics and Its Applications",** Tata McGraw-Hill (7th Edition) (2012)

Reference Books:

1. C. L. Liu, "**Elements of Discrete Mathematics**", Tata McGraw-Hill (2nd Edition)

IT 2102 Digital Systems

Teaching Scheme:	**Examination Scheme:**
Lectures: **3** Hrs/Week	In-Semester: **50** Marks
Tutorial: **1** Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. To learn and understand basic digital design techniques
2. To develop, design and implement combinational and sequential logic circuits
3. To learn programmable logic devices
4. To introduce computer arithmetic

Course Outcomes:

On completion of the course, student will be able to Explain–

1. Apply knowledge of number systems, codes, Boolean algebra and use necessary A.C, D.C Loading characteristics as well as functioning while designing with logic gates.
2. Use logic function representation for simplification with K-Maps and analyze as well as design Combinational logic circuits using SSI & MSI chips.
3. Analyze Sequential circuits like Flip-Flops (Truth Table, Excitation table), their conversion & design the applications.
4. Identify the Digital Circuits, Input/Outputs to replace by FPGA

Unit – I: Number System and Logic Families (05)

Introduction to digital electronics & Boolean algebra. Number Systems - Binary, Octal, Hexadecimal and their conversions. Signed Binary number representation and Arithmetic's: Signed & True Magnitude, 1's complement, 2's complement representation and arithmetic's.
Codes: BCD, Excess-3, Gray code, Binary Code and their conversion. Switching characteristics of BJT & FET, IC Characteristics. TTL: Standard TTL characteristics, Operation of TTL NAND gate, Subfamilies, totem pole, CMOS: Standard CMOS characteristics, operation of CMOS NAND, Subfamilies, Comparison of TTL & CMOS, Interfacing: TTL to CMOS and CMOS to TTL

Unit – II: Combinational Logic Design (08)

Logic minimization: Representation of truth-table, Simplification of logical functions, Minimization of SOP and POS forms, don't care Conditions. Reduction techniques: K-Maps, Quine - McClusky technique. CLC design using SSI chips – Code converters, Adder, Subtracter, n bit Binary adder, look ahead carry generator. Magnitude comparator. Introduction to MSI functions & chips - Multiplexers, Decoder / Demultiplexer, Encoder, Binary adder. CLC design using MSI chips – BCD & Excess 3 adder & subtracter, Implementation of logic functions using MSI chips

Unit – III: Sequential Logic (06)

Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch. Flip- Flops: Design, truth table, excitation table of SR, JK, D, T flip flops. Study of flip flops with asynchronous and synchronous Preset & Clear, Master Slave configuration, conversion from one type to another type of flip flop. Application of flip-flops – Bounce elimination switch, Counters- asynchronous, synchronous and modulo counters study of modulus n counter ICs & their applications to implement mod counters.

Unit – IV: Sequential Logic Design (08)

Registers- Buffer register, shift register types - SISO, SIPO, PISO & PIPO, applications of shift registers - ring counter, twisted ring counter, study of universal shift register. Sequence generators using counters & shift register, Pseudo Random Binary Sequence Generator. Basic design steps-State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, sequence detector using Moore & Mealy model.

Unit – V: Programmable Logic Devices (06)

Algorithmic State Machines- ASM notations, charts (e.g.- counters, washing machine, lift controller, vending machine), design using multiplexer controller method (e.g.- counters). Introduction to PLD's – ROM, PAL, PLA, Design of 4 variable SOP using PLDs, Basic architecture of SPLD and CPLD, Study of CPLD architecture XC9572, Basic architecture of FPGA, CPLD. Design flow

Unit – VI: Computer Arithmetic (07)

A Brief History of computers, Von Neumann Architecture, Harvard architecture, Bus Interconnection, Scalar Data Types, Fixed and Floating point numbers, Booths algorithm for multiplication and its Hardware Implementation, Division: Restoring and Non Restoring algorithms, IEEE standards of Floating point representations, Floating point arithmetic.

Text Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4

Reference Books:

1. W. Stallings, "**Computer Organization and Architecture: Designing for Performance**", 8th Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4
2. C. Hamacher, V. Zvonko, S. Zaky, "**Computer Organization**", 5th edition, McGraw Hill, 2002, ISBN: 007-120411-3

IT 2103 Data Structures I

Teaching Scheme:

Lectures: **3** Hrs/Week

Course Objectives:

1. To learn logic building using algorithm for problem solving
2. To learn logic building for puzzles and games
3. To learn use of different data structures and algorithm asymptotic notations.
4. To learn use of different searching and sorting techniques
5. To learn linear data structures using sequential organization and recursion concept.
6. To learn linear data structures using linked organization.

Course Outcomes:

1. Apply appropriate programming language constructs to develop logical steps to solve a given real world problem.
2. Select appropriate searching and/or sorting techniques for application development.
3. Analyze algorithm complexities and use appropriate algorithms to solve a given problem
4. Select appropriate sequential and linked organization of data structures to solve a given problem

Unit – I: Introduction to Algorithm and Logic building

Concept of algorithm, Algorithmic thinking and Logic building, Solving specific real world problems such as in numerical methods, quantitative aptitude etc. using Operators, control structures, enumeration, structure, union, macros, arrays, functions and parameter passing, scope rules, string manipulation, matrix operations.

Unit – II: Logic building for Puzzles/ Games and File Organization

Logic for password cracking (Brute Force – all possible permutations), puzzle solving & creation like Sudoku, magic square, eight queen, logical games like mine sweeper, connect dots, tic-tac-toe, debugging, dry-run, understand different codes
File Organization: file operations, keyword search

Unit – III: Introduction to Data structures and Analysis of Algorithms

Introduction to Data Structures: Types of data structures, Abstract Data Types, Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity &

Space complexity of an algorithm, Best, Worst and Average case analysis of algorithm.

Unit – IV: Searching and sorting techniques

Need of searching and sorting, Concept of internal and external sorting, sort stability. Searching methods: Linear and binary search algorithms their comparison and complexity analysis Sorting methods: Bubble, selection, insertion, merge, quick, bucket sort and their complexity analysis.

Unit – V: Logic building using linear data structures and recursion

Concept of Linear data structures, ordered list, Multidimensional arrays and their storage representation. Sparse matrix using arrays - addition, polynomial representation.
Concept of recursion and logic building using iterative and recursive methods, Recursive algorithms e.g. Factorial, Fibonacci series, etc. Use of implicit stack in recursion

Unit – VI: Linked List

Concept of linked organization, singly linked list, doubly linked list, circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, comparison of a sequential and linked memory organization, concept of Generalized Linked List, representation polynomial using GLL.

Text Books:

1. R. Gilberg, B. Forouzan, "**Data Structures: A pseudo code approach with C"**, Cenage Learning

Reference Books:

1. Dennis Ritchie, Kernighan, "**The C Programming Language'**, Prentice Hall
2. E. Horowitz, S. Sahani, S. Anderson-Freed, "**Fundamentals of Data Structures in C"**, Universities Press
3. G. A. V. Pai, "**Data structures and Algorithms"**, McGraw Hill
4. Jon Bentley, **"Programming Pearls"**, Addison Wesley

IT 2104 Network Fundamentals

Teaching Scheme:	**Examination Scheme:**
Lectures: **3** Hrs/Week	In-Semester: **50** Marks
Tutorial: **1** Hr/Week	End-Semester: **50** Marks
	Credits: 4

Course Objectives:

1. To understand fundamentals of communication systems.
2. To acquaint themselves with layered model used in computer networks.
3. To understand OSI and TCP/IP models.
4. To understand analyse MAC layer protocols and LAN technologies.

Course Outcomes:

1. Enumerate the layers of the OSI model and TCP/IP.
2. To differentiate between media access schemes.
3. Design the IP addressing schemes for a computer network.
4. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Unit – I: Network – Centric World **(6)**

Communicating in a Network-Centric World, The Architecture of the Internet, Trends in networking, LAN, WAN, MAN, Networking Devices, Network Topologies Point to Point, Point to Multipoint Topologies.

Unit – II: Communicating over the Network **(6)**

The platform for communications, Protocols, OSI Model, TCP/IP Model, Protocol Data Units and Encapsulation, Comparison between OSI and TCP/IP Model, Network Addressing.

Unit – III: Network Layer **(8)**

IP Addressing, Communication from Host to Host ,Network Layer Protocol, Packaging the Transport Layer PDU ,IPv4 Packet Header, Subnetting, Static Routing ,Dynamic Routing ,Routing Protocols

Unit – IV: Ethernet **(6)**

Ethernet Basics, Collision Domain , Broadcast Domain, CSMA/CD , Half- and Full-Duplex Ethernet, Ethernet at the Data Link Layer, Ethernet Addressing , Ethernet Frames ,Channel Bonding, Ethernet at the Physical Layer.

Unit – V: Physical Layer **(7)**

The Theoretical Basis for data communication, Digital Modulation and Multiplexing, The Public Switched Telephone Network and Cable Television, Community Antenna Television, Internet over Cable, Spectrum Allocation, Cable Modems, ADSL Versus Cable, Network Interface.

Unit – VI: Data Link Layer **(7)**

Data Link Layer Design Issues, Error Detection and Error Correction, Sliding Window Protocol, Medium Access Control Sub layer, Channel Allocation Problem, Ethernet MULTIPLE ACCESS PROTOCOLS, ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols,

Text Books:

1. Mark A. Dye, Rick McDonald, Antoon W. Rufi, **"Network Fundamentals",** Cisco Press (2008)

Reference Books:

1. Andrew S. Tennabaum, David J. Weatherall **"Computer Networks",** Pearson (5^{th}edition), (2011)

IT 2105 Digital Systems Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical : **2** Hrs/Week	Practical: **25** Marks
	Credits: 1

Course Objectives:

1. To learn and understand basic digital design techniques.
2. To develop design and implementation skills of combinational and sequential logic circuits.
3. To introduce computer Arithmetic

Course Outcomes:

On completion of the course, student will be able to explain–

1. Apply knowledge of number systems, codes, Boolean algebra and use necessary A.C, D.C Loading characteristics as well as functioning while designing with logic gates.
2. Use logic function representation for simplification with K-Maps and analyze as well as design Combinational logic circuits using SSI & MSI chips.
3. Analyze Sequential circuits like Flip-Flops (Truth Table, Excitation table), their conversion & design the applications.
4. Identify the Digital Circuits, Input/Outputs to replace by FPGA, Advanced processor organization

Suggested List of Laboratory Assignments

1. Design (truth table, K-map) and implementation of 4-bit BCD to Excess-3 and Excess-3 to BCD Code converters.
2. Design (truth table, K-map) and implementation of 4 bit BCD & Excess 3 Adder using IC7483.
3. Implementation of logic functions using multiplexer IC 74153 & decoder IC 74138. (Verification, cascading & logic function implementation)
4. Design (State diagram, state table & K map) and implementation of 3 bit Up and Down Asynchronous Counter using master slave JK flip-flop IC 7476
5. Design (State diagram, state table & K map) and implementation of 3 bit Up and Down Synchronous Counter using master slave JK flip-flop IC 7476
6. Design and implementation of Module 'n' counter with IC7490 and IC 74191
7. Design (State Diagram, State Table, K Map) and implementation of Sequence Generator using Shift Register IC 74194.
8. Design and implement unsigned binary multiplication (3 bit)

Text Books:

1. R.P. Jain, "**Modern Digital Electronics**", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4

Reference Books:

1. W. Stallings, "**Computer Organization and Architecture: Designing for Performance**", 8th Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4

2. C. Hamacher, V. Zvonko, S. Zaky, “**Computer Organization**”, 5th edition, McGraw Hill, 2002, ISBN: 007-120411-3

IT 2106 – Data Structures I Laboratory

Teaching Scheme:

Practical : **4** Hrs/Week

Course Objectives:
1. To learn Python constructs
2. To learn algorithm development and analysis of algorithms
3. To learn linear data structures and their applications
4. To learn different searching and sorting techniques
5. To build logic to solve real world problems
6. To learn debugging to understand different codes & detect logical errors

Course Outcomes:

On completion of the course, student will be able to –
1. Implement appropriate searching and/or sorting techniques to solve a given problem
2. Implement algorithms to illustrate use of data structures such as array, linked list
3. Implement algorithms to create and manipulate database using sequential file organization
4. Debug different code snippets

Suggested List of Laboratory Assignments (13 assignments)

Group A Assignments (Python programming) (Any 5)

1. To check whether a given input number is prime or not
2. To develop a password cracker (brute force - permutations)
3. To develop tic-tac-toe game
4. a) Sort the set of strings in ascending order using Bubble sort and descending order by using Selection sort or Insertion sort. (Display pass by pass output) b) Search a particular string using binary search with and without recursion.
5. Implement Quick Sort to sort the given list of numbers. Display corresponding list in each pass. (with and without recursion)
6. Implement a doubly linked list with following options
   a) Insertion of a node at any location b) Deletion of a node from any location c) Display a linked list d) Display in linked list in reverse e) Reverse the linked list without using additional data structure, no data swapping

Group B Assignments (C programming) (Compulsory)

1. There are 10 students in art class and 15 students in dance class. 8 students are enrolled in both activities. (Sets).
   a) Find the students who are enrolled in both the activities

b) Find the students who are enrolled only in art class
c) Find all the student without repetition

2. Create a Database for employee salary calculation using array of structures and perform following operations on it:
   a) Create Database b) Display Database (tabular format) c) Add a record d) Search a record e) Modify a record f) Delete a record g) Search can be in different manner e.g. Search all records having percentage more than 70.
3. Implement sequential file and perform following operations:
   a) Display b) Add records c) Search record d) Modify record e) Delete record
4. Implement a singly linked list with following options
   a) Insertion of a node at any location
   b) Deletion of a node from any location
   c) Display a linked list
   d) Display in linked list in reverse
   e) Reverse the linked list without using additional data structure, no data swapping
5. Implement a doubly linked list with following options
   a) Insertion of a node at any location
   b) Deletion of a node from any location
   c) Display a linked list
   d) Display in linked list in reverse
   e) Reverse the linked list without using additional data structure, no data swapping

Group C Assignments (C programming) (Any 2)

1. Solve Simultaneous Equations in Three Variables (Matrix)
2. Implement following operations on string with / without pointers (without using library functions)
   a) Length b) Copy c) Reverse d) String comparison e) Palindrome f) Substring g) Search and replace character h) Password validation i) Code / decode
3. Implement polynomial using CLL and perform
   a) Addition of Polynomials b) Multiplication of polynomials c) Evaluation of polynomial

Implement Generalized Linked List to create and display operations

Group D Assignment (Any programming language) (Any 1)

One assignment to be carried out by a group of 2 students.
Each group will design an application using the appropriate data structures – to solve real world problem (proof of concept). The group requires getting the application approved by the respective faculty member.

1. Unit / number system conversions
2. Verification of amount in digits and in words (e.g. as given on cheque)
3. Result analysis of class data (e.g. no. of first classes etc.)
4. Implementation of skip list
5. Operations on polynomials (e.g. add, multiply, evaluate)
6. Searching & counting no. of occurrence & location (line no) of a word in a given
7. Searching & counting no. of occurrence & location (line no) of a word in a given text file

8. Implementation of numerical methods (e.g. Runge Kutta)
9. Implementation to generalize Time / Train based aptitude question (R. S. Agarwal)
10. Recursive solution to problems (e.g. Tower of Hanoi)
11. Develop games (e.g. Tic-tac-toe, sudoku)
12. Text editor (Hint – GLL)
13. Code beautifier (e.g. int a ; - keyword shown in blue color, others in black)

Text Books:

1. Steve McConnell, "**Code complete**", Second edition, 2nd ed. Redmond, WA: Microsoft Press, 2007.
2. E. Balagurusamy, "**Introduction to Computing and Problem Solving Using Python**", McGraw Hill, ISBN : 9352602587

Reference Books:

1. E. Horowitz, S. Sahani, S. Anderson-Freed, "**Fundamentals of Data Structures in C**", Universities Press, 2008
2. R. Gilberg, B. Forouzan, "**Data Structures: A pseudo code approach with C**", Cenage Learning, ISBN 9788131503140.
3. Yashwant Kanetkar, "**Pointers in C**", BPB Publication
4. Rance Necaise, "**Data Structures and Algorithms Using Python**", Wiley, ISBN : 9788126562169

IT 2107 Web Engineering Technology Laboratory

Teaching Scheme: | **Examination Scheme:**

Practical: **2** Hrs/Week | Practical: **25** Marks

Credits: **1**

Course Objectives:

1. To understand various application layer protocols for its implementation in client/server environment

Course Outcomes:

By the end of the course, students should be able to

1. Apply basics of web designing
2. Design a simple web application
3. Implement dynamic web pages
4. Establish client and server-side communication

Group A

A. HTML

Create a registration form using HTML form input elements viz. textbox, text area, radio button and drop down menu, check box, submit, file and reset button. Field should contain name, address, birth-date, qualification, email, phone number, gender, comments, attach photo etc. Use HTML Form elements wherever required. Align all elements using table.

B. CSS

Create a horizontal navigation bar in DIV using external CSS which contain home, about, gallery, enquiry, contacts menus. Also create the same bar in vertical alignment in another DIV in same page.

C. Java Script

1. Write a Java script to create a simple calculator.
2. Write a Java script that read ten numbers and display the count of negative and positive numbers and count of zero from the list.
3. Create form validation program that checks the empty values from that form and alert back using alert function. Use at least 5 components.

D. PHP

1. Create a PHP program in which two values submitted using form and calculate its addition, subtraction, multiplication, modulation, average and division on the same page. Find the greatest number between them and square of each of them using PHP function.
2. Write PHP script to display the squares and cubes of 1 to 10 numbers in tabular format.
3. Write PHP script to validate Email address.
4. Create a login form using session handling in PHP. After successful login display name, address and other details in tabular format of logged user.

E. XML

Write an XML schema that provides tabulated information related to expected height (in cms) and weight (in kgs) for male and female separately for the age groups starting with 5-

10 years, 15-20 years, and so on.

Group B

Design and develop web site in group of 2 using above all learnt technology.

Text Books:

1. **'Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX'** by Kogent Learning Solutions Inc.

Reference Books:

Steven M. Schafer, '**HTML, XHTML and CSS'**, Fourth Edition, Wiley India Edition. ISBN: 978-81-265-1635-3.

IT 2201 Data Structures II

Teaching Scheme:
Lectures: **3** Hrs/Week

Course Objectives:
1. To learn concepts and use of stack and queue data structures.
2. To learn basic tree data structure and traversals with BST
3. To learn graphs, traversals and algorithms on graph data structure.
4. To learn symbol tables and hashing with their applications.
5. To study some advanced tree concepts.
6. To learn different file organizations and their use in practice.

Course Outcomes:
1. Select appropriate data structure to solve real-world problem.
2. Solve problem involving linear data structures.
3. Solve problem involving nonlinear data structures.
4. Make use of different hashing techniques and compare their performances.

Unit – I: Stacks and Queues

Concept of stack, stack as ADT, Implementation of stack using array and linked organization, multistacks, use of stack- Recursion, expression conversion & evaluation. Concept of queues as ADT, Implementation using array and linked organization. multiqueues, priority queue.

Unit – II: Trees

Difference in linear and non-linear data structure, Trees and binary trees-concept and terminology. Expression tree. Conversion of general tree to binary tree. Binary tree as an ADT. Recursive and non-recursive algorithms for binary tree traversals, Binary search trees, Binary search tree as ADT

Unit – III: Graphs

Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Depth First Search and Breadth First Search traversal. Prim's and Kruskal's algorithms for minimum spanning tree, shortest path using Warshall's and Dijkstra's algorithm.

Unit – IV: Tables

Symbol Table: Symbol Table, Huffman's algorithm, Heap data structure, applications of heap, Heap sort **Hash table:** hashing function, collision resolution techniques- linear probing, rehashing, chaining without replacement and chaining with replacement.

Unit – V: Advance Trees

Concept of threaded binary tree. Preorder and In-order traversals of in-order threaded binary tree, AVL Trees, OBST

Unit – VI: File organization

External storage devices, File, File types and file organization (sequential, index sequential and Direct access), Primitive operations and implementations for each type and comparison

Text Books:

1. R. Gilberg, B. Forouzan, "**Data Structures: A pseudo code approach with C**", Cenage Learning

Reference Books:

1. Bruno R Preiss, "**Data Structures and Algorithms with object-oriented design patterns in C++**", Wiley India Edition
2. E. Horowitz, S. Sahani, S. Anderson-Freed, "**Fundamentals of Data Structures in C**", Universities Press
3. G. A.V. Pai , "**Data structures and Algorithms**", McGraw Hill
4. Y. Langsam, M. Augenstin, A. Tannenbaum, "**Data Structures using C and C++**", Prentice Hall of India,

IT 2202 Computer Networks

Teaching Scheme:

Lectures: **3** Hrs/Week	In-Semester: **50** Marks
Tutorial: **1** Hr/Week	End-Semester: **50** Marks
	Credits: **4**

Course Objectives:

1. To understand routing and network layer.
2. Understanding of TCP and UDP key functions.
3. Understanding the role of transport layer in congestion control, fairness and stability of Internet.
4. To understand Wireless Technologies.

Course Outcomes:

1. Analyse the usage of various protocols at the network layer.
2. Compare the routing algorithms.
3. Analyse the usage of various protocols at the transport layer.
4. Comprehend the wireless transmission media.

Unit – I: Internetworking (6)

Internetworking Basics, OSI Model, Data Encapsulation, Introduction to TCP/IP, the process/Application layer Protocols, The Host-to Host Layer Protocols. The Internet Layer Protocols, Internet Protocol.

Unit – II: Introduction to Routing and Packet Forwarding (6)

Inside the Router, CPU, NVRAM, Router Interfaces, Routers and the Network Layer , Command Line Interface Configuration and Addressing , Basic Router Configuration , Building the Routing Table, IP Routing, Path Determination and Switching Functions Protocols.

Unit – III: IP Routing (7)

Routing Basics, Distance vector routing Protocols, Link state routing protocols. Routing Information protocol, Enhanced Interior Gateway Routing Protocol, Open Shortest Path First. Virtual Local area Networks, Network address translation.

Unit – IV: Transport Layer (7)

Transport layer duties and functionalities, application expectations and IP delivery semantics.

UDP: UDP functionality, UDP Header.

TCP: TCP Features, byte-stream, Connection-oriented, TCP Header Format, 2-way, 3-way Handshake, TCP State Diagram, TCP Sliding Window, Congestion Control Algorithms: Leaky Bucket, Token Bucket, Congestion Avoidance. UNIX Sockets. M/M/1 queue analysis.

Unit – V: Application Layer (6)

Client/Server Model, Telnet, Domain Name System, File Transfer protocol: FTP, TFTP, Hyper Text Transfer Protocol, POP3, IMAP, SMTP, E-mail, MIME, Simple Network Management Protocol

Unit – VI: Wireless Technologies & SDN (6)

Introduction to wireless internetwork, IEEE 802.11, Cellular Technology, WLAN, Internet of Things, Bring Your Own Device. Software defined networking, concept, architecture, applications.

Text Books:

1. Andrew S. Tennabaum, David J. Weatherall **'Computer Networks',** Pearson (5thedition), (2011)
2. Behrouz Forouzan ,**'TCP/IP Protocol Suite',** Mc-Graw Hill, (4th Edition) (2010)

Reference Books:

1. Theodore S. Rappaport, **'Wireless Communications'**, Prentice Hall (2nd Edition) (2002)
2. Rick Graziani, Allan Johnson, **'Routing Protocols and Concepts ,** Cisco Press (2011)

IT 2203 Computer Organization and Architecture

Teaching Scheme:

Lectures: **3** Hrs/Week

Tutorial: **1** Hr/Week

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

Credits: 4

Course Objectives:

1. To understand configuration of Computer Systems
2. To understand fundamental working of Computer Systems.
3. To study architecture and features of 8086 microprocessor
4. To learn interfacing of 8086 microprocessor with I/O peripherals

Course Outcomes:

On completion of the course, student will be able to explain–

1. Structure and function of Computer System
2. Architectural details of 8086 microprocessor
3. Memory management and Interrupts of 8086
4. Interfacing of microprocessor with I/O peripherals

Unit – I: Basic Processing Unit and Machine Instructions (07)

Fundamental Concept of basic processing Unit: Register Transfer, Arithmetic Logic Operation, Fetching and storing a word, Execution of Complete Instruction. Instruction and Instruction Sequencing: Instruction Types, Straight line Sequencing, branching, Condition codes. Addressing Modes

Unit – II: Processing Unit 8086 Microprocessor: Architecture, Instruction Descriptions and Assembler Directives (08)

Introduction to 8086: internal Architecture, generation of physical address, minimum/maximum mode, study of 8086 supporting chips 8288(Latch), 8284(Clock Generator),8286(trans receiver),8288(Bus controller), Timing diagram read Write machine cycle. Introduction to assembly language programming- Instruction Descriptions, Assembler Directives.

Unit – III: Assembly Language Programming and Interrupt structure (07)

Address translation, addressing modes, Examples of programming, Procedures and Macros Interrupt Structure, Interrupt service routine, Interrupt vector table, hardware and software interrupts, INTR, NMI, Interrupt response, Execution of ISR, Priorities of interrupt

Unit – IV: Interfacing with 8086-I (07)

8259(Programmable Interrupt Controller)- Block Diagram, control and status register, Interfacing and programming. 8255(Programmable peripheral interface)- Block diagram control word, Interfacing ADC and DAC.

Unit – V: Interfacing with 8086-II (06)

8253/54(programmable interval timer/counter)- Block Diagram, control word. Modes of timer 8251(USART)- Features, Block Diagram, Control and Status register, operating modes.

Unit – VI: Parallel Organization (05)

Parallel Organization – Multiprocessors, Multicores & Clusters. Flynn's Taxonomy for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Symmetric Multiprocessor (SMP) Organization, Multi-threading – Fine Grained, Coarse

Grained & Simultaneous (SMT) Threading, Chip Multiprocessing, Cluster Configuration, UMA, NUMA & CC-NUMA. Multicore Architectures – Hardware & Software Issues in Multicore Organization, Multicore Organizations, Intel X86 Multicore Organizations – Core Duo & Core i7.

Text Books:

1. C. Hamacher, V. Zvonko, S. Zaky, "**Computer Organization**", 5th edition, McGraw Hill, 2002, ISBN: 007-120411-3
2. Douglas Hall, "**Microprocessors and Interfacing, Programming and Hardware**", McGraw-Hill, ISBN: 0–07–100462–9

Reference Books:

1. W. Stallings, "**Computer Organization and Architecture: Designing for Performance**", 8th Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4

IT 2204 Object Oriented Paradigms

Teaching Scheme: **Examination Scheme:**

Lectures: **3** Hrs/Week In-Semester: **50** Marks

Tutorial: **1** Hr/Week End-Semester: **50** Marks

Credits: 4

Course Objectives:

1. The students should be able to understand abstraction
2. The students should be able to understand the encapsulation
3. The students should be able to understand the inheritance and polymorphism.
4. The students will be able to convert a small problem description in an object oriented code

Course Outcomes:

1. The students will be able to abstract required properties and behavior of a class from a description.
2. The students will be able to apply inheritance to a given problem description.
3. The students will be able to derive encapsulation and polymorphic behavior from a given problem description.
4. The students will be able to determine all applicable object oriented features from the given description.

Unit – I: Building blocks of Object Oriented Programming (06)

Revision of procedural programming, Limitations of procedural programming, Algorithmic decomposition Vs Object Oriented decomposition.

Concepts of Class, Object, State of an Object, behavior of an object and identity for an object.

Introduction to scope: private/ protected/ public/package level

Concepts of Information hiding, Abstraction and Encapsulation as what are those and their necessity.

Unit – II: Abstraction (06)

Writing a class with private instance variables and instance methods in appropriate scope, properties with accessor (getXXX) and modifier (setXXX) methods, and constructors. Effective use of comments such as class level, method level, and inline

Class as a user defined data type against primitive data types. Instantiating an object, using it through its abstraction. Introduction to terms 'Reference'

Unit – III: Inheritance and substitution (06)

Method overloading, overloaded constructors, chaining of constructors. 'this' keyword and its concept. division into parts, composition, layers of specialization, subclass, subtypes, forms of inheritance, variations on inheritance, benefits and cost of inheritance

Best practices: naming conventions, packaging (name space).

Methods from Object class: rules for overriding equals(), hashCode() and toString().

Unit – IV: Polymorphism and code reuse (06)

Containment: Code reuse through containment of objects. Object as a smallest reusable unit. Distribution of responsibilities across application. Localization of impact due to changes in requirement.
Inheritance: Concept referring to generalization-specialization, inheritance for members according to the scope, code reuse, method overriding, polymorphism, effects of using base class reference for child class object, chaining of constructors (passing data to super class).

Unit – V: Abstract class and aggregation in Object orientation (06)

Abstract class, abstract methods, concept of Interface, final class/ method
Array of 'primitive data type' and Array of 'user defined data type', introduction to multi dimension array.

Unit – VI: Introduction to I/O Programming and Exception (06)

Introduction to language specific Collections framework, introduction to concept of List/ Set/ Map and techniques to iterate over them.

Text Books:

1. Kathy Sierra, **'OCA / OCP Java SE 7 Programmer I & II Study Guide, Chapter 1, 2 and 7** Oracle press (2014)

Reference Books:

1. Khalid A Mughal, **'A programmer's guide to Java SE 8 oracle certified associate'** Oracle press (2017)

IT 2205 – Data Structures II Laboratory

Teaching Scheme: | **Examination Scheme:**

Practical: **4** Hrs/Week | Practical: **50** Marks

Credits: **02**

Prerequisites:

IT 2106: Data Structures I Laboratory

Course Objectives:

1. To use linear data structures – stack & queue.
2. To learn non-linear data structures and their applications.
3. To learn different file organizations
4. To learn different hashing techniques
5. To understand use of data structures using OOP language

Course Outcomes:

Students will be able to

1. Implement algorithm to illustrate use of linear data structures such as stack, queue.
2. Implement algorithms to create/represent and traverse non-linear data structures such as trees, graphs.
3. Implement algorithms to create and manipulate database using different file organizations.
4. Implement and analyze different hashing techniques with respect to time and space complexity.

Suggested List of Laboratory Assignments (11 assignments)

Group A Assignments (C Programming)

1. Implement stack as an abstract data type using linked list and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix expression.
2. Construct an expression tree from postfix/prefix expression and perform recursive and non-recursive In-order, pre-order and post-order traversals.
3. Implement binary search tree and perform following operations: a) Insert b) Delete c) Search d) Display e) Mirror image f) Display level-wise
4. Represent any real world graph using adjacency list /adjacency matrix find minimum spanning tree using Kruskal's algorithm.
5. Represent a given graph using adjacency matrix /adjacency list and find the shortest path using Dijkstra's algorithm (single source all destination).
6. Implement direct access file using hashing (chaining without replacement) perform following operations on it a) Create Database b) Display Database c) Add a record d) Search a record e) Modify a record

Group B: (Using Python programming) (Any2)

1. Implement priority queue as ADT using single linked list for servicing patients in an hospital with priorities as a) Serious (top priority) b) medium illness (medium priority) c) General (Least priority).
2. Create Binary tree and perform following operations: a) Insert b) Display c) Depth of a tree d) Display leaf-nodes e) Create a copy of a tree
3. Consider a friends' network on face book social web site. Model it as a graph to represent each node as a user and a link to represent the friend relationship between them. Store data such as date of birth, number of comments for each user. a) Find who is having maximum friends b) Find who has post maximum and minimum comments c) Find users having birthday in this month. Hint: (Use adjacency list representation and perform DFS and BFS traversals)
4. Store data of students with telephone no and name in the structure using hashing function for telephone number and implement chaining with and without replacement.
5. A business house has several offices in different countries; they want to lease phone lines to connect them with each other and the phone company charges different rent to connect different pairs of cities. Business house want to connect all its offices with a minimum total cost. Solve the problem by suggesting appropriate data structures

Group C Assignments (C++ / Java) (Any 2)

1. Expression conversion using STL
2. Expression conversion using linked list
3. Binary Tree operations
4. Huffman coding
5. Sequential file handling

Group D Assignment (Any Programming Language) (Any 1)

One assignment to be carried out by a group of 2 students.

Each group will design an application using the appropriate data structures – to solve real world problem (proof of concept). The group requires to get the application approved by the respective faculty member.

1. Implementation of Tower of Hanoi (Non recursive implementation)
2. Recursive solution to problems (e.g. Tower of Hanoi)
3. Text editor (Hint – GLL)
4. Implementation of Process scheduling (e.g. long-term, short-term scheduler)
5. Implementation of AVL trees
6. Implementation of Loss less compression technique (Huffman) – encode & decode
7. Threaded binary tree – thread creation, display
8. Implementation of Hierarchical structure of organization (e.g. no. of first classes etc)
9. Simulation of college network
10. Searching & counting no. of occurrence & location (line no) of a word in a given text file
11. Formation of Magic square
12. Implementation to generalize Time / Train based aptitude question (R. S. Agarwal)
13. Develop games (e.g. Tic-tac-toe, sudoku)
14. Code beautifier (e.g. int a ; - keyword shown in blue color, others in black)

Text Books:

1. Steve McConnell, '**Code complete**', Second edition, 2nd ed. Redmond, WA: Microsoft Press, 2007.
2. E. Horowitz, S. Sahani, S. Anderson-Freed, '**Fundamentals of Data Structures in C**', Universities Press, 2008

Reference Books:

1. R. Gilberg, B. Forouzan, '**Data Structures: A pseudo code approach with C**', Cenage Learning, ISBN 9788131503140.
2. Yashwant Kanetkar, '**Pointers in C**', BPB Publication
3. E. Balagurusamy, '**Introduction to Computing and Problem Solving Using Python**', McGraw Hill, ISBN: 9352602587
4. Rance Necaise, '**Data Structures and Algorithms Using Python**', Wiley, ISBN : 9788126562169

IT 2206 Network Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: **2** Hrs/Week	Practical: **25** Marks
	Credits: **1**

Course Objectives:

1. To understand Routing and its Concepts.
2. To acquaint students with IP routing.
3. To understand dynamic Routing Protocols.
4. To understand Wireless Technologies.

Course Outcomes:

1. Apply routing protocols to a computer network.
2. Compare routing protocols by applying them to a computer network.
3. Apply application protocols to a computer network.
4. Calculate QoS parametrs of a computer network.

Suggested List of Laboratory Assignments

1. Configuration of Local Area Network.
2. Configuration of Static Routes on Router.
3. Configuration of Dynamic Routing Algorithm.
4. Implementation of Virtual LAN.
5. Configuration of EIGRP Protocol.
6. Configuration of OSPF Protocol.
7. Configuration of FTP, TELNET and DHCP.
8. Configuration of wireless network.

Text Books:

1. Antoon Rufi, Priscilla Oppenheimer, Belle Woodward, Gerlinde Brady, **'Network Fundamentals, CCNA Exploration Labs and Study Guide,** Pearson (2008)

Reference Books:

1. Andrew S. Tennabaum, David J. Weatherall **'Computer Networks',** *Pearson* (5^{th}edition), (2011)
2. Behrouz Forouzan ,**'TCP/IP Protocol Suite',** Mc-Graw Hill, (4^{th} Edition) (2010)

IT 2207 Computer Organization and Architecture Laboratory

Teaching Scheme: | **Examination Scheme:**

Practical : **2** Hrs/Week | Practical: **25** Marks

Credits: **1**

Course Objectives:

1. To understand configuration of Computer Systems
2. To understand fundamental working of Computer Systems.
3. To study architecture and features of 8086 microprocessor
4. To learn interfacing of 8086 microprocessor with I/O peripherals

Course Outcomes:

On completion of the course, student will be able to –

1. Write Assembly Language Programs to perform numeric operations.
2. Write Assembly Language Programs to perform string operations.
3. Interface various I/O peripherals with microprocessor.
4. Understand the internal architecture of modern processors.

Suggested List of Laboratory Assignments

1. Write Assembly Language Program (ALP) for

a) Addition and subtraction of 8 bit numbers. OR

b) Program to count negative numbers from signed numbers either stored in memory or given by user. OR

c) Ascending/descending sort

2. Write ALP to convert 4-digit Hex number into its equivalent BCD number and 4-digit BCD number into its equivalent HEX number.

3. Write ALP to perform following operation on string:

a) Find and display length

b) Display reverse

c) Check whether string is palindrome or not.

d) Concatenation of two strings

e) Find number of words

Display proper strings to prompt the user while accepting the input and displaying the result.

4. Write ALP to interface 8255 (PPI) with 8086
5. Write ALP to interface 8251 (Serial Interface) with 8086
6. Write ALP to interface 8254/8253(Timer/Counter) with 8086
7. Write ALP to interface 8259 (Programmable interrupt Controller) with 8086
8. Study Assignment: Explain architecture of Quad core Processor in detail with an application

Text Books:

1. Douglas Hall, "Microprocessors and Interfacing, Programming and Hardware", McGraw-Hill, ISBN: 0–07–100462–9

ference Books:

1. Intel Manual
2. W. Stallings, "Computer Organization and Architecture: Designing for Performance", 8th Edition, Prentice Hall of India, 2010, ISBN 13: 978-0-13-607373-4

IT 2208 Object Oriented Programming Laboratory

Teaching Scheme:
Practical: **2** Hrs/Week

Examination Scheme:
End-Semester: **50** Marks
Credits: **1**

Course Objectives:

The students should be able to understand abstraction

The students should be able to understand the encapsulation

The students should be able to understand the inheritance and polymorphism.

The students will be able to convert a small problem description in an object oriented code

Course Outcomes:

1. The students will be able to abstract required properties and behavior of a class from a description and implement them in java.
2. The students will be able to apply inheritance to a given problem description and implement them in java.
3. The students will be able to derive encapsulation and polymorphic behavior from a given problem description and implement them in java.
4. The students will be able to determine all applicable object oriented features from the given description and implement them in java.

List of assignments

1. Convert the given description into an object oriented language code. An employee has an employeeID, name. Display the data for five employees

2. Convert the given description into an object oriented language code. An employee has an employeeID, name. Every employee has a basic pay and a joining date. Display the data for five employees

3. Convert the given description into an object oriented language code. An employee has an employeeID, name and salutation. Every employee has a basic pay and a joining date. Display the data for five employees

4. Convert the given description into an object oriented language code. An employee has an employeeID, name, salutation and an address. The address has apartment number, apartment name, road, city, state and pincode. Every employee has a basic pay and a joining date. Display the data for five employees

5. Convert the given description into an object oriented language code. An employee has an employeeID, name, salutation and an address. The address has apartment number, apartment name, road, city, state and pincode. Each employee gets a monthly salary. A team leader is an employee and a software engineer is an employee. The team leader gets the monthly salary as basic pay, DA as 70 percent of basic pay and traveling allowance as 15 percent of basic pay. The software engineer gets a monthly salary as basic pay, Da as 35 percent of basic pay and traveling allowance as 12 percent of basic pay.

6. Convert the given description into an object oriented language code. An employee has an employeeID, name, salutation and an address. The address has an apartment number, apartment name, road, city, state and pincode. Each employee gets a monthly salary. A team leader is an employee and a software engineer is an employee. The team leader gets the monthly salary as basic pay, DA as 70 percent of basic pay and traveling allowance as 15 percent of basic pay. The software engineer gets a monthly salary as basic pay, Da as 35 percent of basic pay and traveling allowance as 12 percent of basic pay. Now, it is policy of the company that every software engineer will get an add on compensation if she works for more than 8 hours in a day. The compensation is calculated as Rs 200.00 per hour. If a team lead works for more than 8 hours in a day, she gets an add on compensation as Rs 600.00 for a slab of 4 hours. Incorporate this in the code.

7. Convert the following description in an object oriented language using abstraction, has a relationship, is a relationship, encapsulation and data hiding

A bank issues many credit cards. Each credit card has a credit card no. It has a list of purchases associated with it. Every purchase made using the credit card has date of purchase, amount of purchase and pay back points for that purchase. The credit card has the total payback points accumulated across all the purchases made. The policy for adding the payback points for every purchase is as follows

Sr No	**Date of purchase**	**Quarter**	**Pay back points**
1	1^{st} Jan to 31^{st} Mar	First	1 payback point for every 200 Rs purchase
2	1^{st} April to 30^{th} June	Second	1 payback point for every 150 Rs purchase
3	1^{st} July to 30^{th} Sept	Third	1 payback point for every 100 Rs purchase
4	1^{st} Oct to 31^{st} Dec	Fourth	1 payback point for every 80 Rs purchase

Calculate the total payback points for the following details

Credit Card = 123456789000

Date of purchase	Purchase amount
29^{rd} March	20000.00
10^{th} July	30000.00
15^{th} Oct	15000.00
24^{th} Dec	10000.00

Convert the following description in an object oriented language using abstraction, has a relationship, is a relationship, encapsulation and data hiding
An account has an accountNo, balance and an account holder. An account holder has a name and an address. Address has apartment number, apartment name, road, city, state and pincode. An amount can be withdrawn from an account, deposited to an account or transferred from one account to other account. A saving account is an account. A current account is an account. A saving account gets an interest from the bank with an annual interest rate of 3.5 percent. This interest gets added to the balance amount. A current account is charged with a commission by the bank. The commission is charged annually with a rate of 2.5 percent. This commission gets deducted from the balance of the current account. Create one saving accounts with two deposits and one withdrawal. Create second saving accounts with one deposit and two withdrawals. Create third saving accounts with one deposit, one withdrawal and a transfer to first account. Create fourth account as current account with one deposit, three withdrawals and commission for two years.

Text Books:

1. Kathy Sierra, **'OCA / OCP Java SE 7 Programmer I & II Study Guide (Exams 1Z0-803 & 1Z0-804), Chapter 1 and 2** *Oracle press (2017)*

Reference Books:

1. Khalid A Mughal, **'Programmer's Guide to Java Certification: A Comprehensive Primer',** *Oracle press (2017)*

IT 3101 Database Management Systems

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Data structures
Course Objectives:
Familiarize students with
1. Concepts and applications of database management.
2. Different models and normalization used for database design.
3. Query languages in databases.
4. Basic issues of database design and utilization.

Course Outcomes:
Students should be able to
1. Identify basic purpose and functions of database management system.
2. Build appropriate database schema for the given application.
3. Make use of query commands and concurrency control protocols.
4. Analyze database for given problem domain.

Unit – I: Introduction to DBMS (07)

Database Concepts, Database System Architecture, Data Models, entity, attributes, relationships, constraints, keys, E-R Model, conventions, EER Model, converting ER/EER diagram into tables. Relational Model, Attributes and Domains, Referential Integrities. Relational Algebra: Basic Operations

Unit – II: Database Design and SQL (07)

Database Design, Functional Dependency, Purpose of Normalization, Data Redundancy, Anomalies. Normal forms 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Introduction to SQL, SQL Data Types, DDL, DML and DCL queries, Views, Indexes, Null handling, Nested Queries. PLSQL. Query optimization

Unit – III: Database Transactions (07)

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability, Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules.

Unit – IV: Concurrency control and Advanced Database Architectures (07)

Concurrency Control, Locking Methods, Deadlocks, Protocols, Recovery Methods, Database Architectures, Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Indexing and hashing, Parallel Databases, Distributed Databases.

Unit – V: No SQL and semi structured Data Management **(07)**

Introduction to Big Data, No SQL Databases, MongoDB, Map reduce. XML Databases, DTD, XML Schemas, XQuery, XPath. JSON

Unit – VI: Data Warehousing and Data Mining **(07)**

Data Warehousing, Architecture and features of Data Warehouse, ETL Process, OLAP. Data Mining, Knowledge Discovery, Data Mining techniques, Applications of data mining.

Text Books:

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN- 0-07-120413-X, Sixth Edition.
2. Ramez Elmasri,Shamkant B. Navathe**,** Fundamentals of Database Systems, Pearson Publication, ISBN-13: 978-0-136-08620-8

Reference Books:

1. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81- 317-6092-5.
2. C J Date, An introduction to Database Systems, Addition-Wesley.
3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rd Edition, 2003.
4. Reema Thareja, Data warehousing, Oxford University Press. ISBN 0195699610.

IT 3102 Theory of Computations

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: **1** hr/week

Examination Scheme:
In-Semester: **50** marks
End-Semester**: 50** marks
Credits: **4**

Prerequisites: Discrete structures
Course Objectives:
Familiarize students with

1. Abstract computing models.
2. Types and applications of formal grammars
3. Application of Theory of Computer Science in System Programming

Course Outcomes:
Students should be able to

1. Construct abstract computing models
2. Apply the concepts of formal grammars
3. Analyze Decidable Languages and Reducibility
4. Evaluate computing models.

Unit – I Fundamentals (07)
Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non-deterministic finite automaton, transition diagrams and Language recognizers. NFA to DFA conversion

Unit – II Finite Automata with application (07)
NFA with ℮ transitions - Significance, acceptance of languages, Equivalence between NFA with and without ℮ transitions, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Mealy machines.

Lexical analyzer as an application of Finite Automaton. Introduction to Lex tool

Unit – III Regular Expression and Grammar Formalism (07)
Regular expressions: Identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets

Introduction to Grammar: derivation trees, sentential forms. Right most and leftmost derivation of strings, Chomsky hierarchy

Unit – IV Regular Grammar with application (07)

Regular grammars-right linear and left linear grammars, equivalence between regular grammar and FA, inter conversion, Parsing techniques, Top-down parsing, Bottom-up parsing

Recursive descent parser as an application of Regular Grammar. . Introduction to YACC tool

Unit – V Context free grammars and Push down automata (07)

Context Free Grammars-Ambiguity in context free grammars. Minimization of Context Free Grammars. Normal Forms Chomsky Normal Form, Greibach Normal Form, conversion to CNF and GNF

Push down automata- definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, inter conversion,

Unit – VI Turing Machine (07)

Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines, Universal Turing Machine, decidability/un decidability of problems, Halting problem Correspondence problem, Turing reducibility

Modularized programming concept as an application of Turing machines

Text Books

1. Daniel I.A. Cohen, "Introduction to Computer Theory" Wiley-India, ISBN: 978-81-265-1334-5
2. Vivek Kulkarni, "Theory of Computation", Oxford University Press, ISBN-13: 978-0-19-808458-7.
3. D.M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw-Hill, ISBN-13:978-0-07-463579-7

Reference Books

1. John C. Martin, "Introduction to language and theory of computation", Tata McGraw Hill, Third edition, ISBN 0-07-049939-X
2. Hopcroft Ulman, "Introduction To Automata Theory, Languages And Computations", Pearson Education Asia, 2nd Edition
3. E V Krishnamurthy, "Introduction to Theory of Computer Science", EWP Second 2nd Edition.
4. John J Donovan , "Systems Programming", Tata McGraw-Hill Edition 1991, ISBN 0-07-460482-1

IT 3103 Machine Learning

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: **1** hr/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **4**

Prerequisites: Linear Algebra and Calculus, Probability Basics
Course Objectives:
Familiarize students with
1. Basic learning algorithms and techniques
2. Applications of machine learning
3. Usage of large data sets

Course Outcomes:
Students should be able to
1. Identify different tasks in machine learning
2. Explain wide variety of learning algorithms and techniques
3. Apply proper learning algorithm to data depending on the task
4. Perform evaluation of learning algorithms

Unit – I Introduction to Machine Learning (07)
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross validation
Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning
Features: Types of features-Continuous, Discrete, Nominal, Ordinal. Extraction of Features from text document and image

Unit – II Classification (07)
Binary and Multiclass Classification: Assessing Classification Performance, Performance of multi-class classification
Linear and Non-linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Unit – III Regression and Generalization (07)
Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting
Linear Models: Least Square method,Univariate Regression
Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves
Case Study of Polynomial Curve Fitting

Unit – IV Distance Based Models (07)
Neighbors and Examples, Distance Measures: Euclidian, Manhattan, Minkowski, Hamming. Nearest Neighbor Classification (kNN), Distance based clustering algorithms - K-means, K-medoid, DBScan, Hierarchical Clustering: Single, Complete, Average and Centroid Linkage

Unit – V Rule and Tree based Models (07)

Rule Based Models: Frequent Itemsets, Association rules mining – Apriori Algorithm, Confidence and Support parameters

Tree Based Models: Impurity Measures – Entropy, Gini Index, Information Gain. Decision Trees, ID3

Unit – VI Probabilistic Models (07)

A brief overview of Probability Theory – Discrete Random Variable, Joint Probability, Conditional Probability, Joint Probability, Bayes' Theorem, Independence Assumption, Naïve Bayes Classification, Probabilistic Models with Hidden Variables: Expectation Maximization

Text Books

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
3. Jiawei Han, Micheline Kamber: Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 3rd Edition, July 2011.
4. Kevin Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, 2012.
5. Parag Kulkarni, Prachi Joshi: Artificial Intelligence: Building Intelligent Systems, Prentice Hall of India.

PEIT 3101 Artificial Intelligence

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: 3

Prerequisites: Discrete mathematics, basic probability theory and statistics
Knowledge of any programming language and data structures

Course Objectives:
Familiarize students with
1. The basic principles and applications of Artificial Intelligence.
2. Concepts of problem solving and knowledge representation
3. Concepts of planning and learning

Course Outcomes:
Students will be able to:
1. Assess underlying AI concepts and their usage.
2. Implement classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm, and neural networks.
3. Represent knowledge using logic and infer new facts from it.
4. Apply Artificial Intelligence techniques for problem solving.

Unit – I Artificial Intelligence (07)
Introduction -What is AI? The Foundations of Artificial Intelligence,
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit – II Problem Solving (07)
Problem Solving: Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems: Constraint Propagation, Backtracking Search for CSPs,
Game Playing: Minimax algorithm, alpha-beta pruning.

Unit – III Knowledge Representation (07)
Logical Agents: Knowledge-Based Agents, Propositional logic, First-order Logic,
Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Reasoning Systems for Categories, Reasoning with Default Information

Unit – IV Planning (07)
Planning: Definition of Classical Planning, Algorithm for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches
Planning and Acting in the Real World: Time, Schedules, and Resources.

Unit – V Reasoning and Learning (07)

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Reasoning: Probabilistic Reasoning, Making Simple Decisions: Decision Networks
Learning: Forms of Learning, Supervised Learning, Learning Decision Trees, Ensemble Learning, Knowledge in Learning, Learning Probabilistic Models, Reinforcement Learning.

Unit – VI Artificial Neural Network (07)

Units in neural networks, Neural Network structures, Single layer feed-forward neural networks, Multilayer feed-forward neural networks, Learning in multilayer networks, Learning neural network structures.

Text Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.

Reference Books

1. E. Rich and K.Knight, Artificial Intelligence, Tata McGraw Hill
2. Charniack and D. Mcdermott, Artificial Intelligence, Addison Wesley
3. George F. Luger , "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson
4. N.P. Padhy, "Artificial Intelligence And Intelligent Systems", Oxford University Publishers
5. Parag Kulkarni, Prachi Joshi: Artificial Intelligence: Building Intelligent Systems, Prentice Hall of India.
6. Toby Segaran, Programming Collective Intelligence, O'Reilly

PEIT 3101 Business Intelligence

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: 3

Prerequisites: Linear algebra, probability basics
Course Objectives:
Familiarize students with
1. The role of Business Intelligence in various business applications
2. Methods of data processing and modeling
3. Importance of visualization and reporting in business
4. Decision making process using Business Intelligence

Course Outcomes:
Students will be able to:
1. Identify business problems to provide BI solutions
2. Use data transformation and modeling concepts for building data warehouse
3. Analyze and visualize dimensional models for reporting.
4. Comprehend different BI trends and their applications.

Unit – I Introduction (07)
Concepts of Data, Information, and Knowledge, Design and implementation aspect of OLTP and OLAP/Data Warehouse, Business Intelligence(BI) Concepts and definitions, BI architectural models (Top-down and bottom-Up), Business Applications of BI, Role of Data warehouse in BI, BI system components

Unit – II Dimensional Modeling And Data Warehouse Design (07)
Star schema, Snow flake schema, and Fact Constellation schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions), Facts (additive, semi-additive, non-additive), Junk dimensions, conformed dimensions, Bridge tables

Unit – III ETL (07)
Data Quality, Data profiling, Data enrichment, data duplication, Data cleaning, ETL Architecture and what is ETL, Extraction concept and Change data capture, Transformation concept, Loading concept, Initial and Incremental loading, Full loading, late arriving facts, data staging, Data marts

Unit – IV Reporting (07)
Metadata Layer, Presentation Layer, Data Layer, Use of different layers and overall Reporting architecture, Various report elements such as Charts, Tables, Materialized views, Query rewrite, Ad-hoc reports, Security: report level, data level (row, column),Scheduling.

Unit – V Analytics And Data Visualization (07)
Analytics: Application of Analytics concepts in Business Intelligence, Clustering with K-Means, Classification with Decision tree, In-Memory Analytics and In-DB Analytics
Data visualization: Types of data visualization, Techniques for visual data representations, data Visualization tools- Tableau, Dashboards, **Case study:** Credit card fraud detection, click stream analysis

Unit – VI Recent Trends (07)

Introduction to Big Data, DW appliances, Types of BI: Real time BI, Operational BI, Embedded BI, Agile BI, Smart change data capture using log based techniques

Case Study: BI for sales force management, Social BI systems

Text Books

1. Ralph Kimball, Joe Caserta, "The Data warehouse ETL Toolkit", Publisher: Wiley
2. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining: concepts and techniques", 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.

Reference Books

1. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit", 3rd edition, Publisher: Wiley
2. Reema Thareja, "Data Warehouse", Publisher: Oxford University Press.
3. William Inmon, "Building the Data Warehouse", Wiley publication 4th edition.

IT 3104 Database Management Systems Laboratory

Teaching Scheme:
Practical: **4** hrs/week

Examination Scheme:
In-Semester: **25** marks
Practical: **25** marks
Credits: 2

Prerequisites: Data structures
Course Objectives:
Familiarize students with
1. Implementation of fundamental concepts of database management
2. Use of database management.
3. SQL database system and PLSQL.
4. NOSQL database system.

Course Outcomes:
Students should be able to
1. Make use of database systems.
2. Design and use database schema for given application.
3. Develop a database application with suitable front end.
4. Implement SQL and NOSQL commands.

Group A: Introduction to Databases (Study assignment- Any one)

1. Study and design a database with suitable example using following database systems:
   a. Relational: SQL / PostgreSQL / MySQL
   b. Columnar: Hbase
   c. Document: MongoDB / CouchDB
   d. Graph: Neo4J

   Compare the different database systems based on points like efficiency, scalability, characteristics and performance.
2. Study the SQLite database and its uses. Also elaborate on building and installing of SQLite

Group B: SQL and PL/SQL (Minimum 6)

1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.
2. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
3. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string.
4. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Use group by and having clauses. Retrieve the data from the database based on time and date functions.

5. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (=some, >=some, <all etc.) and set cardinality (unique, not unique).
6. Write and execute suitable database triggers.
7. Write and execute PL/SQL stored procedure and cursor to perform a suitable task on the database.

Group C: NoSQL and Semi structured Databases (Minimum 3)

1. Create a database with suitable example using MongoDB and implement
    - Inserting and saving document
    - Removing document
    - Updating document
2. Execute at least 15 different queries on any suitable MongoDB database that demonstrates following querying techniques:
    - find and findOne
    - Query criteria
    - Type-specific queries
    - $ where queries
    - Create and drop different types of indexes
3. Implement Map reduce example using Mongo DB.
4. Design and implement XML/JSON database.

Group D: Mini Project / Database Application Development

Student group preferably of size 4 students should decide the statement and scope of the project which will be refined and validated by the faculty.

Choose database as per the requirement of the mini project. Draw and normalize the design up to at ER Diagram with normalization in case of back end as RDBMS. Design front end using any open source technology and perform connectivity to the database. Implement suitable database operations along with business logic, validations, reports etc.

IT 3105 Machine Learning Laboratory

Teaching Scheme:
Practical: **4** hrs/week

Examination Scheme:
In-Semester: **25** Marks
Practical: **25** marks
Credits: **2**

Prerequisites: Linear Algebra and Calculus, Probability Basics
Course Objectives:
Familiarize students with
1. Various tasks in Machine Learning
2. Different Machine Learning algorithms
3. Applications of machine learning algorithms for accomplishing given tasks

Course Outcomes:
Students should be able to
1. Apply proper learning algorithm to data depending on the task
2. Compare different learning algorithms performing similar tasks
3. Use large data sets
4. Evaluate the models

Implementation of programs to be done in Python
1. Classify data using Linear Support Vector Machine algorithm
2. Predict values using Linear Regression with one independent variable and one dependent variable
3. Cluster data using k-means algorithm for clustering
4. Identify frequent item item-sets using Apriori algorithm
5. Classify data using Naïve Bayes Classification algorithm
6. Build a small application using machine learning concepts.

Text Books
1. Andreas Muller and Sarah Guido: Introduction to Machine Learning with Python, O'Reilly, 2017
2. Michael Bowles: Machine Learning in Python, Wiley, 2018

Reference Books
1. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.

2. Jiawei Han, Micheline Kamber: Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 3rd Edition, July 2011.
3. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
4. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
5. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

PEIT 3106 Artificial Intelligence Laboratory

Teaching Scheme:
Practical: **2** hrs/week

Examination Scheme:
Oral: **25** marks
Credits: **1**

Course Objectives:
Familiarize students with
1. Basic implementation of AI concepts.
2. Current Trends in AI.

Course Outcomes:
Students will be able to
1. Implement AI core concepts using AI algorithms.
2. Identify appropriate AI techniques for development of applications.
3. Apply basic principles of AI towards problem solving, knowledge representation and learning.
4. Gain basic understanding of various AI applications in intelligent and expert systems, artificial neural networks and other machine learning techniques.

List of Assignments (Any 5)

1. Implement A* algorithm for any of the following problems: a) 8 puzzle b) Missionaries and Cannibals c) Blocks World Problem
2. Solve 8-queens problem using backtracking.
3. Implement a program to solve constraint satisfaction problem using any searching technique.
4. Implement minimax algorithm using alpha-beta pruning.
5. Implement the code for decision tree learning.
6. Implement Truth Maintenance System.
7. Implement Neural network to understand backpropagation.

Group Assignment
1. Develop application such as but not limited to
   a) Chatbot
   b) Interactive Sudoku solver
   c) Stock market predictor (offline past data)
   d) Face Recognition
   e) Captcha breakers
   f) Auto tagging of friends on social media
   g) Pac-Man

PEIT 3106 Business Intelligence Laboratory

Teaching Scheme:
Practical: **2** hrs/week

Examination Scheme:
Oral: **25** marks
Credits: **1**

Prerequisites: Linear Algebra and Calculus, Probability Basics, database concepts

Course Objectives:

Familiarize students with

1. BI tools and technologies
2. Data transformation techniques and modeling
3. Implementation aspects of business analytics and reporting

Course Outcomes:

Students should be able to

1. Identify the business problem and design BI solution
2. Analyze the model
3. Visualize large datasets
4. Implement BI application

Suggested list of laboratory assignments:

Given a Business Problem as Case Study design and build BI solution using BI concepts:

1. Perform dimension modeling and Execute ETL process for building data warehouse
2. Implement OLAP operations on given data set.
3. Visualize data using various charts in Tableau
4. Develop any one application

Text Books

1. Big Data, Black Book, DT Editorial services, 2015 edition
2. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining: concepts and techniques", 2nd Edition, Publisher: Elsevier/Morgan Kaufmann

Reference Books

1. Ralph Kimball, Joe Caserta, "The Data warehouse ETL Toolkit", Publisher: Wiley

IT 3201 Design and Analysis of Algorithms

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: **1** hour

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **4**

Prerequisites: Data structures

Course Objectives:

Familiarize students with

1. Algorithmic approaches for problem solving
2. Basics of computational complexity analysis
3. Various algorithm design strategies.
4. Different classes and solutions to problems such as P, NP etc.

Course Outcomes:

Students should be able to

1. Apply various algorithmic techniques to solve problem.
2. Determine computational complexity for various algorithms.
3. Apply appropriate algorithmic strategy for given problem.
4. Analyze and identify the class of the given problem and apply appropriate algorithms.

Unit – I: Introduction **(07)**

Analysis of Algorithm, Efficiency- Analysis framework, asymptotic notations. Proof Techniques, Introduction to Brute Force method & Exhaustive search, Analysis of Non-recursive and recursive algorithms: Solving Recurrences

Unit – II: Divide and conquer method and Greedy strategy **(07)**

Divide & Conquer method: Merge sort, Quick Sort. Binary search, Finding Max-Min, Large integer Multiplication, TOH. Greedy Method:MST for graph, Dijkstra's Algorithm, Fractional Knapsack problem, Job Sequencing.

Unit – III: Dynamic Programming **(07)**

General strategy, optimal substructure, 0/1 knapsack Problem, Chain matrix multiplication, Bellman-Ford Algorithm, Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem.

Unit – IV: Backtracking **(07)**

General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring, Hamiltonian Cycle, 0/1 Knapsack Problem.

Unit – V: Branch and bound **(07)**

The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem

Unit – VI: Classes of algorithms **(07)**

Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, NP Complete Problems, Parallel Algorithms, Randomized and approximation algorithms

Text Books:

1. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia, ISBN 81-7371-612-9.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford, ISBN 10 : 0-19-809369-1

Reference Books:

1. Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN: 81-203-2141-3.
2. R. C. T. Lee, SS Tseng, R C Chang, Y T Tsai, Introduction to Design and Analysis of Algorithms, A Strategic approach, Tata McGraw Hill, ISBN-13: 978-1-25-902582-2. ISBN-10: 1-25-902582-9.
3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson, ISBN 81- 7758-835-4.
4. Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.

IT 3202 Operating Systems

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Computer Organization, Data Structures
Course Objectives:
Familiarize students with
1. Basic functions and concepts of modern operating systems.
2. Mechanisms to handle processes and threads.
3. Principles of concurrency and deadlock.

Course Outcomes:
Students should be able to
1. Explain the structure of the Operating System and basic architectural components.
2. Apply concepts of process, thread and scheduling.
3. Identify different memory management techniques.
4. Design solutions using IPC and Deadlock handling techniques.

Unit – I Introduction to Operating Systems (07)

Evolution of Operating Systems, Operating Systems Overview, OS structure, Functions of an OS: Program management, resource management, Protection and Security, PC Hardware and Booting, Shell Scripting, AWK, Sed

Unit – II Memory Management (07)

Logical Versus Physical Address Space, Swapping, Contiguous memory allocation, Non-contiguous memory allocation, Internal and external fragmentation, Segmentation, Paging, Structure of the Page Table
Virtual Memory: Demand paging, Prepaging, Thrashing, Page replacement algorithms, Translation look-aside buffer (TLB)

Unit – III Process (07)

Process concept, forking and exec, zombies, orphans, demons, context switching, wait, exit system calls, Scheduling: threads and scheduling algorithms, scheduling algorithms (FCFS, SJF, SRTF, Round robin, multilevel queues, feedback queues)
Linux schedulers -- O(1) and O(n), Linux schedulers – CFS

Unit – IV IPC and Synchronization (07)

IPC, Critical Section, Race Condition, context switching, process related system calls, Critical Sections, Peterson's Solution, Bakery Algorithm, Test&Set, Spinlocks, Mutex, semaphores, producer-consumer, dining philosophers

Deadlocks: Ostrich algorithm, bankers algorithm, deadlock prevention, deadlock detection and recovery

Unit – V I/O and File Management (07)

I/O Devices, Organization of the I/O Function, polling, Disk structure, Disk scheduling and Disk management, files, protection, access methods, directory and disk structure, File-system mounting, File-system structure and File-system implementation, allocation methods

Unit – VI System Software and its importance (07)

Need of System Software, Assemblers: Pass structure of Assemblers, Macro Processor: Macro Definition and call, Macro Expansion. Loaders: Loader Schemes, Compile and Go, General Loader Scheme, Subroutine Linkages, Relocation and linking

Text Books

1. "Operating System Concepts", 9th edition, by Abraham Silberschatz, Pert B. Galvin, and Greg Gagne, Wiley-India edition
2. "Modern Operating Systems", 4th edition, by Andrew S. Tanenbaum, PHI Learning Private Limited, New Delhi

Reference Books:

1. "Operating Systems: Internals and Design Principles", 8th edition, William Stallings, Pearson Education Limited
2. "The Design of the UNIX Operating System", Maurice J. Bach , Pearson
3. "UNIX, concepts and applications", 4th edition, Sumitabha Das, Tata McGraw-Hill Education
4. "Operating Systems Security", Trent Jaeger, Morgan and Claypool Publishers
5. "Linux System Programming", 2nd Edition, Robert Love, O'Reilly
6. "Systems Programming and Operating Systems", 2nd Edition, D. M. Dhamdhere, Tata McGraw-Hill
7. "Systems Programming", Indian Edition, J. J. Donovan, McGraw-Hill

IT 3203 Software Engineering

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: **1** hr/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **4**

Course Objectives:
Familiarize students with
1. Nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
2. Concepts and principles of software design and architecture.
3. Basics of software testing through real life projects
4. Recent trends in software engineering.

Course Outcomes:
Students will be able to:
1. Identify unique features of various software application domains
2. Apply appropriate software development models for real life projects.
3. Identify functional and non-functional requirements for a small-to-medium size software project from real life projects
4. Examine the quality of the software

Unit – I Introduction to Software Engineering (07)
Nature of Software – How is software built? Software Application domains, web-apps, mobile-apps, cloud computing, Preliminaries – The discipline, layers, the process (guiding principles), the practice (guiding principles) and myths, Process Models – Generic process model, process assessment and improvement, prescriptive models, specialized models

Unit – II Software Requirement Analysis (07)
Requirements Capturing - requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (kano diagram)
Requirements Analysis – basics, scenario based modeling, use case model, use case model development, data and control flow model, behavioral modeling using state diagrams
- real life application case study

Unit – III Software Design (07)
Software Design – definition of design, translating requirements model to design model, design considerations (quality guidelines and attributes), design concepts, Introduction to class identification, class relationships, identification of class relationships, Software architecture
UI Design - dealing with different types of users, collecting user-requirements, building narratives, creating personas and scenarios- real life application case study

Unit – IV Software Testing (07)
Software testing basics, Types of testing - unit testing and integrated testing, white box and black box testing, alpha and beta testing, regression testing, Peer testing, Art of debugging,
Software maintenance - real life application case study

Project quality management (CMMI, ISO, Six-sigma)

Unit – V Software Project Management (07)

Planning Scope Management, Creating the Work Breakdown Structure, Effort estimation and scheduling: Developing the Schedule using Gantt Charts, Using Tracking Gantt Charts to Compare Planned and Actual Dates, Critical Path Method, Program Evaluation and Review Technique (PERT) with examples. Estimating Costs, Types of Cost Estimates, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates, Introduction to automated Project management tools

Unit – VI Recent trends in Software Engineering (07)

Computer-aided software engineering (CASE), Risk Management, Software Configuration Management: Tools such as GitHub, Agile development process, Extreme Programming, SCRUM, Cleanroom methodology

Project management trends such as ERP, SAP, Global software development, Test-driven development

Text Books

Roger S. Pressman, '**Software Engineering: A practitioner's approach**', *McGraw Hill*

Reference Books

1. Pankaj Jalote, '**An integrated approach to Software Engineering**', *Springer/Narosa*.
2. Ian Sommerville, '**Software Engineering**', *Addison-Wesley*.
3. Schwaber, K. and Beedle, M. (2001). '**Agile Software Development with SCRUM**', *New Jersey:Pearson*. [ISBN - 9780130676344]
4. Rajiv Mall

PEIT 3201 Advanced Computer Networks

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:
Familiarize students with
1. Basic functions and concepts of advanced computer networks.
2. Principles of performance modeling.
3. Mechanisms to handle congestion and routing.

Course Outcomes:
Students should be able to
1. Compare resource allocation mechanisms in computer networks.
2. Evaluate the performance measures in TCP/IP networks.
3. Analyze advanced routing algorithms.
4. Comprehend Internet design principles.

Unit – I Internet architecture and performance modeling (07)

Introduction. Course logistics. Goals of internet design, Layering abstraction and encapsulation. Network architecture and protocols. Performance of networks: delay and throughput, End-to-end delay, Concept of packetization, Circuit switching vs packet switching, Bandwidth-delay product, and Simple results from queuing theory.

Unit – II Applications: architectures and examples (07)

Application layer architectures: client-server vs. P2P, Socket interface: TCP vs. UDP semantics, Application types: elastic vs. real-time, WWW and HTTP. Persistent vs. non-persistent connections, HTTP message formats, headers, Caching, cookies, FTP, SMTP

Unit – III Transport protocols (07)

Basic function of transport - multiplexing and demultiplexing, UDP- simple transport, TCP connection basics: handshake, reliability, pipelining, congestion control, flow control, Ideal window size and bandwidth delay product, Buffer sizing for TCP, Simple model for TCP throughput, Understanding TCP fairness, RED gateways, Resource allocation, QoS, and fairness, QoS architectures: Intserv and Diffserv, Admission control: Token Bucket Filter

Unit – IV Internet routing (07)

Router scheduling, common router scheduling policies / queuing disciplines
Hierarchical (intradomain and interdomain) routing, IPv6, IP-in-IP tunneling, MPLS, BGP and advanced BGP concepts

Unit – V Link layer (07)

Link layer functions: Link layer addresses, ARP, Shared broadcast, multiple access protocols, the original Ethernet, spanning tree protocol, VLANs, NAT traversal.

Unit – VI Advanced topics (07)

Networking with virtual machines, software switches, Network Function Virtualization, Network Virtualization, Key ideas of traditional networks vs. SDN, history, Ethane: the motivation, OpenFlow: the interface, Onix: SDN controllers, Applications - B4 by Google, Datacenter networking.

Text Books

1. "Computer Networking, A Top-Down Approach", 6th edition, James Kurose and Keith Ross, Pearson Publishers.
2. "Computer Networks, A Systems Approach", 5th edition, Larry Peterson and Bruce Davie, The Morgan Kaufmann series in Networking
3. "Data Networks" 2nd edition Bertsekas and Gallager, Prentice hall publishers (mainly Chapter 3.3 on basic queuing theory

Reference Books

1. "Computer Networks", 6th Edition Andrew Tannenbaum, J. David and Wetherall, Pearson Publishers
2. Tcp/Ip Protocol Suite" 4th Edition Behrouz Forozoun, Tata McGraw-Hill Education Edition.

Reference Papers

1. The design philosophy of the DARPA internet protocols, David Clark.
2. Chord: A Scalable Peer-to-peer Lookup Service for Internet Applications , Stoica et al
3. Congestion Avoidance and Control, Jacobson and Karels.
4. Sizing Router Buffers, Appenzeller et al
5. Bufferbloat: Dark Buffers in the Internet, Gettys and Nichols
6. The Macroscopic Behavior of the TCP Congestion Avoidance Algorithm , Mathis et al.
7. Analysis of the Increase and Decrease Algorithms for Congestion Avoidance in Computer Networks, Chiu and Jain.
8. Random Early Detection Gateways for Congestion Avoidance, Floyd and Jacobson

PEIT 3201 Human Computer Interaction

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Problem Solving and Object Oriented Technologies.
Course Objectives:
Familiarize students with
1. Basic field of human-computer-interaction study
2. Applications of human-computer-interaction to real life use cases.
3. Design of effective human-computer-interactions

Course Outcomes:
Students should be able to
1. Identify importance of HCI study and principles of User-Centered Design (UCD) approach.
2. Design effective user-interfaces following a structured and organized User Centered Design process.
3. Apply proper learning algorithm to data depending on the task
4. Perform evaluation of usability of a user-interface design.

Unit – I Introduction (07)
What is HCI? Disciplines involved in HCI, Why HCI study are important? The psychology of everyday things, Principles of HCI, User-centered Design.

Unit – II Understanding The Human (07)
Input-output channels, Human memory, Thinking: Reasoning and Problem Solving, Human emotions, Individual differences, Psychology and Design.

Unit – III Understanding The Interaction (07)
Models of interaction, Ergonomics, Interaction styles, WIMP Interface, Interactivity, Context of interaction, User experience, Paradigms of Interactions.

Unit – IV HCI - Design Process (07)
What is interaction design?, The software design process, User focus, Scenarios, Navigation Design, Screen Design, Prototyping techniques, Wire-Framing, Understanding the UI Layer and Its Execution Framework, Model-View-Controller(MVC) Framework.

Unit – V HCI - Design Rules , Guidelines And Evaluation Techniques (07)
Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics, Using toolkits, User interface management system (UIMS), Goals of evaluation, Evaluation Criteria, Evaluation through expert analysis, Evaluation through user participation, Choosing an Evaluation Method.

Unit – VI HCI Models And Theories (07)
Goal and task hierarchy model, Linguistic model, Physical and device models, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations, Computer mediated communication, Ubiquitous Computing, Finding things on web Future of HCI.

Text Books

1. Alan Dix (2008). Human Computer Interaction. Pearson Education. ISBN 978-81-317-1703-5.
2. Gerard Jounghyun Kim (20 March 2015). Human–Computer Interaction: Fundamentals and Practice. CRC Press. ISBN 978-1-4822-3390-2.

Reference Books

1. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs (29 August 2013). Designing the User Interface: Strategies for Effective Human-Computer Interaction. Pearson Education Limited. ISBN 978-1-292-03701-1.
2. Donald A. Norman (2013). The Design of Everyday Things Basic Books. ISBN 978-0-465-07299-6.
3. Jeff Johnson (17 December 2013). Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines. Elsevier. ISBN 978-0-12-411556-9.
4. Alan Cooper; Robert Reimann; David Cronin; Christopher Noessel (13 August 2014). About Face: The Essentials of Interaction Design. Wiley. ISBN 978-1-118-76658-3.

PEIT 3201 Online course Swayam

Joy of Computing using Python

Teaching Scheme:	**Examination Scheme:**
Lectures: **3** hrs/week	In-Semester: **50** marks
	End-Semester: **50** marks
	Credits: **3**

Prerequisites: Nil

Course Objectives:
Facilitate the learner
1. To learn the fundamentals of python programming for logic building.
2. To decide appropriate data structures and control structures of Python to solve a problem
3. To familiarize with various python libraries
4. To apply libraries for providing a solution of a problem

Course Outcomes:
Students should be able to
1. Understand the programming logic in Python
2. Apply appropriate data structures, and control structures of Python language to arrive at a solution for a given problem
3. Analyze a given problem and choose appropriate function from the Python libraries.
4. Demonstrate some of the current advances in computing with Python as a language for a given problem

Course Plan:

Week 1: Motivation for Computing
Week 2: Welcome to Programming!!
Week 3: Variables and Expressions : Design your own calculator
Week 4: Loops and Conditionals : Hopscotch once again
Week 5: Lists, Tuples and Conditionals : Lets go on a trip
Week 6: Abstraction Everywhere : Apps in your phone
Week 7: Counting Candies : Crowd to the rescue
Week 8: Birthday Paradox : Find your twin
Week 9: Google Translate : Speak in any Language
Week 10: Currency Converter : Count your foreign trip expenses
Week 11: Monte Hall : 3 doors and a twist
Week 12: Sorting: Arrange the books

PEIT 3202 Natural Language Processing

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Probability Basics
Course Objectives:
Familiarize students with
1. Different levels of natural language processing
2. Language modeling and Parsing techniques used in natural language processing
3. State of art NLP areas

Course Outcomes:
Students will be able to:
1. Identify challenges involved in developing natural language processing system
2. Analyze natural language processing techniques
3. Choose Natural Language Processing techniques for different applications
4. Evaluate natural language processing system

Unit – I Introduction to Natural Language Processing (07)
Introduction: What is Natural Language Processing? Introduction to NLP applications, Brief history of field, Ambiguity and Uncertainty in language, The Different Levels of Language Analysis : NLP tasks in syntax, semantics and pragmatics, The role of machine learning

Unit – II Syntactic Parsing (07)
A Top-Down Parser, A Bottom-Up Chart Parser, Top-Down Chart Parsing, Logic Programming Parsing tools such as Stanford Parser, Human Preferences in Parsing, Application of Natural Language toolkit

Unit – III Language Modeling (07)
Computational Linguistics - Probability Theory , Estimating Probabilities, Part-of-Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Probabilistic language modeling and its applications, Markov models. N-grams. Estimating the probability of a word, and smoothing

Unit – IV Features and Augmented Grammars (07)
Feature Systems and Augmented Grammars : Some Basic Feature Systemsfor English Morphological Analysis and the Lexicon , A Simple Grammar Using Features, Parsing with Features, Augmented Transition Networks: Definite Clause Grammars, Generalized Feature Systems and Unification Grammars

Unit – V Semantic Analysis (07)
Semantics and Logical Form :Word Senses and Ambiguity,The Basic Logical Form,Language Encoding, Ambiguity in Logical Form ,Verbs and States in Logical Form,Case Relations Lexical Resources : WordNet, Semantic web Ontologies

Unit – VI Future of NLP (07)
Sentiment Analysis. Machine Translation MT evaluation tools such as Bleu, WER, Information Extraction, Question answering, Automatic speech recognition, Deep Learning for Natural Language

Processing

Text Books

1. James Allen, “Natural Language Understanding”, Pearson Publication, ISBN: 978-81-317-0895-8 2nd Edition
2. D. Jurafsky, J. H. Martin, “Speech and Language Processing”, Pearson Education, 2002

Reference Books

1. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts, 1999.
2. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval
3. Daniel M.Bikel, ImedZitouni, Multilingual Natural Language Processing Applications

IT 3204 Seminar

Teaching Scheme:
Practical: **2** hrs/Week

Examination Scheme:
Oral: **25** Marks
Credits: 1

Course Objectives:

Familiarize students with

1. Exploring technical literature with the purpose of formulating a project statement.
2. Writing a technical report summarizing state-of-the-art on an identified topic.
3. Formulate intended future work based on the technical review.
4. Understanding scientific approach for literature survey and paper writing.
5. Developing a prototype for the project statement.

Course Outcomes:

Students should be able to

1. Perform focused study of technical literature relevant to a specific topic.
2. Build independent thinking abilities to approach complex problems.
3. Work as a team and follow collaborative work practices.
4. Communicate scientific information to a larger audience in oral and written form.
5. Develop prototype to test and validate project statement

Guidelines for Project Based Seminars

1. A project group consisting of 4 students shall identify problem(s) in Computer Engineering / Information Technology referring to recent trends and developments in consultation with institute guide.
2. Students can choose problem statements from websites with international competitions/ challenges like kaggle, hackerrank, hackerone, bug bounty, bugcrowd etc. and attempt to solve current

challenges/ unsolved problems preferably.

3. The group must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their project topic as decided by the guide.
4. Students should not perform the similar projects/ assignments done before.
5. Students should develop some working prototype/ Hands on development/ participate in competitions etc.
6. The topic and scope should be verified and approved by the guide.
7. Project Statement verification will be done by group of faculty members.
8. Individual seminar topics will be discussed and finalized by the guide.

Guidelines for Seminar Report

1. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department/Principal.
2. First chapter of a project group may talk about the project topic. At the end of the first chapter individual students should begin with introduction of seminar topic and its objectives.
3. Broad contents of review report (20-25 pages) shall be
   i. Introduction of Project Topic
   ii. Motivation, purpose and scope of project and seminar
   iii. Related work (of the seminar title) with citations
   iv. Discussion (your own reflections and analysis)
   v. Conclusions
   vi. Project definition
   vii. References in IEEE Format
4. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection. (Latex, for report writing ; Mendeley, Zotero for collecting, organizing and citing the resources; DupliChecker , PaperRater, PlagiarismChecker, Turnitin and Viper for plagiarism detection)

Guidelines for Seminar Evaluation

1. A panel of examiners - one External examiner & one internal examiner (other than guide) will assess the seminar during the presentation.
2. Criteria for evaluation
   a) New technology / topics.
   b) Working of the prototype developed / Experimentation.
   c) Literature survey
   d) Presentation skills
   e) Utility of project

Project based seminar Timeline

1.	Group formation	1st week
2.	Survey / Topic identification	3rd week
3.	Topic verification	4th week

	(Refer guideline for project based seminar no 8)	
4.	Guide allocation	5th week
5.	Seminar topics identification	6th week
6.	Prototype development/ hands-on	10th week
7.	Seminar report submission	11th week
8.	Presentation	12th week

References

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN :130981745, 4th Edition.
2. Andrea J. Rutherfoord, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition.
3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1st Ed.

IT 3205 Programming Skills Development Laboratory

Teaching Scheme:
Practical: **2** hrs/week

Examination Scheme:
In-Semester: **25** Marks
Credits: **1**

Prerequisites: Object Oriented Programming.

Course Objectives:
Familiarize students with

1. Learn android app development and Java programming
2. The Google app store management
3. Successfully design, code and deploy Android apps.

Course Outcomes:
Students should be able to

1. Learn Android development, Java programming and Android studio from scratch.
2. Breaks even the most complex applications down into simplistic steps.
3. Learn how to work with APIs, web services and advanced databases.
4. Upload your android apps to the Google play and reach millions of android users

Course Contents

1. Set up and walkthrough - Android Studio and build User Interface.
2. Fundamentals of Java Programming used to build Android apps.
3. Inputs, Buttons and Reactive Interfaces.
4. Android Building blocks.
5. Variables, Arrays, Loops, Array Lists, List View.
6. Navigate between screens.
7. Passing information between screens.
8. Think and work - Learn how professional android apps developers.
9. Think and work - Learn how to design android apps.
10. Build several amazing apps - Hands on.
11. Publish your apps on Google Play.

List of Lab Experiments

1. Develop an application that uses GUI components, Fonts and Colors
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Mini Project – Design and Develop of Android App with bit of societal angle. App to be deployed on Android Play Store

Text Books

1. Hello, Android: Introducing Google's Mobile Development Platform (Pragmatic Programmers) 3rd Edition by Ed Burnette, Paperback

2. Android Application Development All-in-One for Dummies 1st Edition, Barry A. Burd. Paperback

Reference Books

1. Beginning Android Tablet Application Development 1st Editionby Wei-Meng Lee, Paperback
2. Professional Android 2 Application Development 2nd Edition,Reto Meier, Paperback.
3. Android Programming for Beginners by John Horton Paperback.

IT 3206 Operating Systems Laboratory

Teaching Scheme:
Practical: **4** hrs/week

Examination Scheme:
In-Semester: **25** marks
Practical: **25** marks
Credits: **2**

Prerequisites: Computer Organization, Data Structures

Course Objectives:

Familiarize students with

1. Shell scripting and its importance.
2. Concepts of processes and threads.
3. Concurrency, Synchronization and deadlocks.
4. Basics of Linux Kernel Programming.

Course Outcomes:

Students should be able to

1. Examine the importance and functioning of shell programming.
2. Illustrate the benefits of thread over process and implement synchronized programs using multithreading concepts.
3. Analyse the concept of deadlock in operating systems and implement it in multiprocessing environment.
4. Design solutions using mutual exclusion, IPC and synchronization.

Suggested List of Laboratory Assignments

1. Create two virtual machines using Type-2 hypervisor having Fedora and FreeBSD installed on them, to understand basic virtualization concept.
2. Shell programming.
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
5. Write a C program to implement multithreading.
6. Implement producer-consumer problem using semaphores.
7. Write a C program to simulate the concept of Deadlock using Dining-Philosophers problem.
8. Write a C program to implement Inter Process Communication (shared memory or pipes or message queues).
9. Write a C program that uses polling to simultaneously check whether a read from stdin and a write to stdout will block.
10. Build and insert loadable kernel module to a running Linux kernel.

Reference Books:

1. “Beginning Linux Programming”, 4th Edition, by Neil Matthew, Richard Stones, Wrox Publication
2. “UNIX, concepts and applications”, 4th Edition, Sumitabha Das, Tata McGraw-Hill Education
3. “Linux System Programming”, 2nd Edition, Robert Love, O’Reilly
4. “Linux Kernel Development”, 3rd Edition, Robert Love, Pearson
5. “Operating System Concepts", 9th edition, Abraham Silberschatz, Pert B. Galvin, and Greg Gagne, Wiley-India edition
6. "Modern Operating Systems", 4th edition, Andrew S. Tanenbaum, PHI Learning Private Limited, New Delhi
7. “Operating Systems: Internals and Design Principles”, 8th edition, William Stallings, Pearson Education Limited

PEIT 3203 Natural Language Processing Laboratory

Teaching Scheme:
Practical: **2** hrs/week

Examination Scheme:
Practical: **25** marks
Credits: **1**

Course Objectives:
Familiarize students with

1. Implementation of NLP core areas.
2. Current NLP research areas.

Course Outcomes:
Students will be able to

1. Apply various NLP algorithms and tools.
2. Analyze challenges in development of NLP applications.
3. Implement NLP application.
4. Design Language Model.

Assignments

1: Parsing using tools such as Natural Language toolkit (NLTK), Stanford Parser
2: Implementation of probabilistic context free grammar
3: Use of lexical resources to implement word sense disambiguation
4: Study of any small application/research paper in areas such as sentiment analysis, machine translation

ME 3101 – Computer Oriented Numerical Methods

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Engineering Mathematics

Co-requisites:
1. Heat Transfer

Course Objectives:

1. To understand numerical errors and error propagation.
2. To apply numerical methods for finding root of the equation.
3. To solve simultaneous linear algebraic equations by numerical methods.
4. To use numerical methods for curve fitting and interpolation.
5. To apply numerical methods for integration and differentiation
6. To implement numerical techniques for ordinary and partial differential equations.

Course Outcomes:

Upon completion of this course, students will be able to:

1. understand errors and error propagation.
2. apply numerical method for finding root of the equation
3. solve simultaneous linear algebraic equations by numerical methods
4. use numerical methods for curve fitting and interpolation
5. apply numerical methods for integration and differentiation
6. Obtain approximate solution of ordinary and partial differential equations applying numerical techniques.

Unit 1: Roots of Equations and Errors (6 hrs)

Bisection method, Newton Raphson method, Successive approximation method
Types of errors, error propagation

Unit 2: Simultaneous Equations (8 hrs)

Gauss elimination method, LU decomposition method, Thomas algorithm for tri- diagonal matrix, Jacobi iteration method, Gauss Seidel method

Unit 3: Curve Fitting and Interpolation (7 hrs)

Least square technique- straight line, quadratic equation, power equation, exponential equation
Interpolation- Newton's forward interpolation, Lagrange's Interpolation, Spline interpolation

Unit 4: Numerical Integration and Differentiation (7 hrs)

Numerical Integration: trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Gauss quadrature, double integration
Numerical Differentiation: Basic finite difference methods

Unit 5: Ordinary and partial differential equations: (14 hrs)

Taylor series method, Euler method, Runge Kutta fourth order method, Runge Kutta 2nd order method for simultaneous equations
Introduction to Finite difference method, Elliptic equation, Parabolic equation

Suggested Texts and Reference Materials:

1. Steven C Chapra, Raymond P. Canale, Numerical methods for engineers, Tata McGraw Hill
2. Steven C Chapra, Applied numerical methods with MATLAB for engineers and scientists, Tata McGraw Hill
3. Dr. B.S. Grewal, Numerical methods in Engineering and science, Khanna Publishers
4. E. Balagurusamy, Numerical methods, Tata McGraw Hill
5. Laurene Fausett, Applied Numerical analysis using MATLAB, PHI
6. P.Kandasamy, K.Thilagavathy, K.Gunavathi, Numerical Methods, S. Chand

ME 3102 - Analysis and Synthesis of Mechanisms

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisites:
1. Engineering Mechanics
2. Rigid Body Dynamics

Course Objectives:

1 To understand basics of planar kinematics of Rigid Bodies
2 To understand drawing velocity and acceleration diagram for simple mechanism
3 To understand how to apply concept of dynamic analysis of mechanisms
4 To understand how to construct and analyze Cam profile
5 To understand how to investigate gyroscopic principles

Course Outcomes:

Upon completion of this course, the student will be able to:

1. identify nature of kinematic pair, chains and mechanisms
2. construct and analyze velocity and acceleration of links in four bar and slider crank mechanisms
3. apply concept of dynamic analysis of mechanisms for slider crank mechanism
4. construct and analyze Cam profile
5. investigate gyroscopic principles for given applications

Unit 1: Planar Kinematics of Rigid Bodies (Review) 4 Hrs.
Review of types of motions, position, velocity and acceleration

Unit 2: Fundamentals and Types of Mechanisms 8 Hrs.
Kinematic link, Types of links, Kinematic pair, Types of constrained motions Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach crieterion, Grubler's criterion, Grashoff's law, Four bar chain and its inversions, Slider crank chain and its inversions, Double slider crank chain and its inversions,
Straight line mechanisms: Peaucellier Mechanism, Scott Russell Mechanism, Grasshopper Mechanism, watt mechanism
Steering gear mechanisms: Condition for correct steering, Davis and Ackermann steering gear mechanism

Unit 3: Displacement, Velocity and Acceleration Analysis of Mechanisms 9 Hrs.
Analytical and Graphical method for displacement, Position analysis of links with vector and complex algebra methods, Loop closure equation, Chase solution, input and output curves, Transmission angle

Analytical Method - Velocity and acceleration analysis of four bar and slider crank mechanisms using vector and complex algebra methods.

Graphical Method - Velocity and Acceleration polygons for simple mechanisms as well as for the mechanisms involving Coriolis component of acceleration, ICR method

Unit 4: Dynamic Analysis of Mechanisms **5 Hrs.**

Dynamic force analysis of reciprocating engine mechanism, Crank shaft torque, Introduction to T-θ diagram.

Unit 5: Dimensional Synthesis of Mechanisms: Analytical and Graphical Method **8 Hrs.**

Introduction to Synthesis of Mechanisms - Type, number and dimensional synthesis. Tasks of Dimentional synthesis: Path, function and motion generation (Body guidance). Precision Positions, Chebychev spacing, Mechanical and structural errors.

Graphical Method: Two and three position synthesis of four bar and slider crank Mechanisms

Analytical Method: Three position synthesis of four bar mechanism using Freudenstein's equation

Unit 6: Cam and Follower, Gyroscopic action **8 Hrs.**

Types of cams and followers, analysis of follower motions, Synthesis of CAM Profile (Graphical Approach), pressure angle, radius of curvature and undercutting. Jump phenomenon of Eccentric cam

Motion of Rigid Bodies in three dimensions, Gyroscopes, Gyroscopic forces and Couples, Gyroscopic effects in Machines

Brief description of tutorial activities:

1. Planar Kinematics of Rigid Bodies (Review)
2. Fundamentals of Mechanisms
3. Mobility and Range of Movement
4. Types of Mechanisms
5. Displacement Analysis of Mechanisms: Analytical and Graphical Method
6. Velocity and Acceleration Analysis of Mechanisms: Analytical and Graphical Method
7. Dynamic Analysis of Mechanisms
8. Dimensional Synthesis of Mechanisms: Analytical and Graphical Method
9. Cam and Follower
10. Gyroscopic action

Text Book:

1. S. S. Ratan, "Theory of Machines", Tata McGraw Hill

References:

1. Asok Kumar Mallik, Amitabha Ghosh, Gunter Dittrich, "Kinematic Analysis and Synthesis of Mechanisms"
2. Thomas Bevan, "Theory of Machines" CBS Publisher and Distributors, Delhi
3. Ashok G. Ambekar, "Mechanism and Machine Theory", Prentice Hall, India
4. Sadhu Singh, "Theory of Machines", Pearson
5. Shigley J. E., and Uicker J.J., "Theory of Machines and Mechanism", McGraw Hill Inc.
6. Hall A. S., "Kinematics and Linkage Design", Prentice Hall
7. Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery", Person Education
8. Erdman A.G. and Sandor G.N., "Mechanism Design, Analysis and Synthesis" Volume-I, Prentice -Hall, India

ME 3103 – Heat Transfer

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisites:
1. Engineering Physics
2. Fluid Mechanics

Course Objectives:

1 To apply laws of heat transfer to ascertain the heat transfer rate
2 To formulate heat conduction equation using given boundary conditions
3 To identify the requirement of extended surfaces for heat transfer enhancement
4 To ascertain the heat transfer rate in forced and natural convection
5 To predict the radiation heat transfer with the use of radiation shield for given application
6 To calculate efficiency of heat exchanger

Course Outcomes:

Upon completion of this course, the student will be able to:

1 apply laws of heat transfer to ascertain the heat transfer rate in steady and transient state heat conduction in solids
2 formulate the equation for heat conduction with heat generation applying suitable BC's
3 evaluate the requirement of extended surfaces for heat transfer and calculate the heat transfer enhancement using it.
4 analyse the convective heat transfer rate using appropriate correlations
5 predict the heat transfer rate in radiation mode and with the use of radiation shield
6 calculate the efficiency of heat exchanger for given set of operating conditions

Unit 1: Steady State Conduction Heat Transfer **16 Hrs.**
Modes of Heat transfer, Fourier's law of heat conduction. Steady heat conduction in 1 – D systems. Heat conduction in composite slab. Heat conduction with internal heat heat generation. Critical radius of insulation and insulating materials, Heat transfer through extended surfaces

Unit 2: Transient Heat Conduction Analysis **3 Hrs.**
Transient heat conduction in solids using lumped heat capacity analysis

Unit 3: Convection Heat Transfer **8 Hrs.**
Mechanism of convection heat transfer, Energy Equation, Forced convection over flat plate, cylinder and sphere. Concepts of thermal and velocity boundary layer, Empirical correlations. Forced Convection in a pipe, thermal Entrance region, Empirical correlations, Reynolds and Colburn's analogy. Non dimensional parameters and its significance.
Natural convection over vertical flat plate and cylinder. Non dimensional parameters and its significance.

Unit 4: Radiation Heat Transfer **6 Hrs.**
Fundamental concepts and laws of radiation, Black and Gray body radiation analysis, Radiation between two gray surfaces, Radiation shields.

Unit 5: Heat Exchangers **6 Hrs.**

Introduction and classification. Overall heat transfer coefficient. Heat exchanger analysis using LMTD and NTU method. Effectiveness of heat exchanger.

Brief description of tutorial activities:

1 Conduction
2 Convection
3 Radiation
4 Heat Exchangers

Suggested Texts and Reference Materials:

1 F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley
2 Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.
3 S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press.

PEME 3101 Program Elective I – (A) Automation and Control Engineering

Teaching Scheme **Examination Scheme**

Lecture: 3 Hrs/week

In semester: 50 marks

End semester: 50 marks

Credits: 3

Prerequisites

1. Fluid Mechanics.
2. Electronics and Electrical Engineering.

Course Objectives:

1. To familiarize with the basic concept of industrial automation.
2. To acquaint with concept of low cost automation with Pneumatic and Hydraulic and systems.
3. To acquaint with the concepts related to fluid power.
4. To familiarize with elements of control systems.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Identify automation need, level, required components and process control.
2. Analyze given needs of automation to design Hydraulic circuit(s).
3. Analyze given needs of automation to design Pneumatic circuit(s).
4. Justify selected component(s)/system from given catalogue(s) for automation application under study.

Unit 1: Introduction to Automation **4 Hrs.**

Definition; Automation in production systems; Automation principles and strategies; Basic elements of an automated system; Advanced automation function; Levels of automation; Types of automation; Benefits and Impact of Automation in Manufacturing and Process Industries, Architecture of Industrial Automation Systems

Unit 2 Hydraulic and Pneumatic Devices **8 Hrs.**

Hydraulic and Pneumatic devices; Different types of valves: DCV, FCV, PCV, Actuators and auxiliary elements in Pneumatic and Hydraulics, their application and use of their ISO symbol

Unit 3: Hydraulic systems **8 Hrs.**

Basic hydraulic circuits involving linear and rotary actuators. Fundamental concept of digital and servo hydraulic controls. Comparison between proportional, digital and servo hydraulic control system

Unit 4: Pneumatic Systems **8 Hrs.**

Basic Pneumatic circuits involving linear and rotary actuators. Design of pneumatic circuits using Cascade method and shift registered method (up to 3 cylinders). Design of Electro-Pneumatics Circuits using single solenoid and double solenoid valves with and without grouping. Design of Pneumatic circuits using PLC Control (ladder programming only and up to 3 cylinders) with application of Times and Counters and concept of Flag and latching.

Unit 5: Assembly Line Automation **8 Hrs.**

Automated assembly system, transfer system, vibratory bowl feeders, non-vibratory feeders, part orienting, feed track, part placing & part escapement systems, Introduction to Material storage/ handling and transport system, and its automation using AS/RS, AGVS and conveyors etc.

Unit 6: Fundamentals of Control System **4 Hrs.**

Control system concepts, classification of control systems, mathematical representation of system equations, response characteristics of components and system through classical solution

Suggested Texts and Reference Materials:

1. Anthony Esposito, Fluid Power with application, 7 th Edn., 2008, Prentice Hall 2. M.P.
2. Groover, Industrial Robotics: Technology, Programming and applications, McGrawHill, 2nd Edn., 2012, ISBN:9780070265097
3. Automation, Production Systems, and Computer integrated Manufacturing (3rd Edition), by Mikell P. Groover, PHI Learning Private Limited, New Delhi.
4. Pneumatics Controls , by Joji P., Wiley India Pvt.Ltd
5. Principles of Control Systems, by U.A. Bakshi, V.U. Bakshi, Technical Publication Pune.
6. Pneumatics Basic Level , by Peter Croser, Frank Ebel, Festo Didactic GmbH & Co. Germany
7. Electro- pneumatics Basic Level, By G. Prede, D.Scholz, Festo Didactic GmbH & Co. Germany
8. Introduction to Hydraulics and Pneumatics, by S. IIango and V. Soundararajan, PHI Learning Pvt. Ltd. New Delhi
9. Vickers Industrial Hydraulics Manual (3rd Edition), Vickers Inc; Maumee, OH
10. Hydraulics and Pneumatic Controls (2nd Edition), by R. Srinivasan, Vijay Nicole Imprints Pvt. Ltd. Chennai.

ME 3101 – Advanced Fluid Mechanics

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 4

Prerequisites:
1. Engineering Physics
2. Engineering mathematics
3. Fluid Mechanics

Course Objectives:

1	To Interpret the mathematical and physical foundations of the continuum mechanics of fluids,
2	To apply the conservation laws to viscous, inviscid, incompressible flows; and boundary layer flows
3	Be able to apply the principles of fluid mechanics to solve engineering problems and to design systems or components to meet desired needs
4	To derive the generic form of N-S equation and able to deduce an analytical solution for simple fluid mechanics problems.

Course Outcomes:

Upon completion of this course, the student will be able to:

1	Student will be able understand the concepts of continuum mechanics of fluids,
2	Student will be relate the conservation laws to different types of fluid flow conditions
3	Student will produce the solution for complex fluid mechanics problems and to design system using fundamental principles.
4	Student will derive the generic form of N-S equations and illustrate the analytical solution for simple flow problems

Unit 1: Reynolds Transport Theorem **9 Hrs.**
Brief recapitulation of some preliminary concepts of Fluid Mechanics : Fluid Kinematics , RTT, Integral and differential forms of governing equations: mass, momentum and energy conservation equations, Navier-Stokes equations, Euler's equation, Bernoulli's Equation.

Unit 2: Navier Stokes Equation **6 Hrs.**
Dynamics of viscous flows - Derivation of Navier-Stokes equation

Unit 3: Exact Solution of N-S Equations **9 Hrs.**
Some exact solutions of Navier-Stokes equation- Couette flows, Poiseuille flows, Fully developed flows in non-circular cross-sections, Unsteady flows, Creeping flows.

Unit 4: Introduction to turbulence **8 Hrs.**

Fundamental concepts turbulence, Prandtl mixing length theory, Turbulent stresses, Turbulence modelling concept and requirement

Unit 5: Boundary Layer theory **8 Hrs.**

Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similarity solutions, Integral form of boundary layer equations, Approximate Methods, Flow separation, Entry flow into a duct.

Unit 6: Compressible Flow **8 Hrs.**

Speed of sound and Mach number, Basic equations for one dimensional flows, Isentropic relations, Normal-shock wave, Fanno and Rayleigh curve, Mach waves, Oblique shock wave,

Suggested Texts and Reference Materials:

1	Introduction to Fluid Mechanics R. Fox and A. MacDonald, John Wiley and Sons
2	Introduction to Fluid Mechanics and Fluid Machines: S. K. Som, Gautam Biswas and Suman Chakraborty, McGraw-Hill Education
3	Fluid Mechanics and its Applications, Vijay Gupta Santosh Gupta New Age international
4	Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen, David R Dowling, Academic Press

PEME 3101 Program Elective I – (D) Non Destructive Evaluation and Testing

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Materials technology 1
2. Materials technology 2
3. Basic Physics

Co-requisites:
Manufacturing Process

Course Objectives:
1. To educate on the concept of fault tolerance in components
2. The course aims to provide an insight on the applications of fundamental sciences to Non Destructive Testing (NDT)
3. To understand the capabilities of non destructive test methods.
4. The course aims to make the students aware of codes, standards

Course Outcomes:
Upon completion of this course, students will be able to:
1. Predict the source of flaw
2. Characterise the flaw
3. Propose an appropriate method of NDT.
4. Interpret and apply codes and standards in the NDT practices

Unit 1: Origins and significance of flaws (9 hrs)
Overview of Manufacturing process related flaws. Type of flaws arising out of casting, forging, rolling, Welding, Extrusion. Definitions, Identification, risk assessment.

Unit 2: Surface and near surface Non Destructive methods (10 hrs)
Dye Penetrant test: Principle, Theory, Methods and techniques.
Basic principle and Theory of Magnetism, Magnetic particle test: Techniques, methods, Interpretation and evaluation, Magnetic particle test equipment and its calibration, field indicators.

Unit 3: Volumetric non destructive methods (10 hrs)
Ultrasonic Flaw detection: Acoustic principles, Basic principles of instrument, Methods of testing, Transducer material properties and sizes, calibration, Various scan techniques: A scan, B scan, C scan.
Radiography: X-ray and gamma ray and their properties, Image formation, image quality sharpness, accuracy. Interpretation of X ray images, Safety, health and license considerations in radiography

Unit 4: NDT practices (9 hrs)
Visual testing, Report writing and data presentation, Acquaintance with codes, standards, specification, and inspection practice.

Suggested Texts and Reference Materials:

1 ASM Metals Handbook, Vol. 17, Nondestructive Evaluation and Quality Control
2 Baldev Raj, T JayaKumar, M. Thavasimuthu, "Practical Non Destructive testing", Narosa Publishing House, 3e
3 Subramanian C.V., "Practical Ultrasonics", Narosa Publishing house, 2008
4 ASNT Continuing education in Non destructive testing manuals, Level II
5 ASME Section V, VIIID, I and Section IX

ME 3104 Computer Oriented Numerical Methods Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical: 25 Marks
Credits: 1

Prerequisites:
Engineering Mathematics

Co - requisites:
Heat Transfer

Course Objectives:
1. To use numerical methods to solve problems.
2. To use mathematical solver.
3. To prepare flowcharts for numerical methods.
4. To write programs for numerical methods.

Course Outcomes:
Upon completion of this lab course, the student will be able to:
1. Apply numerical methods to solve engineering problems.
2. Employ mathematical solver for numerical methods.
3. Prepare flowcharts for numerical methods.
4. write programs for numerical methods

List of Practical Activities:

1. To prepare flowcharts and write programs for finding **Root of Equation**: i)Newton Raphson method ii) Successive approximation method iii) bisection method
2. To prepare flowcharts and write programs for **Simultaneous linear algebraic equations**: i) Gauss elimination methods ii) LU decomposition method iii) Tri-diagonal matrix algorithm iv) Jacobi iteration method v) Gauss Seidel method
3. To prepare flowcharts and write programs for **Curve Fitting** : i) straight line ii) quadratic equation iii) power equation iv) exponential equation
4. To prepare flowcharts and write programs for **Interpolation :** i) Newton's forward interpolation ii) Lagrange interpolation iii) spline interpolation
5. To prepare flowcharts and write programs for **Numerical Integration** : i) Newton Cotes methods ii) Gauss quadrature methods iii) double integration
6. To prepare flowcharts and write programs **Ordinary differential equations:** i) Euler methods ii) Runge Kutta method- 4^{th} order iii) RK2 method for simultaneous ODE
7. To prepare flowcharts and write programs **Partial differential equations :** i) parabolic explicit method

Text Book:

1. Steven C Chapra, Applied Numerical Methods with MATLAB for engineers and Scientists, McGraw Hill Education

ME 3105 - Analysis and Synthesis of Mechanisms Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In semester: 50 marks
Credits: 1

Prerequisites:
1. Engineering Mechanics
2. Rigid Body Dynamics

Course Objectives:

1. To understand basics of planar kinematics of Rigid Bodies
2. To understand drawing velocity and acceleration diagram for simple mechanism
3. To understand how to apply concept of dynamic analysis of mechanisms
4. To understand how to construct and analyze Cam profile
5. To understand how to investigate gyroscopic principles

Course Outcomes:

Upon completion of this course, the student will be able to:

1. identify nature of kinematic pair, chains and mechanisms
2. construct and analyze velocity and acceleration of links in four bar and slider crank mechanisms
3. apply concept of dynamic analysis of mechanisms for slider crank mechanism
4. determine devices for simple motions and tasks
5. construct and analyze Cam profile
6. investigate gyroscopic principles for given applications

List of Experiments:

1. To draw mechanisms for practical applications
2. To Draw Straight Line Mechanisms
3. Velocity and acceleration analysis using Graphical methods - Polygon and ICR
4. Velocity and acceleration analysis using Graphical methods - polygons involving Coriolis component and Klein's construction
5. To synthesize the four bar and slider crank mechanisms using relative pole and inversion methods with three precision positions
6. To draw the cam profiles
7. To verify the cam jump phenomenon for an eccentric cam
8. To verify the gyroscopic principles
9. Introduction to software of Analysis and Synthesis of Mechanisms

Text Book:

1 S. S. Ratan, "Theory of Machines", Tata McGraw Hill

ME 3106 Heat Transfer Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Insem: 50 Marks
Credits: 1

Prerequisites:

1. Engineering Mathematics
2. Engineering Physics
3. Fluid Mechanics

Co - Rerequisites:

1. Heat Transfer

Course Objectives:

1. To conduct experiments involving steady state heat transfer phenomenon
2. To analyze and process the experimental data/observations to ascertain the heat transfer
3. To Illustrate the results in the graphical form
4. To Compare the results with available theoretical/experimental results and deduce the conclusion from it

Course Outcomes:

Upon completion of this lab course, the student will be able to:

1. Conduct experiments involving steady state heat transfer phenomenon
2. Analyze and process the experimental data/observations to ascertain the heat transfer rate
3. Illustrate the results in the graphical form to find the nature of temperature variation over time and length
4. Compare the results with available theoretical/experimental results and deduce the conclusion from it

List of Experiments:

1. Determination of Thermal Conductivity of insulating powder
2. Determination of Thermal Conductivity of composite solid
3. To study the temperature distribution in pin fin
4. Determination of heat transfer coefficient in Natural Convection
5. Determination of heat transfer coefficient in Forced Convection
6. Determination of Emissivity of a Test surface
7. Determination of Stefan Boltzmann Constant

Text Book:

1. C P Kothandaraman S Subramanayam, Heat and Mass transfer data book, New Age International, 8^{th} Edition, 2014.

PEME 3102 Program Elective I Lab – (A) Automation and Control Engineering Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End semester: 25 marks
Credits: 1

Prerequisites

1. Basic Electronics
2. Fluid Mechanics

Course Objectives:

1. To familiarize with different valves and control system for pneumatics/hydraulics, electro- pneumatics/ electro-hydraulics circuits
2. To familiarize with setup and execution of pneumatics/hydraulics, electro- pneumatics/ electro-hydraulics circuits using experimental kit

Course Outcomes:

Upon completion of this lab course, the student will be able to:

1. Set up and execute Hydraulic circuit(s) using experimental kit.
2. Set up and execute Pneumatic circuit(s) using experimental kit.
3. Design Hydraulic/Pneumatic/Electro Pneumatic circuit for defined automation application.
4. Justify selected component(s)/system from manufacturer's catalogue(s) for automation application under study.

List of Experiments:

1. Study of basic circuits using Hydraulics Trainer Kit
2. Study of basic circuits using Pneumatic Trainer Kit
3. Study of basic circuits using Electro Hydraulics Trainer Kit
4. Study of basic circuits using Electro Pneumatic Trainer Kit
5. Analyze Hydraulic circuit(s) and simulate for different working conditions
6. Analyze Pneumatic circuit(s) and simulate for different working conditions
7. Design Hydraulic/Pneumatic system for suitable automation application using manufacturers catalogues
8. Report of field visit to any automation Industry/Environment

PEME 3102 Advanced Fluid Mechanics Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End sem: 25 Marks
Credits: 1

Prerequisites:

1. Engineering Mathematics
2. Engineering Physics
3. Fluid Mechanics

Course Objectives:

1. To understand basics of numerical analysis
2. To analyze and process the experimental data/observations pertaining to fluid mechanics
3. To interpret the results obtained from numerical analysis
4. To Compare the results with available theoretical/experimental results and deduce the conclusion from it

Course Outcomes:

Upon completion of this lab course, the student will be able to:

1. understand basics of numerical analysis
2. To analyze and process the experimental data/observations pertaining to fluid mechanics
3. interpret the results obtained from numerical analysis
4. Compare the results with available theoretical/experimental results and deduce the conclusion from it

List of Experiments:

1.	Determination of boundary layer thickness
2.	Determination of shear force on plate
3.	Determination of drag on airfoil
4.	Determination of Cd and CL for Sphere
5.	Determination of Cd and CL for Cylinder
6.	Laminar flow through a pipe (Friction factor, Entry length, Velocity Profile)
7.	Turbulent flow through a pipe (Friction factor, Entry length, Velocity Profile)

ME 3102 Program Elective I Lab – (D) Non Destructive Evaluation and Testing Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End semester: 25 marks
Credits: 1

Prerequisites:
1. Materials Technology 1
2. Materials technology 2
3. Manufacturing process

Course Objectives:
1. To understand the application of the tools at hand to maximize the efficiency and quality of inspections.
2. To understand the context of NDT in the process of making safe components.
3. To conduct non destructive testing

Course Outcomes:
Upon completion of this lab course, the student will be able to:
1. Set up and calibrate non destructive testing equipment
2. Use techniques for proper examination of objects under inspection, ensuring strict adherence to safety regulations.
3. Interpret and evaluate results with respect to applicable codes, standards, and specifications.

List of Experiments:

1. Task based practical on Visual Inspection
2. Interpretations and discussions
3. Task based practical on Dye penetrant test
4. Interpretations and discussions
5. Task based practical on Magnetic particle test
6. Discussions and interpretations
7. Task based practical on Ultrasonic flaw detection
8. Discussions and interpretations

ME 3107 Manufacturing Processes III

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical examination: 25 Marks
Credits: 1

Objectives:

1. To study conventional machining operations.
2. Understand the different types of cutting of ferrous and non-ferrous metals by various methods and welding processes and characteristics.
3. Understand the concepts of unconventional machining process, types of unconventional machining process.

Course Outcomes:
Learner will be able to:

1. Select required manufacturing process for selected component.
2. Analyze and estimate machining time for lathe machine, drilling machine, milling machine etc.
3. Estimate approximate cost of assembly; prepare conferral (investiture) of manufactured assembly.
4. Understand codes used in programing for CNC machine and basics of manufacturing selected component on CNC machine.

Course contents:

Manufacture assembly involving following operations of minimum 5 components.

1. Turning, Step turning, Taper turning, Grooving, Precision turning, Thread cutting, knurling,
2. Shaping, Drilling, Milling, Grinding, Welding or suitable joining process.
3. Use of CNC machine for precision manufacturing.

Term Work: Manufacture any one assembly from following assembly list:

1. Press Tool Assembly.
2. Couplings.
3. Joints.
4. Wheel Support Assembly.
5. Bearing Puller.

Text Book:

1. Elements of Workshop Technology, Hazra Chaudhary Vol I, II.

Reference Books:

1. Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.
2. Workshop Technology part I, II & III, W. A. J. Chapman.
3. Introduction to Manufacturing Processes, John A. Schey, McGraw-Hill.

ME 3201 Applied Thermodynamics

Teaching Scheme
Lecture: 3 Hrs/week
Tutorial: 1Hr/week

Examination Scheme
In Semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisite:
1. Engineering Thermodynamics
2. Fluid mechanics
3. Heat Transfer

Course Outcome:

Students will be able to
1. Comprehend combustion processes and cycles in IC engines.
2. Ascertain the performance parameters of IC engines from given data.
3. Evaluate isothermal and volumetric efficiency of reciprocating compressor
4. Analyze refrigeration cycles and calculate COP
5. Plot psychrometric processes and perform air conditioning load calculations.
6. Construct velocity triangles of Turbomachines.

Unit 1: IC Engines

Fuel air cycle, actual cycle, combustion in SI engine, combustion in CI engine, Testing of IC engines **(10 Hrs)**

Unit 2: Reciprocating Compressors

Computation of work done, isothermal efficiency, volumetric efficiency, free air delivery, multi-staging of compressor, inter-cooling and after-cooling, capacity control of compressor **(8 Hrs)**

Unit 3: Refrigeration

Basic refrigeration cycles, cascade and multistage refrigeration, vapor absorption system **(8 Hrs)**

Unit 4: Psychrometry

Basic concepts and definitions, psychrometric chart**,** Analysis of various psychrometric processes **(8 Hrs)**

Unit 5: Introduction to Turbo machinery

Classification of turbo machines, comparison with positive displacement machines, fundamental equation governing turbo machines, velocity triangles and their analysis **(6 Hrs)**

Text Books:
1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill
2. M. L. Mathur and R. P. Sharma, A course in Internal Combustion Engines
3. S. Domkundwar, C. P. Kothandraman, A. Domkundwar, Thermal Engineering, Dhanpat Rai & Co.
4. Arora C. P. , Refrigeration and Air Conditioning, Tata McGraw-Hill
5. Manohar Prasad, Refrigeration and Air Conditioning , Willey Eastern ltd

References:

1. Dossat Ray J, Principles of refrigeration, Willey Eastern Ltd
2. Stockers W.F. and Jones J.W. , Refrigeration and Air Conditioning, McGraw Hill International
3. ASHRAE and ISHRAE handbooks

ME3202 - Machine Design

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1 Hr/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 4

Prerequisites:

1. Stress-Strain relationships, types of loads and stresses (S.O.M.)
2. Engineering materials and their properties (Material Science and Metallurgy)

Course Objectives:

1 To design simple machine elements subjected to static loads.
2 To compute the torque transmission capacity by the given power screw.
3 To analyze the machine elements subjected to fluctuating loads.
4 To apply A.S.M.E. code for shaft design.
5 To calculate the size of a mechanical joint, subjected to eccentric load.
6 To determine the spring dimensions for given requirement.

Course Outcomes: Upon completion of this course, the student will be able to,

1 Design simple machine elements subjected to static loads.
2 Compute the torque transmission capacity by the given power screw.
3 Analyze the machine elements subjected to fluctuating loads.
4 Apply A.S.M.E. code for shaft design.
5 Calculate the size of a mechanical joint, subjected to eccentric load.
6 Determine the spring dimensions for given requirement.

Contents

Unit I: Introduction to Design Engineering: Design considerations, design process, design synthesis, standards in design, selection of materials, and selection of manufacturing processes.
Unit II: Design against static load: Modes of failures, types of stresses, theories of failures, design of simple machine elements.
Unit III: Design against fluctuating load: Fatigue failure, endurance limit, design for infinite and finite life, for completely reversed and fluctuating loads.
Unit IV: Design of machine elements: Design of shafts, couplings, power screws, mechanical joints, and mechanical springs.

Suggested Texts and Reference Materials:

1) Shigley J.E. and Mischke C.R., “Mechanical Engineering Design”,McGraw Hill Publication Co. Ltd.
2) Spotts M.F. and Shoup T.E. ,“Design of Machine Elements” ,Prentice Hall International.
3) Black P.H. and O. Eugene Adams ,“Machine Design”,McGraw Hill Book Co. Inc.
4) Willium C. Orthwein,“Machine Components Design”,West Publishing Co. and Jaico Publications House.
5) Bhandari V.B ,“Design of Machine Elements”, Tata McGraw Hill Publication Co. Ltd.
6) Juvinal R.C,“Fundamentals of Machine Components Design”,John Wiley and Sons.
7) Hall A.S., Holowenko A.R. and Laughlin H.G,“Theory and Problems of Machine Design” , Schaum’s Outline Series.
8) Design Data, P.S.G. College of Technology, Coimbatore.

ME 3203 – Metrology and Quality Control

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:

1. Basic Manufacturing Processes
2. Machine Design

Course Objectives:

1. Understand the objectives of metrology, methods of measurement, selection of measuring instruments and standards of measurement.
2. Understand the concept of tolerance, limits of size, fits, geometric and position tolerances, gauges and their design procedure.
3. Understand the advances in Metrology such as use of CMM, Laser, Machine Vision System for Metrology etc.
4. Understand the process of use of Quality Control Technique in engineering industries.
5. Understand Quality Management System.

Course Outcomes:
Upon completion of this course, the student will be able to:

1. Select suitable instrument / gauge / method to measure linear and angular dimensions.
2. Calibrate measuring instruments
3. Design inspection gauges
4. Select and apply appropriate Quality Management Tool and Quality Control Technique for clearly defined problem.
5. Apply Statistical Quality Control tool(s) to for clearly defined problem.

Unit 1: Introduction to Calibration & Geometric Form Measurement 8 Hrs.

Introduction: Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision
Calibration: Concept and procedure, traceability Comparators: Mechanical, Pneumatic, Optical, Electrical (LVDT)
Geometric Form Measurement: Straightness, Flatness, Roundness - Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate.

Unit 2: Design of Gauges and Dedicated Metrology 9 Hrs.

Design of Gauges: Tolerances, Limits and Fits [IS 919-1993], Taylor's principle, Types of gauges, Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design (numerical).
Thread Metrology: Thread form errors, Measurement of Minor, Major and Effective diameter (Three Wire Method), Flank angle and Pitch, Floating Carriage Micrometer (Numerical).

Gear Metrology: Errors in Spur Gear form, Gear tooth Vernier, Constant chord, Base tangent (Numerical), Gear Rolling Tester. Profile Projector, Tool maker's microscope and their applications

Unit 3: Advances in Metrology **9 Hrs.**

Coordinate Measuring Machine (CMM): Fundamental features of CMM – development of CMMs – role of CMMs – types of CMM and Applications, – types of probes

Machine Vision Systems: vision system measurement – Multisensory systems.

Interferometer: Principle, NPL Interferometer

Laser Metrology: Basic concepts of lasers, advantages of lasers, laser interferometers, types, applications

Unit 4: Concept of Quality and Statistical quality control **8 Hrs.**

Various Definitions and Quality Statements, Cost of quality & value of quality, Deming's cycles & 14 Points, Juran Trilogy approach, Old New Seven Tools, Quality Circles.

Statistical quality control: Statistical concept, Frequency diagram, Concept of variance analysis, Control Chart for Variable (X & R Chart) & Attribute (P & C Chart), Process capability(Indices: cp, cpk, ppk), Statistical Process Control (Numerical).

Unit 5: Acceptance Sampling and TQM **8 Hrs.**

Acceptance Sampling: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: Single, Double (Numerical), Multiple, Comparison of Plan, calculation of sample size, AOQ, Probability of Acceptance (Numerical)

TQM: Introduction, Quality Function Deployment, 5S, Kaizen, Poka yoke, Kanban, JIT, FMECA, Zero defects, TPM. Six Sigma: DMAIC - Concept and Applications.

Quality Management System: Need for quality management system – design of quality management system - quality management system requirements – ISO 9001, TS-16949, ISO-14000, Quality Audit

References:

1 Jain R.K., Engineering Metrology, Khanna Publication.

2 I. C. Gupta, Engineering Metrology, Dhanpath Rai Publication.

3 Bewoor A. K. and Kulkarni V. A., Metrology and Measurements, Tata McGraw hill Publication.

4 Narayana K.L., Engineering Metrology, Scitech Publications (India) Pvt Limited.

5 Juran J. M., Quality Handbook, McGraw Hill Publications.

6 Grant S.P., Statistical Quality Control, Tata McGraw hill Publication.

7 ASTME, Handbook of Industrial Metrology, Prentice Hall of India Ltd.

8 Basterfield D. H., Quality control, Pearson Education India, 2004.

9 Kulkarni V. A. and Bewoor A. K., Quality Control, John Wiley Publication.

PEME 3201 Program Elective II – (A) Machines and Mechanisms

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Engineering Mechanics
2. Rigid Body Dynamics
3. Analysis and Synthesis of Mechanisms

Course Objectives:

1 To understand the constructional and geometrical features of gears.

2 To determine the forces in gear pairs.

3 To analyze the gear trains for torque and motion.

4 To understand the constructional and operational features of flexible drives

5 To become conversant with balancing problems of machines.

6 To obtain the unbalanced forces and couples for rotating and reciprocating masses.

Course Outcomes: The students will be able to,

1. Compute the unbalanced forces and couples for rotating and reciprocating masses
2. Describe the constructional features, classification and applications of gears.
3. Analyze the gear trains for given motion transmission.
4. Compute the operational parameters of gear pair for given motion transmission.
5. Explain constructional and operational features of flexible drives.
6. Determine the torque capacity of clutches and brakes.

Contents: Spur Gear 6 Hrs.
Unit 1:

Gear drives: Classification, features, selection, applications.
Spur gear: Terminology, law of gearing, tooth profile, arc of contact, contact ratio, interference and undercutting, standard gear tooth systems, force analysis.

Unit 2: Helical, Bevel, Worm and Worm Wheel 4 Hrs.

Helical gears: Terminology, virtual number of teeth, force analysis.
Bevel Gear: Classification, terminology, formative gear, force analysis.
Worm and worm wheel: Advantages and limitations, terminology, geometrical relationships, force analysis, efficiency.

Unit 3: Gear Trains 6 Hrs.

Types of gear trains, analysis of epicyclic gear trains, holding torque – simple, compound and epicyclic gear trains, torque on sun and planetary gear train.

Unit 4: Friction Clutches, Brakes and Dynamometer 6 Hrs.

Pivot and collar friction, plate clutches, cone clutches, centrifugal clutch, torque transmitting capacity. Classification of brakes, shoe brakes, block brakes, band brakes, and band and block brakes, braking torque analysis. Different types of absorption and transmission type dynamometer.

Unit 5: Belt, Rope and Chain Drives 6 Hrs.

Belt drive: Materials and construction, classification, features, geometric relationships, tensions in belt, maximum power transmission, selection from manufacturer's catalogue, belt tensioning methods.
Wire Ropes: Construction of wire ropes lay of wire ropes, stresses in wire rope, selection of wire ropes, rope drum construction and design.
Chain Drives: Classification, geometric features, polygon effect, modes of failure for chain, lubrication of chains.

Unit 6: Balancing of machines and Step–Less-Regulation 8 Hrs.

Balancing: Static and dynamic balancing, balancing of rotating masses in single and several planes, primary and secondary balancing of reciprocating masses, balancing in single cylinder engines, balancing in multi-cylinder in-line engines, direct and reverse cranks method -radial and V engines.
Stepless regulation: Continuous Variable Transmissions - Geometry, Velocity and torque analysis of Faceplate variators, Conical variators, Spheroidal and cone variators, Variators with axially displaceable cones, PIV drives.

Text Book:

1 Ashok G. Ambekar, "Mechanism and Machine Theory", Prentice Hall, India

References:

1 S. S. Ratan, "Theory of Machines", Tata McGraw Hill
2 Thomas Bevan, "Theory of Machines" CBS Publisher and Distributors, Delhi
3 Asok Kumar Mallik, Amitabha Ghosh, Gunter Dittrich, "Kinematic Analysis and Synthesis of Mechanisms"
4 Sadhu Singh, "Theory of Machines", Pearson
5 Shigley J. E., and Uicker J.J., "Theory of Machines and Mechanism", McGraw Hill Inc.
6 Hall A. S., "Kinematics and Linkage Design", Prentice Hall
7 Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery", Person Education
8 Erdman A.G. and Sandor G.N., "Mechanism Design, Analysis and Synthesis" Volume-I, Prentice -Hall, India

PEME 3201 Product Design and Manufacturing

Teaching Scheme – Swayam Online

Examination Scheme:
In Semester Exam: 50 Marks
End semester: 50 Marks
Credits: 3

Brief information:

Innovation, better management, throughput improvements, and expansion of new technologies have led Product Design and Manufacturing as a compelling field for the students. Managing the product development process, right from idea generation to final product manufacturing has to be systematic and effective to meet the customer needs, while incorporating the time-to-market constraint as well. This course presents an overview of the product design and development process, along with the manufacturing systems aspects. The concepts Design for Manufacturing, Assembly, and Environment, and analytical tools for development, costing and manufacturing would help the students and practitioners learn to conceptualize, design, and manufacture competitively-priced quality products. Reverse Engineering, Prototyping and Simulation using soft tools are also incorporated make the students learn the advanced methods in manufacturing.

Course Outcomes:

By taking this course, the learner will be able to–

1. Apply the product design and manufacturing techniques for product development
2. Choose and apply appropriate solutions for product development.
3. Choose appropriate models for Design for Environment, and Quality Control
4. Develop programs to demonstrate some of the current advances in
: Computer Integrated Manufacturing

Course layout

Week 1 : Introduction to product design and manufacturing
Week 2 : Product design morphology
Week 3 : Visual Design, and Quality Function Deployment (QFD)
Week 4 : Value Engineering
Week 5 : Material, and Manufacturing process selection
Week 6 : Design for Manufacturing, Assembly, and Maintenance
Week 7 : Design for Environment, and Quality Control
Week 8 : Patenting, and Creativity
Week 9 : Rapid Prototyping
Week 10 : Plant Layout Design
Week 11 : Computer Integrated Manufacturing
Week 12 : Reverse Engineering, and Managing Competitiveness

Books and references

- Eppinger, S. and Ulrich, K., 2015. Product design and development. McGraw-Hill Higher Education
- Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009. Integrated product and process design and development: the product realization process. CRC Press.
- Boothroyd, G., 1994. Product design for manufacture and assembly. Computer-Aided Design, 26(7),

PEME 3201 Introduction to Robotics (Online course Swayam)

Teaching Scheme: Swayam Online

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Course Objective

1. To get acquainted with basic components of robotic systems.
2. To study various gripper mechanisms and sensors and understand role of suitable control system.
3. To understand statistics & kinematics of robots
4. To develop competency in obtaining desired motion of the robot.
5. To study various programming methods in robotics.
6. To understand need of modern techniques in robotics.

Course Outcomes:

On completion of the course, students will be able to -

1. Identify different type of robot configuration with relevant terminology.
2. Select suitable sensors, actuators and drives for robotic systems.
3. Understand kinematics in robotic systems.
4. Design robot with desired motion with suitable trajectory planning.
5. Select appropriate robot programming for given application.
6. Understand need of IoT, machine learning, simulation in robotics

Course Content

- Introduction to robotics- History, growth; Robot applications- Manufacturing industry, defense, rehabilitation, medical etc., Laws of Robotics
- Robot mechanisms; Kinematics- coordinate transformations, DH parameters
- Forward kinematics, Inverse Kinematics
- Jacobians, Statics, Trajectory Planning
- Actuators (electrical)- DC motors, BLDC servo motors
- Sensors , sensor integration
- Control – PWM, joint motion control, feedback control
- Computed torque control
- Perception, Localisation and mapping
- Probabilistic robotics, Path planning, BFS; DFS; Dijkstra; A-star; D-star; Voronoi; Potential Field; Hybrid approaches
- Simultaneous Localization and Mapping
- Introduction to Reinforcement Learning

Books and references:

1. Robert J Schilling, Fundamentals of Robotics, Prentice Hall India, 200
2. John J Craig, Introduction to Robotics, Prentice Hall International, 2005

	PEME3202(A) Computational Fluid Dynamics	
Teaching Scheme: **Theory: 3 Hrs/week** **Credit: 3**		**Examination Scheme:** **In Sem: 25+25 Marks** **End Sem: 50 Marks**

Prerequisites	
	Fluid dynamics, Heat transfer, Numerical methods
Course Objectives	
	To introduce students to,
	1. Finite volume method (FVM) of discretization for differential equations ,
	2. Development of solution of discretized equations using various methods,
	3. Development of numerical codes for diffusion and convection problems,
	4. CFD techniques to fluid dynamics and heat transfer problem,
Course Outcomes	
	Students will be able to
	1. Discretize a given differential equation with FVM,
	2. Write a numerical code for diffusion and convection problems,
	3. Develop a Navier-Stokes equation solver,
	4. Apply CFD techniques to real life industrial problems.
Unit 1	**Introduction to CFD:**
	Governing equations: the continuity equation, momentum equation and energy equations, convective forms of the equations and general description, Reynolds transport theorem. Classification of partial differential equations; physical examples of elliptic, parabolic and hyperbolic equations. Mathematical nature of the flow equations& their boundary conditions.
Unit 2	**Discretization Methods:**
	Discretization Methods: The discretization concept, the structure of discretization equations, methods of deriving the discretization equations. Finite difference method, Finite volume method. Concept of consistency, accuracy, stability and Convergence.
Unit 3	**Solution of Discretization Equations**
	Tri-Diagonal Matrix Algorithm (TDMA), Application of TDMA Method to Two dimensional Problem
Unit 4	**Finite Volume Method for Diffusion Problems:**
	Finite Volume Method for Diffusion Problems: Finite Volume Method for one dimensional steady state Diffusion, Worked Example – One dimensional steady state Diffusion, Finite Volume Method for Two Dimensional Diffusion Problem
Unit 5	**Finite Volume Method for Convection-Diffusion Problem:**

	Finite Volume Method for Convection-Diffusion Problem: Steady one dimensional convection and Diffusion, Central Differencing Scheme, Properties of Discretization Schemes, Assessment of Central Differencing Schemes for Convection Diffusion Problem, Upwind Differencing Scheme Hybrid Differencing Scheme
Unit 6	**Solution Algorithms:**
	Solution Algorithms for Pressure-Velocity Coupling Steady Flow, Staggered Grid, Momentum Equations, Simple Algorithm, Assembly of Complete Method.
References	
1	S. V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill.
2	John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor &Francis
3	Versteeg, H. K. and Malalasekara, W. (2008). Introduction to Computational Fluid Dynamics: The Finite Volume Method. Second Edition (Indian Reprint) Pearson Education.
4	4. Anderson, J.D. Computational Fluid Dynamics, McGraw Hill, 1995.

PEME 3202 Program Elective III – (B) Mechanics of Composite Materials

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Engineering Mechanics
2. Strength of Materials
3. Engineering Metallurgy

Course Objectives:
1. To understand a perspective utilization and processing of composite materials
2. To analyze lamina of composite material at micro and macro level
3. To analyze the laminated composite material at macro level
4. To understand testing methods of composite materials to evaluate mechanical properties

Course Outcomes:
Upon completion of this course, the student will be able to:
1. Define need, utilization of class of composite material, its constitution, list its application fields and demonstrate the various fabrication process
2. Micro and macro-mechanical analysis of the composite material at lamina level
3. Analyze the laminated composite material at a macro level using classical lamination theory
4. Define testing methods of composite materials to evaluate mechanical properties

Unit 1. Introduction to composite: 06 Hrs
Introduction to advanced materials and types, Definition, General Characteristics, Applications, Fibers, Types of fibers, Mechanical Properties of fibers; Matrix, Types of matrix, Polymer Matrix- Thermoset and Thermoplastic, Fillers/Additives/Modifiers of Fiber Reinforced Composites

Unit 2. Manufacturing of composites: 06 Hrs
Fabrication process for thermoset and thermoplastic PMC, open mould process as hand layup techniques; structural laminate bag molding, production procedures for bag molding; filament winding, and Closed mould process as pultrusion, performing, thermo-forming, injection molding, blow molding, Process parameters.

Unit 3. Elastic and strength Behavior of Lamina: 12 Hrs
Introduction, Volume and mass fraction, density, void content, evaluation of elastic moduli, ultimate strength of unidirectional lamina
Review and definition of stress, strain and Elastic Moduli, Hooke's Law for different types of materials, Hook's law for 2D unidirectional and angular lamina, engineering constants of an angle lamina, Strength failure theories of an angle lamina

Unit 4. Elastic Behavior of Laminate: **10 Hrs**

Introduction to Laminate Code, Strain-displacement relations, Stress-strain relation for a laminate, force and moment resultants related to mid plane strains and curvatures, In-Plane engineering constants of a laminate, Flexural engineering constants of a laminate

Unit 5. Testing of Composites: **06 Hrs**

Societies for Testing Standards, Background to Mechanical Testing of Composites, Test Method and analysis of Tensile Properties, Compressive Properties, Flexural Properties, In-Plane Shear Properties, Inter-laminar Shear Strength properties, Impact Properties.

Reference Books:

1. Autar K. Kaw, "Mechanics of Composite Materials", CRC Press, Taylor & Francis Group, 2012.

2. Isaac M. Daniels, Ori Ishai, "Engineering Mechaincs of Composite Materials", Oxford University Press, 2010

3. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004.
4. Robert M. Jones, "Mechanics of Composite Materials" 2nd Edition, CRC Press 1998

PEME 3202 Program Elective III – (D) Jig and Fixture Design

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Manufacturing Processes-I
2. Manufacturing Processes-II
3. Manufacturing Processes-III

Co-requisites:
NIL

Course Objectives:
1 To learn appropriate clamping method for jig or fixture.
2 To learn about locating devices and redundant location in jig or fixture.
3 To develop capability to design jigs and fixtures for lathe, milling and drilling M/C.

Course Outcomes:
Upon completion of this course, students will be able to:
1 Select appropriate clamping devices for jig or fixture.
2 Define basics of jig or fixture and choose locating devices for jig or fixture.
3 Index component and design jig for a given application.
4 Design milling fixtures for a given applications.
5 Apply knowledge of turning, grinding, boring, broaching, welding and modular fixtures for mass production applications.

Unit 1: Introduction (3 hrs)
Definition of Jigs and Fixtures, Difference between jigs and fixtures, Advantages, Steps for design.

Unit 2: Design of locators (6 hrs)
General principle of degrees of freedom and constraints, fool-proofing, other principles in the design of locators, various types of locators.

Unit 3: Design of clamps 6 hrs)
Principles of Clamping, Classification of Clamps.

Unit 4: Drilling Jigs (6 hrs)
Introduction, types of jigs, components of jig.

Unit 5: Design of milling fixtures (6 hrs)
Introduction, salient features of milling fixtures, classification of milling fixtures.

Unit 6: Other types of fixtures (6 hrs)
Turning, grinding, boring, broaching, welding and modular fixtures, advantages and disadvantages of modular fixtures, consideration of safety factors while designing of jig and fixtures.

Suggested Texts and Reference Materials:

1 K. Venkataraman, 'Design of jigs, fixtures and press tools', Wiley.
2 Kempster, 'Introduction to Jigs & Tool Design', Viva Books Pvt Ltd,1998.
3 D. Cyryll, G. H. Lecain, V. C. Goold, 'Tool Design', McGraw Hill, 2002.
4 P. H. Joshi, 'Jigs and Fixtures design manual', McGraw Hill, 2003.

ME 3204 Applied Thermodynamics Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
InSemester: 25 marks
Credits: 1

Prerequisite:
1. Engineering Thermodynamics
2. Fluid mechanics
3. Heat Transfer

Course Objectives:
1. To study performance parameters of IC Engines.
2. To conduct trial and do performance calculations for reciprocating air compressor.
3. To evaluate performance of refrigeration cycles.
4. To analyze various psychrometric processes.
5. To verify impulse momentum principle.

Course Outcome:

Upon completion of this lab course, the student will be able to
1. Conduct trial on IC engine and calculate performance parameters.
2. Conduct trial on reciprocating air compressor to ascertain volumetric and isothermal efficiency
3. Compute performance parameters of refrigeration systems
4. Perform trial on air conditioning tutor to understand different psychrometric processes
5. Perform experiment to understand impulse momentum principle.

List of Experiments:
1. Trial on petrol engine
2. Trial on Diesel engine
3. Trial on vapor compression test rig
4. Trial on ice plant test rig
5. Trial on air conditioning test rig
6. Trial on reciprocating air compressor
7. Verification of impulse momentum principle.

Text Books:
1. V. Ganesan, Internal Combustion Engines, Tata McGraw Hill
2. M. L. Mathur and R. P. Sharma, A course in Internal Combustion Engines
3. S. Domkundwar, C. P. Kothandraman, A. Domkundwar, Thermal Engineering, Dhanpat Rai & Co.
4. Arora C. P. , Refrigeration and Air Conditioning, Tata McGraw-Hill
5. Dr. Bansal R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications

ME3205 - Machine Design Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral: 25 Marks
Credits: 1

Prerequisites:

1. Stress-Strain relationships, types of loads (S.O.M.)
2. Engineering materials and their properties (Material Science and Metallurgy)
3. Principles of engineering drawing, fits and tolerances (Machine Drawing)

Course Objectives:,

1 To describe the design process, materials and manufacturing aspects and theories of failures.
2 To select the necessary data from relevant standards/standard guidelines.
3 To apply the necessary stress equations to design the given assembly.
4 To present the design work in the form of report and drawings.

Course Outcomes: Upon completion of this course, the student will be able to

1 To describe the design process, materials and manufacturing aspects and theories of failures.
2 To select the necessary data from relevant standards/standard guidelines.
3 To apply the necessary stress equations to design the given assembly.
4 To present the design work in the form of report and drawings.

Contents:

A) Design Projects: - Group of students will be designing an assembly for the given application. The design process and the calculations will be mentioned in design report. Assembly and details drawings will be prepared on drawing sheets.
B) Lab Assignments: - Students will be completing lab assignments based on design process, engineering materials, manufacturing considerations in design and theories of failures.

Suggested Texts and Reference Materials:

1. Shigley J.E. and Mischke C.R., “Mechanical Engineering Design”,McGraw Hill Publication Co. Ltd.
2. Spotts M.F. and Shoup T.E. ,“Design of Machine Elements” ,Prentice Hall International.
3. Black P.H. and O. Eugene Adams ,“Machine Design”,McGraw Hill Book Co. Inc.
4. Willium C. Orthwein,“Machine Components Design”,West Publishing Co. and Jaico Publications House.
5. Bhandari V.B ,“Design of Machine Elements”, Tata McGraw Hill Publication Co. Ltd.
6. Juvinal R.C,“Fundamentals of Machine Components Design”,John Wiley and Sons.
7. Hall A.S., Holowenko A.R. and Laughlin H.G,“Theory and Problems of Machine Design” , Schaum’s Outline Series.
8. “Design Data”,P.S.G. College of Technology, Coimbatore.

ME 3206 Metrology and Quality Control Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In semester: 25 marks
Credits: 1

Course Objectives: Students are expected to –

1 **Understand** the methods of measurement and selection of measuring instruments.
2 To learn the concept of tolerance, limits of size, fits, geometric and position tolerances, gauges and their design procedure..
3 To learn the process of use of Quality Control Technique in engineering industries.

Course Outcomes:

Upon completion of this course, students will be able to:

1 **Select** suitable instrument / gauge / method to measure linear and angular dimensions.
2 **Calibrate** measuring instruments
3 **Select** and **apply** appropriate Quality Management Tool and Quality Control Technique for clearly defined problem.
4 **Apply** statistical quality control tool to for clearly defined problem.

List of Experiments:

Part [A] Experiment no. 1 and 6 are mandatory. Perform any three from experiments no. 2 to 5 & any three

1. Measurement of linear and angular dimensions using standard measuring instruments.
2. Error determination of linear / angular measuring instruments and determination of linear and angular dimensions of given part, MSA (Gauge R & R).
3. Calibration of measuring instrument. Example – Dial gauge, Micrometer, Vernier (any one)
4. Verification of dimensions & geometry of given components using Mechanical comparator.
5. Machine tool alignment testing on machine tool – Lathe / Drilling / Milling.
6. Demonstration of surfaces inspection using optical flat/interferometers.
7. Determination of geometry & dimensions of given composite object / single point tool, using profile projector and tool maker's microscope.
8. Measurement of thread parameters using floating carriage diameter measuring machine.
9. Measurement of spur gear parameters using Gear Tooth Vernier, Span Micrometer/ Gear Rolling Tester.
10. Determination of given geometry using coordinate measuring machine (CMM).

Part [B] Statistical Quality Control (SQC) (Any 2 assignments)

Note - Use of computational tools [such as Minitab / Matlab / MS Excel] are recommended

1. Analyze the fault in given batch of specimens by using Seven quality control tools for engineering application USING STD. FORMATS.
2. Determination of process capability from given components and plot variable control chart/attribute chart.
3. Case study on various tools in Total Quality Management (TQM).

Text Book:

1. Jain R.K., Engineering Metrology, Khanna Publication.
2. I. C. Gupta, Engineering Metrology, Dhanpath Rai Publication.
3. Bewoor A. K. and Kulkarni V. A., Metrology and Measurements, Tata McGraw hill Publication.
4. Narayana K.L., Engineering Metrology, Scitech Publications (India) Pvt Limited.
5. Juran J. M., Quality Handbook, McGraw Hill Publications.
6. Grant S.P., Statistical Quality Control, Tata McGraw hill Publication.
7. ASTME, Handbook of Industrial Metrology, Prentice Hall of India Ltd.
8. Basterfield D. H., Quality control, Pearson Education India, 2004.
9. Kulkarni V. A. and Bewoor A. K., Quality Control, John Wiley Publication.

	PEME3203A Computational Fluid Dynamics Lab	
Teaching Scheme: **Theory: 2 Hrs/week** **Credit: 1**		**Examination Scheme:** **ESE: 25 Marks**

Prerequisites	
	Fluid dynamics, Heat transfer, Numerical methods
Course Objectives	
	To introduce students to,
	1. Finite volume method (FVM) of discretization for differential equations.,
	2. Development of solution of discretized equations using various methods,
	3. Development of numerical codes for diffusion and convection problems,
	4. CFD techniques to fluid dynamics and heat transfer problem
Course Outcomes	
	Students will be able to
	1. Carry out discretization and numerical formulation of a given differential equation with FVM,
	2. Write a numerical code for diffusion and convection and pressure-velocity coupling,
	3. Develop a Navier-Stokes equation solver,
	4. Apply CFD techniques to real life industrial problems using CFD softwares
	Programming Assignments: 1 Development of FVM code for one dimensional steady state and unsteady conduction problem 2 Development of FVM code for two dimensional steady state conduction problem 3 Development of FVM code for steady state one dimensional Convection-Diffusion Problem using central differencing scheme 4 Development of FVM code for steady state one dimensional Convection-Diffusion Problem using upwind and other convection schemes 5 Lid Driven Cavity problem using SIMPLE algorithm on structured grid 6 Lid Driven Cavity problem using PISO algorithm unstructured grid 7 Assignment on conduction through a composite slab using Fluent 8 Assignment on Lid Driven cavity on Fluent and comparison with the code 9 Assignment on flow through a pipe using Fluent 10 Assignment on meshing of a complex geometry **Visiting Lectures:** Visiting lectures will be conducted by the professionals from Industries/Research labs etc.

References	
1	S. V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill.
2	John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor &Francis
3	Versteeg, H. K. and Malalasekara, W. (2008). Introduction to Computational Fluid Dynamics: The Finite Volume Method. Second Edition (Indian Reprint) Pearson Education.
4	4. Anderson, J.D. Computational Fluid Dynamics, McGraw Hill, 1995.

PEME 3203 Program Elective III Lab – (B) Mechanics of Composite Materials

Teaching Scheme	Examination Scheme
Practical: 2 Hrs/week	End semester: 25 marks
	Credits: 1

Course Objectives:

1. To understand a perspective on utilization of composite materials in structure
2. To analyze the composite material at lamina level
3. To analyze the laminated composite material
4. To understand methods of composite materials testing

Course Outcomes: Upon completion of this course, the student will be able to:

1. Demonstrate fabrication process of unidirectional polymer composites
2. Develop program to analyze lamina made of polymer matrix composite material
3. Develop program to analyze laminate made up of polymer composites
4. Test and evaluate mechanical properties of polymer composites as per ASTM standards

Lab work to be accomplished

1. Develop Program for micro mechanical analysis of composite lamina
2. Develop Program for macro mechanical analysis of composite lamina and laminate
3. Develop program for failure analysis of composite laminate using different failure theories.
4. Manufacturing of unidirectional and multidirectional fiber reinforced polymer matrix composites
5. Tensile testing of composite lamina to find out tensile strength and tensile modulus
6. Flexural testing of composite lamina to find out flexural strength and flexural modulus
7. Izod/Charpy impact test of composite lamina to find out impact strength

PEME 3203 Program Elective III Lab – (D) Jig and Fixture Design Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End semester: 25 marks
Credits: 1

Course Objectives:

1. To learn appropriate clamping method for jig or fixture.
2. To learn about locating devices and redundant location in jig or fixture.
3. To develop capability to design jigs and fixtures for lathe, milling and drilling M/C.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Select appropriate clamping devices for jig or fixture.
2. Utilize locating devices jig or fixture.
3. Index component for mass production using jig or fixture.
4. Design jigs and fixtures for a given applications.

Lab work to be accomplished

1. Design of jig for machine component
2. Design of fixture for machine component

ME 3207 Seminar

Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/week	In semester: 25 marks
	Credits: 1

Course Objectives:

1. To identify and compare technical and practical issues related to the area of course specialization.
2. To outline annotated bibliography of research demonstrating scholarly skills.
3. To prepare a well-organized report employing elements of technical writing and critical thinking.
4. To demonstrate the ability to describe, interpret and analyse technical issues and develop competence in presentation.

Course Outcome: With this seminar report and presentation, the student will be able to

1. To identify historic points of technological advance in engineering
2. To read, understand and interpret technical and non-technical information
3. To source and comprehend technical literature and other credible sources of information
4. To analyze sourced technical information for feasibility, viability, and sustainability
5. To produce clear, well-constructed, and well-supported written engineering documents
6. To demonstrate effective communication skills using various presentation techniques

Course Contents: The evaluation of the seminar report is proposed with the following stages.

Stage-I In this stage the student is expected to deliver the following: 1. Topic selection 2. Literature review 3. State of the art related to the topic of interest

Stage-II 1. Problem statement 2. Methodology 3. Scope and objectives A review of the student's progress should be made after In-Sem examination, within a week. During this review, the student is expected to complete Stage-1 and Stage-2.

Stage-III 1. Quantification of results 2. Concluding remarks or summary

Stage-IV 1. Final report 2. Final presentation/viva.

The final presentation/viva will be assessed by an internal panel. The internal panel will consist of the seminar guide and a subject expert, approved by the HOD.

The contents of the seminar report and presentation (as mentioned in section-3 and section-4) are expected to include the following: Abstract/Summary, Introduction: Scope and Methodology, Literature review (The review should be conducted from recent research papers), Case study and References.

References:

1. Technical Communication, Mike Markel, Bedford/St. Martin's; Ninth edition, 2009
2. Technical Writing, Basu, Prentice Hall India Learning Private Limited, 1st Edition, 2007
3. Technical Writing, O.N. Pandey, S.K. Kataria & Sons; 2014th edition
4. The Insider's Guide to Technical Writing, Kristaa Vaan Lann, XML Press, 2012
5. LaTeX Beginner's Guide, Stefan Kottwitz, Packt Publishing; 2nd edition

OEED1201 EL-IV Modal Analysis

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: Nil

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:

1. Advanced Mathematics and Numerical Techniques
2. Vibration and Acoustic

Course Objectives:

1. To teach the basics of the theory and practice of modal analysis
2. To introduce experimental methods in modal analysis
3. To teach basics of digital signal processing of measurements
4. To teach estimation and extraction of modal parameters (natural frequencies, damping and mode shapes) from measured data
5. To teach construction of mathematical models from extracted modal parameters
6. To introduce advanced topics on dynamic sub-structuring, modal reduction, modal expansion, model updating, and vibration testing of weakly nonlinear structures

Course Outcomes:

Students will, on completion of the course:

1. Get familiar with theoretical and practical aspects of structural dynamics
2. Develop the ability to plan for experimental testing of structural vibrations
3. Gain understanding of sensor and actuator selection and placement
4. Gain understanding of the basics of digital signal processing of measurements, and its impact on quality of measured data
5. Gain the ability to reconstruct mathematical models describing the structure based on experimental modal analysis
6. Appreciate role of modal analysis in system identification, model updating, and condition monitoring

Unit 1: Background and Theory of Modal Testing

Experimental Modal Analysis (EMA), Theoretical Modes, Time Domain Structural Response, The Frequency Domain Response, Experimental Modal Analysis (EMA) Procedure

Unit 2: Single-Degree-of-Freedom (SDoF) and 2DoF Systems

The Single Degree of Freedom System: Spring k, Mass m, Damper c, Motion of an SDoF System, The Impulse Response Function, h(t), The Frequency Response Function (FRF), Displaying the FRF Nyquist Plot, Structural Dynamic Relationships, Two Degrees of Freedom (2DoF), 2DoF Frequency Response

Unit 3: Multiple-Degrees of Freedom (MDoF) Systems

Natural Frequencies and Mode Shapes, Modal and Frequency Matrices, Orthogonality and Normalization, Decoupling the Equations, Single Point Excitation and Response, Mode Shapes for: Cantilever Beam, Mode Shape Animation

Unit 4: Some Essentials of Signal Processing

Analog to Digital (A-D) Conversion, Aliasing, FFT, DFT, Windowing for Continuous, Random and Transient Signals, System Identification Using the FFT, Signal Averaging Coherence, Rules of Signal Processing, Time and Frequency Domain Terminology

Unit 5: Setting up the Modal Test:

Support the Structure, Free Boundary, Mounting Transducers, Contact Resonance, Mounting Methods: Stud, Superglue, Beeswax, Magnet, Mounting Base, Double-Mount, Setting up the Analyzer, Random Excitation, Impact Excitation, Windowing the Response Coherence Function, Coherence Examples

Unit 6: Modal Parameter Extraction

Natural Frequencies, Modal Damping and Modal Constant, Modal Inferposition Using Single Mode Methods: “Quadrature” method, “Circle Fit” Method, Modal Residues, Multiple Mode Methods

Books:

1. Jimin He and Zhi-Fang Fu, Modal Analysis, Butterworth-Heinemann, Oxford, 2001, ISBN 9780750650793
2. D. J. Ewins, Modal Testing: Theory, Practice and Application, 2nd Edition, Wiley Publications, ISBN: 978-0-86380-218-8

MED 2101 Project Stage I

Teaching Scheme
Practical: 18 Hrs/week

Examination Scheme
InSem: 125 Marks
Oral: 100 Marks
Credits: 9

Course Objectives:

1. To identify societal and engineering needs; formulate a problem statement, articulate aims and objectives to create solutions for complex problems.
2. To carry out literature Survey relevant to the problem and decide appropriate solution methodology to arrive at a solution of real life engineering problems.
3. To apply principles of mechanical engineering and interdisciplinary knowledge to carry out design analysis of complex engineering problems using research based methods.
4. To Form teams, work effectively and be able to plan the project activities for timely completion of the project.

Course Outcome:

After learning the course the students should be able to –

1. Identify societal and engineering needs; formulate a problem statement, articulate aims and objectives to create solutions for complex problems.
2. Survey literature relevant to the problem and decide appropriate solution methodology to arrive at a solution of real life engineering problems.
3. Apply principles of mechanical engineering and interdisciplinary knowledge to carry out design analysis of complex engineering problems using research based methods.
4. Form teams, work effectively and be able to plan the project activities for timely completion of the project.

Content:

The project work shall be based on the knowledge acquired by the student during the work and preferably it should meet and contribute towards the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.

Project Stage – I is an integral part of the project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation of mathematical model and design of the Set-up etc.

As a part of the progress report of Project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected dissertation topic. The student shall submit the duly certified progress report of Project work Stage-I in Standard format for satisfactory completion of the work by the concerned guide and Head of the Department.

MED2201 Project Stage II

Teaching Scheme	**Examination Scheme**
Practical: 28 Hrs/week	InSem: 200 Marks
	Oral: 150 Marks
	Credits: 14

Course Objectives:

1. To learn modern engineering tools and techniques during execution of the project and develop an ability of self-learning and life-long learning.
2. To develop sustainable and environment friendly solutions.
3. To inculcate a sense of academic integrity and ethics.
4. To present their solutions in the form of reports, presentations in front of a diverse group of people

Course Outcome:

After learning the course the students should be able to –

1. Learn modern engineering tools and techniques during execution of the project and develop an ability of self-learning and life-long learning.
2. Develop sustainable and environment friendly solutions.
3. Inculcate a sense of academic integrity and ethics.
4. Present their solutions in the form of reports, presentations in front of a diverse group of people.

Content:

In Project Work Stage – II, the student shall complete the remaining part of the project which will consist of the fabrication of set up required for the project, work station, conducting experiments and taking results, analysis & validation of results and conclusions.

The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work by the concerned guide and Head of the Department.

OEHS 4101A: ADVANCED COURSE IN ENTREPRENEURSHIP

FROM BUSINESS MODEL TO PRODUCT MARKET FIT

Core Contact hours: 45 Flex Contact Hours: 15
Assignments (done after class) are 30 hours

Assessment plan:
Class Participation and Assignments - 30%
Quizzes - 10%
Final Exam - 30%
Capstone Project - 30%

Prerequisite:

Basic Course or a student who has a Business Model and an MVP

Course Objectives:

1. To understand the importance of growth and to be able to chart a path towards growth
2. To revisit your business model
3. To give a growth orientation your customer acquisition, operations, revenue and sales strategy
4. To list and comply with the requirements relating to regulatory compliance
5. To be able to effectively pitch your venture to potential stakeholders

Course outcomes:

Students will be able to

1. Validate the business model designed for product market fit
2. Formulate and test the business strategies for the growth of business 3. Comply with the requirements relating to regulatory compliance for the business proposed
4. Pitch their venture to potential stakeholders

Description about course:

In this course, students will learn about how to achieve product market fit. They will revisit their business model and look for opportunities for growth in their customer segments, in their channels, and in the other blocks of the Business Model and validate it. Then they will set their traction goal and chase that during the course. They identify channels, enhance their revenue streams and focus on sales. They will learn to work on their financial model and make a pitch deck. They will build their Sales, Ops, Hiring, and Technology Plan. Potential show stoppers such as Compliances, Legal and Registrations will be covered as well.

Course Contents:

Module I: Getting Ready for Growth

• Why growth stage is different compared to startup phase
• Why Product-Market fit is not enough
• Case study
• To assess readiness for growth
•To chart a growth path

Module II: Expanding Customer Base

Revisit your business model and develop few variants (more business model types)
• Identify additional customer segments that your solution can address • Evaluate business models for the new customer segments
• Relook at the Problem Statement (can you expand the scope and scalability of your business by repositioning your problem statement?)
• Explore additional ways to monetize

Module III: Scaling

• How to gain traction beyond early customers
• Defining traction (in quantifiable terms) and identifying the most important metrics to measure traction
• Calculate cost of new customer acquisition
• Estimate your customer lifetime value (LTV)
• Identifying waste in your operations and focusing your team on what is important for traction

Module IV: Channels and Strategy:

• Identify Channels using Bulls Eye Framework
•Measuring the effectiveness of selected channels
• Budgeting and planning

Module V: Growing Revenues

• Stabilizing key revenue streams
• Developing additional revenue streams (licensing, franchising)
• Exploring new channels and partnerships

Module VI: Sales Planning:

Understanding why customers buy and how buying decisions are made; listening skills
• Sales planning, setting targets
•Unique Sales Proposition (USP); Art of the sales pitch (focus on customer needs, not on product
• Follow-up and closing a sale; Asking for the sale

Module VII: Strengthening Sales:
Building a professional sales team
• Sales compensation and incentives
• Sales planning, setting targets

Module VIII: Improving Margins

Testing price elasticity
• Optimizing costs and operational expenses
• Advanced concepts of unit costing

Module IX: Financial Modeling:

• Financial modeling of your venture's growth
• Analyzing competitor and peer's financial models

Module X: Legal :

• Overview of legal issues and their impact on entrepreneurs
• Importance of getting professional help (legal and accounting)
• Importance of being compliant and keeping proper documentation
• Patents and Intellectual property
• Trademarks

Module XI: Mentors, Advisors, and Experts:

• The importance of a Mentor and how to find one
• Role of business advisors and experts for specific targets in your growth plan

References:

https://lms.learnwise.org/

http://www.unstoppablegrowth.com/core/where_to_grow.asp?groupCode=

9 https://hbr.org/2003/12/growth-outside-the-core

https://www.boardofinnovation.com/business-revenue-model-examples/

https://hbswk.hbs.edu/item/do-bonuses-enhance-sales-productivity-a-dynamic structural-analysis-of-bonus-based-compensation-plans2

http://www.mca.gov.in/MinistryV2/registrarofcompanies.html

https://cleartax.in/s/annual-compliance-checklist-startups

http://www.wipo.int/portal/en/index.html

https://www.inc.com/young-entrepreneur-council/why-mentors-and-advisors-are-must haves-for-every-founder.html

CE 4102 Software Engineering

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits: 3

Prerequisites: Software Design and Architecture (CE 3203)

Course Objectives:
To facilitate the learner to -

1. Develop familiarity with the software design and component based software engineering.
2. Get exposure to the various facets of agile software process model.
3. Learn the basic concepts of refactoring.
4. Gain knowledge about the various aspects of designing and testing of web applications.

Course Outcomes:
By taking this course, the learner will be able to -

1. Apply the concepts of component-level design to realize the solution of a system.
2. Analyze the agile software process model for application development.
3. Analyze the refactoring methods to restructure the classes.
4. Make use of various concepts of designing and testing for web applications.

Unit 1: Software Design Concepts and Component-Level Design (07)
Design within the context of Software Engineering, The design process, Design concepts, Design model. Component-Level Design: What is a component, Designing class-based components, Steps of component-level design, Component-based development.

Unit 2: Introduction to Agile Software Development (07)
Why agile software development - Limitations of traditional process models, Evaluating Agile Benefits, Understanding the Agile Manifesto, Outlining the Four Values of the agile Manifesto, Defining the 12 Agile Principles, Agile approaches - Lean, Scrum and Extreme Programming, Agile team.

Unit 3: Agile Project Planning and Software Practices (07)
Agile project inception, User stories, Estimation, Agile plan.
Agile software practices: Refactoring, Test-driven development, Continuous integration.

Unit 4: Introduction to Refactoring (07)
What is Refactoring, Why and when to refactor, Duplicated code, Long method, Extract method, Large class, Extract class, Alternative classes with different interfaces, Move method, Move field, Rename method, Replace method with method object.

Unit 5: Refactoring Methods (07)
Replace data value with object, Change unidirectional association to bidirectional, Switch statements, Replace conditional with polymorphism.

Remove control flag, Introduce assertion, Replace constructor with factory method, Replace error code with exception.
Pull up field, Pull up method, Push down method, Push down field, Extract subclass, Extract superclass, Extract interface, Replace inheritance with delegation.

Unit 6: Design and Testing of Web Applications (07)

WebApp design quality, Design goals, Design pyramid, WebApp interface design, Asthetic design, Content design, Architecture design, Navigation design, Component-level design, Object-oriented hypermedia design method.
Testing concepts for WebApps, Testing process - overview, Content testing, User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing, Performance testing.

Text books:

1. Roger S. Pressman, '**Software Engineering: A Practitioners Approach'**, *Tata McGraw Hill*, (7th Edition) (2010).
2. Jonathan Rasmusson, **'The Agile Samurai: How Agile Masters Deliver Great Software',** *Shroff Publishers and Distributers (SPD)*, ISBN: 978-93-5213-411-3, (2016).
3. Martin Fowler, Kent Beck, John Brant, William Opdyke and Don Roberts, **'Refactoring: Improving The Design of Existing Code'**, *Pearson Education*, ISBN: 978-81-317-3466-7, (2017).
4. Mark C. Layton, Steven J. Ostermiller, **'Agile Project Management for Dummies',** *Wiley*, (2nd Edition), (2017).

Reference books:

1. Ian Sommerville, '**Software Engineering'**, *Person Education*, (8th Edition) (2008).
2. Grady Booch, James Rumbaugh, Ivar Jacobson, **'The Unified Modeling Language User Guide'**, *Pearson Education*, (2nd Edition) (2008).

Web References:

1. Official website of R. S. Pressman and Associates, Inc: http://www.rspa.com/
2. Agile Software process model: https://www.agilealliance.org/
3. Basics of Scrum: https://www.scrumalliance.org/

HS 4101 ORGANIZATIONAL BEHAVIOR

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:
To facilitate the learner to
1. Develop familiarity with the concepts related to organizational behavior.
2. Gain knowledge about personality traits and individual behavior.
3. Study group dynamics.
4. Get exposure to the recent trends in Organizational behavior.

Course Outcomes:
After completion of the course, students will be able to
1. Explain concepts of organizational behavior, its importance and culture.
2. Outline meaning of personality and how individual behavior impact organization.
3. Relate with ideas of group dynamics and influence of groups in work place.
4. Recall latest trends in Organizational behavior.

Unit I: Introduction (07)
Management and Organizational Behavior (OB), Organizational behavior in historical perspective, Developing an OB model, Challenges and Opportunities for OB, Foundation of individual behavior.

Unit II: Individual (08)
Personality, personality frameworks, big five model, perception, individual decision making, attitudes, components of attitudes, attitudes and behavior, Job attitudes, values

Unit III: Diversity and Ethics (06)
Environmental context : diversity and ethics, Communication, Case studies

Unit IV: Trends (07)
International organizational behavior, emotional intelligence, strategic organizational behavior, Intra-preneurship, flat organization

Unit V: Group Dynamics (08)
Foundation of group behavior, stages of group development, group decision making, team building, organizational conflicts and negotiation, power and politics

Unit VI: Dynamic Environment and Culture (06)
Information technology and globalization, Human resource policies and practices, Learning

Text Books:

1. Stephen P. Robbins, Timothi A.Judge, **'Organisational Behavior'**, 18th Global Edition, Pearson Education(2017),ISBN: 978-0-13-410398-3

2. Dr. S. S. Khanka, **'Organisational Behaviour (Text and Cases)',** S.Chand & Company Pvt.Ltd. (2018), ISBN 978-81-219-2014-8
3. Fred Luthans, **'Organizational Behavior '**, 12th Edition, McGraw Hill Publication, ISBN-978-1-25-909743-0

Reference Books:

1. Moorhead, Griffin, 'Introduction to Organizational Behavior', India Edition, Cengage Learning, ISBN: 978-81-315-1242-5
2. P. Subba Rao, 'Organisational Behaviour (Text , Cases and Games)' Himalaya Publishing House, ISBN 978-93-5024-673-3
3. K. Aswathappa, 'Organisational Behavior : Text, Cases & Games', Tenth Revised Edition,Himalaya Publishing House, ISBN 978-93-5051-588-4

Online Recourses:

1. https://nptel.ac.in/downloads/110105034/#

OE 4101 Soft Computing

Teaching Scheme
Lectures : 3 Hrs/Week

Examination Scheme
In Semester : 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:
To facilitate the learners to -

1. To understand basics in soft computing
2. To understand concepts of fuzzy logic and fuzzy sets
3. To understand supervised and unsupervised neural network architecture, training and testing algorithms
4. To understand concept evolutionary programming, genetic algorithm and swarm intelligent systems

Course Outcomes:
By taking this course, the learner will be able to -

1. Identify various soft computing and artificial neural network constituents to solve the problems in engineering domain
2. Experiment with fuzzy logic principles
3. Apply learning algorithms in artificial neural networks
4. Make use of principles of genetic algorithm and swarm intelligence in solving engineering problems

Unit 1: Introduction to Intelligent systems, soft tools and Artificial Neural network (07)

Soft computing constituents and conventional Artificial Intelligence, Artificial Neural network: definition, advantages of artificial neural network, Fuzzy Set Theory, Genetic algorithm, hybrid systems: neuro fuzzy, neuro genetic, fuzzy genetic, soft computing, Introduction to Artificial Neural Network: Fundamental concepts, basic models of artificial neural network, important terminologies of ANNs, McCulloch- Pitts Neuron, linear separability.

Unit 2: Fuzzy logic and fuzzy sets (07)

Introduction to fuzzy logic, fuzzy sets, fuzzy set operations, properties of fuzzy sets, classical relation, fuzzy relation, membership function, fuzzification, Methods of membership value assignments, lambda-cuts for fuzzy set, lambda-cuts for fuzzy relations, defuzzyfication.

Unit 3: Supervised Learning Networks (07)

Introduction, Perceptron Networks: Perceptron learning rule, Architecture, perceptron training algorithm for single output classes, perceptron training algorithm for multiple output classes, perceptron network testing algorithm, Back Propagation Network: flowchart for training process, training algorithm, linear factors of back- propagation networks, number of training data, number of hidden layer nodes, testing algorithm of back- propagation networks

Unit 4: Associative Memory Networks and Unsupervised Learning Networks (07)

Associative Memory Networks: Introduction, Training algorithm for pattern association: Hebb rule, Autoassociative Memory networks, Bidirectional associative memory: architecture, discrete bidirectional associative memory, Unsupervised Learning Networks: Introduction, Fixed wright competitive nets: max net, Kohonan Self organizing feature maps, counterpropogation networks, full counter propogation net.

Unit 5: Genetic Algorithm (07)

Introduction, biological background, genetic algorithms and search space, genetic algorithm vs. traditional algorithms, basic terminologies in in genetic algorithm, simple GA, operations in genetic algorithm: encoding- binary, octal, selection- Roulette wheel selection, random selection, crossover- single point cross over, two point crossover, mutation- flipping, interchanging, stopping condition for genetic algorithm flow, constraints in genetic algorithm

Unit 6: Swarm Intelligent Systems (07)

Introduction, background of Ant Intelligent systems, Importance of the Ant Colony Paradigm, Ant colony systems, Development of Ant colony systems, Applications of Ant Colony Intelligence, the working of ant colony systems, practical swarm intelligent systems: The basic of PSO method, Characteristic features

Text Books:

1. S.N. Sivanandam- **"Principles of Soft Computing",** Second Edition, Wiley India- ISBN- 9788126527410, 2008
2. J. S. R. Jang, CT Sun and E.Mizutani, **"Neuro-Fuzzy and Soft Computing" ,** PHI PVT LTD, ISBN 0-13-261066-3. 2015
3. N.P.Padhy, **"Artificial Intelligence and Intelligent Systems"** Oxford University Press, ISBN 10: 0195671546, 2005

References:

1. De Jong, **"Evolutionary Computation: A Unified Approach",** Cambridge (Massachusetts): MIT Press. ISBN: 0-262-04194-4. 2006
2. S. Rajsekaran and G.A. Vijayalakshmi Pai, **"Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications"** , Prentice Hall of India, ISBN: 0451211243, 2003
3. Sinha N.K., **" Soft Computing And Intelligent Systems: Theory And Applications"**, ISBN-13: 978-0126464900, Elsevier. 2007.

OE 4101 Introduction to Cyber Crime and Forensics

Teaching Scheme:
Lecture: 3 Hrs./week

Examination Scheme:
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

To facilitate the learners to-

1 Learn fundamental concepts of cyber security
2. Understand Security challenges presented by mobile devices and information system access in cybercrime world
3 Learn tools used in Computer forensics and Cyber Applications
4. Understand risks associated with social media networking

Course Outcome:
By taking this course the learner will be able to-

1.Classify Cyber Crimes
2. Identify threats and risks within context of Cyber Security
3. Outline various laws and acts in Cyber security
4. Appraise various tools used in Cyber Security/ Digital forensics

UNIT- I: Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, Ethical dimensions of cybercrime,Ethics and Morality,Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes (7)

UNIT – II:Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector- Infrastructure / Cloud Computing. (7)

UNIT – III: Cybercrime: Mobile and Wireless Devices : Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices,Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile,Organizational Security Policies an Measures in Mobile Computing Era, Laptops. (8)

UNIT IV:Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers,Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow. (7)

UNIT V: Cyber Security: Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations. (7)

Unit VI : Digital Forensics- Introduction to Digital Forensics, Forensics Software and Hardware, Evaluating computer forensic tools , Software tools and Hardware Tools, New Trends, Sample Case studies. (6)

TEXT BOOK:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. ISBN 978-81-265-2179-1
2. Computer Forensics and Investigations Bill Nelson, Amelia Phillips and Christopher Stuart Cenage learning. ISBN 978-81-315-1946-2

REFERENCE BOOK:

1. Intoduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group
2. Eoghan Casey,"Digital evidence and computer crime Forensic Science,Computers and the Internet , ELSVIER,2011 ISBN 978-0-12-374268-1

CE 4103 Internet of Things Laboratory

Teaching Scheme
Laboratory : 2 Hrs/week

Examination Scheme
Oral: 50 Marks
Credits: 1

Course Objectives:
To facilitate the learners to -

1. Understand various development boards used for Internet of Things(IoT).
2. Learn and Understand the fundamentals of sensor based applications.
3. Implement and solve the problems using high level language.
4. Develop mini applications on IoT boards with proper design.

Course Outcomes:
By taking this course, the learner will be able to :–

1. Implement Internet of Things on various development boards.
2. Design the minimum system for sensor based application.
3. Solve the problems related to the primitive needs using IoT.
4. Develop IoT application for distributed environment.

Example List of Laboratory Assignments:

Assignments Group A (Mandatory)

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller (History & Elevation)
2. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board.
3. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs
4. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
5. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image.

Assignments Group B (Any 2)

1. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee.
2. Assignments on Beagle Bone Black :
   a. Write an application using Beagle board to control the operation of stepper motor.
   b. Write an application using Beagle board to control the operation of a hardware simulated traffic signal.
   c. Write an application using Beagle board to control the operation of a hardware simulated lift elevator.
3. Assignments on Cloud of Things:
   a. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.

b. Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.

c. Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.

Assignments Group C (Any 1)

Sample Mini Project Statements :

1. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.
2. Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user's approval.

References:

1. *Rajkamal, **'Internet Of Things: Architecture and Design Principles'** McGraw Hill Education (India) Private Limited.*
2. *Ovidiu Vermesan, Peter Friess, **'Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems'***, River Publishers.
3. *Honbo Zhou, **'The Internet of Things in the Cloud'**, CRC Press(2013).*
4. *Peter Waher, **'Learning Internet of Things'**, Packt Publishing (2015).*
5. *https://onlinecourses.nptel.ac.in/*

CE 4104 Project Phase-I

Teaching Scheme	Examination Scheme
Tutorial : 2 Hrs /week	In Semester: 100 marks
Practical: 14 Hrs/Week	End Semester: 50 marks
	Credits: 9

Summary of the subject:

Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. It also provides an opportunity to learn new technologies and frameworks .It gives an enriching experience of working with industry and / or work with real life problems.

Projects are undertaken in small groups. It emphasises on team work and gives the students chance to present and polish their interpersonal and intrapersonal skills.

The projects undertaken, span a diverse range of topics. Projects can be sponsored by a sponsoring company, faculty defined, research oriented or self defined and vary from year to year. Projects can be undertaken in various domains like Artificial Intelligence, Data Warehousing, Data mining, Machine learning, App development, Network security, Networking, Cloud computing, Embedded Systems, Systems programming and many more. Approval of the problem statement by the Course Coordinator is required.

The course necessarily introduces the dimension of workload management. By applying suitable software development processes and project management concepts, students have to conduct this relatively unstructured "assignment" over the course of the semester.

The projects are assessed using a continuous evaluation process. Students can do seminar presentation, submission of a report, oral and technical presentation to present their work.

This course is to be conducted in the first semester.

Course Objectives:

To facilitate the learners to-

1) Explore state of art ,research approaches, algorithms, products in the domain.
2) Formulate a significant and challenging problem statement of relevance.
3) Provide a suitable and acceptable design solution to meet requirements considering relevent social,ethical and legal issues.
4) Have systematic approach as a team following best practices and engineering processes.
5) Choose and learn relevant tools, APIs, languages, frameworks, technologies for implementation of the project

6) Choose and apply appropriate SDLC approach like waterfall model, agile, RAD, Incremental model, Spiral, Prototyping etc.

7) Develop their personal skills

Course Outcomes:

By taking this course the learner will be able to -

1) Work in a team to develop the knowledge, skills, ethics and attitudes of a professional engineer.

2) Select appropriate tools, API, technologies to build a tested, working prototype, system.

3) Deliver solutions to real life problems that are acceptable.

4) Construct quality documents for entire Software Development Life Cycle.

5) Defend and justify effectively the work done, learning achieved, learning experience, and usefulness of product or service.

Evaluation Criteria:

The project work of the team will be assessed by the Project Guide. The guide will review the work done throughout the duration of the course. The guide can give assignments. The Final semester oral examination will be conducted by examiners where the project group has to present their work using presentations.

Assessment should be done on the basis of the following points:

- The quality of oral, written presentations.
- Fitness of project to problem statement.
- Innovations, well thought contributions in giving a solution, meeting requirements, use of technology and algorithms.
- The process including the project software engineering, teamwork and documentation.
- Understanding which tools, APIs and technologies can be applied and how.

PECE 4201 Java Full Stack Technologies

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credits : 3

Prerequisites: Data Structures and Algorithms II (CE 2201)

Course Objectives:
To facilitate the learner to -

1. Get exposure to full stack development in Java technologies.
2. Develop familiarity with the client side Java technologies.
3. Gain comprehensive knowledge about Java server side technologies for enterprise application development in practice.
4. Get familiar with the web services based approach for real-life application development.
5. Get acquainted with the database development technologies in Java.

Course Outcomes:
By taking this course, the learner will be able to -

1. Choose suitable client side Java technologies.
2. Analyze Java server side technologies for enterprise application development.
3. Analyze the characteristics of web services paradigm.
4. Analyze the role of Java database development technologies to realize their suitability for application development.

Unit 1: Client Side Web Technologies **(07)**
n-tier architecture, HTML, JavaScript (JS), Document Object Model (DOM), Introduction to JQuery, Asynchronous JavaScript And XML (AJAX).

Unit 2: Server Side Java Web Technologies **(07)**
Introduction to server side technology, Java Servlets, Java Server Pages (JSP), JSP tags.

Unit 3: AngularJS **(06)**
Overview, Model View Controller (MVC) architecture, directives, controllers, modules, forms.

Unit 4: Java 2 Enterprise Edition (J2EE) Technologies **(08)**
Introduction to J2EE technologies, Enterprise Java Beans (EJB), Java Messaging Service (JMS), Remote Method Invocation (RMI).

Unit 5: Java Web Services **(07)**

Web Services: Overview, Java Web services based on SOAP and REST,
Case studies: Facebook API.

Unit 6: Java Database Programming and Hibernate **(07)**

Java Database Connectivity (JDBC), JPA (Java Persistence API).
Hibernate: Overview of Hibernate, architecture, Hibernate Object/Relational Mapping.

Text books:

1. Kogent Learning Solutions Inc., **'Web Technologies: HTML, JS, PHP, Java, JSP, ASP.NET, XML, AJAX, Black Book'**, *DreamTech Press*, ISBN: 978-81-7722-997-4, 2015.
2. Kogent Learning Solutions Inc., **'Java Sever Programming Java EE6 Black Book'**, *DreamTech Press*, ISBN: 978-81-7722-936-3, 2013.
3. William Crawford, Jim Farley, **'Java Enterprise in a Nutshell'**, *O'Reilly*, ISBN-13: 978-0596101428, 3rd Edition, 2005.

References books:

1. Shyam Seshadri and Brad Green, **'AngularJS Up and Running'**, *O'Reilly*, ISBN: 978-93-5110-801-6, 2014.
2. Kevin Mukhar, Chris Zelenak, James L. Weaver and Jim Crume, **'Beginning Java EE5: From Novice to Professional'**, *Apress*, ISBN-13: 978-8181284020, 2006.
3. Jim Keogh, **'The Complete Reference J2EE'**, *McGraw Hill Education*, ISBN: 978-0-07-052912-0, 2012.

Web References:

1. https://learn.jquery.com
2. https://docs.angularjs.org/guide/concepts

PECE 4201: Deep Learning

Teaching Scheme
Lectures : 3 Hrs/Week

Examination Scheme
In Semester : 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisites :
Artificial Intelligence and Machine Learning (CE3202)

Course Objectives:
To facilitate the learners to -

1. Understand building blocks of Deep Neural Networks.
2. Understand various optimization algorithms used for training Deep Neural Networks.
3. Understand the working of Convolution Neural Network (CNN), Recurrent Neural Network (RNN), GRUs, Long Short Term Memory (LSTMs).
4. Have knowledge of Deep Architectures for solving various applications.

Course Outcomes:
By taking this course, the learner will be able to -

1. Apply the fundamental mathematical concepts to Deep Learning.
2. Interpret the basics Neural Networks for understanding of deep learning.
3. Apply the concepts of neural networks to design Convolution Neural Network and Recurrent Neural Network.
4. Apply available Deep Learning solutions to real time applications.

Unit 1: Machine learning Recap **(06)**

Linear Algebra, Prababilities and Information theory, Basics of Machine Learning: Model Selection and Train/Validation/Test Sets, Bias Variance trade off, Overfitting, Regularization, Confusion matrix, Precision, Recall, F-score, ROC, K-fold cross validation

Unit 2: Introduction to Deep Learning **(06)**

Limitations of Machine Learning, History of Deep Learning, How does Deep Learning works? Advantages of Deep Learning, Applications of Deep Learning, Perceptrons, Sigmoid neurons

Unit 3: Basics of Neural Networks **(08)**

Feed-forward neural network, Multi-Layer Dense Architecture, Activation Functions, Loss Function, Dropout, Stochastic Optimization: mini-batch gradient descent, Back Propagation, Gradients, hyper-parameters, over-fitting, regularization

Unit 4: Convolution Neural Network (CNN) **(07)**

Architecture: convolution Pooling Layers, Padding, Use of CNNs for classification, use for data compression, semantic segmentation, Image denoising, object detection

Unit 5: Recurrent Neural Network (RNN) **(08)**

Architecture, Gates, Use for time series data (anomaly detections), Use for text (sentiment) classification problem, generate new text, Introduction to GRUs, LSTMs

Unit 6: Advanced Deep Learning **(07)**

Deep Learning applications in Computer Vision / NLP / Text Mining / Big Data / IoT using ImageNet, AlexNet, VGG Net, ResNet etc. Introduction to Generative Adversarial Networks, Deep Reinforcement Learning.

Text Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, **“Deep Learning”,** MIT Press Ltd. ISBN:9780262035613, 0262035618

2. Josh Patterson and Adam Gibson, **“Deep Learning – A Practitioner's approach”**, O'Reilly Publication, 1st edition August 2017 ISBN : 9789352136049

References:

1. Nikhil Baduma, Nicholas Locascio, **“Fundamentals of Deep Learning: Designing Next Generation intelligence Alogrithms”**, O'Reilly Publication, ISBN 10: 9352135601 , ISBN 13: 978- 9352135608

OE 4102 - Introduction to Natural Language Processing

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Course Objectives:
To facilitate the learner to:

1. Understand various aspects of Natural Language Processing.
2. Learn Phonological, Morphological, Syntactic and Semantic processing.
3. Understand issues related to ambiguity of Natural Language.
4. Understand the advanced applications of Natural Language Processing.

Course Outcomes:
By taking this course, the learner will be able to:

1. Explain importance of Natural Language Processing.
2. Identify the fundamental concepts and techniques of Natural Language Processing.
3. Analyze ambiguous structure of Natural Language.
4. Summarize the advanced applications of Natural Language Processing.

Unit 1-Introduction to Natural Language Understanding (06)
The Study of Language, Applications of Natural Language Understanding, Evaluating language Understanding Systems, Different levels of Language Analysis.

Unit 2-Fundamentals of Phonetics (07)
Speech Sounds and Phonetic Transcription, Articulatory Phonetics, The Vocal Organs, Place of Articulation of Consonants, Manner of Articulation of Consonants, Vowels, Syllables, Phonological Categories and Pronunciation Variation, Phonetic Features, Predicting Phonetic Variation, Factors Influencing Phonetic Variation.

Unit 3-Fundamentals of Morphology (08)
Concept of Morphology, Survey of English Morphology, Inflectional Morphology, Derivational Morphology, Cliticization, Non-Concatenative Morphology, Agreement, Finite-State Morphological Parsing, Construction of Finite-State Lexicon, Finite-State Transducers(FST), Sequential Transducers and Determinism, Finite-State Transducers for Morphological Parsing, Transducers and Orthographic Rules, Word and Sentence Tokenization.

Unit 4-Fundamentals of Syntax **(06)**

The elements of Noun Phrases, Verb Phrases, Adjective Phrases, Adverbial Phrases and Simple Sentences, Grammars and Sentence Structure, Construction of a Good Grammar, A Top-Down Parser, A Bottom-Up Chart Parser, Top-Down Chart Parsing, Part-of-Speech Tagging.

Unit 5-Fundamentals of semantics and Discourse **(08)**

Word Senses, Relations Between Senses, WordNet, Word Sense Disambiguation, The Need for Discourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense, and Aspect, Managing the Attentional Stack, Concept of Pragmatics

Unit 6-Applications of Natural Language Processing **(07)**

Machine Translation, Sentiment Analysis, Question Answering Systems, Cross Lingual Information Retrieval, Natural Language Interface to Database, Extractive and Abstractive Summarization Systems, Indian Language WordNets.

Text books:

1. Jurafsky, David, James H. Martin, '**Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition**', *Pearson Education Limited, Dorling Kindersley(India) Pvt. Ltd. (Indian Subcontinent Version)*(2014), ISBN: 987-93-325-1814-4.
2. James Allen, '**Natural Language Understanding**', *Pearson Education Limited, Dorling Kindersley(India) Pvt. Ltd. (Indian Subcontinent Version)(2007)*, ISBN: 987-81-317.

Reference Books:

1. Manning, Christopher D., Hinrich Schütze, '**Foundations of Statistical Natural Language Processing**', *Cambridge Publication(1999)*, ISBN: 0262133601.
2. Steven Bird, ewan Klein, and Edward Loper, '**Natural Language Processing with Python**', *O'Reilly Media*, 2009.

OE 4201 : e-Business
(Open Elective-III)

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
In Semester : 50 Marks
End semester : 50 marks
Credits : 3

Prerequisites : No Prerequisites

Course Objectives :

To facilitate the learners to -

1. Understand the technological, economic and social phenomena behind rapid changes in the e-businesses
2. Have a good working knowledge of e-business concepts, applications and technologies
3. Understand the e-business models and infrastructure
4. learn how e-business concepts are applied to different fields, such as: education, banking, tourism and so on
5. Inspire with online business ideas and motivate them to apply in the real life.
6. Study the new trends in e-business, e-commerce

Course Outcome :

By the end of this course, students should be able to -

1. Explain the concepts of e-business and e-business models
2. Apply suitable principles and practices of designing and developing e-business website
3. Apply necessary back end system components required for successful e-business implementations
4. Outline the meaning of e-business security and how it impacts the business
5. Relate e-business, BI and KM to fulfil modern e-business trends

Unit I: Introduction (07)
E-commerce and e-business, advantages of e-business in growth of a business, Transition from traditional business to e-business, features of e-business technology, e-business models, IT Infrastructure requirements of e-business **Case Study :** Various e-business models

Unit II : Building e-business Websites (7)
Issues involved in designing a website, designing in-house websites, steps involved in website development, e-business and website development solutions, Advantages of using an e-business solution, selection of a suitable e-business solution, security issues involved in websites, tracking and analysing website traffic data. Digital Marketing **Case Study**

Unit III : e-Business Infrastruture / Back end Systems **(7)**

Back end system support requirements - security, scalability, availability, adaptability, manageability, maintainability, assurance, interoperability, load balancing; internet technology, World Wide Web, Internet software; Content management, **Case Study**

Unit IV : e-security & online payment systems **(7)**

e-Business security policy, risks and risk assessment, practice guidelines to e-security, legal framework and enforcement, ethical, social and political issues in e-business

Performance characteristics of online payment systems, online payment methods, security and risk handling in online payments, fraud detection in online payments, IT Act 2000, digital signatures, digital certificates, and PKI; **Case Study**

Unit V : Knowledge management & BI for strategic e-business **(8)**

From information processing to knowledge world, aligning knowledge with business, knowledge management platforms, state of knowledge and measuring parameters; knowledge industry, knowledge strategy, and knowledge workers

Business and Intelligence - applications and importance of business intelligence, implementation of intelligence, building BI systems, selecting BI tools, integrating BI and KM, decision-making and BI, **Case Study**

Unit VI : Launching an e-Business and e-business trends **(6)**

Launching a successful e-business – requirement analysis, managing Web site development, search engine optimization, Evaluate Web sites on design criteria.

Future and next generation of enterprise e-business, challenges and new trends, ethical and regulatory issues

References

Text Books	
1	Papazoglou, Michael and Pieter Ribbers, "E-Business : Organizational and Technical Foundations", John Wiley, 2nd Edition (Sept 2011)
2	Parag Kulkarni, Sunita Jahirabadkar, Pradeep Chande, "E-Business", Oxford University Press (May 2012)
Reference Books	
1	Daniel Amor, "The E-business (R)evolution", Prentice Hall PTR (2000)
2	Kenneth Laudon, Carol Guercio, "E-commerce : Business, Technology, Society", Prentice Hall, 4th Edition (January 2008)
3	Kalakota Ravi, Marcia Robinson, "E-Business 2.0 – Roadmap for Success", Pearson Education, 2nd Edition (2004)

OE 4201D: Big Data and Analytics

Teaching Scheme
Lectures : 3 Hrs / week

Examination Scheme
In Semester : 50 Marks
End semester : 50 marks
Credits : 3

Course Objectives :

To facilitate the learners to -

1. Understand the concepts, challenges and techniques of Big data and Big data analytics
2. Introduce the concepts of Hadoop, Map Reduce framework and R for Big data analytics
3. Teach students in applying skills and tools to manage and analyze the big data

Course Outcome :

By the end of this course, students should be able to -

1. Relate big data concepts with various application
2. Choose Hadoop ecosystem components based on requirement of application
3. Apply Data Analytics life cycle for business decisions and strategy definition
4. Use various R constructs to solve different queries
5. Compare various Data Analytic Methods and trends

Unit I: Introduction (08)

Database Management Systems, Structured Data, SQL. Unstructured data, NOSQL, Advantages of NOSQL,Comparative study of SQL and NOSQL. Big data overview, characteristics of Big Data, Applications of Big data.

Unit II : Big Data Architectures, Hadoop (06)

Introduction to Big Data and Hadoop, Building blocks of hadoop: Ecosystem, HDFS, HBASE

Unit III: Map Reduce (07)

Map Reduce Working, the Mapper and Reducer,InputFormats and OutputFormats, YARN, HIVE, Sqoop, Introduction to Spark

Unit IV: Data Analytic Life Cycle (07)

Data Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Discovery, Data preparation, Model Planning, Model Building, Communicate Results, Opearationalize. Case Study: GINA

Unit V : Analytics using R **(08)**

R Fundamental : Math, Variables, Strings, Vectors, Factors, Vector operations; Data structures in R : Arrays & Matrices, Lists, Data frames; Conditions and loops, Objects and Classes; Working with file in R ; Basic statistical methods using R

Unit VI : Data Analytic Methods and trends **(06)**

Statistical Methods, Machine learning methods – supervised, unsupervised; recommendation systems, Big data Visualization

Text Books:

1. Data Science and Big Data Analytics, Wiley, 1st Edition (January 2015)
2. “Big Data, Black Book : Covers Hadoop 2, MapReduce, Hive, YARN, Pig , R and Data Visualization” ,Dreamtech Press (27 May 2015),ISBN-13-978-9351197577

Reference Books

1. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game",MC Press(November 2012)
2. J.Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big Data for Dummies”, 1st Edition (April 2013)
3. Tom White, “Hadoop: The Definitive Guide”, O′Reilly, 3rd edition (June 2012)
4. Abraham Silberschatz, Henry Korth, S. Sudarshan, “Database System concepts”,McGraw Hill Education, 6th Edition (December 2013).
5. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing (November 2013)
6. Shiva Achari ,“Hadoop Essentials - Tackling the Challenges of Big Data with Hadoop” ,Packt Publishing(April 2015), ISBN:978-1-78439-668-8

CE 4202 Network and Information Security Laboratory

Teaching Scheme
Laboratory : 2 Hrs/week

Examination Scheme
Oral – 50 Marks
Marks – 50
Credit : 1

Course Objectives:

To Facilitate the Lerners to:-

1.Understand Basic Cryptography Algorithms
2.Learn various techniques for secure data transmission
3. Recognize the need of Network Perimeter Security
4.Learn various techniques used for common attacks

Course Outcome :

By taking this course the learner will be able to :-

1. Implement Standard Cryptography Agorithms
2. Apply the digital signature for secure data transmission
3. Apply packet filtering concept
4. Demonstrate some common attacks

Sample /Suggested List of Assignments :

1. Implement DES algorithm

2. Implement RSA algorithms

3. Implement Message Digest Algorithm and demonstarte the collision resistance property

4. Implementation of Diffie Hellman Key exchange

5. Creation and Verification of Digital Signatures

6. Simulation of packet Filtering (ACL) concepts using CISCO packet Tracer

7. Create a small application to demonstrate SQL injection and Cross Site scripting attacks

8. Develop a website to demonstrate how the contents of the web site can be changed by attackers if it is http based and not secured

9. Case Study - Enterprise network Security/ Wireless Security / Security Information and Event Management using IBM QRadar

CE 4203 Project Phase-II

Teaching Scheme
Tutorial: 2 Hrs /week
Practical:16Hrs/Week

Examination Scheme
In Semester: 100 marks
End Semester: 50 marks
Credits: 10

Summary of the subject:

This course is an extension to Project Phase-I to be completed in the semester I.

The course focuses on workload management, implementation, usage of tools, testing and delivering deliverables as per the plan presented and finalized in the semester I. Students have to apply project management concepts.

The projects are assessed using the continuous evaluation process by presentation, submission of a report, oral and technical presentation.

This course is to be conducted in the second semester.

Course Objectives:

To facilitate the learners to-

1) Provide a suitable and acceptable design solution to meet requirements.
2) Have systematic approach as a team following best practices and engineering processes.
3) Develop their personal skills.
4) Test rigourously the system developed.
5) Consolidate their work in a furnished report.

Course Outcomes:

By taking this course the learner will be able to -

1) Work in a team to develop the knowledge, skills, ethics and attitudes of a professional engineer.
2) Build a reasonably complex, useful and tested project which could be a product or service using appropriate tools, technologies.
3) Construct quality documents for entire Software Development Life Cycle.
4) Defend and justify effectively the work done, learning achieved, learning experience, and usefulness of product or service.

Evaluation Criteria:

The project work of the team will be assessed by the Project Guide. The guide will review the work done throughout the duration of the course. The Final semester oral examination will be conducted by examiners where the project group has to present their work using presentations.

Assessment should be done on the basis of the following points:

- The quality of oral, written presentations.
- Fitness of project to problem statement.
- Innovations, well thought contributions in giving a solution, meeting requirements, use of technology and algorithms.
- The process including the project software engineering, teamwork and documentation.
- Extent to which tools and technologies have been applied.

CE 4204 Project based online course

Teaching Scheme
Lecture : 2 Hrs /week

Examination Scheme
In Semester: 50 marks
Credits: 02

Summary:

This course will be undertaken by the students as a part of their preparation for conducting their final year Btech project. All group members belonging to the final year Btech project group should do the course. The project guide will play the crucial role in deciding the online course to be undertaken by the project group members. The student shall register and complete the project based online course preferably in semester- I but may complete the same till the end of semester-II.

EC 4101 VLSI DESIGN

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credits: 3

Course Objectives:
1. To design combinational, sequential circuits using Verilog HDL
2. To describe behavioral and RTL modeling of digital circuits
3. To explain and compare Programmable Logic Devices
4. To introduce the concepts and techniques of digital CMOS design

Course Outcomes:
After completion of the course, students will be able to
1. Explain the fundamentals of Verilog HDL
2. Design digital systems using Verilog
3. Analyze the architecture of PLD's according to technology and application change
4. Analyze the impact of non ideal effects on MOSFETs
5. Design digital circuits using CMOS transistors

Unit I: Introduction to Verilog HDL (08)
Trends in HDL, Design Flow, Hierarchical Modeling Concepts, Modules and Ports, Instances, Lexical Conventions, Data Types, System Tasks and Compiler Directives.

Unit II: Verilog Constructs and Modeling Styles (08)
Continuous Assignments, Procedural Assignments, Operators in Verilog, Conditional Statements, Loop Statements, Task and Functions. Gate-Level Modeling, Gate Type, Gate Delay, Dataflow Modeling, Delays, Expressions, Operators, and Operands, Operator Types, Behavioral Modeling, Structured Procedures, Timing Controls, Sequential and Parallel Blocks, Generate Blocks.

Unit III: Modeling of Combinational and Sequential Logic (12)
Adder, ALU, Multiplexer, De-multiplexer, Decoders, Comparator, Parity Generator and Checker, Flip-flops, Counters, Shift registers, Memory, modeling of FSM.

Unit IV: Programmable Logic Devices (06)
CPLD Architecture, features, specifications and applications. FPGA Architecture, features, specifications and applications.

Unit V: Digital CMOS Circuits (08)
CMOS, MOSFET parasitics, Technology scaling, Channel length modulation, Body Effect, Latch Up effect, Hot electron effect, Velocity saturation, Power dissipations, CMOS Inverter, CMOS combinational logic design, Transmission gates, Layout Design Rules.

Text Books:

1. S. Palnitkar, **"Verilog HDL – A Guide to Digital Design and Synthesis",** *Pearson*, (3rd Edition), (2010).
2. Neil H. E. Weste, David Money Harris, **"CMOS VLSI Design: A Circuit & System Perspective",** *Pearson Publication* (4th Edition), (2010).

Reference Books:

1. J Bhaskar, **"A Verilog HDL Primer (3/e)",** *Kluwer*, (3rd Edition), (2005).
2. Wyane Wolf, **"Modern VLSI Design (System on Chip)",** *PHI Publication,* (3rd Edition), (2002).

Online Recourses:

1. https://onlinecourses.nptel.ac.in/noc18_cs48/

EC 4102 COMPUTER NETWORKS AND SECURITY

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:
1. Introduce network models and functions of each layer
2. Describe basic concepts of the threats for data and network
3. Introduce the fundamentals of cryptography and network security

Course Outcomes:
After completion of the course, students will be able to
1. Describe and analyze the functions of layers of OSI model and compare with the TCP/IP model
2. Explain and evaluate networking protocols, inter-networking devices and their functions
3. Explain the Quality of Service parameters for Internet applications
4. Describe the threats to the data and network and the techniques to resolve them

Unit I: Physical layer and Data Link layer (07)
Networks models: OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Data Transfer: DSL, Cable TV Networks. Data link control: Framing, Flow Control (Stop and Wait and Sliding Window Protocols), error control (CRC), HDLC and PPP, Multiple access: Random access (Aloha, CSMA, CSMA/CD) protocols.

Unit II: Wired and Wireless LANS (07)
Wired LANS: Ethernet (IEEE 802.3), Ethernet standards (Ethernet, Fast Ethernet and Gigabit Ethernet) Wireless LANS: IEEE 802.11, Bluetooth IEEE 802.15, Connecting LANS, Connecting devices, Network emulation demonstration with NIC card and MAC address on Ubuntu platform.

Unit III: Network Layer (08)
Network layer functions, Logical addressing: IPv4, IPv6 addresses, IPv4 to IPv6 conversion unicast routing algorithms with the protocols (RIP, OSPF and BGP), Network layer Protocols: ARP, RARP, ICMP and IGMP, demonstration of Ipconfig/all, ping, tracert commands and analysis of IPv4, IPv6, ARP and ICMP protocols using wireshark.

Unit IV: Transport layer and Application Layer (06)
Process to Process Communication, addressing, Transport layer protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transport Protocol (SCTP), Quality of services (QoS): data flow characteristics, traffic shaping, Internet Applications and protocols, Domain Name System (DNS), E-mail, FTP, HTTP, demonstration of TCP, UDP, HTTP and DNS using wireshark.

Unit V: Data Security **(06)**
Security goals, Attacks and Defense strategies, Cryptography: Substitution cipher, DES, AES and RSA algorithms, Digital signatures, Authentication protocols: One-Way Authentication, Mutual Authentication, Dictionary Attacks, Centralized Authentication, Needham-Schroeder Protocol, Kerberos.

Unit VI: Network Security **(08)**
Network, transport and application layer security, Attacks: DoS and DDoS, Session High jacking and Spoofing, ARP Spoofing and Attacks on DNS, Viruses, Worms and Malware, Virus and Worm Features.

Text Books:

1. Behrouz A. Foruzan, **"Data communication and Networking"**, *Tata McGraw-Hill*, (5th Edition), (2013).
2. Andrew S. Tannenbaum, **"Computer Networks"**, *Pearson Education*, (4th Edition), (2003).
3. William Stallings **"Cryptography and Network Security Principles and Practice'",** *Pearson Education* **(**7th Edition), (2017).
4. Leon-Garcia, Widjaja, **"Communication Networks",** *Tata McGraw Hill,* (2nd Edition**),** **(**2004).

Reference Books:

1. Wayne Tomasi, **"Introduction to Data Communication and Networking"**, *Pearson Education*, (1st Edition), (2007).
2. James. F. Kurouse and W. Rouse, **"Computer Networking: A Top down Approach Featuring",** *Pearson Education*, (3rd Edition), (2007).
3. William Stallings, **"Data and Computer Communication"**, *Pearson Education*, (8th Edition), (2000).
4. Greg Tomsho, Ed Tittel, David Johnson, **"Guide to Networking Essentials"**, Thomson *India Learning*, (5th Edition), (2007).

Online Recourses:

1. https://nptel.ac.in/courses/106105081/
2. https://nptel.ac.in/courses/106105031/
3. https://trai.gov.in/
4. https://www.itu.int/online/mm/scripts/gensel9?_ctryid=1000100560

HS 4101 MANAGEMENT FOR ENGINEERS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:
1. To develop understanding about the basics of management functions
2. To explain the concept of total quality management
3. To analyze cost and financial aspect of the business
4. To develop the strategic thinking and decision making abilities in the rapidly changing global business environment

Course Outcomes:
After completion of the course, students will be able to
1. Explain the principles and functions of management
2. Identify social responsibility and ethical issues involved in the Organization
3. Apply tools of quality management
4. Analyze the cost, financial aspects of business and the need of globalization

Unit I: Basics of Management **(08)**

Introduction, Definition of management, characteristics of management, functions of management: Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision making.

Unit II: Organizational Environments and Cultures **(06)**

External environments, Internal environments, Ethics and social responsibility.

Unit III: Quality Management **(10)**

Definition of quality, continuous improvement definition of quality, types of quality, quality of design, conformance and performance, phases of quality management, Quality Management Assistance Tools: Ishikawa diagram, Pareto Analysis, Pokka Yoke (Mi stake Proofing), Quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management, The ISO 9001:2015, Quality Management System Standard, Software quality management with respect to CMM level and ISO standard.

Unit IV: Cost and Financial Accounting **(10)**

Basic concepts of cost accounting, Classification and analysis of costs, Marginal costing, Break-even point, Cost Volume Profit analysis, key financial statements, financial analysis.

Unit V: Globalization **(06)**

Global trends and commerce, new opportunities offered by globalization, preparation for globalization, globalization drivers, implementation issues related to globalization, quality of global leadership.

Text Books:

1. Stephen P. Robbins, Mary Coulter, **"Management",** *Prentice Hall of India*, (8^{th} Edition), (2014).
2. Charles W.L Hill, Steven L McShane, **"Principles of Management",** *McGraw Hill Education, Special Indian Edition*, (2007).
3. M.Y Khan, P. K Jain, **"Financial Management"**, *McGraw Hill Education*, (8^{th} Edition), (2018).

Reference Books:

1. Gail Freeman-Bell, James Balkwill, **"Management in Engineering",** *Prentice Hall of India*, (2^{nd} Edition), (2005).
2. T. R. Banga, S.C. Sharma, **"Industrial organization and Engineering Economic",** *PHI Publication*, (25^{rd} Edition), (2002).
3. M.C. Shukla, **"Business Organization and Management",** *PHI Publication*, (2^{rd} Edition), (2002).
4. C. M. Chang, **"Engineering Management: meeting the Global Challenges",** Publisher: *CRC Press*, (2016).

OE 4101 DIGITAL VIDEO PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To provide basic knowledge of Digital Video Processing concepts and its standards.
2. To extend numerous concepts from still 2-D images to dynamic imagery 3-D images.
3. To introduce new concepts unique to spatio-temporal data such as timeline, motion, tracking etc.

Course Outcomes:
After completion of the course, students will be able to

1. Analyze the importance of digital video standards over analog video standards
2. Explain the modeling of video image formation using projection theory
3. Compare the Block matching and Optical flow estimation algorithms
4. Compare different background subtraction techniques and tracking algorithms
5. Apply digital video processing concepts for development of the specific application

Unit I: Basics of Video (06)
Analog video signal and standards, Digital video signal and standards and need of digital video, sampling of video signals

Unit II: Time-Varying Image Formation Models (08)
Three-dimensional motion models ,Rigid motion in the Cartesian Coordinates, Rigid motion in the Homogeneous Coordinates, Deformable motion, Geometric Image Formation, Perspective projection, Orthographic projection, Photometric Image Formation, Lambertian Reflectance model, Photometric effects of 3-D motion

Unit III: 2D Motion Estimation Techniques (12)
2 D motion Correspondence and Optical Flow, 2-D Motion Estimation-The Occlusion Problem, Aperture Problem, 2-D Motion Field models methods using the Optical Flow Equation-The Optical Flow Equation, Second-Order differential methods, Block motion model, Horn and Schunck method, Estimation of the Gradients, Adaptive Methods. Generalized Block motion, Block matching Method, Motion estimation.

Unit IV: Background Subtraction techniques for moving object detection (06)
Frame differencing, Mean and Median filtering, Gaussian Mixture Model (GMM), Kernel density estimation.

Unit V: Motion Tracking (04)
Basic Principles, Motion Tracking using Optical flow, blob tracking, colour feature based mean shift, Kalman tracking.

Unit VI: Applications of Video Processing **(06)**

Video Surveillance, Object tracking, Video Watermarking etc.

Text Books:

1. A. Murat Tekalp, **“Digital Video Processing”**, *Prentice Hall*, (2nd Edition), *(*2015).

Reference Books:

1. Yao Wang, Jorn Ostermann, Ya-Qin Zhang, **“Video Processing and Communications”,** *Prentice Hall*, (2nd Edition), 2002
2. Alan C. Bovik, **“The Essential Guide to Video Processing”**, *Elsevier Science*, (2nd Edition), (2009).

Online Recourses:

1. Fundamentals of Digital Image and Video Processing - coursera

EC 4103 VLSI DESIGN LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral : 50 Marks
Credits: 1

Course Objectives:

1. To draw the layout of digital CMOS circuits using Microwind
2. To simulate, synthesize and implement combinational and sequential circuits using Verilog HDL on PLD

Course Outcomes:

After completion of the course, students will be able to

1. Draw and analyze the digital CMOS circuits layout
2. Design CMOS layout for any Boolean expression
3. Simulate digital circuits using Verilog and analyze its synthesis report
4. Implement digital circuits on PLD

List of Experiments:

A. To prepare CMOS layout in selected technology for:
   1. Inverter, NAND, NOR gates.
   2. Half Adder.
   3. 2:1 Multiplexer using transmission gates.
   4. Four variable Boolean expression.

B. To write, simulate , synthesize and implement Verilog code for:
   5. Mux and DeMux.
   6. Four bit ALU.
   7. 4 bit Up-Down Counter.
   8. Traffic light controller using FSM.

EC4104 PROJECT PHASE I

Teaching Scheme	**Examination Scheme**
Tutorial: 02 Hours / Week	In Semester: 100 Marks
Practical: 14 Hours / Week	Oral: 50 Marks
	Credits: 9

Course Outcomes:

After completion of the course, students will be able to

1. Identify a problem in a real-life application
2. Select an appropriate methodology to solve identified problem
3. Plan the stages for executing the project
4. Discuss and present methodology
5. Develop and test the modules

Guidelines:

A. **Approval of the Project Concept: -** The project should be done in a group. The Synopsis of Project s concept should be drafted and submitted for approval to the departmental committee, at the beginning of the academic year. Only after obtaining the approval, the students should start working on the Project.

B. **Guidance: -** One Guide will be assigned to each Project Group. In case of Industry-Sponsored Projects, one Guide is required to be assigned by the concerned Industry, in addition to the College Guide.

C. **Documentation of the Project-related work: -** A Log-book is required to be maintained by the students for the relevant technical documentation and logging of the tasks / activities.

D. **Reporting: -** The students should report to their Guide regularly and the Logbook should be checked and authenticated by the Guide.

E. **Expected Deliverables:-** System Design and its Simulations.

F. **Evaluation: -** A Report consisting of Literature Survey, Design Methodology etc., is required to be submitted prior to the evaluation process. The said report needs to be certified by the Guide and the department authority. The evaluation should be based on the presentation of Project s Concept and 50 percent completion of work. The said evaluation should be done by TWO EXAMINERS (Internal and External).

G. **Evaluation Criteria : -** Innovation, Depth of Understanding, Individual member s contribution, Presentation skills, Internal Guide s assessment for the work done during the semester and Report of the Project work as mentioned above.

EC 4201 BROADBAND COMMUNICATION SYSTEMS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To explain different components of Broadband communication system
2. To identify system design issues and the role of WDM components in advanced optical fiber communication system
3. To describe the basics of orbital mechanics and the look angles from ground stations to the satellite
4. To illustrate the satellite subsystems
5. To design Satellite Link for Up Link and Down Link

Course Outcomes:
After completion of the course, students will be able to
1. Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers
2. Describe optical sources and detectors and determine their performance parameters
3. Calculate link power budget and rise time budget of optical link and describe WDM components
4. Describe satellite subsystems and compute orbital parameters for satellite
5. Design of satellite uplink and downlink

Unit I: Fiber optic communications system (07)
Electromagnetic Spectrum and Optical spectral bands, Key elements of fiber optic communications system, Ray theory of propagation: Fiber types, Transmission characteristics of optical fibers, Intra modal Dispersion, Intermodal dispersion.

Unit II: Optical Sources & Detectors (06)
Introduction to optical sources: Wavelength and Material Considerations, LEDs and semiconductor LASERs: principle of working and their Characteristics, Material Considerations, PN, P-I-N, Avalanche photodiodes and photo transistors: Principle of working and characteristics.

Unit III: Design considerations in optical links & WDM (07)
Point to point Links: System design considerations, Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques, Overview of WDM, WDM Components: 2 x 2 Fiber Coupler, Optical Isolators and Circulators, Multiplexers and De-multiplexers, Fiber Bragg Grating, Diffraction Gratings, Overview of Optical Amplifiers: SOA, EDFA in brief.

Unit IV: Orbital Mechanics and Launchers (07)

History of Satellite Communication, Orbital Mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and Launch Vehicles, Orbital effects in Communication system performance.

Unit V: Satellites subsystems (06)

Satellite Subsystems, Attitude and control systems (AOCS), Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment Reliability and space qualification.

Unit VI: Satellite Communication Link Design (07)

Introduction, Basic transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design of Specified C/N: Combining C/N and C/I values in Satellite Links, System Design Examples.

Text Books:

1. Gerd Keiser, **"Optical Fiber Communications",** *Tata McGraw Hill*, (5th Edition), (2013).
2. John M. Senior, **"Optical Fiber Communications: Principles and Practice",** *PHI,* (3rd Edition), (2008).
3. Timothy Pratt, Charles Bostian, Jeremy Allnutt "**Satellite Communications**", *John Wiley &Sons*, (3rd Edition), (2002).

Reference Books:

1. Djafar K. Mynbaev and Lowell L. Scheiner, **"Fiber Optic Communications Technology",** *Pearson Education*, (1st Edition), (2000).
2. Govind P. Agrawal, **"Fiber Optic Communication Systems",** *Wiley India*, (3rd Edition), (2002).
3. Dennis Roddy, "**Satellite Communications**", McGraw Hill, (4th Edition), (2017).

Online Recourses:

1. https://onlinecourses.nptel.ac.in/noc18_ee28

PEEC 4201 MOBILE COMMUNICATION

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To introduce the fundamentals of cellular system design and the techniques used to maximize the capacity of cellular network
2. To describe the basics of multi-path fading and various parameters used to characterize small scale fading
3. To explain various multiple access techniques
4. To explore the architecture and call processing of GSM and CDMA system

Course Outcomes:

After completion of the course, students will be able to

1. Explain the basics and design challenges of cellular networks
2. Analyze signal propagation issues and their impact on the communication system performance
3. Compare and determine capacity of different multiple access techniques
4. Describe the architecture, operation and call processing of GSM system
5. Describe CDMA system and analyze it's design parameters

Unit I: Cellular Fundamentals (10)

Introduction to wireless Communication Systems, Evolution in cellular standards, Cellular concepts, Introduction, Frequency reuse, Channel assignment, Handoff, Interference and System capacity, Trunking and Grade of service, Improving coverage and capacity.

Unit II: Mobile Radio Propagation (10)

Propagation Mechanism, Free space loss, Reflection, Diffraction, Scattering, Fading and Multipath, Small scale multipath propagation, Impulse response model of multipath channel, Parameters of mobile multipath channels, Types of small scale fading, Equalization techniques.

Unit III: Coding and Multiple Access Techniques for Wireless Communications (06)

Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, Multiple Access Techniques, FDMA, TDMA, FHMA, CDMA, SDMA, OFDM.

Unit IV: Global System for Mobile Communications (GSM) (07)

Evolution of Mobile standards, System Overview, The air interface, Logical and Physical channels, Synchronization, GMSK modulation, Call establishment, Handover.

Unit V: CDMA (07)

System overview, Air interface, Coding, Spreading and modulation, Logical and physical channels, Handover, Comparison of WCDMA and CDMA 2000, Overview of LTE, Introduction to 5G, Comparison between 4G and 5G.

Text Books:

1. Theodore S Rappaport**, "Wireless Communications Principles and Practice",** *Pearson Education,* (2nd Edition), (2014).
2. Andreas F Molisch**, "Wireless Communications**"**,** *Wiley India***,** (2nd Edition), (2013)**.**

Reference Books:

1. Vijay K Garg, Joseph E Wilkes, "**Principles and Applications of GSM"***,* *Pearson Education ,* (5th Edition), (2014).
2. *Vijay K Garg, Joseph E Wilkes,* "**IS-95CDMA and CDMA 2000 Cellular/PCS Systems Implementation"**, *Pearson Education,* (5th Edition), (2014).
3. R. Blake, **Wireless Communication Technology",** *Thomson Delmar,* (1st Edition)*,* (2015).
4. W.C.Y. Lee, "**Mobile Communications Engineering: Theory and applications"**, *McGraw-Hill International*, (2nd Edition), (2015).

Online Recourses:

1. https://onlinecourses.nptel.ac.in/noc18_ee29/

OE 4201 COMPUTER VISION

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50Marks
Credits: 3

Course Objectives:

1. To explain the mapping from 3D world to 2D world
2. To describe hands on Camera calibration techniques and basics of stereo imaging
3. To describe the concepts of feature analysis and extraction techniques such as Corner detector, Scale Invariant Feature Transform
4. To introduce the concepts of machine learning

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the image formation and working of camera as an image sensor
2. Analyze the procedure of camera calibration
3. Analyze the importance of stereo imaging
4. Compare different feature detectors and descriptors techniques
5. Apply machine learning algorithms for computer vision applications
6. Apply computer vision concepts for development of the specific application

Unit I: Camera Calibration and Stereo Imaging (12)

Camera calibration: pin hole, thin lens equations, FOV, DOF, CCD and COM sensor, camera parameters, camera calibration Stereo imaging: epipolar geometry, rectification, correspondence, triangulation, RANSAC algorithm, Dynamic programming.

Unit II: Feature Detection and Descriptors (08)

Corner detector, Edge Detector, Histogram of Gradient, Scale Invariant Feature Transform.

Unit III: Introduction to Machine Learning for Computer Vision (13)

Supervised and Non supervised learning, KNN, Machine learning framework, Classifiers, Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network, CNN.

Unit IV: Applications (07)

Non-visible-light Imagery: Infrared imaging applications, Applications of computer vision: Image mosaiking, Pedestrian classification, Image in painting.

Text Books:

1. M. Shah, “**Fundamentals of Computer Vision”**, *Online book*, (1997).
2. D. A. Forsyth, J. Ponce**, “Computer Vision, A Modern Approach”,** *Prentice Hall*, (2nd Edition), (2003).
3. R. Szeliski, “**Computer vision algorithms and applications”**, *Springer-Verlag*, (2nd Edition), (2010).
4. Tom Mitchell**, “Machine Learning.. First Edition”,** *McGraw- Hill*, (1st Edition), (2017).

Reference Books:

1. L. G. Shapiro, George C. Stockman, "**Computer Vision**", *Prentice Hall*, (1st Edition), (2001).
2. E. Trucco, A. Verri, "**Introductory Techniques for 3-D Computer Vision**", *Prentice Hall*, (1st Edition), (1998).
3. D. H. Ballard, C. M. Brown, "**Computer Vision**", Prentice Hall, (1st Edition), (1982).
4. M. Sonka, V. Hlavac, R. Boyle, "**Image Processing, Analysis, and Machine Vision**", *Thomson Press*, (3rd Edition), (2011).

OE 4201 AUTOMOTIVE ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:
1. To explain the operation of basic Automotive system components
2. To explain various sensors and their interfacing in Automotive applications
3. To describe the system view of various Automotive Control and Communication systems
4. To introduce the diagnostic methodologies and safety aspects in Automotive system

Course Outcomes:
After completion of the course, students will be able to
1. Explain the functioning of automotive system components and compare I. C. Engines
2. Discuss the working principle of sensors and their use in automotive applications
3. Discuss the role of automotive control systems to improve the fuel efficiency and emission quality
4. Explain diagnostic tools and their operation
5. Discuss the safety norms, standards and safety systems in modern automobiles

Unit I: Fundamentals of Automotive Systems (10)
Overview of Automotive System, System Components, Basics of Petrol, Diesel and Gas Engines, Evolution of Electronics in Automotive, Engine configuration and its associated components, Ignition system, Drive Train, Suspension system, Braking system, Steering system, Fuel Delivery system, Alternator and battery charging circuit, Alternative fuels, Overview of Hybrid vehicle, Introduction to autonomous Car.

Unit II: Automotive Sensors, Actuators, Control systems (10)
Systems approach to Control and Instrumentation : Concept of a system, Analog and Digital system, Basic Measurement system, Analog and Digital Signal Processing, Sensor characteristics, In-vehicle Sensors :Air flow sensing, Crankshaft Angular Position sensing, Throttle angle sensing, Temperature sensing, EGO sensor, Vibration sensing (in Air Bags) , Actuators : Fuel injector, EGR actuator, Ignition system, VVT, BLDC motor, Electronic Engine Control, Engine Management System strategies and Methods of improving engine performance and efficiency.

Unit III: Microcontrollers / Microprocessors in Automotive domain (08)
Critical review of Microcontroller/Microprocessor, Architecture of 8-bit/16-bit Microcontrollers with emphasis on Ports, Timers / Counters, Interrupts, Watchdog Timer, PWM, Criteria to choose the appropriate microcontroller for automotive applications, Automotive grade processors.

Unit IV: Automotive Communication Protocols (06)
Overview of Automotive Communication Protocols, CAN, LIN, FLEXRAY, MOST,

Communication Interface with ECUs, Interfacing techniques and interfacing with infotainment gadgets, Applications of telematics in automotive domain - GPS and GPRS.

Unit V: Safety systems in Automobiles and Diagnostics (08)

Active Safety Systems-- Anti-lock Braking System, Traction Control System, Electronic Stability Program, Passive Safety systems – Airbag System, Advanced Driver Assistance System (ADAS), Fundamentals of Diagnostics, Self Diagnostic System, On-Board Diagnostics and Off-Board Diagnostics.

Text Books:

1. Williams. B. Ribbens, **"Understanding Automotive Electronics"**, *Elsevier Science, Newnes Publication*, (6^{th} *Edition), (2003).*
2. Robert Bosch, **"Automotive Electronics Handbook",** *John Wiley and Sons*, (2004).

Reference Books:

1. Ronald K Jurgen, **"Automotive Electronics Handbook"**, *McGraw-Hill*, (2^{nd} Edition), (1999).
2. James D Halderman, **"Automotive Electricity and Electronics"**, *PHI Publication* (2005).
3. Tom Denton, **"Automobile Electrical & Electronic Systems",** *Routledge*,(4^{th} Edition).
4. Jack Erjavec, **"A Systems Approach to Automotive Technology",** *Cengage Learning.*
5. V.A.W.Hillier, **"Fundamentals of Automotive Electronics ",** *Nelson Thornes.*
6. Tom Denton, **"Advanced Automotive Diagnosis",** *Elsevier*, (2^{nd} Edition), (2006).

Online Recourses:

1. https://nptel.ac.in/downloads/108103009/
2. http://www.ignou.ac.in/upload/Unit-3-61.pdf

EC 4202 BROADBAND COMMUNICATION SYSTEMS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral : 50 Marks
Credits: 1

Course Objectives:

1. Interpret performance parameter of optical fiber
2. Describe characteristics of optical sources& detectors
3. To design optical fiber communication link
4. To understand satellite communication link

Course Outcomes:

After completion of the course, students will be able to

1. Compute parameters of optical fiber NA , attenuation and bending losses
2. Illustrate characteristics of optical sources& detectors
3. Calculate link power budget and rise time budget of the optical link
4. Demonstrate satellite communication link

List of Experiments:

1. To measure the numerical aperture of optical fiber
2. To determine attenuation and bending loss of optical fiber
3. To Plot VI characteristics of LED used in optical fiber communication
4. Compare the performance of APD for different load resistor and biasing voltage
5. Tutorial on Power budget and time budget analysis of optical fiber system
6. Establish a direct communication link between Transmitter and Receiver for tone signal.
7. To establish satellite link between Transmitter and Receiver for audio-video signal.
8. Tutorial on satellite link design

EC 4203 PROJECT PHASE II

Teaching Scheme
Tutorial: 02 Hours/Week

Practical: 16 Hours / Week

Examination Scheme
In Semester: 100 Marks
Oral: 50 Marks

Credits: 10

Course Outcomes:
After completion of the course, students will be able to
1. Build and Test the hardware and/or software modules
2. Achieve the intended outcome through a systematic work plan
3. Draft the report and present the outcome of project
4. Demonstrate the working project and analyze the process to achieve the results

Guidelines:

A. Verification of the technical design using simulation tools and other appropriate methods. The verification results should be documented in the Logbook and authenticated by the respective guide. Weekly attendance should be logged in with the respective guide and will be monitored.

B. Assembly of the system by taking into account the appropriate design considerations.

C. Testing of the assembled system and validation of the objective proposed in the Project's Synopsis. The validation results should be documented in the Logbook and authenticated by the respective guide.

D. A report mentioning the project work done during the entire academic year, is required to be submitted. The said report should be certified by the respective guide and the college Authority. The same should be presented during the exam.

E. The working of the Project's set-up should be demonstrated during the exam. The exam should be conducted by TWO Examiners (Internal and External).

EC 4204 PROJECT BASED ONLINE COURSE

Teaching Scheme
Tutorial: 02 Hours/Week

Examination Scheme
In Semester: 50 Marks
Credits: 02

Course Objective:
To obtain the domain knowledge as required for the completion of the project

Course Outcome:
1. Explain the basics concepts as required to complete the project
2. Apply domain knowledge to implement the project

OEHS 2101: Entrepreneurship and IP Strategy (NPTEL)

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	ISE: 50 Marks
	ESE: 50 Marks
	Credits: 3

Course Objectives:

1. To discuss intellectual property strategy to protect inventions and innovations of new ventures.
2. To develop skills of commercial appreciation by allocating knowledge about substantive aspects of management, strategy and legal literature.
3. The course will make participants appreciate the nature, scope and differences of IP, its different utilities and approaches
4. The course will make participants manage and strategize IP lifecycle effectively throughout the journey of start-up, in a time when it is aspired highly by the economy and society.
5. Participants will learn the fundamentals and advanced strategies of IP. They will be given the opportunity for understand the same in the MSME sector. They will finally be provided brief exposure about the valuation techniques and audits of IP.

Course Outcomes:

After completion of the course, students will be able to

CO1 Illustrate the importance of securing intellectual property to protect inventions and innovations of new ventures

CO2 Appreciate the scope, nature, protection process and infringement of Trademarks and Patents as an entrepreneur

CO3 Appreciate the scope, nature, protection process and infringement of Copyrights and Industrial Design as an entrepreneur

CO4 Apply various concepts of IP and Entrepreneurship in strategic valuation and audit of IP management at MSMEs

Unit I: Introduction to entrepreneurship and intellectual property: Definition, concepts (05)

1. Introduction, 2. What is entrepreneurship? 3. What do you understand by IP?, 4. Whether entrepreneurship and IP related? What is the role of IP strategy in entrepreneurship? 5. Case study I IT industry

Unit II: **Innovation and entrepreneurship:** **(05)**

1.Innovation, invention and creativity, 2. Types of innovation, 3. Innovation, market and IP, 4. Open innovation and IP, 5. Case Study II - Biotechnology

Unit III: **IPR: Trademark and entrepreneurship:** **(05)**

1. Trademark-Definition, 2. Trademark-Types, 3. Trademark-Registration, 4. Trademark infringement, 5. Case study III - Textile industry

Unit IV: **IPR: Patent and entrepreneurship:** **(05)**

1. Patent-introduction, 2. Patent infringement, 3. Patent strategies- I, 4. Patent strategies- II

5. Capsule version

Unit V: **IPR: Copyright and entrepreneurship:** **(05)**

1. Copyright Definition and subject matter, 2. Copyright and related rights, 3. Copyright registration and entrepreneurship, 4. Copyright infringement, 5. Case study IV Film industry

Unit VI: **IPR: Industrial design and entrepreneurship:** **(05)**

1. Industrial Design- Definition, concept, 2. Industrial Designs Act - Key features, 3. Industrial Design-Business, 4. Industrial Design infringement, 5. Case study V - Automobile industry

Unit VII: **IP strategy & entrepreneurship** **(05)**

1. IP strategy for start-up and MSME, 2. IP transaction introduction, 3. IP valuation, bank loan, insurance, 4. Success story and business model of a few start-ups, 5. Case Study VI Pharma industry and Agriculture.

Unit VIII: **Entrepreneurship & IP - Government initiates:** **(05)**

1.Incubators, research parks, 2.Various Government policies, 3.Integrative approach Entrepreneurship & IP strategy, 4.Capsule revision, 5.Am I ready to venture my start up? (Course applicability)

Books and References:

1. Ove Granstrand, **The Economic and management of Intellectual Property** , (1999)
2. Narayanan, V. K., **Managing technology and innovation for competitive advantage** , first edition, Pearson education, New Delhi, (2006)
3. Idris, K. (2003), **Intellectual property: a power tool for economic growth** , 2nd edition, WIPO publication no. 888, Switzerland
4. Bosworth D. & Webster E, **The Management of Intellectual Property** , Edward Elgar.
5. Berman, **Ideas to Assets** , Wiley publications
6. Richard Dorf & Thomas Byers, **Technology ventures from idea to enterprise** , 2nd edition.
7. Neeraj Padey, Khushdeep Dharni Intellectual Property Rights , 1st Edition, August 2014

Online Resources:

1. NPTEL Course: **"Entrepreneurship and IP Strategy"**
   https://onlinecourses.nptel.ac.in/noc22_hs110/preview
2. **WIPO: Global Forum for Intellectual Property**
3. http://www.wipo.int/portal/en/index.html
4. **Intellectual Property India**
   http://www.ipindia.nic.in/

OEHS2101 Industrial Safety Engineering
(Online NPTEL Swayam)

Teaching Scheme	**Examination Scheme**
Lecture : 3 Hrs/week	In semester : 50 marks
	End semester : 50 marks
	Credits : 3

Course Objectives:
Students are expected to –
1. Understand criticality of safety in industrial environment
2. Understand concept and application risk, safety and reliability
3. Understand accident root cause analysis
4. Understand of the key elements of various safety standards

Course Outcome:
1. Students will be capable to do critical examination of factory premises from safety point of view.
2. Students will be capable to do carry out risk and safety analysis
3. Students will be able to analyse root cause analysis of accidents.
4. Students will be design safety provisions confirming to various standards.

Unit 1: Introduction to Industrial Safety
Introduction, key concepts, terminologies, and safety quantification, safety by design,
Fault tree and event tree analysis (qualitative & quantitative)
Unit 2: Risk Assessment and Analysis
Bow-tie and quantitative risk assessment (QRA), safety function deployment, Safety vs reliability – quantification of basic events (repair to failure, repair-failure-repair, and combined processes),
Safety vs reliability – quantification of basic events
Unit 3: Systems Safety Analysis
Systems safety quantification (e.g., truth tables, structure functions, minimal cut sets)
Human error analysis and safety
Unit 4: Investigation of Accidents
Accident investigation and analysis, Application of virtual reality
Unit 5: Safety Standards
OSHAS 18001 and OSHMS

Books:

1. Probabilistic Risk Assessment for Engineering and Scientists, Komamoto and Henley, IEEE Press, 1995.
2. Industrial Accident Prevention, Heinrich et al., McGraw Hill, 1980.
3. Techniques for safety management - A systems approach, Petersen D, ASSE 1998.

IN 4101 Process Instrumentation & Control

Teaching Scheme **Examination Scheme**
Lectures: 3hrs/week **In-Sem: 50 Marks**
End-Sem: 50 Marks
Credit: 3

Course Prerequisite: Principle and applications of various Sensors and Transducers, Basics of control systems, Principle of actuators and final control element and their applications.

Course Objectives:
1. To delineate the principles of multi-loop controllers and nonlinear systems
2. To design the multivariable control systems for interacting processes
3. To develop and analyze the control loops for various process applications

Course outcomes: The students will be able
1. To identify the characteristics of given process
2. To compare the features of different control strategies
3. To select appropriate control strategy for given application
4. To develop the instrumentation and control loops for various processes

Unit I: Multi-Loop Control & Nonlinear Systems
(7Hrs)
SLPC and MLPC features, Feedback, feed forward control, cascade control, ratio control, selective control, split-range control
Nonlinear Elements in Loop: Limiters, Dead Zones, Backlash, Dead Band Velocity Limiting, Negative Resistance, Improvement in nonlinear process performance through Deterministic Control Loop Calculations, Calculations of the measured variable, final control element selection, cascade control design, Real time implementation issues

Unit II: Multivariable Control
(7Hrs)
Concept of Multivariable Control: Interactions and it's effects, Modelling and transfer functions, Influence of Interaction on the possibility of feedback control, important effects on Multivariable system behaviour Relative Gain Array, effect of Interaction on stability and multiloop Control system. Multiloop control Performance through: Loop Paring, tuning, Enhancement through Decoupling, Single Loop Enhancements.

Unit III: Heat exchanger and Boiler controls
(7Hrs)
Types, gain and time constants, degrees of freedom. Basic controls in Heat exchangers, Steam Heaters, Condensers, fired heaters and vaporizers. Advanced Control Override, Feed forward Control.
Types, Components, Boiler controls like Drum level control (1,2,3,5 element), Airfuel ratio control, Combustion controls, Steam temperature and pressure control, Safety interlocks, Burner management system, startup and shutdown procedures, boiler safety standards

Unit IV: Distillation Column control
(7Hrs)
Mass and Energy balance, column feed control, column pressure control, control of overhead and bottom composition, distillate reflux flow control. Frequency response, lag in liquid and vapour flow, concentration lag, predicting the behaviour of control system

Unit V: Reactor and pumps and compressor control
(7Hrs)
Types of reactions and reactors, factors governing the conduct of reaction, stability of reactors, time constant, effects of lag, flow control, temperature control, pH control, end point detection of continuous and batch reactors. Sequential & logic control in batch process, batch production management.
Pumps: Types, Basic Controls, Multipump system controls. Compressors: Types, Basic Controls.

Text Books:
1. Process Control Systems-F.G. Shinskey, TMH.
2. Instrument Engineers' Handbook: Process Control: B.G. Liptak, Chilton.
3. Optimization of Industrial Unit Processes - Bela G. Liptak
Reference Books:
1. Boiler Control Systems: David Lindsey, Mc GRAW-HILL

IN 4102: Industrial Automation

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50
Marks Credit: 3

Prerequisite: Basics of control system components.

Course Objectives:
1. Understand the basic concepts of automation and its requirements.
2. To develop an automation project and its documentation.
3. To learn and apply standards and recommended practices to automation.
4. To understand the activities followed in automation projects.

Course Outcomes: The student will be able to
1. Classify and compare the types of automation systems.
2. Select suitable communication protocol for the required automation system.
3. Develop the logic for a given PLC/DCS system, implement it on hardware and validate.
4. Configure and implement database management, alarm and security management in the automation system.

Unit 1: Introduction Plant wide control systems and Automation Strategy: (06)
Introduction to Industrial Automation, Introduction to automation tools Performance criteria Control system audit, Performance criteria, Development of (URS) for automation, (FDS) for automation tools.

Unit 2: Instrumentation Communication Protocols : (07)
Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, HART Protocol, Foundation Fieldbus H1and HSE, Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

Unit 3: PLC based automation: (07)
Logic development using (Ladder, FBD, SFC, Structure Text), Analog control loop configuration in PLC (PID controller configuration), Interfacing HMI and SCADA. PLC based automation project development.

Unit 4: Distributed Control System Basics: (07)
DCS introduction, Architecture of different makes, comparison, specification, latest trend and developments, function Blocks, DCS support to Enterprise Resources Planning (ERP), performance criteria for DCS and other automation tools.

Unit 5: Distributed Control System Engineering and Design (06)
DCS detail Engineering, configuration and programming, Development and configuration of User Interface (UI), database management, reporting, alarm management, diagnosis, security and user access management.

Unit 6: Process safety and Safety Management Systems (06)
Introduction to process safety, Process Hazard Analysis, Safety Integrity Level (SIL), Introduction to IEC 61511, SIS Application of safety system

Text Books:

1. S.K.Singh , “Computer aided process control”, PHI.
2. Garry Dunning , “Introduction to Programmable Logic Controllers” , Thomson Learning.
3. Krishna Kant , “Computer Based Process control” , PHI

Reference Books:

1. Samuel Herb, “Understanding Distributed Process Systems For Control”, ISA.
2. Webb & Reis, “Programmable Logic Controllers: Principles and Applications” , PHI.

HS 4101 Management Information System

Teaching Scheme **Examination Scheme**
Lecture: 3 hrs/Week **In-Sem: 50 Marks**
End-Sem: 50 Marks
Credits: 3

Prerequisite: NA

Course Objectives:
1. To introduce the students to the Management Information Systems
2. Its application in organizations and related technology
3. The course would expose the students to the managerial issues relating to information systems.
4. Help them identify and evaluate various options in Management Information Systems.

Course Outcomes: By the end of the course, students should be able to
1. Understand the usage of Information Systems in management.
2. Understand the activities that are undertaken in acquiring an Information System in an organization.
3. Identify various Information system solutions like ERP, CRM, Data warehouses
4. Analyze the issues in successful implementation of these technology solutions in any organization.

Unit I: Introduction to Management Information Systems (6 Hrs)
Need, Purpose and Objectives - Contemporary Approaches to MIS - Information as a strategic resource - Use of information for competitive advantage - MIS as an instrument for the organizational change.

Unit II: Information System in Business (8 Hrs)
Introduction to Information System; System Concepts; System & Sub System; System Feedback; Types of Information System; Applications; System Development Life Cycle (SDLC)

Unit III: Management of Information Systems, Technology, and Strategy (8 Hrs)
The Technology: Computer and Computer Processing; Role of Information Technology in Organization; Information System and Strategy; Strategic Analysis. The Information Center, Plant Operation management and digitization.

Unit IV: Systems Analysis and Design: (6 Hrs)
Systems Development Life Cycle - Alternative System Building Approaches - Prototyping - Rapid Development Tools - CASE Tools - Object Oriented Systems

Unit V: Decision Support Systems
(6 Hrs) Group Decision Support Systems - Executive Information Systems - Executive Support Systems - Expert Systems and Knowledge Based Expert Systems - Artificial Intelligence

Unit VI: Enterprise Information System
(6 Hrs)
Use of Information systems in Various Business Processes; Role of IS in Cross Functional Systems and EIS; Information Systems for Managerial Decision Support and Strategic Advantage Information, Management and Decision Making; Decision Support Systems (DSS); Group Support Systems; Executive support Systems. Tools / software used for MIS system, typical architecture of MIS

Text Books:
1. Management Information Systems, Laudon and Laudon, 7th Edition, Pearson Education Asia
2. Management Information Systems, Jawadekar, Tata McGraw Hill
3. Management Information Systems - Sadagopan, Prentice Hall
4. Analysis and Design of Information Systems, Rajaraman, Prentice Hall

Reference Books:
1. Decision Support Systems and Intelligent Systems, Turban and Aronson, Pearson Education Asia
2. Management Information Systems, Schultheiss, Tata McGraw Hill
3. Management Information Systems, Davis and Olson, Tata McGraw Hill
4. Management Information Systems - Jayant Oke

OE 4101(A) System Engineering and Management

Teaching Scheme Lectures: 3hrs/week
Examination Scheme In-Sem: 50 Marks End-Sem: 50 Mark
Credit: 3

Prerequisite: Process Loop Components

Course Objectives:
1. Know the basic concepts of Project Engineering and Management.
2. Understand various engineering documents.
3. Apply standards, and recommended practices.
4. Know the activities followed in instrumentation projects.

Course Outcomes: By the end of the course, students should be able to
1. Define and understand the Project Life cycle.
2. Develop organization, team, work distribution, planning and estimation.
3. Prepare instrumentation detailed engineering documents as per specified standards.
4. Define activities followed in the Instrumentation projects.

Unit-I Basic Concept of Project Management: (6 Hrs)
Definition, Types and Life cycle phases of project, Basics of Project management, Project Planning, Scheduling, Cost estimation.

Unit-II Instrumentation Project Documentation and Standards (8 Hrs)
Importance of documents, Introduction to ISA standards, Preliminary documents (PFD, Material balance, P&ID etc.) and detail engineering (Process data sheets, instrument index, instrument specification sheet, calculation sheets) .

Unit-III Control Panels and Wiring Documentation (8 Hrs)
Instrument Cable Types, Control centers and Panels, Specification, Control room engineering, GA drawings, Terminal Strip reports for panels, Cable trays, Loop wiring diagrams, logic diagram, Instrument Installation sketches.

Unit-IV Procurement Activities (8 Hrs)
Vendor registration, Tendering and bidding process, Bid evaluation, Purchase orders, contracting,

Unit-V Installation and testing (6 Hrs)
Inspection and Testing: Factory Acceptance Test (FAT) Team, Planning, documentation, Customer or Site Acceptance Test (CAT or SAT), Team, Planning, documentation. Test and inspection reports.

Unit-VI Commissioning Activities (6 Hrs)

Pre-commissioning planning activities, documents required for Cold Commissioning and hot commissioning, Performance trials and final hand over, Calibration records,

Assignments:

1. Development of SOW/WBS/Organization structure for any I&C Project
2. Study of Process flow diagram and Material Balance sheet.
3. Development of P&ID (ISA S5.1, ISA S5.3)
4. Development of Instrument Index sheet
5. Development of Specification sheets (ISA S20)
6. Development of GA and mimic diagram of a control panel (ISA S5.5)
7. Development of Loop Wiring Diagram/Logic diagram (ISA S5.4 and ISA S5.2)
8. Preparation of Inquiry, Quotation, Comparative statement, Purchase orders
9. Preparing documents for FAT/SAT or CAT 10. Preparing commissioning documents.

Text Books:

1. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing)
2. Management systems by John Bacon (ISA)
3. Process control Instrument Engineers Handbook by Liptak.

Reference Books:

1. Instrument Installation Project Management (ISA).
2. Successful Instrumentation & Control Systems Design , by Michael D. Whitt (ISA)

OE 4101B: Bio-Informatics

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisite: Advanced-Digital Signal Proceesing knowledge

Course Objectives:
1. To develop advanced skills to critically analyze and solve problems in biotechnology.
2. To be enable to evaluate data using bioinformatics.
3. To be able to identify potential uses and opportunities of this data.
4. To be able to understand the recent developments in a specialized area of biotechnology.

Course Outcomes: The student will be able to
1. define basics of Bioinformatics.
2. compare and select different Bioinformatics Databases.
3. apply different algorithms to various Bioinformatics databases to develop new models.
4. analyse and interpret the outputs from algorithms for given applications.

Unit 1: Introduction to Bio-Informatics (05)
Defination, applications, Protein and DNA structure, Biological Data Acquisition: The form of biological information. Retrieval methods for DNA sequence, protein sequence

Unit 2: Bio-Informatics Databases (07)
Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary sequence databases, protein sequence, Information on various databases and bioinformatics tools available. For eg; nucleic acid sequence database (GenBank, EMBL, DDBJ), protein sequence databases (SWISS- PROT, TrEMBL, PIR, PPB)

Unit 3: Algorithms for bioinformatics (07)
Introduction to various machine learning techniques and their applications in bioinformatics. Genetic algorithm, Support Vector Machine, Neural Network and their practical applications towards the development of new models, methods and tools for bioinformatics

Unit 4: Sequence Analysis (07)
Various file formats for biomolecular sequences - genbank, fasta, gcg, msf, nbrf-pir, etc Basic concepts of sequence similarity, identity and homology, paralogues. Sequence based database searches - BLAST and FASTA algorithms

Unit 5: Sequence Alignment (07)
Pair wise and Multiple Sequence Alignments (MSA). Basic concept of sequence alignment, Pair wise alignment (Needleman and Wunsch, Smith and Waterman algorithms), MSA (Progressive and Hierarchical algorithms). Their use for analysis of Nucleic acid and protein sequences and interpretation of results

Unit 6: Phylogeny (06)
Phylogeny analysis, definition and description of phylogenetic trees and its types. Various computational methods in phylogenetic and molecular evolutionary analysis

Text Books/Reference Books:

1. Hooman Rashidi, Lukas K. Buehler, 'Bioinformatics Basics: Applications in Biological Scienceand Medicine' (2nd Edition) (May 2005)
2. Des Higgins (Ed),Willie Taylor (Ed), 'Bioinformatics: Sequence, Structure and Databanks - Apractical approach' (1st Edition) (October 2000)
3. N.J. Chikhale and Virendra Gomase, 'Bioinformatics- Theory and Practice' (1st Edition)(July2007)
4. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
5. Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRCMathematical Biology & Medicine), by SorinDraghici
6. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
7. Current topics in computational molecular biology, Tao, Jiang, Ying Xu, Michael Q.Zang

OE 4101C: Avionics

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester:50Marks
Credit: 3

Prerequisite: Basics of Control Systems, Basics of Communication System

Course Objectives:
1. To integrate the digital electronics with cockpit equipment
2. To understand the various principles in flight disk and cockpit panels.
3. To understand the communication techniques used in aircraft.
4. To explain the modern era of flight control system

Course Outcomes: The student will be able to
1. identify the mechanical and electronic hardware required for aircraft.
2. compare the communication and navigation techniques used in aircrafts.
3. disseminate the autopilot and cockpit display related concepts.
4. compare and identify different actuators in avionics.

Unit 1: Introduction to Avionics (07)
Basics of Avionics-Basics of Cockpits-Need for Avionics in civil and military aircraft and space systems – Integrated Avionics Architecture –Military and Civil system – Typical avionics System and Sub systems – Design and Technologies.

Unit 2: Digital Avionics Bus Architecture (07)
Avionics Bus architecture–Data buses MIL–RS 232- RS422-RS 485-AFDX/ARINC-664-MIL STD 1553 B–ARINC 429–ARINC 629- Aircraft system Interface

Unit 3: Flight Deck and Cockpit (07)
Control and display technologies CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – ARINC 818-Civil cockpit and military cockpit: MFDS, PFDS-HUD, HMD, HMI

Unit 4: Avionics Systems (07)
Communication Systems – Navigation systems – Flight control systems – Radar electronic Warfare – Utility systems Reliability and maintainability Fundamentals- Certification-Military and civil aircrafts.

Unit 5: On Board Navigation Systems (07)
Over view of navigational aids, Flight planning, Area navigation, required time of arrival, RNAV architecture , performance aspects, approach and landing challenges, regulatory and safety aspects, INS, GPS and GNSS characteristics.

Unit 6: Basics of Final Control Element (07)
Basics of pneumatic, hydraulic and electric actuators, Function of DC Servo motor, AC Servo motor function of pneumatic, hydraulic actuators.

Text Books:

1. R.P.G. Collinson, "Introduction to Avionics", Chapman & Hall Publications, 1996.
2. N. S. Nagaraja(1996),Elements of electronic navigation, 2 edition, Tata McGraw Hill, New Delhi.

Reference Books:

1. Cary R .Spitzer, "The Avionics Handbook", CRC Press, 2000.
2. Middleton, D.H. "Avionics Systems", Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.
4. Brain Kendal, "Manual of Avionics", The English Book House, 3rd Edition, New Delhi, 1993

IN 4103: Industrial Automation Lab

Teaching Scheme
Practical: 2 Hr/Week

Examination Scheme
Oral: 50 Marks
Credit: 1

Prerequisite: Basics of control system components, Basics of Process Instrumentation

Course Objectives:
1. To understand the basic concepts of automation and its requirements.
2. To develop automation project.
3. To understand the principles of multi-loop controllers and nonlinear systems.
4. To understand the activities followed in automation projects.

Course Outcomes: The student will be able to
1. Implement different control strategies and compare the performance
2. Develop the URS and FDS for any small automation project
3. Develop the PLC/DCS logic for the given application
4. Implement and test the developed logic for the given application.

List of Experiments: (students are expected to perform any 8 experiments)
1. Automatic control of Single Capacity Process
2. Automatic control of Two Capacity Process
3. Automatic control of Temperature and Set Point Programming
4. Comparison of Feedback and Feed Forward Control
5. Preparing URS and FDS for any small automation project.
6. Prepare cause and effect document for any small process and also develop logic diagram
7. Develop and implement any PLC and/or DCS program using FBD and SFC programming language.
8. Interfacing of PLC to any SCADA through Modbus protocol and/or OPC.
9. Developing and implementing any control loop using PLC system.
10. Developing and implementing any control loop using DCS system
11. Developing and configuring Graphic User Interface for any control loop.
12. Configuration of any HART device to PLC and/or DCS system.
13. Configuration of any Foundation Fieldbus device to PLC and /or DCS system.
14. Configure and implement different alarms in PLC and/or DCS system.
15. Configuring and implementing any Advanced process control function block
16. Preparing a HaZOp document for any small process (Case Study)

IN 4104: Project Phase I

Teaching Scheme **Examination Scheme**

Tutorial: 2 Hr/Week In semester: 100 Marks

Practical: 14 Hr/Week Oral: 50 Marks

Credit: 9

Course Outcomes: The student will be able to

1. identify technical problem related to industry, healthcare, society, research organizations.
2. apply the achieved technical knowledge and skills to define the problem statement.
3. identify, design and implement the various stages involved in solving the defined problemstatement.
4. test the designed stages to get the desired solution.

The students are expected to work in suitable size groups. The work contribution of each group member should be approaching towards the final solution. The work should be completed in the stipulated time.

IN 4201: Process Data Analytics

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester:50
Marks Credit: 3

Prerequisite: Concepts of Mathematics and Computational techniques

Course Objectives:
1. To explore the statistical analysis techniques for various kinds of data.
2. To understand the concepts and types of Artificial Intelligence and Machine Learning Algorithms.
3. To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms.

Course Outcomes: The student will be able to
1. Apply standard statistical inference procedures to draw conclusions from data analysis.
2. List and define the basic concepts of artificial intelligence and machine learning.
3. Compare and select various machine learning algorithms for solving practical problems.
4. Implement various machine learning algorithms to different domains.

Unit 1: Introduction to statistical analysis **(07)**
Statistical Analysis, introduction, methods, definitions Descriptive Statistics, Probability distributions Inferential Statistics, Two Sample Tests, Type 1 and Type 2 Errors Inferential Statistics through hypothesis tests, Permutation & Randomization Test ANOVA and Test of Independence

Unit 2: Regression Analysis and related tools **(07)**
Introduction, Methods, Types. Linear and Multiple Regression Methods Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification ANOVA and Test of Independence Introduction to R and Python programming Introduction to Advanced Pattern Recognition

Unit 3: Introduction to Artificial Intelligence and Machine Learning **(07)**
Introduction to machine learning and concepts and comparison with biological intelligence. Differentiating algorithmic and model based frameworks. Introduction to Neural Networks and Fuzzy Logic as techniques for Machine Learning

Unit 4: Supervised Learning Methods **(07)**
Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines, Deep Learning

Unit 5: Unsupervised Learning Methods **(07)**
Clustering, Associative Rule Mining, Introduction to Big Data and Challenges for big data analytics

Unit 6: Classifiers **(07)**

Cases Studies of Classifiers implemented by various methods for applications in the field of Process Industry, Biomedical Field, Network domain and similar other domains

Text Books:

1. Montgomery, Douglas C. and Runger, George C. (2014) Applied Statistics and
2. Probability for Engineers, 6 th edition, John Wiley & Sons, Inc (ISBN- 978-1118539712).
3. An Introduction to R, by Venables and Smith and the R Development Core Team.
4. Data Analysis and Graphics Using R; An Example-based Approach, by John Maindonald and John Braun. Cambridge Series in Statistical and Probabilitistic Mathematics, 2003.
5. Sheldon M. Ross,"Introduction to Probability and Statistics for Engineers and Scientists", 4^{th} edition, Academic Press; 2009.

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands-On Approach", VPT, 2016
3. E. Alpaydin, "Machine Learning", MIT Press, 2010.
4. K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
5. C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
6. Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
7. John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.
8. Chandan K. Reddy and Charu C Aggarwal, "Healthcare data analytics", Taylor & Francis, 2015
9. Hastie, Trevor, et al. "The elements of statistical learning". Vol. 2. No. 1. New York: springer, 2009.
10. Montgomery, Douglas C., and George C. Runger. "Applied statistics and probability for engineers" John Wiley & Sons, 2010.

IN 4202: Process Data Analytics Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 50 marks
Credit: 1

Prerequisite: Concepts of Mathematics and Computational techniques

Course Objectives:
1. To explore the statistical analysis techniques for various kinds of data.
2. To understand the concepts and types of Artificial Intelligence and Machine Learning Algorithms.
3. To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms.

Course Outcomes: The student will be able to
1. Apply standard statistical inference procedures to draw conclusions from data analysis.
2. Analysis of data using various statistical methods.
3. Develop programming logic for various machine learning algorithms.
4. Implement various machine learning algorithms to process industries.

List of Experiments: (students are expected to perform any 8 experiments)
1. Introduction to linear and multiple regression function in MATLAB
2. Applying linear & multiple regression to process data from a typical process plant
3. Implement ANOVA for a database
4. Data Analysis using K nearest neighbor Regression
5. Introduction to programming in R
6. Linear regression in R
7. Implementation of Neural Networks for standard data set
8. Implementation of Fuzzy logic for classification of standard data set.
9. Implement a classifier for application in field of process industry using data from a standard source.

IN 4203: Project Phase II

Teaching Scheme
Tutorial: 2 Hr/Week
Practical: 16 Hr/Week

Examination Scheme
In semester: 100 Marks
Oral: 50 Marks
Credit: 10

Course Outcomes: The student will be able to
1. identify technical problem related to industry, healthcare, society, research organizations.
2. apply the achieved technical knowledge and skills to define the problem statement.
3. identify, design and implement the various stages involved in solving the defined problemstatement.
4. test the designed stages to get the desired solution.

The students are expected to work in suitable size groups. The work contribution of each group member should be approaching towards the final solution. The work should be completed in the stipulated time.

IN 4204 PROJECT BASED ONLINE COURSE

Teaching Scheme
Tutorial: 02 Hours/Week

Examination Scheme
In Semester: 50 Marks
Credit: 2

Course Objective:
To obtain the knowledge in the respective domain based on the respective project statement.

Course Outcome:

1. Develop additional skill set related to the selected project statement
2. Apply the domain knowledge in design and implementation of the project

PEIN 4201A: Process Modeling and Optimi ation

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50
Marks Credit: 3

Prerequisite: Process Instrumentation , Automatic Control System, Control system Design

Course Objectives:
1. Understand and develop system s mathematical models.
2. Learn the use of Numerical methods in solving the model equations.
3. To learn to various optimization techniques.

Course Outcomes: The student will be able to
1. Define and list types of mathematical models.
2. Develop a mathematical model of process.
3. Simulate and analyze the system performance.
4. Apply the optimization techniques and analyze the results.

Unit 1: Modeling Aspects & Mathematical Models **(06)**

Definition of process model, physical and mathematical modeling, deterministic and stochastic process. Introduction, uses of mathematical models, classification of mathematical methods, scope of coverage, principles of formulation, fundamental laws, continuity equations, energy equations, equation of motion, transport equation, equation of state, equilibrium, kinetics

Unit 2: Mathematical Modeling of Mechanical & Chemical Engineering Systems **(06)**
Process models of some typical systems in differential equations form, , dead time, first and second order models, higher order models, Behavior of first order and second order system

Unit 3: Mathematical Models **(06)**
Mathematical Models of Tanks in series, Tanks in parallel Reaction dynamics, Modeling the chemical reactions, CSTR models, Plug flow reactor model, modeling of flash drum, distillation columns, evaporators, dryers, heat exchangers.

Unit 4: Basic concept of Optimi ation **(06)**
Optimization: Concept, need, Essential features of optimization Problem, Concepts of objective functions, Equality and Inequality Constraints, Payback period, Return of Investment, Net present Value, Internal Rate of Return. Classification of optimization problem based on Existence of constrains, Nature of design variables, Physical Structure of the problem, Equation Involved, Permissible values, of design variable, Deterministic Nature of the variables, separability of the variable, Number of objective functions. Continuity of functions, Convex and Concave functions, Convex Region, Extremum of the objective functions, quadratic approximation, Feasible region.

Unit 5: Optimi ation of Unconstrained Functions & Linear Pr ogramming **(06)**
One-Dimensional search numerical methods for optimizing a function of one variable , scanning and bracketing procedures, Newton, Quasi Newton and Secant methods,Runge Kutta method.

Unit 6: Unconstrained Multivariable Optimi ation **(06)**
Simplex method, Direct Methods, Indirect Methods, Steepest Descent method.
Linear Programming : Basics of Linear Programming, Simplex Algorithm

Text Books:
1. W. L. Luyben, Process, Modeling, Simulation and Control for Chemical

Engineers• by McGraw Hill, 1973.
2. Thomas Edgar, David Himmelblau, Optimization of Chemical Processes• Second edition, McGraw Hill, 2001.

Reference Books:
1. W. F. Stoecker, Design of Thermal Systems International Education, McGraw hill 1989.
2. J. Malley, Practical Process Instrumentation and Control • McGraw Hill.
3. Deo Narsingh ,System Simulation with digital Computer • Prentice Hall India, New Delhi.
4. Singiresu S.Rao,Engineering Optimization (Therory & Practice),third Edition,New Age International(p) Ltd,Publishers.

PEIN 4201(B): Digital Control

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Basics of Control System

Course Objectives:

1. To learn and understand control system design.
2. Design various digital controllers and study the response of those controllers.
3. To learn and understand stability of system in z-plane.
4. Introduce optimal control design and it's need.

Course Outcomes: The student will be able to

1. analyze system design in various planes S-W-Z and its mapping.
2. analyze stability of a system in S-plane and Z-plane
3. design and analyze system using classical method and state space.
4. design optimal control for a discrete system.

Unit 1: Introduction to Discrete Time Control System **(06)**

Basic building blocks of Discrete Time Control system, Sampling Theorem, Choice of Sampling Rate and Multirate Sampling, Z Transform and Inverse Z Transform for applications for solving Differential Equations, Impulse Sampling, Reconstruction: Data Hold, Mathematical Model of Zero Order Hold

Unit 2: Pulse Transfer Function and Digital Controllers **(06)**

The Pulse Transfer Function, Pulse Transfer Function of Open Loop and Closed Loop Systems, Pulse Transfer Function of Digital PID Controller, Velocity and Position forms of Digital PID Controller, Deadbeat Response and Ringing of Poles, Design of Deadbeat Controller.

Unit 3: Stability Analysis of Discrete Time Control System **(06)**

Stability regions in S-plane, W-plane and Z-plane and Mapping between the three planes, Stability Tests for Discrete System, Jury Stability Criterion, Bilinear Transformations.

Unit 4: Design of Discrete Time Control System- State Space Approach **(06)**

Different Canonical forms, Relation between State Equations and Pulse Transfer Function, Solution of Discrete Time State Space Equations, Cayley-Hamilton Theorem, Discretization of Continuous Time State Equation, Pulse Transfer Function Matrix, Eigen Values, Eigen Vectors and Matrix Diagonalization.

Unit 5: Pole Placement and Observer Design **(06)**

Concept of Controllability and Observability, Pole Placement Design by State Feedback, Design of feedback gain matrix using sufficient condition, Ackerman's formula, State Observers Types.

Unit 6: Introduction to Optimal Control **(06)**

Basics of Optimal Control, Performance Indices, Quadratic Optimal Control and Quadratic Performance Index.

Text Books:

1. Discrete Time Control systems by K. Ogata, Prentice Hall, Second Edition,2003.
2. Digital Control and State Variable Methods by M. Gopal, Tata McGraw Hill, 2003.
3. Digital Control by Kannan Moudgalya, John Wiley and Sons, 2007.

Reference Books:

1. Digital Control of Dynamic Systems by G.F.Franklin, J.David Powell, Michael Workman 3rd Edition, Addison Wesley, 2000.
2. Digital Control Engineering by M. Gopal, Wiley Eastern Ltd, 1989.
3. Digital Control by Forsytheand W. and Goodall R.N McMillan,1991.
4. Digital Control Systems by Contantine H. Houpis and Gary B. Lamont, *2nd Edition*, McGraw-Hill International, 2002.

PEIN 4201(C): Building Automation

Teaching Scheme
Lectures: 3 Hr/Week
Credit: 3

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks

Prerequisite: Basics of Electronics and Instrumentation

Course Objectives:
1. To understand Building automation systems
2. To understand the working of various Building Automation components.
3. To learn the Building Automation with applications.

Course Outcomes:
The student will be able to
1. Interpret and investigate the system requirements for BAS systems.
2. Classify, compare and choose the suitable BAS systems for the applications.
3. Articulate the purpose and operation of HVAC system components.
4. Analyze and validate the design of BAS systems.

Unit 1: Introduction to Building Automation Systems (07)
Intelligent building, Intelligent architecture and structure, Facilities management vs. Intelligent buildings, Lifecycle of building, Evolution of intelligent buildings. BAS System Hierarchy – Field level components, Direct Digital Control (DDC), Supervisory Controller, Server, Operator
Workstation (OWS). Different systems in BAS which includes HVAC, security, fire, lighting
systems. Importance of each system in BAS. Process of BAS design, Role of different stakeholders
(Architect, contractor, consultant, application engineer and engineer) in BAS system design,
Comfort parameters for human being- temperature, humidity, flow, pressure, clean air, CO_2%.
Unit 2: Fire Alarm Systems I
(07)
Introduction, Block diagram of FAS, Fire –Meaning, Fire Development Stages, Fire Sensors &
Detectors, Detector Placement, Detectors Required For Various Applications, Notification
appliances: types, specifications, installations guidelines. Fire Extinguishing Principles, Fire
Extinguishers & Its Classification.
Unit 3: Fire Alarm Systems II

(07)
FAS types and Architectures , FAS Loops and classification, comparision of loops, FAS
Communication Protocols, Various Fire Standards, Power Supply and voltage drop Calculations,
Cause & effect matrix.
Unit 4: Security Systems
(07)
Introduction, Access Control – Concept, Generic Model, Components, Types, Features, Card
Technologies, Communication Protocols, Controllers, Concept of Antipassback, Biometrics
Systems: Issues With Biometrics, Need and Applications, components of biometric systems
CCTV Systems: Introduction, Applications, CCTV Camera types, Camera Basics, Types of CCTV
systems: Traditional and Advanced CCTV Systems, Video Recording, Drawbacks, Digital Video
Recording, Features, Functionalities, Digital Vs Analog Recording, Digital Video Management
System .Unit 5: HVAC Water Systems
(07)
Design, working of different types of chilled water system- single chiller system, series chiller
system, parallel chiller system. Working of different components of chilled water system- decoupler
line, bypass line, primary circuit, secondary circuit, and condenser pumps. Concept of free cooling-
direct waterside, series waterside, parallel waterside free cooling.
Hot Water Systems: Concept of geothermal system, Working, design of different types of hot water
system- with boilers, heat exchanger with steam input, heat exchanger with hot water input,
geothermal system, solar system and combination of all listed systems.
Unit 6: HVAC Air Systems
(07)
Concept of Air handling unit. Design, working of different components in AHU- damper, filter,
cooling coil, heating coil, fan, heat recovery wheel, humidifier. Working, configuration,
characteristics for different types of dampers. Damper Sizing, Design and working of different
types of AHU. Operation of different modes.Concept of Variable Air Volume (VAV) system-Design,

working, use of different types of VAV- CAV, Design, working, use of radiation coil, chilled beam,
CRAC unit, VRV systems, unit heater, Fan coil unit and unit ventilator.

Text Books:

1. Robert Gagnon, Design of Special Hazards and Fire Alarm Systems.
2. Damjanovski, Vlado, CCTV, Butterworth-Heinemann , 3 rd ed.
3. Benantar M., Access Control System
4. Montgomery R, Fundamentals of HVAC Control Systems , Elsevier Publications
5. Roger W. Haines “HVAC Systems Design Handbook”, Fifth Edition
6. James E. Brumbaugh “HVAC Fundamentals”, volume 1 to 3
7. “Basics of Air Conditioning” ISHRAE, Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0004 for online shopping)

Reference Books:

1. “All About AHU’s”, ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0005 for online shopping)
2. “Chillers Basics”, ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0009 for online shopping)
3. “HVAC Handbook Part-1”, Indian Society of Heating, Refrigerating & Air Conditioning Engineers
4. “Handbook – Industrial Ventilation Application”, 2004 , Indian Society of Heating, Refrigerating & Air Conditioning Engineers

PEIN 4201 (D): Power Plants and Safety Instrumentation

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/Week	**In-Sem: 50 Marks**
Credit: 3	**End-Sem: 50 Marks**

Course Prerequisite: Basics of process control fundamentals, knowledge of Unit operations and basics of control strategies.

Course Objectives:
1. To expose the students to the detail process of various types of power plants.
2. To impart knowledge on various measurements and instrumentation involved in various types of power plants.
3. To provide the knowledge on specific measurement techniques and control systems practiced in boiler and turbine units.

Course Outcomes: The students will be able to

1. Identify the different unit operations, process control equipments involved in different types of power plants like thermal, nuclear and hydroelectric power plants
2. Apply his knowledge to select appropriate measurement techniques for measurement of various process parameters involved in power plants
3. Analyze and develop various control loops for processes involved in power plants
4. Assess various automation tools to develop automation strategy to Thermal power plant

Unit I: Introduction to thermal power plant (7 Hrs)

Thermal power plant process: Coal and ash circuit, Air and flue gas circuit, Water and steam circuit, Water treatment plant, DM plant, cooling water circuit
Main equipments: Boiler, steam turbines, generator, boiler feed pump, condensate extraction pump, deaerator etc
Measurements in power plants and sensors used: Measurement of feed water flow, air flow, steam flow and coal quantity, drum level measurement, Steam pressure and temperature measurement, flue gas analyzer, fuel composition analyzers, flame monitoring, Turbine speed and vibration measurement.

Unit II: Boiler and Turbine Controls (7 Hrs)

Boiler control: steam pressure control with load index, coal mill control, furnace draft control, drum-level controls, super heater temperature control, fuel/air ratio, oxygen, CO and CO_2 trimming, combustion efficiency, excess air, parallel and cross limited combustion control.
Turbine control: Turbine speed and load control, transient speed rise, automatic load frequency control, Turbine oil cooling system, Turbine run up system, Thermal stress control, Vibration, eccentricity, axial shift. Instrumentation in Generator cooling systems, Generator control system.

Unit III: Application of DCS in Thermal power plant control (7 Hrs)
Automation strategy, Automatic boiler control, diagnostic functions and protection, Electrohydraulic governor system, Automatic startup system, Distributed control to improve reliability Need of condition monitoring systems, Fault tolerant control system in thermal power plants.

Unit IV: Nuclear power plant (7 Hrs)

Nuclear power plant method of power generation, Basic physics of nuclear reactors Atomic structure, isotopes, radioactivity, basics of fission reaction, moderation, criticality Components of nuclear reactor Radiation sources and protection safety objectives Rad-waste management Safety Practices in Indian NPPS, Radiological Protection to workers and public, Dose limits, Health physics

Unit V: Nuclear power plant Instrumentation (7 Hrs)

Control loops for different types of nuclear reactors, Process sensors for nuclear power plants for radiations detection, temperature measurement etc, Safety in nuclear power plant, reliability aspects

Unit VI: Hydroelectric power plant Instrumentation (7 Hrs)

Hydroelectric power plant process, Types of water turbines, Governing system in water turbine of hydro power plant, Regulation & monitoring of voltage & frequency of output power, Electrical substation controls, SCADA solution to improve reliability, Safety system in hydro power, Pollution & effluent monitoring & control, Energy Management

Text Books:

1. Power Plant Instrumentation , K. Krishnaswamy, M. Ponnibala
2. Computer Based Industrial Control, Krishna Kant
3. Power Plant Engineering, Domkundwar
4. Power Plant Engineering, Manoj Kumar Gupta

Reference books:

1. Power Plant Instrumentation and Control Ajay Debnath, Swapan Basu Academic Press Elsevier
2. Process Control, Liptak
3. Boiler Control Systems, David Lindsley, Mc-Graw Hill
4. Power Plant Instrumentation and Controls, Philip Kiameh
5. G.F. Knoll, “Radiation Detection & Measurement”, 2nd edition, John Wiley & Sons, 1998.
6. Energy Management Handbook: W.C. Turner
7. Pollution: M.N.Rao and H.V. Rao.

OE 4201 (A): Instrumentation in Agriculture & Food Industry

Teaching Scheme
Lectures: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisite: Basics of sensors and transducers, knowledge of Unit operations and basics of process control, PLC and pneumatic and hydraulic instrumentation

Course Objectives:
1. To know the scope of Instrumentation in agriculture field
2. To Know greenhouse, food packaging automation schemes
3. Understand sensors used in agriculture field and weather monitoring stations
4. To get acquainted with foof quality standards

Course Outcomes: The student will be able to
1. identify the different unit operations, process control equipments involved in different types of process industries
2. select appropriate measurement techniques for measurement of various process parameters related to soil, green house, Dam and agro-metrology
3. analyze and develop various control loops for processes involved in various food processing plants
4. assess various automation tools to develop automation strategy to Dam, Green house, food processing and packaging in accordance to various food standards

Unit 1: Introduction **(07)**
Necessity of instrumentation & control for agriculture, engineering properties of soil: fundamental definitions & relationships, index properties of soil, permeability & seepage analysis, shear strength, Mohrs circle of stress, active & passive earth pressures, stability & slopes, Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouples

Unit 2: Instrumentation in Process industry **(07)**
Flow diagram of sugar plant & instrumentation set up for it, flow diagram of fermenter & control(batch process), flow diagram of dairy industry & instrumentation set up for it, juice extraction control process & instrumentation set up for it

Unit 3: Instrumentation in Irrigation and Green house System **(07)**
Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems, soil moisture measurement methods: resistance based method, voltage based method, thermal based method, details of gypsum block, irrigation scheduling, irrigation efficiencies, Application of SCADA for DAM parameters & control. Green houses & instrumentation: ventilation, cooling & heating, wind speed, temperature & humidity, rain gauge carbon dioxide enrichment measurement & control

Unit 4: Instruments in Agriculture **(07)**
Automation in earth moving equipments & farm equipments, implementation of hydraulic, pneumatic & electronics control circuits in harvesters cotton pickers, tractor etc. classification of pumps: pump characteristics, pump selection & installation. Agrometrological instrumentation weather stations, surface flux measurement, soil water content measurement using time-domain reflectrometery(TDR).

Unit 5: Food Processing **(07)**

Definition, Food quality measurement , food safety and standards bill 2005, central committee for food standards, Agmark, Bureau of Indian Standards, Codex Standards, recommended international code of hygiene for various products, Design consideration: cold storage, atmospheric controller and preservatives; biosensors.

Unit 6: Automation in Food Industry

Application of SCADA & PLC in food packing industry, Trends in modern food processing, Equipments for creating and maintaining controlled atmosphere.

Text Books:

1. D. Patranabis, "Principles of Industrial instrumentation", TMH (2010), ISBN-13: 978-0070699717
2. Michael. A.M, " Irrigation : Theory and Practice" , Vikas Publishing House Pvt Ltd, Second edition (2008), ISBN-13: 978-8125918677
3. Curtis D. Johnson, " Process control and instrumentation technology", , 8th Edition, 2015 ,Person, ISBN: 9789332549456, 9332549451
4. Akalank Kumar Jain , Vidhi Jain "Food Safety and Standards Act, Rules & Regulations", Akalank Publications; 13th Edition edition (2015), ISBN-13: 978-8176393584

Reference books:

1. Rosana G. Moreira, "Automatic Control for Food Processing Systems (Food Engineering Series)", Springer; 2001 edition (28 February 2001), ISBN-13: 978-0834217812
2. Bela G. Liptak , "Instrument Engineers' Handbook, Process Control and Optimization", CRC Press; 4 edition (29 September 2005), ISBN-13: 978-0849310812.
3. Robert H. Brown, " CRC Handbook of Engineering in Agriculture, Volume II: Volume I (C R C SERIES IN AGRICULTURE)", CRC Press; 1 edition (30 June 1988), ISBN-13: 978-084933862

MKSSS's Cummins College of Engineering for Women Karvenagar Pune-411052

DEAN ACADEMICS
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Karvenagar, Pune-411052

OE 4202B: Advanced Digital Signal and Image Processing

Teaching Scheme
Lectures: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: Basics of Digital Signal and Digital Image Acquisition

Course Objectives:
1. To study concepts and properties of Multirate DSP.
2. To learn concepts of Adaptive Filters.
3. To learn basic concepts and enhancement technique of Digital Image.
4. To study various applications of digital image processing in biometrics.

Course Outcomes: The student will be able to
1. suggest the use of Multirate DSP
2. design and implement the adaptive filters.
3. apply concepts of Digital image processing for advanced systems.
4. apply various image enhancement techniques for real time applications.

Unit 1: Multirate digital signal processing (06)
Basic multirate operation (up sampling, down sampling), Efficient structures for decimation and interpolation, Decimation and interpolation with polyphase filters,Noninteger sampling rate conversion , Efficient multirate filtering Applications.

Unit 2: Stochastic Processes and Spectral estimation (06)
Introduction, WSS signals and linear systems, spectral factorization, models of stochastic processes Spectral estimation: Periodogramm-based nonparametric methods: Periodogram, Bartlett's method, Welch's method, Blackman-Tukey method. Parametric methods for power spectrum etimation: AR,MA and ARMA modeling.

Unit 3: Adaptive filtering (06)
Principles of Adaptive filtering , LMS and RMS Algorithms, Applications in noise and echo cancellation, Homomorphic Signal Processing , homomorphic system for convolution, properties of complex-spectrum, Applications of homomorphic deconvolution.

Unit 4:Fundamentals of Digital Image Fundamentals (06)
Digital image representation, fundamental steps in image processing, Elements of digital image processing systems, Image fundamentals: Gray, Colour and Black and white. Color image models : RGB, CMY, HIS, etc models. Various Image Format, Sampling and quantization, Relationship between pixels, Statistical parameters (w.r.t. DIP) : Mean, standard deviation, variance,SNR, PSNR etc.

Unit 5: Image Enhancement (06)
Enhancement by point processing, spatial filtering, enhancement in the frequency domain. Contrast intensification: linear stretching, non-linear stretching, histogram specification, low contrast stretching. Smoothing: Image averaging, mean filter, order statistics filter, edge preserving smoothing. Sharpening: High pass filtering, homomorphic filtering.
Image Transforms: Basic transformations, Perspective transformation, 2-D Transforms: Fourier transform, Discrete cosine transform, Short time Fourier transform, Gabor transform, Radon transform, SVD, Wavelet Transforms, Hough Transform, Watershed Transform

Unit 6: Image segmentation and Image Compression

(06)

Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding,
region -oriented segmentation Representation and description: Representation schemes,
descriptors, regional descriptors, pattern and pattern classes, Introduction Classifiers. Introductionto image compression.

Text Books:

1. J. Proakis , Charles M. Rader, Fuyun Ling, Christopher L. Nikias, Advanced Digital SignalProcessing, (Macmillan Coll Div) (1992)
2. Glenn Zelniker, Fred J. Taylor, Advanced Digital Signal Processing, (CRC Press) (1994)
3. Gonzalez and Woods, Digital Image Processing with Matlab, Pearson Education,
4. Arthur Weeks Jr., Fundamentals of Digital Image Processing, Prentice-Hall International.

Reference Books:

1. A.V.Oppenheim and R.W.Schafer, Discrete time Signal Processing, (Prentice Hall) (1992)
2. Haykins, Adaptive Filter theory, (Prentice Hall) (1986)
3. Madhuri Joshi, Digital Image Processing, Prentice-Hall International.
4. A.K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.
5. K. R. Castleman, Digital Image Processing, Prentice-Hall International.
6. Pratt William, Digital Image Processing, John Wiley & Sons

An Autonomous Programme Structure of
M. Tech. Instrumentation and Control Engineering
Specialization: Automation
(AY: 2019-2020)
SEMESTER II

INA 1201 Computer Organization

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/Week	In sem: 25 Marks
	End sem: 50 Marks
	Credit: 3

Prerequisite: Basic computer skills and logic development skills

Course Objectives:

1. To provide better understanding of functions of different operating systems
2. To provide knowledge of software testing and communication protocols
3. To understand the software development life cycle

Course Outcomes: Students will be able to

1. To explain the operating system functions in detail.
2. To differentiate real time operating system and operating system.
3. To evaluate the performance of any developed software.
4. To use the proper communication channel and software for transforming and storing the data

Unit I: Operating System Overview **[6 Hrs]**
Concepts of Operating System and its services, Types of operating systems Process Management: Concept, scheduling, operations on process CPU scheduling: Basic concepts, CPU scheduling algorithms Deadlocks: Characterization, Handling, Recovery Disk scheduling algorithms

Unit II: Memory and File Management **[8 Hrs]**
Memory Management: Address Binding, Overlays, Swapping, Contiguous memory allocation, Paging, Segmentation
Virtual memory: Concept, Demand paging, Prepaging, Page size considerations, Page replacement algorithms, Thrashing
File system management: Concept, file access methods, directory structures, file allocation methods

Unit III: RTOS, Parallel Computers **[6 Hrs]**
Real Time & embedded System OS: Concepts, Types, their differences, Handheld Operating Systems.
Parallel Computers: Basic concepts, Types of parallelism, Classification of Parallel Systems, Flynn's Taxonomy, Array Processors, Clusters, and NUMA Computers.
Multiprocessor Systems : Structure & Interconnection Networks,Multi-Core Computers: Introduction, Organization and Performance.

Unit IV: Computer Communication **[6 Hrs]**
Computer Communication: ISO-OSI Seven Layer model, The TCP/IP reference model Introduction to LAN, LAN topologies, IEEE standards for networking- IEEE 802.3, IEEE 802.4, IEEE 802.5, Circuit switching and Packet switching networks, Features and capabilities of TCP/IP, Industrial Ethernet, Introduction to IEEE 1394, its configuration and advantages.

Unit : Database management System **[4 Hrs]**
Introduction to DBMS, Disadvantages of File Processing System, characteristics of DBMS Data Model, SQL Programing.

Unit VI: Software Testing **[6 Hrs]**
Software Development Life Cycle and its models: a. Linear Sequential b. Rapid development c. Incremental d. Component based Software Analysis, Software Design, Software Implementation

Software Testing: fundamentals, white box, black box testing, control structure testing, specific environment testing, comparison testing, orthogonal testing, strategic approach to testing, unit testing, integrated testing, validation testing, system testing, CASE tools

Software debugging: Standard guidelines, debugging techniques- use of break points, test macros, output files for sampled inputs, instruction set simulation, laboratory tools

Software maintenance: Preventive, Corrective, Adaptive, Enhancement, System Re-engineering

Text Books:

1. Operating System Concepts by Silberschatz, Galvin, Gagne
2. Parallel Computer architecture and programming by V. Rajaraman, C. SivaRam Murthy, PHI
3. Computer Networks by Andrew Tanenbaum, Prentice Hall.
4. Introduction To Data Compression by Khalid Sayood, Morgan Kaufmann Publishers, Inc.
5. Software Engineering by Ian Somerville, 4th edition, Addison Wesley publication

Reference Books:

1. Computer Architecture and Parallel processing by Kai Hwang, Faye Briggs, McGraw Hill International Editions
2. Computer Networks Protocols, Standards and Interfaces by Uyless Black, PHI
3. High Speed Networks TCP/IP and ATM design principles by William Stallings.
4. Software Engineering, A practitioner's Approach, 6th edition, McGraw Hill International Editions

INA 1202 Manufacturing Execution Systems

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/Week	In Sem: 50 Marks
Tutorial: 1 Hr/Week	End Sem: 50 Marks

INA 1202 Manufacturing Execution Systems

Teaching Scheme **Examination Scheme**

Lecture: 3 Hrs/Week In Sem: 50 Marks

Tutorial: 1 Hr/Week End Sem: 50 Marks

Credit: 4

Course Objectives:

1. To learn basics of MES and Technologies.
2. To learn how to implement MES in Production Systems.
3. To study various Applications and Case Studies of MES.

Course Outcomes: After having the course, students are expected to

1. Understand what and why MES in modern production systems
2. Setup, analysis, and giving possible application of MES
3. Know the connection of function within production systems to MES

Unit I: Introduction **[6 Hrs]**

Historical Development of Manufacturing Execution Systems. Definition of Terms. Shortfalls of Existing Architectures and Solutions. Demands of Future Production Management Systems

Unit II: Concept and Technologies **[6 Hrs]**

Commonalities between Existing Approaches and MES, Norm & Guidelines, Recommendations, Adjacent Areas, Product Lifecycle Management, Production Flow-Oriented Design: Cross-System Cohesiveness. Data Model for Product Definition, Data Model for Resource Management, System and Auxiliary Data, Order Fulfillment Data.

Unit III: Core Function – Production Flow – Oriented Planning **[6 Hrs]**

Integration within Overall Process, Order Data Management, Supply Management within theMES, The Planning Process, The Importance of The Control Station, Personnel Planning andRelease of Orders, Order Processing: General Information on Order Processing, OrderPreparation and Setup, Order Control, Performance Data, Maintenance Management.

Unit IV: Software Architecture and IT Systems **[6 Hrs]**

Software Architecture, Database, Interface with Other IT Systems, User Interfaces, Evaluation of Cost Effectiveness of MES: General Information on cost-Effectiveness,General Information on Evaluation, The Benefits of an MES, The Cost of an MES.

Unit V: Implementing an MES in Production **[6 Hrs]**

Implementing IT Systems in General, Preparation of Implementing Project, Analysis of theActual Situation, Creation of a Project Plan, Contract Specifications, Selection of a SuitableSystem, Implementation Process.

Unit VI: Applications & Case Studies **[6 Hrs]**
Merging the Systems, The MES as a Medium of Product-Development Management, Standardization of Function Modules, Merging Consultancy Activities and IT Systems, Application and case studies.

Reference Books:

1. Heiko Meyer, Franz Fuchs, Klaus Thiel, "Manufacturing Execution Systems", McGraw-Hill, 2009.
2. Heiko Meyer, Franz Fuchs, Klaus Thiel, "Manufacturing Execution Systems (MES):Optimal Design, Planning, and Deployment", McGraw-Hill, 2009.

List of Tutorials:

1. Concepts and Technologies: Norms and Guidelines
2. Supply Management within the MES
3. Interaction between the ERP System and the MES
4. Software Architecture in MES
5. Data Management and Archiving
6. Evaluation of the Cost-Effectiveness of MES
7. Implementing an MES in Production
8. Examples for Application (Case studies)

INA 1203 Advanced Control Systems

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credit: 3

Prerequisite: Basics of Electrical, Electronics and Instrumentation

Course Objectives :
1. To understand Advanced Control Concepts
2. To understand the designing of Advanced Control algorithms
3. To learn Advanced Control Systems with applications.

Course Outcomes: Student will be
1. Able to understand various Control Strategies.
2. Able to design and Implement Advanced Control Strategies.
3. Able to choose appropriate Control for various Applications.

Unit I: Stability Analysis **[6 Hrs]**
Time domain and Frequency domain analysis, Controller Tuning.
Unit II: Special Control Techniques **[6 Hrs]**
Control loops and Control Techniques
Unit III: Multivariable Control Analysis **[6 Hrs]**
Introduction to state -space methods, Control degrees of freedom analysis and analysis, Interaction, Bristol arrays, Tuning of multivariable controllers.
Unit IV: Advanced Control Techniques/Strategies **[6 Hrs]**
Sliding Mode Control, Adaptive Control, Model Predictive Controller, Multi Loop Control.
Unit V: Control Loops **[6 Hrs]**
Development of control loops, Instrumentation scheme for various Industrial Units like Boiler, Heat Exchanger, Evaporator, etc.
Unit VI: Fuzzy Logic and Neural Networks in Control applications **[6 Hrs]**
Design of controllers(PI-PID, etc) based on fuzzy logic and neural networks, Introduction to statistical process control, Case studies.

Text Books:
1.Process Control, F. G. Shinskey, McGraw Hill Book Company.
2.Process, Modeling, Simulation and Control for Chemical Engineers, W. L. Luyben, McGraw Hill.

3.Process Control Modeling, Design, and Simulation, B. W. Bequette, PHI Reference Books: 4.Process Control, Bela G Liptak, CRC Press, 2005 2.Chemical Process Control, stephanopoulos George, PH

End Sem: 50 Marks
Credit: 3

Prerequisite: Basics of Electrical, Electronics and Instrumentation

Course Objectives :

1. To understand Advanced Control Concepts
2. To understand the desigining of Advanced Control algorithms
3. To learn the Advanced Control Systems with applications.

Course Outcomes: Student will be

1. Able to understand various Control Strategies.
2. Able to design and Implement Advanced Control Strategies.
3. Able to choose appropriate Control for various Applications.

Unit I: Stability Analysis **[6 Hrs]**
Time domain and Frequency domain analysis, Controller Tuning.

Unit II: Special Control Techniques **[6 Hrs]**
Control loops and Control Techniques

Unit III: Multivariable Control Analysis **[6 Hrs]**
Introduction to state -space methods, Control degrees of freedom analysis and analysis, Interaction, Bristol arrays, Tuning of multivariable controllers.

Unit IV: Advanced Control Techniques/Strategies **[6 Hrs]**
Sliding Mode Control, Adaptive Control, Model Predictive Controller, Multi Loop Control.

Unit V: Control Loops **[6 Hrs]**
Development of control loops, Instrumentation scheme for various Industrial Units like Boiler, Heat Exchanger, Evaporator, etc.

Unit VI: Fuzzy Logic and Neural Networks in Control applications **[6 Hrs]**
Design of controller(PI-PID, etc) based on fuzzy logic and neural networks,
Introduction to statistical process control, Case studies.

Text Books:
1.Process Control, F. G. Shinskey, McGraw Hill Book Company.
2.Process, Modeling, Simulation and Control for Chemical Engineers, W. L. Luyben, McGraw Hill.
3.Process Control Modeling, Design, and Simulation, B. W. Bequette, PHI

Reference Books:
1.Process Control, Bela G Liptak, CRC Press, 2005
2.Chemical Process Control, Stephanopoulos George, PH

INA 1204 Artificial Intelligence & Machine Learning

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In-Sem: 50 marks
End-Sem: 50 marks

Credit: 3

Prerequisite: Concepts of Mathematics and Computational techniques

Course Objectives:
1. To explore the statistical analysis techniques for various kinds of data.
2. To understand the concepts and types of Artificial Intelligence and Machine Learning Algorithms.
3. To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms.

Course Outcomes: The students will be able to
1. Formalize a given problem in the different AI methods.
2. Implement basic AI algorithms.
3. Evalutae decision tree learning algorithms.
4. Analyze research based problems using Machine Learning Techniques.

Unit I: Fundamentals of Artificial Intelligence **[7 Hrs]**
Unit 1: Introduction, A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems.

Unit II: Searching **[7 Hrs]**
Depth First Search, Breadth First Search, Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm.

Unit III: Planning **[7 Hrs]**
Blocks world, STRIPS, Implementation using goal stack, Continuous Planning Machine Learning Algorithms.

Unit IV: Knowledge Representation **[7 Hrs]**
Knowledge based agents, Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, First order Logic,Basics of PROLOG.

Unit V: Machine Learning **[7 Hrs]**
Types of Learning: Supervised, Unsupervised, Reinforcement.
Learning System:Well posed learning problem, Designing a learning system, Issues in machine learning. Hypothesis, Target Function, Cost Function, Gradient, Training, Testing, Cross-validation, Evaluating hypothesis accuracy.

Unit VI: Algorithms **[7Hrs]**
SVM: Kernel functions, Linear SVM, Nonlinear SVM. Hidden Markov model, Genetic algorithm, Regression analysis, Multivariable regression Clustering Algorithm and recurrent Networks: k-means algorithm, k-nearest neighbor learning, weighted majority algorithm, Principal component Analysis (PCA), Collaborative Filtering.

Text Books:

1. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hil
2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.
3. T. Mitchell, Machine Learning,", McGraw-Hill, 1997.
4. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

Unit VI: Energy Management Audit **[6 Hrs]**

Definition, Energy Audit- need, Types of Energy Audit, Energy Management (audit) approach-understanding energy costs, Bench Marking, Energy Performance, Matching Energy use to Requirement, Maximizing System Efficiencies, Optimizing the Input Energy Requirements, Fuel and Energy Substitution, Energy Audit Instruments,

Text Books:

1. John W. Twidell & Anthony D.Weir, "Renewable Energy Resources".
2. Geofrey Boyle, "Renewable Energy: Power for a Sustainable Future", OUP in assn with Open University, 1996.
3. B. H. Khan: Non-Conventional Energy Sources

Reference Books:

1. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
2. Principles of Thermal Process: Duffie -Beckman.
3. Solar Energy Handbook: Kreith and Kreider (McGrawHill)
4. Solar Cell: Marteen A. Green

PEINA 1201 B Vehicle Intelligence

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/Week	In Sem: 50 Marks
	End Sem: 50 Marks

Credit: 3

Course Objectives:

1. To develop advanced skills to critically analyse and solve problems in vehicles.
2. To be able to evaluate Vehicle Intelligence requirements.
3. To be able to identify potential users and opportunities for intelligent vehicles.

Course Outcomes: Student will have

1. Comprehensive fundamental and technical knowledge sensors/transducers used in vehicle intelligence.
2. Ability to understand analyse and use various SI and CI management systems.
3. Ability to use On Board Diagnostics.

Unit I: Fundamentals **[4 Hrs]**

Automotive Electric Systems, Batteries, Alternator, Starter Motor, Ignition System, Headlamps, Horns, Wiper Motor etc.

Unit II: Sensors and Actuators **[8 Hrs]**

sensors for speed, pressure, crank shaft position, cam position, Mass Air Flow Rate (MAF), Throttle position, Oxygen Concentration. Various types of actuaters for vehicle

Unit III: Electronic Ignition System **[6 Hrs]**

Power Train, SI Engine Management, Layout Components of SI CI Systems, Throttle Body, MPFI, Principle of Operation of ignition systems, Contact Less Electronic Ignition Systems, Electronic Spark Timing Control.

Unit IV: CI Engine Management **[6 Hrs]**

Fuel Injection System, Parameters Affecting Combustion, Noise and Emission in CI Engines, Electronically Controlled Unit Injection System, Layout of the Common Rail Fuel Injection System, Working of Components like Fuel Injector, Fuel Pump, Rail Pressure Limiter, Flow Limiter.

Unit V: On Board Diagnostics and Efficiency Monitoring **[6 Hrs]**

Indian Scenario Transmission Systems: OBDI, Chassis Control System, ABS, Active Suspension System. Battery condition monitoring system, Tyre pressure monitoring system, vehicle lighting and control, Parking assistant system, Test-bench instrumentation for Vehicle-Performance Analysis.

Unit VI: Recent Trends in Vehicles and Automation **[6 Hrs]**

E-call system, Curse control system, Lane departure warning system, overtake assist system, Infotainment system, Autonomous vehicle systems, Self-navigating system, safety systems, Automatic parking system. Electric vehicles, Hybrid vehicles

Text Books:

1. C. P. Nakra, "Basic Automotive Electrical Systems", Dhanpat Rai Publications 33.
2. A. W. Judge, "Modern Electrical Equipments".
3. P. L. Kohali, "Automotive Electrical Equipments", TMH
4. N. R. Khatawale, "Automotive Electrical Auxiliary Systems".

Reference Books:

1. Young and Griffith, “Automotive Electrical Systems”, Butterworth Pub.
2. William H. Grouse, “Automotive Mechanics”, TMH.
3. Morris Mano, “Digital Logic and Computer Design”, Prentice Hall.

PEINA 1201 C System Modeling and Simulation

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/Week	In Sem: 50 Marks
	End Sem: 50 Marks
	Credit: 3

INA 1203 Advanced Control Systems

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credit: 3

Prerequisite: Basics of Electrical, Electronics and Instrumentation

Course Objectives :
1. To understand Advanced Control Concepts
2. To understand the designing of Advanced Control algorithms
3. To learn Advanced Control Systems with applications.

Course Outcomes: Student will be
1. Able to understand various Control Strategies.
2. Able to design and Implement Advanced Control Strategies.
3. Able to choose appropriate Control for various Applications.

Unit I: Stability Analysis **[6 Hrs]**
Time domain and Frequency domain analysis, Controller Tuning.
Unit II: Special Control Techniques **[6 Hrs]**
Control loops and Control Techniques
Unit III: Multivariable Control Analysis **[6 Hrs]**
Introduction to state -space methods, Control degrees of freedom analysis and analysis, Interaction, Bristol arrays, Tuning of multivariable controllers.
Unit IV: Advanced Control Techniques/Strategies **[6 Hrs]**
Sliding Mode Control, Adaptive Control, Model Predictive Controller, Multi Loop Control.
Unit V: Control Loops **[6 Hrs]**
Development of control loops, Instrumentation scheme for various Industrial Units like Boiler, Heat Exchanger, Evaporator, etc.
Unit VI: Fuzzy Logic and Neural Networks in Control applications **[6 Hrs]**
Design of controllers(PI-PID, etc) based on fuzzy logic and neural networks, Introduction to statistical process control, Case studies.

Text Books:
1.Process Control, F. G. Shinskey, McGraw Hill Book Company.
2.Process, Modeling, Simulation and Control for Chemical Engineers, W. L. Luyben, McGraw Hill.

3.Process Control Modeling, Design, and Simulation, B. W. Bequette, PHI Reference Books: 4.Process Control, Bela G Liptak, CRC Press, 2005 2.Chemical Process Control, stephanopoulos George, PH

1. To understand Advanced Control Concepts
2. To understand the designing of Advanced Control algorithms
3. To learn the Advanced Control Systems with applications.

Course Outcomes: Student will be

1. Understand various Control Strategies.
2. Able to Design and Implement Advanced Control Strategies.
3. Able to choose appropriate Control for various Applications.

List of Experiments:

1. Identify and obtain the model of the given system.
2. Analyze the given system in time domain and determine the time domain specifications of the same.
3. Analyze the given system in frequency domain and determine the frequency domain specifications of the same.
4. Design a controller for a multivariable system.
5. Implement model predictive controller for a typical process on simulation platform.
6. Implement sliding mode controller for a typical process on simulation platform.
7. Implement Neural network based (PID) controller for a typical process on simulation platform.
8. Implement Fuzzy logic (PID) controller for a typical process on simulation platform.

INA 1206: Artificial Intelligence and Machine Learning Lab

Teaching Scheme	**Examination Scheme**
Lab: 2 Hrs/Week	Oral: 25 Marks
	Credit: 1

Course Objectives:

1. To explore the statistical analysis techniques for various kinds of data.

2. To understand the concepts & types of Artificial Intelligence & Machine Learning Algorithms.
3. To be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms.

Course Outcomes: The students will be able to

1. Formalize a given problem in the different AI methods.
2. Implement basic AI algorithms.
3. Evaluate decision tree learning algorithms.
4. Analyse research based problems using Machine Learning Techniques.

List of Experiments:

1. Analysis of AI and Non-AI technique by implementing any two player game.
2. Implementation of Expert system in PROLOG.
3. Implementation of any real time problem using PROLOG.
4. Implement the Back Propagation Algorithm on a dataset obtained from UCI ML repository.
5. Implement Support Vector Machine algorithms on a dataset.
6. Implement Genetic algorithm algorithms on a dataset.
7. Implement K-means algorithms on a dataset.
8. Implement PCA algorithms on a dataset.

PEINA 1202 A Power Generation and Management Lab

Teaching Scheme
Lab: 2 Hrs/Week

Examination Scheme
In Sem: 25 Marks
Credit: 1

Course Objectives:

1. To understand the need and sources of energy generation.
2. To study the power generation schemes based on renewable energy sources.
3. To identify potential uses and opportunities of various energy generation methods.

PEINA 1202 B Vehicle Intelligence Lab

Teaching Scheme	Examination Scheme
Lab: 2 Hrs/Week	In Sem: 25 Marks
	Credit: 1

Course Objectives:
1. To develop experimentation skills in vehicles.
2. To be able to evaluate Vehicle Intelligence requirements.
3. To be able to understand advanced systems in vehicles.
.
Course Outcomes: Student will have
1. Comprehensive fundamental and technical knowledge sensors/transducers used invehicle intelligence.
2. Ability to understand and analyse instrumentation system for vehicle
3. Ability to design or modify an instrumentation system for vehicle.

List of Experiments:
lab./ assignments on the syllabus
1. Non contact speed measurements for petrol engine.
2. Specific fuel consumption of vehicle(average as km/lit.of fuel)
3. pressure controlled air filling system for tyre
4. Max. Acceleration measurement
5. Breaking distance measurement.
6. Max. Speed detection for vehicle.
7. Battery monitoring system
8. Lamp failure detection.
9. Anti- pinch control for windshield

INA 1101 Advanced Mathematics and Statistical Methods

Teaching Scheme
Lecture: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credit: 4

Course Objectives:
1. Gain knowledge of Laplace and Z Transforms.
2. Gain knowledge of the principles of inferential statistics & descriptive statistics.
3. Gain knowledge of the basic principles and concepts of elementary statistical techniques.

Course Outcomes:
1. Able to use Laplace and Z transforms on various applications.
2. Able to perform various test like t-test, F-test, chi-square test for data analysis.
3. Able to perform linear regression analysis & able interpret results in view of research to provide critical comment.

Unit I: Laplace & Z Transform **[6 Hrs]**
Basics of Laplace and Z Transform and relation between LT & ZT, Properties and Theorems in LT, LT of standard functions, Application of LT for solving Linear Differential Equations, ZT of standard sequences, Inverse Z, Solution of Differential Equations.

Unit II: Descriptive Statistics & Principles of Inferential Statistics **[6 Hrs]**
Introduction to basics of Statistics, Probability, random variables, Mean, Median, Kurtosis, Skewness, Standard Deviation, Correlation, Covariance and application of basis terms to various data sets. Population Distribution, Sample Distribution, Central Limit Theorem, Hypothesis Testing, p-value, Confidential Interval

Unit III: Concepts of Elementary Statistics **[6 Hrs]**
Need of various statistical tests, single sided tests and two-sided tests, t-test: its basics and result interpretation, F-test: its basics and result interpretation, chi-square test: its basics and result interpretation

Unit IV: Regression Analysis **[6 Hrs]**
Similarities and difference between the various techniques, Basics of Regression, Linear Regression Analysis, Applications and Interpretation, Quadratic Regression Analysis, Applications and Result Interpretation.

Unit V: Stochastics Simulation and Parametric Bootstrapping **[6 Hrs]**
Probability Distribution, ANOVA, Standard Parametric Statistical Models, Introduction to 'R' widely used Statistical Language.

Unit VI: Application of Statistical Data Analysis and Interpretation **[6 Hrs]**
Selection of data for analysis, Application of correct test for the analysis of data, Interpretation of results. Case study discussion.

Reference Books:

1. C. R. Wylie, L.C. Barrette, "Advanced Engineering Mathematics", McGraw Hill Publications, New Delhi, 6th Edition, 2003, ISBN-13: 978-0070721883.
2. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd, 8th Edition, 2004, ISBN: 047-115-4962.
3. S. P. Gupta, "Statistical Methods", Sultan Chand & Sons Publications, New Delhi, 28th Edition, ISBN10: 818-054-7396.
4. P. S. G. Kumar, "Research Methods and Statistical Techniques", BR Publisher, 2004, ISBN-10: 978-817-646-4451.

List of Tutorials: Tutorials should be conducted using MATLAB/Excel

1. Calculate Mean, Median, Skewness, Kurtosis, Standard Deviation for any data set.
2. Calculate Covariance & Correlation between the two data sets.
3. Application of Single Sided t-test and its Interpretation.
4. Application of Two-Sided t-test and its Interpretation.
5. Application of F-test and its Interpretation.
6. Linear Regression Analysis and its Interpretation.
7. Quadratic Regression Analysis and its Interpretation.
8. ANOVA Test

INA 1102 Research Methodology

INA 1102 Research Methodology

Teaching Scheme
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credits: 4

Course Objectives:
1. To understand basic concepts of research and research methodology
2. To understand principles behind Research problem formulation
3. To study Instrumentation schemes for Data collection
4. To understand Statistical methods for Data Analysis
5. To prepare a research/ project proposal

Course Outcomes: Student will be able to
1. Formulate Research Problems
2. Decide Instrumentation schemes for Data collection
3. Apply Statistical methods for Data Analysis
4. Write research proposals, and present Technical Papers

Unit I: Research Problem [7 Hrs]
Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem

Unit II: Basic Instrumentation [7 Hrs]
Instrumentation schemes, Static and dynamic characteristics of instruments used in experimental set up, Performance under flow or motion conditions, Data collection using a digital computer system, Linear scaling for receiver and fidelity of instrument, Role of DSP is collected data contains noise.

Unit III: Applied Statistics [6 Hrs]
Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis, Moments and response curve methods, State vector machines and uncertainty analysis, Probable errors in the research, Error analysis

Unit IV: Modeling and Prediction of Performance [8 Hrs]
Setting up a computing model to predict performance of experimental system, Multi-scale modeling and verifying performance of process system, Nonlinear analysis of system and asymptotic analysis, Verifying if assumptions hold true for a given apparatus setup, Plotting family of performance curves to study trends and tendencies, Sensitivity theory and applications.

Unit V: Developing a Research Proposal [8 Hrs]

Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student ¯a presentation and assessment by a review committee consisting of Guide and external expert only, Other faculty members may attend and give suggestions relevant to topic of research.

Reference Books:

1. S. Melville, W. Goddard, `Research Methodology: An introduction for Science & Engineering students_, Juta and Company, 1996.
2. R. Kumar, `Research Methodology: A Step by Step Guide for Beginners_, Pearson Education, 2nd Edition, 2005.
3. Dr. C. R. Kothari, `Research Methodology: Methods and Techniques_, New Age Publication, 2nd Edition, 2010.
4. R. Panneerselvam, `Research Methodology_, PHI Learning (2 edition), 2014.
5. S. Gupta, `Research Methodology and Statistical Techniques_, Deep and Deep, 2005.
6. N.J. Rajagopalan, `Research Methodology_, Depti Civil (Rev. Edition), 1994.

List of Tutorials:

1. Searching a correct/related Research Papers.
2. Reading of Research Paper.
3. Synthesis of Research Paper.
4. Classification of Research Papers based on Types of Research.
5. How to write a Review Paper.
6. How to write a Research based Conference & Journal Paper.
7. Presentation on Research Proposal ¯ Business Case (10 Slides only)

INA 1103 Industrial Internet of Things

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credit: 3

Course Objectives:
1. To study technology compliant to Industry 4.0.
2. To study various connectivity technologies and protocols for IIoT.
3. To study the adaptability of industrial sector to Industry 4.0.

Course Outcomes: Student will be able
1. To understand the structure and components of IIoT
2. To apply suitable connectivity technologies and protocols for different applications
3. To configure IIoT enabled devices using different platforms
4. To discuss actual applications and security used in different sectors in industry

Unit I: Introduction to IIoT **[6 Hrs]**
IoT Basics, Components, Architecture, Interdependencies, Categories, Gateways, Associated Technologies, Challenges, Considerations, Scalability IIoT Business Model, Reference Architecture
Role of Sensors, Actuators and Networks in IIoT.

Unit II: Connectivity Technologies of IIoT **[6 Hrs]**
Connectivity Technologies: Introduction, Features, Working Principle, Addressing, Routing and Applications of 6LoWPAN, RFID, Introduction, Features, Components, Methods, Variants, Communication, Response Models, Message Types and Applications of MQTT, CoAP, XMPP, AMQP or Equivalent.

Unit III: Communication Protocols in IIoT **[6 Hrs]**
Introduction, Features, Components, Methods, Variants, Communication, Topologies, Response Models, Message Types and Applications of IEEE802.15.4, Zigbee, HART and Wireless HART, Bluetooth, Zwave, ISA100.11.A, NFC and Equivalent.

Unit IV: Platforms in IIoT **[6 Hrs]**
Definition, Roll, Selection: Scalability, Ease of Use, Third Party Integration, Deployment Option, Data Security, Function of IOT Platform, Types of Platform: Application Enablement and Development, Network, Data and Subscriber Management, Device Management. Using a Web Interface– Programming, APIs / Packages, Arduino Interfaces, Integration of Sensors and Actuators with physical devices lke Arduino/Raspberry Pi.

Unit V: Security in IIoT **[6 Hrs]**
Introduction, Features, Components, Multihop Paths, Challenges of WSN, Detection and Connectivity, Event Aware Topology Management, Information Theoretic Self Management of WSN, Applications, Introduction to Big Data Analytics and Cloud Computing, Data Security, IIoT Privacy, Security and Governance Introduction, Overview of Governance.

Unit VI: Case Study and applications in Industrial Sector **[6 Hrs]**

IOT Applications in Home - Infrastructures, Buildings, Security, Industries, Home Appliances. Applications in Factories, Food Industry, Health Care, Inventory Management and Equivalent.

Text Books:

8. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by CRC Press.
9. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press.
10. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving". World of M2M Communications, ISBN: 978-1-118-47347-4, Wiley Publications.

Reference Books:

1. Dieter Uckelmann, Mark Harrison, Florian, "Architecting the Internet of Things", Springer.
2. "The Internet of Things: Key Applications and Protocols", by, Wiley
3. Olivier Hersent, David Boswarthick, Elloumi, Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things", Publisher: Lightning Source Inc; 1st Edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978- 0989973700.

INA 1104: Robotic Process Automation

Teaching Scheme
Lectures: 3 Hrs/Week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credits: 3

Course Objectives:
1. To introduce the basic concepts, parts of robots and types of robots.
2. To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
3. To select the robots according to its usage.
4. To select suitable major control components required to automate a process or an activity

Course Outcomes: After the successful completion of this course, the student will be able
1. To explain the basic principles of Robotic technology, configurations, control and programming of Robots.
2. To Design an industrial robot which can meet kinematic and dynamic constraints.
3. To identify potential areas for automation and justify need for automation
4. To identify suitable automation hardware for the given application.

Unit I: Introduction [6 Hrs]
Automation and Robotics, Historical Development, Basic Structure of Robots, Robot Anatomy, Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations.

Unit II: Control System in Robotics [6 Hrs]
Concepts about Basic Control System, Control Loops of Robotic Systems, Different Types of Controllers -Proportional, Integral, Differential, PID controllers. Sensors in robotics

Unit III: Control Technologies in Automation [6 Hrs]
Industrial Control Systems, Process Industries Versus Discrete- Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. PLC programming as per IEC61131-3 standard.

Unit IV: Computer Based Industrial Control [6 Hrs]
Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems & RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems.

Unit V: Transforms and Kinematics in Robotics [6 Hrs]
Forward and inverse kinematics, DH matrix transformation, Jacobian and differential motion, Static and dynamic analysis

Unit VI: Trajectory Planning [6 Hrs]
Introduction, General Design Consideration on Trajectories, Joint- interpolated trajectories. Applications of robotics.

Text Books:
1. ‘Process Automation’ by Gary dunning
2. ‘Industrial Process Automation Systems’ by B. R. Mehta, Y. Jaganmohan Reddy
3. ‘Introduction to Industrial Automation’ by Stamatios Manesis, George Nikolakopoulos

4. Robotics, control vision and intelligence - Fu, Lee and Gonzalez. McGraw Hill International, 2nd edition, 2007.
5. Introduction to Robotics - John J. Craig, Addison Wesley
6. M.P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, 5th edition, 2009.
7. Krishna Kant, “Computer Based Process Control”, Prentice Hall of India, 2nd edition, 2010.
8. S.K.Singh, “Computer Aided Process Control”, Prentice Hall of India, 1st edition, 2004.

Reference Books:

1. ‘Process Automation Handbook’ by Jonathan Love
2. ‘Computer Control of Processes’ by M Chidambaram
3. Robotics for Engineers – Yoram Koren, McGraw Hill International, 1st edition, 1985.
4. Industrial Robotics - Groover, Weiss, Nagel, McGraw Hill International, 2nd edition, 2012.
5. Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 20

1. ‘Process Automation’ by Gary dunning
2. ‘Industrial Process Automation Systems’ by B. R. Mehta, Y. Jaganmohan Reddy
3. ‘Introduction to Industrial Automation’ by Stamatios Manesis, George Nikolakopoulos
4. Robotics, control vision and intelligence - Fu, Lee and Gonzalez. McGraw Hill International, 2nd edition, 2007.
5. Introduction to Robotics - John J. Craig, Addison Wesley
6. M.P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, 5th edition, 2009.
7. Krishna Kant, “Computer Based Process Control”, Prentice Hall of India, 2nd edition, 2010.
8. S.K.Singh, “Computer Aided Process Control”, Prentice Hall of India, 1st edition, 2004.

Reference Books:

1. ‘Process Automation Handbook’ by Jonathan Love
2. ‘Computer Control of Processes’ by M Chidambaram
3. Robotics for Engineers – Yoram Koren, McGraw Hill International, 1st edition, 1985.
4. Industrial Robotics - Groover, Weiss, Nagel, McGraw Hill International, 2nd edition, 2012.
5. Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 20

PEINA 1101 A Building Automation System

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
In Sem: 50 Marks
End Sem: 50 Marks
Credit: 3

Prerequisite: Basics of Electrical, Electronics and Instrumentation

Course Objectives :

1. To understand Building automation systems
2. To understand the working of various Building automation components.
3. To learn the Building automation with applications.

Course Outcomes: Student will be

1. Able to understand working of Building Automation System.
2. Able to design Building Automation Systems.
3. Able to implement Building Automation System.

Unit I Fire Alarm Systems **[6 Hrs]**
Introduction, Block diagram of FAS, Fire –Meaning, Fire Development Stages, Fire Sensors & Detectors, Notification appliances, Fire Extinguishers.

Unit I FAS types and Architectures **[6 Hrs]**
FAS Loops, FAS Communication Protocols, Fire Standards, FAS Power Supply Design, Cause & effect matrix.

Unit III Security Systems **[6 Hrs]**
Introduction, Access Control Concept and Components, Communication Protocols, Biometrics Systems.

Unit IV CCTV Systems **[6 Hrs]**
Introduction, CCTV Camera types, Types of CCTV systems, Video Recording and Digital Video Management System.

Unit V HVAC System Parameters **[6 Hrs]**
Basic HVAC Science, HeatTransfer Principles, Psychrometry, HVAC Sensors & Transducers, Valves and Actuators.

Unit VI HVAC Components **[6 Hrs]**
AHU, Water Systems, Refrigeration Cycles.

Text/Reference Books:

1. Robert Gagnon, Design of Special Hazards and Fire Alarm Systems.
2. Damjanovski, Vlado, CCTV, Butterworth-Heinemann , 3rd ed.
3. Benantar M., Access Control System
4. Montgomery R, Fundamentals of HVAC Control Systems , Elsevier Publications

PEINA 1101 B Asset Management System

2. Arthur Weeks Jr., Fundamentals of Digital Image Processing, Prentice-Hall International.
3. W. Pratt, Digital Image Processing, Wiley Publication, Fourth Edition, 2013.

Reference Books:

1. Madhuri Joshi, Digital Image Processing, Prentice-Hall International.
2. A.K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.
3. K. R. Castleman, Digital Image Processing, Prentice-Hall International.
4. Pratt William, Digital Image Processing, John Wiley & Sons

INA 1105 Industrial Internet of Things Lab

Teaching Scheme | **Examination Scheme**
Lab: 2 Hrs/Week | In Sem: 25 Marks
Credit: 1

Course Objectives:

1. To study technology compliant to Industry 4.0.
2. To study various connectivity technologies and protocols for IIoT.
3. To study the adaptability of industrial sector to Industry 4.0.

Course Outcomes: Student will be able

1. To implement IoT connectivity to basic devices
2. To develop their own application based on IIoT
3. To comment on hardware, software and components in an application

List of Experiments:

Any 4 Practicals from 1-5 on Raspberry Pi / Arduino Board

1. Manipulating status of given output device.
2. Interfacing of any sensor.
3. Reading and displaying Analogue input voltage.
4. LED intensity variation depending upon potentiometer variation.
5. Speed variation of dc motor.

Any one application like

1. Interfacing of Raspberry Pi &/ Arduino Board with computer using any protocol.
2. Interfacing of sensor and sending data to mobile as SMS or to computer.
3. Wireless communication between two boards.
4. Sending sensor data to google sheets or any spread sheet. etc

Study, documentation, hardware and software design and component identification for any application in industrial sector as case study

INA 1106: Robotic Process Automation Lab

Teaching Scheme | **Examination Scheme**

INA 1106: Robotic Process Automation Lab

Teaching Scheme
Lab: 2 Hrs/Week
Credit: 1

Examination Scheme
Practical: 25 Marks

Course Objectives:
1. To study different automation tools like PLC, SCADA and DCS.
2. To study the sensors and control systems related to robotics
3. To understand the mathematical analysis of motion control of a robot.

Course Outcomes: By the end of the course, students should be able to
1. Develop PLC programs for various applications using different PLC instructions
2. Use DCS system for developing control loops
3. Develop HMI for any loop using SCADA
4. Simulate the motion analysis and control equations related to robotics

List of Experiments:
1. Develop & implement any PLC program as per IEC61131-3 standard.
2. Interfacing of PLC to any SCADA.
3. Developing and implementing any control loop using PLC system.
4. Developing and implementing any control loop using DCS system
5. Developing and configuring Graphic User Interface for any control loop.
6. Configure and implement different alarms in PLC and/or DCS system.
7. Velocity and position measurement using optical encoder
8. Simulation of forward kinematics and inverse kinematics
9. Simulation of trajectory path

Lab: 2 Hrs/Week Practical: 25 Marks

Credit: 1

Course Objectives:

1. To study different automation tools like PLC, SCADA and DCS.
2. To study the sensors and control systems related to robotics
3. To understand the mathematical analysis of motion control of a robot.

Course Outcomes: By the end of the course, students should be able to

1. Develop PLC programs for various applications using different PLC instructions
2. Use DCS system for developing control loops
3. Develop HMI for any loop using SCADA
4. Simulate the motion analysis and control equations related to robotics

List of Experiments:

1. Develop & implement any PLC program as per IEC61131-3 standard.
2. Interfacing of PLC to any SCADA.
3. Developing and implementing any control loop using PLC system.
4. Developing and implementing any control loop using DCS system
5. Developing and configuring Graphic User Interface for any control loop.
6. Configure and implement different alarms in PLC and/or DCS system.
7. Velocity and position measurement using optical encoder
8. Simulation of forward kinematics and inverse kinematics
9. Simulation of trajectory path

PEINA 1102 A Building Automation System Lab

Teaching Scheme **Examination Scheme**

Lab: 2 Hrs/Week Oral: 25 Marks

Credit: 1

Course Objectives:

1. To understand Building automation systems.
2. To understand the working of various Building automation components.
3. To learn the Building automation with applications.

Course Outcomes: Student will be

1. Able to understand working of Building Automation System.
2. Able to design Building Automation Systems.
3. Able to implement Building Automation System.

List of Experiments :

Students are expected to perform minimum eight experiments from the above syllabus.
The tentative list of experiments: (not limited to this list only):

1. To study Architecture of BMS & IBMS
2. To study FAS systems and components
3. To study SLC wiring and loops classifications
4. To study cause and effect matrix-Fire alarm system
5. To study Access Control System Architecture and components.
6. To study CCTV System Architecture and types of cameras
7. To study Psychometric chart and various parameters
8. To study different types of Air Handling Units
9. To study various terminal unit systems (CAV, VAV)
10. To study Chilled Water System and loops
11. To study Hot Water System and loops
12. Case study of FAS system.
13. Case study of CCTV system.
14. Case study of Access Control System.
15. Case study of HAVC system.

PEINA 1102 B Asset Management System Lab

Teaching Scheme	**Examination Scheme**
Lab: 2 Hrs/Week	Oral: 25 Marks

HS 4101 Green Computing

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Basic Sciences
Course Objectives:
Familiarize students with

1. Knowledge of green computing practices to minimize negative impacts on the environment.
2. Principles of green computing.
3. Green Computing and how it can help improve environmental sustainability.
4. Green Computing in enterprises and its impact.

Course Outcomes:
Students should be able to

1. Relate to the socio-cultural aspects of green computing.
2. Create awareness about green computing and promote a green agenda in their working environments leading to the green movement.
3. Apply green computing skills such as energy efficiency, IT assets disposal, carbon footprint estimation, reporting and development of green products.
4. Justify green initiatives while developing applications and services in enterprises.

Unit – I: Introduction to Green Computing **(07)**

Environmental Impacts of IT, Need of green computing, Green IT Standards, Enterprise Green IT Strategy, Hardware: Reuse, Recycle and Dispose, present scenario in industry, health issues relevance, Software: Energy-Saving Software Techniques

Unit – II: Software Development and Green Data Centers **(07)**

Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics

Unit – III: Green Data Storage and Networks **(07)**

Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management, Objectives of Green Network Protocols, Green Network Protocols and Standards

Unit – IV: Enterprise Green IT Strategy (07)

Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information

Unit – V: Green Computing Services and Roles (07)

Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise

Unit – VI: Regulating Green Computing (07)

The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Green Data Centres, Social Movements

Text Books:

1. San Murugesan, G. R. Gangadharan: Harnessing Green IT, WILEY, 1st Edition-2013.

Reference Books:

1. Woody Leonhard, Katherrine Murray, Green Home computing for dummies , Augu 2009, WILEY
2. Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmenta Intelligence , CRC Press, June 201 1
3. Alin Gales, Michael Schaefer, Mike Ebbers, Green Data Center: steps for th Journey , Shrof f/IBM redbook, 2011.
4. Jason Harris, Green Computing and Green IT-Best Practices on regulations & industry , Lulu.com, 2008
5. Carl Speshocky, Empowering Green Initiatives with IT , John Wiley & Sons, 2010.
6. Wu Chun Feng (Editor), Green computing: Large Scale energy efficiency , CR Press, 2012.

OE 4101 Software Testing and Quality Assurance

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Any programming language
Course Objectives:
Familiarize students with
1. Application of testing strategies in projects.
2. Test management strategies and tools for testing
3. Various quality assurance models

Course Outcomes:
Students should be able to
1. Analyze the project scenario and to select proper testing technique
2. Apply testing techniques to deliver a project
3. Choose quality assurance models for the project
4. Choose one of the latest testing tools suitable for the project

Unit – I: Software testing fundamentals **(07)**

Testing as a Process, Software testing principles, The tester s role in a software development organization, Origins of defects, Defect classes, Testing fundamentals, the defect repository and test design, Defect examples, Developer /Tester support for developing a defect repository. Process model to represent Different phases, Lifecycle models

Unit – II: Levels of testing **(07)**

Need for levels of testing, Unit testing, Integration testing, System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing, Stress testing, Regression testing, Alpha, Beta and Acceptance testing.

Unit – III: Testing techniques **(07)**

Using White Box Approach to Test design - Static Testing, Structural Testing, Unit Functional Testing, Challenges in White box testing, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing.

Unit – IV: Fundamentals of software quality assurance **(07)**

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 quality control Tools and Modern Tools.

Unit – V: Quality assurance models **(07)**

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM, Clean-room software engineering ,Defect Injection and prevention, Inspections & Walkthroughs, Case Tools and their effect on Software Quality.

Unit – VI: Software test automation and current industry trends **(07)**

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug. Combining Manual and Automated Testing, Adoption of DevOps, Big Data Testing, IoT Testing, Introduction to testing tools.

Text Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices,Pearson
2. Ilene Burnstein, Practical Software Testing, Springer International edition

Reference Books:

1. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications
2. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition
3. Stephen Kan, Metrics and Models in Software Quality, Addison Wesley, Second Edition
4. Watts S Humphrey, Managing the Software Process, Pearson Education Inc.

IT 4103 Software Architecture and Design Pattern Laboratory

Teaching Scheme:	**Examination Scheme:**
Practical: **2** hours/week	Oral: **50** marks
Tutorial: NIL	Credits: **1**

Prerequisites: Web Engineering Technology, Programming skill development laboratory

Course Objectives:

Familiarize students with

1. One client side programming Technology
2. One server side programming Technology
3. Developing a multiuser application

Course Outcomes:

Students should be able to

1. Apply appropriate technology to design the client side of the application
2. Apply appropriate technology to design the server side part of the application
3. Design the persistent layer classes their connection to database
4. Deploy and run the complete application

List of Assignments

1. Identify a system having three or four user expectations. Prepare its use case model
2. For the same system, prepare its analysis class model.
   Implement it using java language
3. For the same system, refine the analysis model and prepare the design class model.
   Implement it using java. Include appropriate applicable design patterns while designing the system.
4. Add view classes to your model and run the code handling appropriate events.
5. Design persistent layer classes and connect the business logic to database.
6. Deploy the application on server and ensure that it runs for various clients.
   Comment on the Quality attributes addressed in the system.

Text Books

1. Robert Sebasta, Programming the world wide web, Pearson Education, Edition 7, 2013
2. Deitel, Deitel and Nieto, Internet and World wide web how to program
   Pearson Education, Edition 5, 2013

Reference Books

1. Kogent Learning Solutions Inc Web Technologies Black Book 2009

IT 4104-PROJECT PHASE – I

Teaching Scheme:
Tutorial: **2** hrs/week
Practical:**14** hrs/week

Examination Scheme:
In semester: **100** marks
Oral: **50** marks
Credits: **9**

Course Objectives :
Familiarize students with:

1. The practical implementation of theoretical knowledge gained till date.
2. implementation of their ideas/real time industrial problem/ current application of Computer Science or Information Technology.

Course Outcomes :
At the end of this course the student should be able to :

1. Formulate a statement for the problem in Computer Science or Information Technology domain.
2. Prepare prototype for the identified problem.
3. Prepare System Specifications.
4. Work in team using ethical practices.

Following activities are expected to be completed in Project Phase-I:

1. Identification of Problem
2. Feasibility study
3. Formulation of Problem Statement
4. Abstract writing
5. Literature Survey
6. Project planning and maintaining log
7. High level System Design
8. Preparation of UML diagram using Tools.
9. Study of technology/platform
10. Technical Report writing
11. Start project based online course.

All this should be done with frequent meetings with internal and external guide.
The log has to be maintained.

Every project group has to give 2 Reviews in Semester-I

In Review-I, Point 1 to 4 should be completed. Demonstration and discussion with reviewers will be done.

In Review-II, Point 5 to 11 should be completed. Demonstration and discussion with reviewers will be done.

IT 4201 Information and Cyber Security

Teaching Scheme:	**Examination Scheme:**
Lectures: **3** hours/week	In-Semester: **50** marks
Tutorial: NIL	End-Semester: **50** marks
	Credits: **3**

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:

Familiarize students with

1. Information Security course surveys central concepts in applied information security and cyber security.
2. Make students aware of the major security risks and attack vectors.
3. Provides tools and practices for building secure systems.
4. Design, develop and support a global security system using the state of mind and reasoning on software systems security.

Course Outcomes:

Students should be able to

1. Implement the cipher techniques.
2. Analyze the various security algorithms and protocols.
3. Use different open source tools for network security and analysis.
4. Develop security systems.

Unit – I Cryptographic Techniques and Algorithms I (07)

Classical Encryption Techniques, Block Ciphers and DES, Basic Concepts in Number Theory and Finite Fields, Advanced Encryption Standard (AES), Block Ciphers. Operations,

Unit – II Cryptographic Techniques and Algorithms II (07)

Pseudo Random Number Generation and Stream Ciphers , Public Key Cryptography, Cryptographic Hash Functions Message Authentication Codes

Unit – III Cryptographic Protocols I (07)

Digital Signatures, Public-Key Certificates PKI, PKIX, and X.509, CA Hierarchy , User Authentication Protocols Public-Key Certificates PKI, PKIX, and X.509, CA Hierarchy

Unit – IV Cryptographic Protocols II (07)

Advanced Protocols: Zero knowledge Proofs, Identity based public key, Secure elections, Secure multi-party computation, and Digital cash.

Unit – V **Network Security** **(07)**

IP Security , Transport Level Security (TLS) HTTPS, HTTPS Use, Secure Shell (SSH), SSH Protocol Stack, Wireless Network Security, Wireless Network Threats, Countermeasures Mobile Device Security

Unit – VI **Cyber security** **(07)**

Electronic Mail Security: Email Security Enhancements, Pretty Good Privacy (PGP), S/MIME Intrusion Detection Malicious Software

Text Books

1. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson.

Reference books

1. D. R. Stinson: Cryptography: Theory and Practice (Discrete Mathematics and Its Applications), 3e, CRC Press.
2. B. Schneier: Applied cryptography: protocols, algorithms, and source code in C, 2e, John Wiley & Sons.
3. Bernard Menezes: Network Security & Cryptography, 1st Edition, Cengage Learning, Delhi, 2011.

PEIT 4201 Principles of Compiler Design

Teaching Scheme:
Lectures: **3** hrs / week
Tutorial: NIL

Prerequisites: Data Structures, Theory of Computation, Operating System

Course Objectives:
Familiarize students with
1. Process of compilation.
2. Tools used for the development of compilers and other language translation softwares.
3. Basic issues in code generation and optimization.

Course Outcomes:
Students should be able to
1. Design a lexical analyzer for a subset of C language.
2. Design a syntax analyzer for a subset of C language.
3. Generate intermediate code for the given programming language construct.
4. Apply different code optimization & generation techniques for a given code.

Unit – I: Introduction to Compiler & Lexical Analysis **(07)**

Introduction to compilers Design issues, passes, phases, symbol table Preliminaries, Memory management, Lexical Analysis Tokens, Regular Expressions, Process of Lexical analysis, Block Schematic, Automatic construction of lexical analyzer using LEX, LEX features and specification

Unit – II: Syntax Analysis **(07)**

Syntax Analysis Grammar (ambiguous, unambiguous, CFG), top-down parser (RDP, Predictive) and bottom-up parsers (SLR, LR-1, LALR), Error detection and recovery, automatic construction of parsers using YACC

Unit – III: Semantic Analysis **(07)**

Introduction to Semantic analysis, Need of semantic analysis, type checking, Syntax directed translation scheme, Intermediate code - need, types: Syntax Trees, DAG, Three Address codes: Quadruples, Triples and Indirect Triples, Intermediate code generation of declaration statement and assignment statement.

Unit – IV: Runtime Storage Management **(07)**

What is run-time support? Parameter passing methods, Storage allocation, Activation records, Static scope and dynamic scope, Heap memory management, Garbage Collection

Unit – V: Code optimization **(07)**

Machine Independent: Peephole optimizations: Common Sub-expression elimination, Removing of loop invariants, Induction variables and Reduction in strengths, use of machine idioms

Unit – VI: Code Generation **(07)**

Basic block, Register allocation and Assignment, Simple code generator, Sethi Ulman algorithm for code generation

Text Books:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tool Addison Wesley, ISBN:981 235 885-4.
2. Kenneth C. Louden , Compiler Construction: Principles and Practice , Course Technology ISBN-10: 0534939724, ISBN-13: 978-0534939724.

Reference Books:

1. Dick Grune, Bal, Jacobs, Langendoen, Modern Compiler Design , Wiley, IS 81-265-0418-8.
2. J R Levin, T Mason, D Brown, Lex and Yacc , O'Reilly , 2000 ISBN 81-7366-061-X.
3. K Muneeswaran, Compiler Design , Oxford University press, ISBN 0-19-806664-3.
4. Allan Holub, Compiler design in C , Prentice Hall, ISBN-13: 978-0131550452, ISBN 0131550454.

PEIT 4201 Information Retrieval

Teaching Scheme:
Lectures: **3** hrs/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Data structures
Course Objectives:
Familiarize students with
1. Concepts if Information Retrieval System.
2. Indexing techniques of Information retrieval System
3. Clustering in information retrieval system
4. Understand information sharing on semantic web

Course Outcomes:
Students should be able to
1. Model the working of information retrieval search system
2. Analyze Search Strategies used in Information retrieval system
3. Evaluate Information retrieval system using different statistical measures
4. Design techniques for information retrieval system

Unit – I: Introduction **(07)**

Basic Concepts of Information Retrieval, IR system architecture. Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Porter Stemmer, Retrieval Evaluation: Precision, Recall, F-Score, Mean Average Precision, Mean Reciprocal Rank, User oriented measures

Unit – II: Indexing and Clustering **(07)**

Indexing and Index Term Weighing, Probabilistic Indexing, Inverted file, Suffix trees & suffix arrays, Signature Files, Clustered files, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm

Unit – III: Search Strategies **(07)**

Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended Boolean retrieval, Latent semantic indexing, Fuzzy set retrieval

Unit – IV: Web Mining **(07)**

Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Mata-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack, Searching using Hyperlinks

Unit – V: Semantic Search Systems (07)

Semantic Search systems, Semantic Web, Ontology, Searching across ontologies, semantic web search, Google knowledge graphs

Unit – VI: Trends In Information Retrieval (07)

Case Study: Google Analytics, Search Engine Optimization, Ranking Algorithms, Recommendation Systems: Collaborative Filtering.

Text Books:

1. Yates & Neto, Modern Information Retrieval, Pearson Education, ISBN:81-297-0274-6
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk).,2ndISBN:978-408709293

Reference Books:

1. Grigoris Antoniou and Frank van Harmelen, A semantic Web Primer, Massachusetts.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutzen, Introduction to Information Retrieval, Cambridge University Press, Online book, ISBN:978-0-521-86571-5.

PEIT 4201 Internet of Things

Teaching Scheme:
Lectures: **3** hours/week
Tutorial: NIL

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Computer Networks
Course Objectives:
Familiarize students with
1. Logical and Physical design of IOT
2. IOT architecture and its structural aspects
3. Various IOT Protocols
4. IOT solutions and applications

Course Outcomes:
Students will be able to:
1. Interpret logical and physical design of IOT enabling technologies
2. Link IOT architecture with its different structural aspects
3. Differentiate various IOT protocols
4. Propose IOT solutions for various applications

Unit – I Introduction (07)
Definition and characteristics of IOT, Physical design of IOT: Things in IOT, IOT Protocols, Logical Design of IOT: IOT functional blocks, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies

Unit – II IOT Network Architecture (07)
IOT Architecture, IoT levels and Deployment templates: Level 1 to Level 5.Introduction to M2M, Difference between IoT and M2M, IoT protocol stack, Fog Computing, Edge Computing

Unit – III IOT Physical Devices and Objects (07)
Basic building blocks of IOT Device, Sensors, Actuators, and Smart Objects, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, pcDuino, Beagle Bone Black, CubieBoard, ARDUINO, SCADA

Unit – IV IOT Networking and Addressing techniques (07)
RFID technology, Wireless Sensor Networks, IPv6 Protocol Overview, comparison of IPv4 and IPv6, IPV6 tunneling, IPsec in IPv6, Quality of Service in IPv6

Unit – V IOT Protocols and Cloud offerings (07)
IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN, MQTT protocol
Introduction to cloud storage models and communication API's, web services for IoT

Unit – VI IOT Applications (07)
Smart City, Agriculture, healthcare, Retails, Environment

Text Books

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti, University

Press, 2015, ISBN: 978- 8173719547.

2. "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Daniel Minoli, Wiley Publications, 2013, ISBN: 978-1-118- 47347-4

Reference Books

1. "The Internet of Things: Connecting Objects to the Web", Hakima Chaouchi, Wiley Publications, ISBN: 978-1- 84821- 140-7.
2. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Cisco Press, 16 Aug 2017, ISBN: 978-1- 58714-456- 1 599.

PEIT 4201 Software Defined Networks

Teaching Scheme:	**Examination Scheme:**
Lectures: **3** hours/week	In-Semester: **50** marks
Tutorial: NIL	End-Semester: **50** marks
	Credits**: 3**

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:

1. Appraise SDN
2. To comprehend role of data, control, and management planes and their separation
3. Differentiate between network virtualization and network function virtualization
4. Analyze Openflow protocol.

Course Outcomes:

Students should be able to

1. To develop conceptual design of SDN solutions.
2. To apply network virtualisation for industry standard solutions
3. To solve industry case-studies based on SDN.
4. Analyze the functions and components of the SDN architecture.

Unit – I SDN architecture and Fundamentals. (07)

Introduction: The Modern Data Center, Roles and Separation of data, control and management Planes, Advantages and Disadvantages. Need of SDN, Genesis of SDN.

Working of SDN: Fundamental characteristics, SDN Devices, SDN controllers, Applications

Unit – II Openflow and Abstraction (07)

Introduction: Definition, OpenFlow architecture, Flow & Group Tables, types, Hybrid Approaches, The OpenFlow forwarding and pipeline model. OpenFlow Advantages and Limitations, OpenFlow Protocol.

Unit – III Network Virtualization (07)

Definition, Concepts, Benefits of Network Virtualization, Components of a Virtual Network, Applications, Existing Network Virtualization Framework

Unit – IV Control Plane (07)

Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.

Unit – V Data Plane (07)

Data Plane: Software-based and Hardware-based; Programmable Network, Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.

Unit – VI Network Function Virtualization (07)

Introduction: Concepts, Comparison of NFV and NV, Implementation and Application, Data Center Networks, Application of NFV in LTE, IMS, Content Delivery, Mobile Networks

Text Books

1. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, O'Reilly Media, ISBN:10:1-4493-4230-2, 978-1-4493-4230-2
2. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN:9780124166752, 9780124166844

Reference books

1. Vivek Tiwari, SDN and OpenFlow for Beginners, Digital Services, 10: 1-940686-00-8 13: 978-1-940686-00-4
2. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design,CRC
   Press,ISBN:10: 1466572094
3. Open Networking Foundation (ONF)Documents, https://www.opennetworking.org
4. Online Reading, http://www.nec-labs.com/ lume/sdn-reading-list.html,

OE 4201 Unified Communication

Teaching Scheme:
Lectures: **3** hours/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:
Familiarize students with
1. Compare Circuit switching and packet switching related to performance parameters.
2. Choose VOIP protocols for unified communications.
3. Analyze contact center as application of unified communications.
4. Interpret emerging technologies/protocols in VOIP communications.

Course Outcomes:
Students should be able to
1. Apply VOIP unified communications and analytics concepts to Contact Center Working.
2. Design and Implement VOIP protocols for telecommunication systems/applications.
3. Interpret and apply current or emerging knowledge in telecommunication engineering.
4. Use relevant mathematics and computer science concepts as tools.

Unit – I Introduction to digital and lP Telephony (07)

Digital Telephony: circuit switched networks, ss7, ISDN, Exchanges, E.164 Numbering Plans IP Telephony: Packet switched Networks, signaling & Media separation' Media Encapsulation ' RTP and RTCP, Audio and Video Codecs.

Unit – II VolP Protocols (07)

H.323 Network Elements, H.323 protocol, H.323 Call flows, SIP Network Elements, SIP Protocols, SIP Call Flows, H.248 protocol : Media Gateways, Media Gateway controllers, commands, Transactions, Contexts, Terminations, Descriptors' Packages

Unit – III Unified Communications (07)

Local and Network features, Voice & Data Integration, Collaboration, Mobility, Business Applications: Framework for custom applications, computer Telephony Interface, Application Sequencing.

Unit – IV **Inbound Contact Center** **(07)**

Call Centers: Introduction, Evolution and classification of Contact Centers.
Inbound Contact Center :Introduction Self Service / Interactive Voice Response, Routing, Intelligent Routing, VXML
Agent : Skills, Selection Algorithms, Modes, Service Observing, Recording

Unit – V **Outbound Contact Center and Reporting** **(07)**

Outbound contact center: Introduction, Proactive contact: voice, SMS, E-mail & chat. Contact Center Reporting: Types of Reports, Business use cases.
Analytics: Agent Performance, Occupancy

Unit – VI **Emerging technologies in Telecommunications** **(07)**

High Availability: Load balancing, Reliability, Failover & Failback, Location Redundancy, Hardware footprint, cloud Computing, Emerging Technologies: Google Glass, WebRTC, Hosting on Cloud.

Text Books

1. Allan Sulkin, "PBX Systems for IP Telephony" McGraw-Hil! Professional

Reference books

1. ITU-T H.323 Packet-based multimedia communications systems
2. ITU-TH.225Call Signaling Protocols and media stream packetization
3. ITU-T H-245 Control protocol for multimedia communication
4. IETF RFC 326131P: Session Initiation Protocol
5. IETF RFC4566 SDP: Session Description Protocol
6. Contact Center for' Dummies, Wiley Publishing Inc.
7. Real Time Communication with WebRTC, O'Reilly Publishing

IT 4202 Information and Cyber Security Laboratory

Teaching Scheme:
Practical: **2** hours/week

Examination Scheme:
Oral exam: **50** marks
Credits: **1**

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:

1. Learn to implement the algorithms DES, RSA, MD5, SHA-1 etc.
2. Make students aware of the major security risks and attack vectors.
3. Provides tools and practices for building secure systems.
4. Learn to use network security   like GnuPG, KF sensor, Net Strumbler

Course Outcomes:
Students should be able to

1. Implement the cipher techniques
2. Analyze the various security algorithms and protocols
3. Use different open source tools for network security and analysis
4. Develop security systems.

List of experiments:

1.Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts (any 2) :
a) Caesar Cipher
b) Playfair Cipher
c) Hill Cipher
d) Vigenere Cipher
e) Rail fence   row & Column   Transformation

2. Implement the following algorithms (any 3)
a) DES
b) RSA Algorithm
c) Diffie-Hellman
d) MD5
e) SHA-1

3.Implement the Signature Scheme

4. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

5. Analysis the Security Vulnerabilities of E-commerce services. / Analysis the security vulnerabilities of E-Mail Application

6. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)

7. Study assignment: (any 1)
   A. Study of different wireless network components and features of any one of the Mobile Security Apps.
   B. Study of the features of firewall in providing network security and to set Firewall Security in windows.
   C. Study of different types of vulnerabilities for hacking a websites / Web Applications.

Text Books

1. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson.

Reference books

1. B. Schneier: Applied cryptography: protocols, algorithms, and source code in C, 2e, John Wiley & Sons.
2. Bernard Menezes: Network Security & Cryptography, 1st Edition, Cengage Learning, Delhi, 2011.

IT 4203-Project Phase – II

Teaching Scheme:
Tutorial: **2** hrs/week
Practical: **16** hrs/week

Examination Scheme:
In-Semester: **100** Marks
Oral: **50** marks
Credits: **10**

Prerequisites: BTech-Project Phase I   Semester I

Course Objectives:
Familiarize students with:

1. Product development cycle.
2. Paper presentation activities.
3. Technical writing.

Course Outcomes:
At the end of this course the student should be able to:

1. Propose a System model.
2. Apply technical knowledge for solving a problem.
3. Create solution for problem in Computer Science and Information Technology.
4. Test product/service.

Following activities are expected to be completed in Project Phase-II:

1. Completion of online course.
2. Additional literature survey.
3. Detailed System design.
4. Implementation of project.
5. Write test cases.
6. Test developed project using testing tools.
7. Writing journal/conference paper on the project.
8. Participations in project competitions.
9. Project report preparation.

All this should be done with frequent meetings with internal and external guide.
The log has to be maintained.
Every project group has to give 2 Reviews in Semester-II
In Review-III, Point 1 to some part of 4 should be completed. Demonstration and discussion with reviewers will be done.
In Review-IV, remaining part from Point 4 to 9 should be completed. Demonstration and discussion with reviewers will be done.
At least one paper should be published in reputed International conference/International journal.

IT 4204 Project Based Online Course

Teaching Scheme:
Lecture: **2** hrs/week

Examination Scheme:
In-Semester: **50** marks
Credits: **2**

Course Objectives:

Familiarize students with
1. Exploring technical literature with the purpose of formulating a project statement.
2. Formulate intended future work based on the course they have registered.
3. Developing a prototype for the project statement.

Course Outcomes:

Students should be able to
1. Perform focused study of technical literature relevant to a specific topic.
2. Build independent thinking abilities to approach complex problems.
3. Extract desired knowledge from Online course.
4. Apply course knowledge for implementing the project.

Contents

1. The Project guide will suggest one/two online courses (which students have not studied till date)
2. Multiple courses can be taken by different group member of the same group.
3. Assignments related to project should be completed.

ME 4101 – CAD/CAM and Automation

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/week	In semester: 50 marks
	End semester: 50 marks
	Credits: 3

Prerequisites:
1. Strength of material
2. Manufacturing process

Course Objectives:

1	To apply homogeneous transformation matrix for geometrical transformations of 2D& 3D CAD entities
2	To apply mathematical models to get different type of curve generation
3	To write G&M codes based part program of CNC lathe and milling operations
4	To analyze 1D and 2D structural problems using finite element methods
5	To demonstrate digital manufacturing methods and Define structure and mechanism of industrial robotic system

Course Outcomes:
Upon completion of this course, students will be able to:

1	Apply homogeneous transformation matrix for geometrical transformations of 2D& 3D CAD entities
2	Apply mathematical models to get different type of curve generation/ Model the curves, surfaces and solid geometry
3	Write G&M codes based part program of CNC lathe and milling operations
4	Analyze 1D and 2D structural problems using finite element methods
5	Demonstrate digital manufacturing methods and Define structure and mechanism of industrial robotic system

Unit 1: Computer Graphics **8 Hrs**
Transformations (2D & 3D) : Introduction, Formulation, Translation, Shear, Rotation, Scaling and reflection, Homogeneous representation, Concatenated transformation, Mapping of geometric models, Inverse transformations, Introduction to 3D transformation
Projections : Orthographic, Isometric, Perspective projections

Unit 2: Geometric Modeling **8 Hrs**
Curves – Introduction, Analytical curves (Line, circle, ellipse, parabola, hyperbola), Synthetic curves (Hermite Cubic Spline, Bezier, B-Spline Curve)
Surfaces – Introduction, Surface representation, Analytic surfaces, Synthetic Surfaces, Hermite bicubic, Bezier, B-Spline, Coons patch surface, Applications in freeform surfaces
Solids - Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry (CSG), Boolean operation for CSG

Unit 3: Computer Aided Manufacturing **6 Hrs**
Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Working principal of CNC Lathe, Turning Centers, Milling Machine, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle.

CNC Lathe part programming (FANUC): Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc.
*CNC Milling part programming (FANUC)***:** Linear and circular interpolation, Pocketing, contouring and drilling cycles.

Unit 4: Finite Element Analysis (FEA) 10 Hrs
Introduction : Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads and constraints), General FEM procedure, Applications of FEM in various fields, meshing, p and h formulation, Advantages and disadvantages of FEM
One Dimensional Problem: Finite element modeling, coordinate and linear shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, (stepped bar, spring in series and parallel]
Trusses : Introduction, 2D Trusses, Element stiffness matrix for truss, Assembly of Global Stiffness Matrix , load vector

Unit 5: Digital Manufacturing , Robotics and Artificial Intelligence 8 Hrs
Rapid Prototyping : Introduction, classification of RP Processes (SLA, LOM, SLS, FDM, 3D printing), Working principle, features, models & specification of process, application, advantages and disadvantages, Rapid Tooling and STL format, Concept of 4D Rapid Prototyping.
Introduction to Robotics: Structure of Robotic System - Point to point & continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic. Drives, Controllers, Industrial Applications
Artificial Intelligence: Introduction, need and application, problem solving through forward and backward search, introduction to machine learning and industry 4.0

Suggested Texts and Reference Materials:

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Rao P. N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
3. Chandrupatla T. R. and Belegunda A. D. -Introduction to Finite Elements in Engineering - Prentice Hall India.
4. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010
5. S. K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional
6. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.

ME4102 – Transmission System Design

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:

1. Strength of machine elements (S.O.M.)
2. Engineering materials and their properties (Material Science and Metallurgy)
3. Principles of machine design (Machine Design)

Course Objectives:

1 To analyze the forces in rigid drives during power transmission.
2 To apply the AGMA equations to design a gear pair.
3 To select a drive element from manufacturer's catalogue.
4 To evaluate the tensions and stresses to design a flexible drive.
5 To explain the constructional and operational aspects of mechanical transmission systems
6 To discuss the design considerations of electric and hybrid transmission systems.

Course Outcomes: Upon completion of this course, the student will be able to,

1 Analyze the forces in rigid drives during power transmission.
2 Apply the AGMA equations to design a gear pair.
3 Select a drive element from manufacturer's catalogue.
4 Evaluate the tensions and stresses to design a flexible drive.
5 Explain the constructional and operational aspects of mechanical transmission systems.
6 Discuss the design considerations of electric and hybrid transmission systems.

Unit I: Elements of transmission systems-I (Rigid drives-I): Classification and selection of gears, standard tooth systems, modes of failures, terminology and force analysis, gear design based on strength (AGMA equations), dynamic load by velocity factor and Buckingham's equation. **8 Hrs**

Unit II: Elements of transmission systems-II (Rigid drives-II): Formative gear and force analysis of helical and bevel gears, design based on strength (AGMA equations), velocity factor and Buckingham's equation. Design of worm and worm gear based on strength and thermal considerations. **8 Hrs**

Unit III: Anti-friction Bearings and Flexible Drives : Ball and roller bearings, magnetic bearings, ball screw systems: Modes of failures, static and dynamic load ratings, equivalent dynamic load, reliability of bearing, bearing life, load-life relationship and selection of bearings from manufacturer's catalogue. Power rating, tensions, stresses and selection from manufacturer's catalogue for flexible drives. **8 Hrs**

Unit IV: Mechanical Transmission Systems: Gear boxes for automobiles and industrial use: Constant mesh, sliding mesh, synchromesh, differential and planetary gear box, and epicyclic power train. **6 Hrs**

Unit V: Electric and Hybrid Vehicle Transmission Systems: EV transmission configurations, transmission components, torque-speed characteristics, EV motor sizing, hybrid drive trains, sizing of components. **5 Hrs**

Unit VI: Series and Parallel Electric Drive Systems: Control strategies, sizing of major components, power ratings, traction motors, engine generator, and drive train parameters.
Design examples: GM two mode hybrid, Toyota Prius, Hyundai Ioniq Hybrid, Volkswagen Golf GTE. **5 Hrs**

Suggested Texts and Reference Materials:

1. Shigley J.E. and Mischke C.R., “Mechanical Engineering Design”, McGraw Hill Publication Co. Ltd.
2. Spotts M.F. and Shoup T.E. ,“Design of Machine Elements” ,Prentice Hall International.
3. Bhandari V.B ,“Design of Machine Elements”, Tata McGraw Hill Publication Co. Ltd.
4. Black P.H. and O. Eugene Adams ,“Machine Design”,McGraw Hill Book Co. Inc.
5. Willium C. Orthwein,“Machine Components Design”,West Publishing Co. and Jaico Publications House.
6. “Design Data”,P.S.G. College of Technology, Coimbatore.
7. Juvinal R.C,“Fundamentals of Machine Components Design”,John Wiley and Sons.
8. Hall A.S., Holowenko A.R. and Laughlin H.G,“Theory and Problems of Machine Design” , Schaum’s Outline Series.
9. Michael Nikowitz, ‘Advanced Hybrid and Electric Vehicles, System Optimization and Vehicle Integration’, Springer International Publishing Switzerland 2016.
10. Iqbal Husain, ‘Electric and Hybrid Vehicles, Design Fundamentals’, CRC PRESS.

HS 4101 -- Economics for Engineers

Teaching Scheme	Examination Scheme
Lecture: 3 Hrs/week	In semester: 50 marks
	End semester: 50 marks
	Credits: 3

Course Objectives:
1 To enable students to understand the Fundamental Economic Concepts
2 To enable students to understand the techniques of Inflation Factor
3 To Enable students to understand market structure and pricing theory.

Course Outcomes: Upon completion of this course, the student :
1 Will develop the Basics of Economics to solve engineering problems
2 Will be able to apply cost analysis in industry domain
3 Will be able to apply economically sound decisions

Unit 1: INTRODUCTION TO ECONOMICS 8 Hrs
Introduction To Economics- Flow In An Economy, Concept Of Engineering Economics – Engineering Efficiency, Revision of concepts like Economic Efficiency, Scope Of Engineering Economics – Element Of Costs, Marginal Revenue, Sunk Cost, Opportunity Cost, Break Even Analysis -P/V Ratio, Elementary Economic Analysis – Material Selection For Product Design Selection For A Product, Process Planning.
Unit 2: VALUE ENGINEERING 8 Hrs.
Make Or Buy Decision, Value Engineering – Function, Aims, Value Engineering Procedure. Interest Formulae And Their Applications –Time Value Of Money, Single Payment Compound Amount Factor, Single Payment Present Worth Factor, Equal Payment Series Sinking Fund Factor, Equal Payment Series
Unit 3: CASH FLOW 8 Hrs.
Methods Of Comparison Of Alternatives – Present Worth Method (Revenue Dominated Cash Flow Diagram), Future Worth Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Annual Equivalent Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Rate Of Return Method, Examples In All The Methods.
Unit 4: REPLACEMENT AND MAINTENANCE ANALYSIS 5 Hrs.
Replacement And Maintenance Analysis – Types Of Maintenance, Types Of Replacement Problem, Determination Of Economic Life Of An Asset, Replacement Of An Asset With A New Asset – Capital Recovery With Return And Concept Of Challenger And Defender, Simple Probabilistic Model For Items Which Fail Completely.
Unit 5: DEPRECIATION 8 Hrs.
Depreciation- Introduction, Straight Line Method Of Depreciation, Declining Balance Method Of Depreciation-Sum Of The Years Digits Method Of Depreciation, Sinking Fund Method Of Depreciation/ Annuity Method Of Depreciation, Service Output Method Of Depreciation-Evaluation Of Public Alternatives- Introduction, Examples, Inflation Adjusted Decisions – Procedure To Adjust Inflation, Examples On Comparison Of Alternatives And Determination Of Economic Life Of Asset.

Suggested Texts :
1.Panneer Selvam, R, “Engineering Economics”, Prentice Hall Of India Ltd, Second Edition ,New Delhi, 2013.
2. Banga and Sharma, “Industrial Organisation and Engineering Economics”, Khanna Publishers,Twenty Fifth ,2006

Reference books :

1.Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics And Analysis” Engg. Press, Texas, 2010. 2.Degarmo, E.P., Sullivan, W.G And Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011. 3.Zahid A Khan: , “Engineering Economy”, Dorling Kindersley, 2012

OE 4101L Automotive Technology

Teaching Scheme
Lectures: 3Hrs/week

Examination Scheme
In Sem.- I, II : 50marks
End Sem.: 50 Marks
Credits: 3

Pre-requisite:
1. Basic Mechanical Engineering.

Objectives:
1. To study layout of the vehicles.
2. To understand function of various components of automotive systems.
3. To understand use of alternative fuels for vehicle.

Course Outcomes:
Students will be able to:
1. Identify different layouts of automobile vehicle and engine auxiliary systems.
2. Explain types and function of transmission systems in vehicle.
3. Identify types, function of different steering, brakes and suspension systems to solve problems using required knowledge.
4. Compile use and need of alternative fuels.
5. Discuss current emission norms and identify use of emission control systems.

Unit 1: Vehicle Structure and Engine auxiliary systems: 8 Hrs
Vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine. Electronically controlled gasoline injection system for SI engines. Electronically controlled diesel injection system, Electronic ignition system.

Unit 2: Transmission Systems: 7 Hrs
Conventional transmission system, Automatic transmission system (fluid coupling, clutch less drive, fluid flywheel – torque converter), Semi-automatic transmission, continuously variable transmission (CVT), dual clutch hybrid transmission.

Unit 3: Steering, Brakes and Suspension Systems: 7 Hrs
Steering geometry and types of steering gear box - Power Steering, Active and passive Suspension Systems, Pneumatic and Hydraulic Braking Systems, Regenerative breaking, Anti-lock Braking System (ABS) and Traction Control.

Unit 4: Electric and hybrid vehicles: 6 Hrs
Concept of electric and hybrid vehicle, EV and HEV fundamentals, architecture and dynamics (power, regenerative breaking, torque speed relationship, performance, etc.) of

EV and HEV power train, drives and energy sources in EV and HEV. Vehicles with hydrogen fuel cells.

Unit 5: Modern Energy Sources: **6 Hrs**

Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LNG), Bio-fuels, lithium-ion battery, hydrogen fuel cell in Automobiles.

Unit 6: Emission control in automobiles: **6 Hrs**

Emission and Fuel Roadmap Euro 6 / BS V norms (proposed 2020-21), Exhaust gas re-circulation (EGR), Electrostatic precipitation (Particulate matter) and Engine emission control (three way catalytic converter system SCR and particulate filter).

Text Book:

1. Kirpal Singh, Automobile Engineering Vol 1 and 2, Standard Publishers, 7th Edition, 1997.
2. M. Chris and M. A. Masrur, Hybrid Electric Vehicles, Wiley Publications, 2nd Edition, 2017.

Reference Books:

1. K. K. Jain and R. B. Asthana, Automobile Engineering, Tata McGraw Hill Publishers, New Delhi, 1999.
2. Dr. K. R. Govindan, Automobile Engineering, Anuradha Publications, Chennai, 2013.
3. Joseph Heiner, Automotive Mechanics, Litton Education Publishing Ins., New York, 1999.
4. Angelin, Automotive Mechanics, Tata McGraw Hill Pub. Comp. Ltd., 10th Edition, 2004.

OE 4101 Finite Element Analysis

Teaching Scheme

Lectures: 3Hrs/week

Examination Scheme

In Semester: 50 marks

End Semester: 50 Marks

Credits: 3

Pre-requisite:

1. Engineering Mathematics
2. Numerical Methods
3. Applied Mechanics

Course Objectives:

1. To carry out discretization of differential equations using finite element method
2. To perform analysis of engineering problems using finite element method
3. To understand and interpret results obtained with FEA software tools.

Course Outcomes: Students will be able to

1. Derive discretization equations from differential equations for one- and two-dimensional problems
2. Solve static and dynamic engineering problems using FEA
3. Develop numerical codes in C/C++/Matlab for simple problems.
4. Perform simulations of rweal-life problems using FEA software tools

Unit 1: Introduction: **4 Hr**

Typical Application Examples, Automotive Applications, Manufacturing Process Simulation, Electrical and Electronics Engineering Applications, Aerospace Applications

Unit 2: **10 Hrs**

Finite Element Formulations: Weighted Residual Method, Use of a Single Continuous Trial Function, The General Weighted Residual (WR) Statement, Weak (Variational) Form of the Weighted Residual Statement, Functional and Differential Equation Forms, Principle of Stationary Total Potential (PSTP), Rayleigh–Ritz Method, One-dimensional Bar Finite Element, One-dimensional Heat Transfer Element

Unit 3: **12 Hrs**

One-dimensional Finite Element Analysis: General Form of the Total Potential for 1-d, Generic Form of Finite Element Equations, The Linear Bar Finite Element, The Quadratic Bar Element, Determination of Shape Functions, Element Matrices, Beam Element, Selection of Nodal d.o.f., Determination of Shape Functions, Element Matrices, Frame Element, One-dimensional Heat Transfer

Unit 4: **8 Hrs**

Two-dimensional Finite Element Analysis: Approximation of Geometry and Field Variable, Simple Three-noded Triangular Element, Four-noded Rectangular Element, Six-noded Triangular Element, Natural Coordinates and Coordinate Transformation, Alternate Methods of Deriving Shape Functions, Natural Coordinates—Quadrilateral Elements, Natural Coordinates—Triangular Elements, 2-d Elements for Structural Mechanics, Generic Relations, Three-noded Triangular Element, Four-noded Rectangular Element

Unit 5: **6 Hrs**

Dynamic Analysis Using Finite Elements: Vibration Problems, Equations of Motion Based on Weak Form, Axial Vibration of a Rod, Transverse Vibration of a Beam, Transient Vibration Analysis, Modelling of Damping, The Mode Superposition Scheme, Direct Integration Methods, Thermal Transients-Unsteady Heat Transfer in a Pin-Fin

Books:

1. Daryl L. Logan, A First Course in the Finite Element Method
2. Cook, R. D., Malkus, D. D. and Plesha, M. E., Concepts and Applications of Finite Element Analysis
3. Seshu, P., Textbook of Finite Element Analysis
4. Chandrupatla, T. R. and Belegundu, A. D., An Introduction to the Finite Element Method in Engineering

Karvenagar, Pune-411052

DEAN ACADEMICS
MKSSS's Cummins College of Engineering for Women
Karvenagar, Pune-411052

Principal
MKSSS's Cummins College of Engg. For Women, Karvenagar, Pune-52.

APPROVED BY
Governing Body Members
MKSSS's Cummins College of Engineering for Women
Karvenagar, Pune-411052

Industrial Engineering and Management

Final Year B.E Sem-I										
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Termwork		
OE 4101	Open Elective I	3	0	0	50	50	0	0	100	3

Course objectives:

The Industrial Engineering course prepares students to…

1. Understand type of organisation and calculate partial and total productivity
2. Learn the fundamental knowledge, skills, tools and techniques of methods study and work measurement.
3. Understand type of production environments, resource planning and control methods.
4. Learn basic resource scheduling techniques, human resource management and industrial safety norms.

Course Outcomes:

- **Students will be able to…**

1. **Identify** type of organisation and **analyze** partial and total productivity
2. **Manage** and implement different techniques of methods study and work measurement of process under consideration for improvement.
3. **Analyze** production environment under consideration w.r.to its resource planning and control.
4. **Apply** basic resource scheduling and human resource management techniques.

1. Introduction to Industrial Management and Productivity Analysis 6

- **Industrial management:** Functions and principles of management; Organisation: Concept, characteristics, structures and types of organisation- (formal line, military, functional, line and staff organisation);
- **Productivity analysis:** Definition, measurement of productivity: productivity models and index (numerical); factors affecting the productivity; productivity improvement techniques;
- Definition and scope of Industrial Engineering.

2. Method Study 7

- **Work Study:** Definition, objective and scope of work-study.
- **Method Study :** Definition, objective and scope of method study, activity recording and exam aids, Charts to record moments in shop - operation process charts, flow process charts, travel chart, two handed chart and multiple activity charts. Charts to record movement at work place - principles of motion economy, classification of moments, SIMO chart, and micro motion study. Definition and installation of the improved method;
- **Human factors** in Work-Study;
- **Value Engineering and Value Analysis**.

3. Work Measurements 6

- **Introduction:** Definition, objectives and uses; Work measurement techniques:
- **Time study:** Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating and standard rating, standard performance, scales of rating, factors affecting rate of working, allowances and standard time determination(numerical);
- **Work samplin**g: Need and procedure, sample size determinations (numerical);
- **Synthetic motion studies**: PMTS and MTM. Introduction to MOST (numerical).

4. Production Management 7

- **Production Planning and Control:** Types of production systems, functions of PPC, Aggregate production planning; Master Production Schedule; ERP
- **Forecasting techniques**: Causal and time series models, moving average, exponential smoothing, trend and seasonality; (Numerical).
- **Supply Chain Management:** Concept, Strategies, Supply Chain Network, Push and Pull Systems, Logistics, Distribution; Order Control strategies: MTO, MTA, MTS.

5. Facility Management 6

- **Facility Layout:** Factors affecting facility location; Types of Plant Layout; Computer Aided Layout Design Techniques; Assembly Line Balancing (Numerical);
- **Material Handling and Inventory Control:** Principles, Types of Material Handling Devices; Stores Management, Inventory costs, Types of inventory models - Deterministic and Probabilistic, Concept of EOQ, purchase model without shortages (Numerical); ABC and VED Analysis (Numerical).

Unit 6: Project Scheduling, Human Resource and Industrial Safety 6

- **Scheduling Techniques:** CPM and PERT(Numerical);
- **Human Resource Development:** Functions: Manpower Planning, Recruitment, Selection, Training; Concept of KRA (Key Result Areas); Performance Appraisal (Self, Superior, Peer, 360^0);

Text Books

1. Industrial Engineering and Production Management, M Mahajan, Dhanpat Rai and Co.

2. Industrial engineering and management by O. P. Khanna, Dhanpatrai publication

3. Industrial Engineering , Martend Telsang, S. Chand Publication.

4. Industrial Organisation & Engineering Economics by Banga and Sharma, Khanna publication.

5. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S. Chand, 1991

6. J. K. Sharma, Operations Research : Theory And Application, Laxmi pub. India.

Reference Books

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBH

Publishing Company, New Delhi, Second Indian Adaptation, 2008

2. Maynard's Industrial Engineering Hand Book By H.B. Maynard, KJell, McGraw Hill

Education, 2001

3. Zandin K.B. - Most Work Measurement Systems, ISBN 0824709535, CRC Press, 2002.

- Assignment based evaluations are designed. **This evaluation is treated as T1-Marks**. Marks will be calculated (at the end of semester) on the basis of successful completion / submission of assignments explained to you time to time on the basis of syllabus content. [Note: these assignments are part of activity based learning. Hence, students are to work in a group to complete following assignments].

Assignment Details	Mapped COs
1. Case study based Assignment on Method Study. [Data may be collected from: 1) Day to day activity : Workshop, Library, Admin area, Canteen, Parking 2) Students visiting industrial area for project 3) Quality concept Assignments in a Group.]	**CO1**
2. Hands on Assignment on application of Work Measurement technique(s). [1) Using stopwatch work measurement can be completed. (E.g. in workshop)]	**CO1, CO1**
3. Simulation / Assignment on Routing & Scheduling Model. [Open Source Softwares 1) Flexsim (Videos are available online) 2) Arena - Student Version 3) Pro model – Student Version 4) Excel templates available online. Note: Backward / Forward Scheduling concepts are to be included.]	**CO1, CO4**
4. Assignment on simulation of Manufacturing System / Service System Operations for demand forecasting of the given product using any two methods. [1) Data from shops malls, manufacturing company, etc.]	**CO1, CO4**
5. Assignment on simulation determination of EOQ and plot the graphs. [1) Use of any freeware available.]	**CO1, CO4**
6. Assignment on analysis of Manufacturing / Service Operation for Capacity Planning. [1) Define capacity term for the real life environment you are working for (e.g. foundry= tons of casting, hospital = no. of bed, etc.) 2) Study and collect the data of Variation in demand and capacity planning. 3) Analysis the pattern of data set and report… how they manage the change in capacity.]	**CO1, CO4**
7. Case study based assignment on supply chain model. [1) Select any real life supply chain (any engineering product processing, vendors for vegetable grocery, etc.) 2) Identify all major supply chain elements and prepare supply chain diagram and report.]	**CO1, CO4**
8. Assignment on analysis of (selected) plant layout modeling / Simulation for bottleneck / line balancing. [Plant layout with its detail (with Scale) and identify the type.]	**CO1, CO4**
9. Assignment on analysis of material handling system - for the selected plant layout. [This assignment must be completed with the help of plant layout visited in earlier assignment.]	**CO1, CO4**
10. Case study based assignment on identification of Key Result Areas for performance appraisal for selected company (3600 feedback). [Real life case studies.]	**CO1, CO4**
11. Assignment on industrial safety audit of selected work environment. [Download standard questionnaire and visit any work environment and submit it as assignment.]	**CO1, CO4**
<u>Note</u>: If student groups working with industry for their project, they are advised to collect data related to above mentioned assignments for submission.	

ME 4103 CAD/CAM and Automation Laboratory

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
End semester: 50 marks
Credits: 1

Prerequisites:
1. Strength of material
2. Manufacturing process

Course Objectives:

1 To apply homogeneous transformation matrix for geometrical transformations of CAD entities
2 To compute stresses, strains, and deflection for bar, truss and beam problems under static loading using finite element tool
3 To incorporate manufacturing simulation tool for virtual manufacturing of lathe and milling part
4 To demonstrate 3D printing technique for preparing of prototype models

Course Outcomes:

Upon completion of this course, students will be able to:

1 Apply homogeneous transformation matrix for geometrical transformations of CAD entities
2 Compute stresses, strains, and deflection for bar, truss and beam problems under static loading using finite element tool
3 Incorporate manufacturing simulation tool for virtual manufacturing of lathe and milling part
4 Demonstrate 3D printing technique for preparing of prototype models

List of Practical Activities:

1. Write a Programs for transformation of different objects using MATLAB solver
2. Solve 1D bar problems for stress and deflection analysis using ANSYS
3. Solve 2D truss problems for stress and deflection analysis using ASYSS
4. Stress and deflection analysis of plate/bracket using ANSYS
5. Tool path generation of Turning components using Feature CAM tool
6. Tool path generation of Milling components using Feature CAM tool
7. Manufacture assembly components using 3D printing machine
8. Assignment of robot gripper design

Text Book:

1. Ibraim Zeid, Mastering CAD/CAM – Tata McGraw Hill Publishing Co. 2000
2. Nitin S. Gokhale, Practical Finite Element Analysis, Finite to Infinite; First edition

ME 4104 Project Phase I

Teaching Scheme
Practical: 14 Hrs/week

Examination Scheme
InSem: 100 Marks
Oral: 50 Marks
Credits: 9

Course Objectives:

1. To identify societal and engineering needs; formulate a problem statement, articulate aims and objectives to create solutions for complex problems.
2. To carry out literature Survey relevant to the problem and decide appropriate solution methodology to arrive at a solution of real life engineering problems.
3. To apply principles of mechanical engineering and interdisciplinary knowledge to carry out design analysis of complex engineering problems using research based methods.
4. To Form teams, work effectively and be able to plan the project activities for timely completion of the project.

Course Outcome:

After learning the course the students should be able to

1. Identify societal and engineering needs; formulate a problem statement, articulate aims and objectives to create solutions for complex problems.
2. Survey literature relevant to the problem and decide appropriate solution methodology to arrive at a solution of real life engineering problems.
3. Apply principles of mechanical engineering and interdisciplinary knowledge to carry out design analysis of complex engineering problems using research based methods.
4. Form teams, work effectively and be able to plan the project activities for timely completion of the project.

1. Prepare Two Hard Bound Copies of your manuscript.

2. Limit your project report to 100– 120 pages (preferably)

3. The footer must include the following: Institute Name, B.Tech. (Mechanical) Times New Roman 10 pt. and centrally aligned.

4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned.

5. Print the manuscript using a) Letter quality computer printing. b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified. c) Use 1.5 line spacing. d) Entire report shall be of 5- 7 chapters

6. Use the paper size 8.5 11 or A4 (210 197 mm) Please follow the margins given below. Margin Location Paper 8.5 11 Paper A4 (210 197 mm) Top 1 25.4 mm Left 1.5 37 mm Bottom 1.25 32 mm Right 1 25.4mm

7. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.

8. Section titles should be bold with 14 pt. typed in all capital letters and should be left aligned.

9. Sub-Section headings should be aligning at the left with 12 pt. bold and Title Case (the first letter of each word is to be capitalized).

10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
a) Illustrations should not be more than two per page. One could be ideal
b) Figure No. and Title at bottom with 12 pt.
c) Table No. and Title at top with 12 pt.
d) Legends below the title in 10 pt.
e) Leave proper margin in all sides

INSTRUCTIONS FOR PROJECT REPORT WRITING
It is important that the procedures listed below be carefully followed by all the students of B.Tech. (Mechanical Engineering).
1. Prepare Three Hard Bound Copies of your manuscript.
2. Limit your Project Report report to 100– 120 pages (preferably)
3. The footer must include the following: Institute Name, B.Tech. (Mechanical) Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned.
5. Print the manuscript using
a) Letter quality computer printing.
b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified.
c) Use 1.5 line spacing.
d) Entire report shall be of 5- 7 chapters
6. Use the paper size 8.5 11 or A4 (210 mm) 197 Please follow the margins given below. Margin Location Paper 8.5 11 Paper A4 (210 197 mm) Top 1 25.4 mm Left 1.5 37 mm Bottom 1.25 32 mm Right 1 25.4mm
7. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.
8. Section titles should be bold with 14 pt. typed in all capital letters and should be left aligned. 9. Sub-Section headings should be aligning at the left with 12 pt. bold and Title Case (the first letter of each word is to be capitalized).
10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
a) Illustrations should not be more than two per page. One could be ideal
b) Figure No. and Title at bottom with 12 pt.
c) Table No. and Title at top with 12 pt.
d) Legends below the title in 10 pt. e) Leave proper margin in all sides f) Illustrations as far as possible should not be photo copied.

11. Photographs if any should be of glossy prints

12. Please use SI system of units only.

13. Please number the pages on the front side, centrally below the footer

14. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author

15. Symbols and notations if any should be included in nomenclature section only

16. Following will be the order of report
i. Cover page and Front page (as per the specimen on separate sheet)

ii. Certificate from the Institute (as per the specimen on separate sheet)
iii. Acknowledgements
iv. Contents
v. List of Figures
vi. List of Tables
vii. Nomenclature
viii. Abstract

(A brief abstract of the report not more than 150 words. The heading of abstract i.e. word "Abstract" should be bold, Times New Roman, 12 pt and should be typed at the center. The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on motive, method, key-results and conclusions in Abstract.
1. Introduction (2-3 pages) (TNR – 14 Bold)
1.1 Problem statement (TNR – 12)
1.2 Objectives
1.3 Scope
1.4 Methodology
1.5 Organization of Project Report
2. Literature Review (10-15 pages) Literature Review (10-15 pages) Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.
3. This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (15- 20 pages)
4. Experimental Validation - This chapter shall be based on your own experimental work (15-20 pages)
5. Concluding Remarks and Scope for the Future Work (2-3 pages)
References ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)

17. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, … and for subheadings 1.1, 1.2, …. etc and section subheadings 2.1.1, 2.1.2, …. Etc.

18. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source / citation of it. Please follow the following procedure for references

Reference Books : Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions : Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, ASHRAE Trans, 1991, 97 (1), pp. 90 – 98. Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, Int. Journal of Refrigeration, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings : Colbourne, D. and Ritter, T. J., Quantitative assessment of flammable refrigerants in room air conditioners, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc. : United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002. ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent : Patent no, Country (in parenthesis), date of application, title, year.

Internet : www.(Site) [Give full length URL] accessed on date

ME 4201 – Turbomachines

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Prerequisites:
1. Applied Thermodynamics
2. Fluid Mechanics

Course Objectives:

1	Compute the power developed and efficiency of hydraulic turbine
2	Determine head developed by a centrifugal pump and power required to operate it
3	Calculate the diagram efficiency and diagram power for a given steam turbine
4	Perform calculations for the power developed and efficiency for gas turbine
5	Construct velocity triangles and calculate slip of centrifugal compressor

Course Outcomes:
Upon completion of this course, the student will be able :

1	Compute the power developed and efficiency of hydraulic turbine
2	Determine head developed by a centrifugal pump and power required to operate it
3	Calculate the diagram efficiency and diagram power for a given steam turbine
4	Perform calculations for the power developed and efficiency for gas turbine
5	Construct velocity triangles and calculate slip of centrifugal compressor

Unit 1: Introduction **4 Hrs**
Turbo machines (Hydraulic & Thermal), Classification of Turbo machines, Comparison with positive displacement machines, Fundamental equation governing turbo machines, Concepts of Velocity triangle and impact of jet on curved vanes

Unit 2: Introduction & Hydraulic Turbines **8 Hrs**
Pelton wheel- Construction, principle of working, velocity diagrams and analysis, design aspects, Reaction Water Turbines : Classifications, Francis, Propeller, Kaplan Turbines, construction features, velocity diagrams and analysis, degree of reaction,

Unit 3: Steam Turbines **8 Hrs.**
Steam Turbines: Classifications (Axial and Radial), construction details, compounding of steam turbines,
velocity diagrams and analysis of Impulse and reaction turbines (single stage), governing of steam turbines

Unit 4: Centrifugal Pumps **5 Hrs.**
Classification of rotodynamic pumps, components of centrifugal pump, types of heads, velocity triangles
and their analysis, effect of outlet blade angle, cavitation, NPSH, specific speed, performance characteristics of centrifugal pump, Cavitation, open, semi open impeller pumps

Unit 5: Centrifugal Compressor **8 Hrs.**
Classification of rotodynamic compressors, blowers, fans. Centrifugal compressor: Construction, flow process on T-S Diagram, velocity diagram and Euler's work, slip factor and its effect on work input, actual work input, dimension parameters, surging, choking, stalling.

Unit 6: Gas Turbines **8 Hrs.**

Construction and Working of Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Actual cycle effect of operating, variables on thermal efficiency, inter-cooling reheating, & regeneration cycle,

Suggested Texts and Reference Materials:

1	Jagdish Lal, Hydraulic Machines, Metropolitan Book Company
2	William W. Peng, Fundamentals of Turbomachinery, John Wiley & Sons.
3	Turbines, Compressors & Fans, S.M. Yahya, Tata-McGraw Hill
4	S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, IV edition, Butterworth-Heinemann Publ., 1966.
5	R. K. Rajput Hydraulic Machines, S. Chand
6	V. Ganeshan, Gas Turbines, Tata Mcgraw Hill

PEME4201 – Mechanical Vibrations

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisites:

1. Rigid body dynamics
2. Machines and Mechanisms
3. Machine Design

Course Objectives:

1	To understand the methods to find natural frequency of system subjected to undamped free vibrations.
2	To analyze the system subjected to vibrations with viscous/coulomb damping.
3	To calculate the amplitude and phase difference for various cases of forced vibrations.
4	To explain the features and applications of various vibration measuring devices.
5	To describe various vibration control methods.
6	To understand basics of noise measurement and determine the overall db level.

Course Outcomes:

Upon completion of this course, the student will be able to,

1	evaluate the natural frequency of system subjected to undamped free vibrations.
2	analyze the system subjected to vibrations with viscous/coulomb damping.
3	calculate the amplitude and phase difference for various cases of forced vibrations.
4	determine natural frequencies and mode shapes of two degree of freedom system.
5	explain features and applications of various vibration measurement and vibration control methods.
6	discuss the basics of noise measurement and determine the overall db level.

Unit–I: Single Degree of Freedom Systems – Free Vibration
Fundamentals of Vibration: Elements of a vibratory system, S.H.M., degrees of freedom, modeling of a system, concept of linear and non-linear systems, equivalent spring, linear and torsional systems. **Undamped free vibrations:** Natural frequency by equilibrium and energy methods for longitudinal and torsional vibrations.
Unit–II: Damped free vibrations: Different types of damping, free vibrations with viscous damping - over damped, critically damped and under damped systems, dry friction damping.
Unit–III: Single Degree of Freedom Systems - Forced Vibrations
Forced vibrations of longitudinal and torsional systems, simple harmonic excitation, excitation due to reciprocating and rotating unbalance, base excitation, magnification factor and phase difference, force and motion transmissibility.
Unit–IV: Two Degree of Freedom Systems - Undamped Vibrations
Free vibration of spring coupled systems – longitudinal and torsional, natural frequency and mode shapes. Eigen value and Eigen vector by Matrix method, Geared systems.
Unit–V: Vibration Measurement and Control
Vibration measurement: Basics of vibration measurement, vibration measuring devices, FFT Analyzer, vibration exciters. Vibration standards.
Vibration control: Control of natural frequency, vibration isolators, and absorbers, control at source, path, receiver. Active and passive systems.
Unit–VI: Introduction to Noise
Fundamentals of acoustics, decibels, sound pressure level, sound intensity, sound fields, sound reflection, absorption and transmission, pass-by-noise, noise measurement environments, noise standards.

Suggested Texts and Reference Materials:

1. Rao S. S., 'Mechanical Vibrations', Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd.
2. Grover G. K., 'Mechanical Vibrations', Nem Chand and Bros.
3. Thomson, W. T., 'Theory of Vibration with Applications', CBS Publishers and Distributors.
4. V P Singh, 'Mechanical Vibrations', Dhanpat Rai & Sons.
5. Kelly S. G., 'Mechanical Vibrations', Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd.
6. Meirovitch, 'Elements of Mechanical Vibrations', McGraw Hill.
7. M.L.Munjal, 'Noise and vibration control', Cambridge University Press India Private Limited.
8. Bies, D. and Hansen, C., 'Engineering Noise Control - Theory and Practice', Taylor and Francis.

PEME 4201 Advanced Manufacturing Processes

Teaching Scheme	Examination Scheme
Lectures: 3Hrs/week	In Semester: 50marks
	End Semester: 50 Marks
	Credits: 3

Pre-requisite: MP-I, MP-II.

Objectives:

1. To impart the fundamentals of various metal cutting practices, fundamentals of machine tools and processes.
2. To impart fundamental knowledge of non-traditional and MEMS machining.

Course Outcomes: Students will be able to,

1. Describe features and applications of screw thread and gear manufacturing processes.
2. Demonstrate finishing processes like polishing, burnishing, buffing.
3. Exploit use of non-traditional and MEMS machining processes to diversify and improve manufacturing technology in the region.
4. Judge the limitations and scope of machines to perform variety of operations.

Unit 1: Manufacturing and Finishing Processes for Screw Threads and Gear: 6 Hrs
Basic Introduction, thread milling, die threading, Thread rolling, Thread grinding. Gear hobbing, Hobbing technique, Gear finishing processes- gear shaving, gear lapping, gear grinding and gear burnishing. Roller burnishing process. Super finishing processes (Polishing, Buffing).

Unit 2: Non-Traditional machining processes: 8 Hrs
Introduction, Principle of ECM process, parameters of the processes, electrochemical grinding, electrochemical deburring, chemical machining. Abrasive flow machining (AFM), Magnetic abrasive finishing (MAF) – working, system, rocess variables, performance parameters and applications

Unit 3: MEMS: 6 Hrs
Introduction to MEMS, Definition and classification – applications, Bulk Micromachining, Wet and Dry Etching, Surface Micromachining, Chemical Vapor Deposition, Lithography, Wafer Bonding.

Unit 4: Advanced Metal Forming and Welding: 6 Hrs
High velocity hydro forming, High velocity mechanical forming, electromagnetic forming, High Energy Rate forming (HERF), Spinning (introduction to shear Spinning). Friction Stir Welding, Thermit welding,

Unit 5: Additive Manufacturing Processes: 6 Hrs

Introduction, principles and development in additive manufacturing technology, powder based fusion process, extrusion based system, sheet lamination process, direct write technologies.

Unit 6: E-MANUFACTURING: 6 Hrs

Nano manufacturing techniques and micromachining, High Speed Machining and hot machining

Text Book:

1. Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Pearson (2005)

Reference Books:

1. Fundamentals of Modern Manufacturing – Materials, Processes and Systems, M. P. Groover, Wiley India, 5th Edition.
2. V. K. Jain, Advanced Machining Processes, Allied Publishers Pvt. Ltd. 2002.
3. Elements of Workshop Technology: Machine Tools (Volume – 2) by S. K. Hajra Choudhary, A. K. Hajra Choudhary, Nirajhar Roy, Media promotors (2010).
4. Sheet metal forming: Processes and applications – Tayalam Atlan, ASM International USA.
5. Friction Stir welding and Processing – Rajiv S. Mishra, ASM International.
6. Additive Manufacturing Techniques – Ian Gibson, Springer.

OE 4201 -Renewable Energy Sources

Teaching Scheme

Lecture: 3 Hrs/week

Examination Scheme

In semester: 50 marks

End semester: 50 marks

Credits: 3

Pre-requisites:- None

Course Objectives:-

1. Students will be able to understanding basic characteristics of renewable sources of energy and technologies for their utilization.
2. Students will learn engineering approach for renewable energy projects.
3. Students will analyze energy potential of renewable sources of energy.

Course Outcome:-

1. Students will be able to Understand of different renewable sources of energy and technologies for their utilization.
2. Select engineering approach to problem solving when implementing the projects on renewable sources of energy.
3. Undertake simple analysis of energy potential of renewable sources of energy.
4. Students will be able to describe main elements of technical systems designed for utilisation of renewable sources of energy.

Unit1. Solar Energy **8 Hrs**

Solar potential, Solar radiation geometry, Solar radiation data, radiation measurement, Types of Solar Collectors, Collection efficiency, Testing of Solar collectors – IS code, Applications of Solar Energy, Solar Desalination system, Solar dryer, Concentrating collectors, line type- point type Solar Energy storage. Solar PV Principle, Photo-cell materials, Solar batteries, solar tracking system,

Unit2. Wind Energy **6 Hrs**

Wind parameters and wind data, Power from wind, Site selection, Wind energy conversion systems and their classification, Construction and working of typical wind mill, characteristics of wind generators, Design considerations for wind mills, Operation and maintenance of wind mills, wind farms, floating wind turbine, transitional depth technology, deepwater floating technology.

Unit3. Biomass Technology **6 Hrs**

Introduction, Energy plantation, Combustion and fermentation, Biomass gasification, types of gasifire, Updraught, downdraught, crossdraught Pyrolysis, various applications of Biomass energy, Bio-fuel types, Biomass gasification boiler

Unit4. Hydro Power systems **6 Hrs**

Introduction, types and system components, discharge curve and estimation of power potential, turbines for hydro power system, pump storage system

Unit5. Waste Heat Recovery Technology **6 Hrs**

Introduction, classification, advantages and application, commercially viable waste heat recovery devices, saving potential

Unit6. Hybrid Energy Systems **6 Hrs**

Need for Hybrid systems, Range and type of hybrid systems, Case studies of Solar-PV, Wind-PV, Micro hydel-PV, Biomass-Diesel systems, 2,3,4 Way Hybrid Energy System. Applications for hybrid energy system.

Reference Books:

1. Solar Energy by Dr. S.P.Sukhatme Tata McGraw Hill.
2. Non Conventional Energy Sources by G.D.Rai.- Khanna Publishers.
3. Energy Technology by S. Rao, Dr. B.B.Parulekar Khanna Publishers.
4. Godfrey Boyle, Renewable Energy, Power for a sustainable future, Oxford university
5. Energy Engineering by R.S. Kulkarni & Dr. S.V. Karmare.
6. Non Conventional Energy Sources by Dr. L. Umanand.
7. Introduction to Non Conventional Energy Resources by Raja, SciTech Publications.

OE 4201 Operations Research

Teaching Scheme | **Examination Scheme**

Lectures: 3Hrs/week

In Semester: 50 marks

End Semester: 50 Marks

Credits: 3

Pre-Requisites: Engineering Mathematics, Theory of probability, Statistics.

Course Objectives

1. To familiarize the students with the use of practice oriented mathematical applications for optimization functions in an organization.
2. To familiarize the students with various tools of optimization, probability, statistics and simulation, as applicable in particular scenarios in industry for better management of various resources.

Course Outcomes: Learner will be able to.....

1. Illustrate the need to optimally utilize the resources in various types of industries.
2. Formulate and analyze various real life industrial operations.
3. Apply Operations Research techniques to industrial operations.
4. Demonstrate cost effective strategies in various applications in industry.

Unit 1: Introduction: Operation Research **8 hrs**

Introduction: Definition, Evolution and Classification of Quantitative Methods and Operations Research Techniques, Methodology, Advantages and Limitations.

Linear Programming: Introduction, Formulation, Simplex Method (Big – M and Two Phase Methods), Dual Simplex Method (Conversion of primal to dual)

Introduction to Sensitivity Analysis.

Decision Theory: Meaning and Steps in Decision Making, Types of Management Decisions, Decision under Certainty, under Risk, under Uncertainty, Decision Trees.

Unit 2: Transportation Model **8 hrs**

Introduction, Formulation, Basic Method of Solving Transportation Problem, Optimization Methods like UV and Stepping Stone Method, Concept of Trans-shipment Methods as an Extension of Transportation. Assignment Problem- Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem.

Unit 3: Theory of Games and Investment Analysis **8 hrs**

Theory of Games : Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance, Solution by Graphical Method, m x n size Game Problem, Iterative method, Introduction to formulation of games using Linear Programming.

Investment Analysis: Break-Even Analysis, Payback Period Method, A (A) R Method, DCF Method, IRR Method, Introduction to Probabilistic Models.

Unit 4: Inventory Control and Replacement Analysis **8 hrs**

Inventory Control - Deterministic Models- Shortage, without shortage; Probabilistic Inventory Models,Introduction to Concept of Service level.
Replacement Analysis - Replacement of Items that Deteriorate, Replacement of Items that FailSuddenly.

Unit 5: Queuing Theory and Sequencing models **8 hrs**Queuing Theory -
BOS Mechanical Engineering SPPU Page 24
Sequencing models: Solution of sequencing Problem - Processing of n jobs through two machines, Processing of n jobs through three machines, Processing of two jobs through m Machines, Processing ofn jobs through m Machines

Unit 6: Network Models **8 hrs**
Network Models: Fulkerson's rule, concept and types of floats, CPM and PERT, Introduction to crashing.Simulation: Introduction, Monte-Carlo Simulation method, Simulation of Inventory and Queuing Problems.
Introduction to Multi Object Decision Making: Goal Programming Formulation.

Text Books

1. N. D. Vora, Quantitative Techniques.
2. Prem Kumar Gupta, D. S. Hira, Problems in Operations Research: Principles and Solutions, S.Chand, 1991
3. J. K. Sharma, Operations Research : Theory And Application, Laxmi pub. India.
4. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.

Reference Books

1. Belegundu, ― Optimization Concepts and Applications in engineering, Cambridge Uni. Press, India
2. Hillier F.S., and Lieberman G.J., Operations Research, Eight Edition, Mc. Tata McGraw Hill, India
3. Ravindran, ―Engineering optimization Methods and Appliations‖, 2nd edition, Wiley, India
4. Ravindran, Phillips and Solberg, Operations Research Principles and Practice, Second Edition, Mc.WSE Willey,
5. Operations Research - An introduction, Hamdy A Taha, Pearson Education.

ME 4202 – Turbo machines Lab

Teaching Scheme
Lab: 2 Hrs/week

Examination Scheme
Oral: 50 marks
Credits: 1

Prerequisites:

1. Applied Thermodynamics
2. Fluid Mechanics

Co - requisites:

1. Turbomachines

Course Objectives:

1. To conduct experiments involving various parameters of different turbo machines
2. To calculate the output parameters of given turbomachines based on the input parameters
3. To Illustrate the characteristics in the graphical form
4. To Compare the results with available characteristic curves and deduce the conclusion from it

Course Outcomes: Upon completion of this lab course, the student will be able to:

1. Conduct experiments involving different turbomachines
2. calculate the output parameters of given turbomachines based on the input parameters
3. plot the various characteristics curves
4. Compare the results with available theoretical/experimental results and deduce the conclusion from it

List of Experiments:

1. Verification of impulse moment principle
2. Study and trial on impulse water turbine (Pelton wheel) and plotting of main and operating characteristics
3. Study and trial on any one hydraulic reaction turbine and plotting of main and operating characteristics
4. Study and trial on centrifugal pump and plotting operating characteristics
5. Study and trial of rotary compressors.
6. Visit to hydro/steam power plant and report to be submitted.
7. Performance Test on Gear (Oil) Pump Test Rig

ME 4203 Project Phase II

Teaching Scheme | **Examination Scheme**

Practical: 16 Hrs/week
Credits: 10

InSem: 100 Marks Oral: 50 Marks

Course Objectives:

1. To learn modern engineering tools and techniques during execution of the project and develop an ability of self-learning and life-long learning.
2. To develop sustainable and environment friendly solutions.
3. To inculcate a sense of academic integrity and ethics.
4. To present their solutions in the form of reports, presentations in front of a diverse group of people

Course Outcome:

After learning the course the students should be able to

1. Learn modern engineering tools and techniques during execution of the project and develop an ability of self-learning and life-long learning.
2. Develop sustainable and environment friendly solutions.
3. Inculcate a sense of academic integrity and ethics.
4. Present their solutions in the form of reports, presentations in front of a diverse group of people.

1. Prepare Two Hard Bound Copies of your manuscript.

2. Limit your project report to 100– 120 pages (preferably)

3. The footer must include the following: Institute Name, B.Tech. (Mechanical) Times New Roman 10 pt. and centrally aligned.

4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned.

5. Print the manuscript using a) Letter quality computer printing. b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified. c) Use 1.5 line spacing. d) Entire report shall be of 5- 7 chapters

6. Use the paper size 8.5 11 or A4 (210 197 mm). Please follow margins given below. Margin Location Paper 8.5 11 Paper A4 (210 197 mm) Top 1 m 25.4 mm Left 1.5 37 mm Bottom 1.25 32 mm Right 1 25.4mm

7. All paragraphs will be 1.5 lines spaced with a one blank line between each paragraph. Each paragraph will begin with without any indentation.

8. Section titles should be bold with 14 pt. typed in all capital letters and should be left aligned.

9. Sub-Section headings should be aligning at the left with 12 pt. bold and Title Case (the first letter of each word is to be capitalized).

10. Illustrations (charts, drawings, photographs, figures) are to be in the text. Use only illustrations really pertinent to the text. Illustrations must be sharp, clear, black and white. Illustrations downloaded from internet are not acceptable.
a) Illustrations should not be more than two per page. One could be ideal

b) Figure No. and Title at bottom with 12 pt.
c) Table No. and Title at top with 12 pt.
d) Legends below the title in 10 pt.
e) Leave proper margin in all sides

INSTRUCTIONS FOR PROJECT REPORT WRITING

It is important that the procedures listed below be carefully followed by all the students of B.Tech. (Mechanical Engineering).

1. Prepare Three Hard Bound Copies of your manuscript.
2. Limit your Project Report report to 100– 120 pages (preferably)
3. The footer must include the following: Institute Name, B.Tech. (Mechanical) Times New Roman 10 pt. and centrally aligned.
4. Page number as second line of footer, Times New Roman 10 pt. centrally aligned. 5. Print the manuscript using

a) Letter quality computer printing.
b) The main part of manuscript should be Times New Roman 12 pt. with alignment - justified. c) Use 1.5 line spacing.
d) Entire report shall be of 5- 7 chapters

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a) Illustrations should not be more than two per page. One could be ideal
b) Figure No. and Title at bottom with 12 pt.
c) Table No. and Title at top with 12 pt.
d) Legends below the title in 10 pt. e) Leave proper margin in all sides f) Illustrations as far as possible should not be photo copied.

11. Photographs if any should be of glossy prints

12. Please use SI system of units only.

13. Please number the pages on the front side, centrally below the footer

14. References should be either in order as they appear in the thesis or in alphabetical order by last name of first author

15. Symbols and notations if any should be included in nomenclature section only

16. Following will be the order of report

i. Cover page and Front page (as per the specimen on separate sheet)
ii. Certificate from the Institute (as per the specimen on separate sheet)
iii. Acknowledgements
iv. Contents

v. List of Figures
vi. List of Tables
vii. Nomenclature
viii. Abstract

(A brief abstract of the report not more than 150 words. The heading of abstract i.e. word “Abstract” should be bold, Times New Roman, 12 pt and should be typed at the center. The contents of abstract should be typed on new line without space between heading and contents. Try to include one or two sentences each on motive, method, key-results and conclusions in Abstract.
1. Introduction (2-3 pages) (TNR – 14 Bold)
1.1 Problem statement (TNR – 12)
1.2 Objectives
1.3 Scope
1.4 Methodology
1.5 Organization of Project Report
2. Literature Review (10-15 pages) Literature Review (10-15 pages) Discuss the work done so far by researchers in the domain area and their significant conclusions. No derivations, figures, tables, graphs are expected.
3. This chapter shall be based on your own simulation work (Analytical/ Numerical/FEM/CFD) (15- 20 pages)
4. Experimental Validation - This chapter shall be based on your own experimental work (15-20 pages)
5. Concluding Remarks and Scope for the Future Work (2-3 pages)
References ANNEXURE (if any) (Put all mathematical derivations, Simulation program as Annexure)

17. All section headings and subheadings should be numbered. For sections use numbers 1, 2, 3, … and for subheadings 1.1, 1.2, …. etc and section subheadings 2.1.1, 2.1.2, …. Etc.

18. References should be given in the body of the text and well spread. No verbatim copy or excessive text from only one or two references. If figures and tables are taken from any reference then indicate source / citation of it. Please follow the following procedure for references

Reference Books : Collier, G. J. and Thome, J. R., Convective boiling and condensation, 3rd ed., Oxford University Press, UK, 1996, pp. 110 – 112.

Papers from Journal or Transactions : Jung, D. S. and Radermacher, R., Transport properties and surface tension of pure and mixed refrigerants, ASHRAE Trans, 1991, 97 (1), pp. 90 – 98. Bansal, P. K., Rupasinghe, A. S. and Jain, A. S., An empirical correction for sizing capillary tubes, Int. Journal of Refrigeration, 1996, 19 (8), pp.497 – 505.

Papers from Conference Proceedings : Colbourne, D. and Ritter, T. J., Quantitative assessment of flammable refrigerants in room air conditioners, Proc. of the Sixteenth International Compressor Engineering Conference and Ninth International Refrigeration and Air Conditioning Conference, Purdue University, West Lafayette, Indiana, USA, 2002, pp. 34 – 40.

Reports, Handbooks etc. : United Nations Environmental Programme, Report of the Refrigeration, Air Conditioning and Heat Pumps, Technical Option Committee, 2002, Assessment - 2002. ASHRAE Handbook: Refrigeration, 1994 (Chapter 44)

Patent : Patent no, Country (in parenthesis), date of application, title, year.

Internet : www.(Site) [Give full length URL] accessed on date

ME4204 Project Based Online Course

Examination Scheme:
In-Semester: **50** marks
Credits: **2**

Course Outcomes:
Students should be able to
1. Perform focused study of technical literature relevant to a specific topic.
2. Build independent thinking abilities to approach complex problems.
3. Extract desired knowledge from Online course.
4. Apply course knowledge for implementing the project.

Contents
1. The Project guide will suggest one/two online courses (which students have not studied till date)
2. Multiple courses can be taken by different group member of the same group.
3. Assignments related to project based online course should be completed.

AC1201 Entrepreneurship Development

Teaching Scheme: Practical: 2 Hrs/Week

Examination Scheme:

In-Semester: --

End-Semester: --

Credits: NIL

Course Objectives:

1. An understanding of the scope of Entrepreneurship Development
2. To make them understand key areas of Business development
3. Understand different sources of finance, project preparation and legal requirements for Business.
4. Understand the significance of Entrepreneurship and economic growth.
5. Application of engineering skills in entrepreneurial activities etc.

Course Outcomes:

1. Develop an entrepreneur attitude.
2. Analyze business opportunity and will be ready with business plan
3. Take decisions related to procurement and application of funds.
4. Students are better prepared to become effective team members and can better support their employers as innovators.

Unit – I: Modern Small Business Enterprises (06)

Role of Small- scale Industries Concepts and definitions of SSI Government Policy and Development of the Small-scale sector in India , Growth and performance of small scale Industries in India, Small and Medium Enterprises in other countries, Problems for Small-scale Industries in a free Economy Institutions supporting small Business Enterprises: Central Level, State Level, Other agencies and Industry Associations.

Unit – II: Entrepreneurship and Emerging areas (10)

Importance of Entrepreneurship Concepts of Entrepreneurship and corporate Entrepreneurship Characteristics of a successful Entrepreneurship 0Classification of Entrepreneurship Myths of Entrepreneurship Emerging areas in Entrepreneurship: Women Entrepreneurship: Types, Challenges, Opportunities, Achievements,, Problems, Remedial Measures & supporting Institutions and Role Models of Woman Entrepreneurs in India, Self Help Group Rural Entrepreneurship: meaning, need, Problems, Development, Role of NGO‟s, Entrepreneurship in agriculture, TRYSEM Social Entrepreneurship: Genesis & Characteristic International Entrepreneurship. E-Entrepreneurship: Concept, Purpose and Essence Profiles of successful Entrepreneurs of each emerging field

Unit – III: Setting Up a Small Business Enterprise (10)

Identifying the Business Opportunity, assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, Business opportunities in various sectors Formalities for Setting Up of a Small Business Enterprises Environment Pollution Related Clearances.

Unit - IV: Financial Management in small Business (10)

Importance of Financial Management, Accountancy, Preparation of balance sheets and assessment of economic viability, Capital structure, Cost of capital, Sources of Finance, Working capital Management, Capital Budgeting decisions: Pay-back period, discounted cash flow, internal rate of return and net present value methods. Taxation – Direct, Indirect Taxes.

Unit – V: Production Management in small Business (05)

Production Management, Materials Management, inventory control, Productivity, Break Even Analysis Total quality management Environmental Management System.

Unit – VI: Legal Requirements (04)

Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes Industrial Relations Laws: workman compensation act, Labour Laws, Environment and Pollution Control laws.

Reference Books:

1. P. M. Charantimath, „Entrepreneurship Development and Small Business Enterprises‟, Pearson Education India (2nd edition),(2005).

2. V. Desai, „Dynamics of Entrepreneurial Development and Management‟, Himalaya Publishing House, (4th edition),(2007).

3. J. Forbat, „Entrepreneurship‟, New Age International Pvt Limited, (2008).

4. J. L. Massod, „Essential of Management‟, Prentice Hall of India, (4th edition), (1986).

5. M. Lall, S. Sahai, „Entrepreneurship‟, Excel Books, (2nd edition), (2008).

6. N. Baporikar, „Entrepreneurship Development and Project Management‟, Himalaya Publishing House, (2nd edition),(2013).

7. Gupta, Srinivasan, „Entrepreneurship Development in India‟, Sultan Chand & Sons, (new edition),(2013).

20ES01L Basic Electrical and Electronics Engineering Lab

Teaching Scheme:
Practical: 2 Hrs./Week

Examination Scheme:
Term Work: 25 marks
Credits: 1

Course Outcomes:

After completion of course, students will be able to

1. Perform basic domestic wiring
2. Apply circuit laws to find the parameters of given electrical network
3. Build a basic regulated DC power supply
4. Obtain frequency response of CE amplifier
5. Build basic digital circuits

List of experiments:

1. Introduction of different electrical and electronics components and instruments.
2. To perform electrical wiring to control lamps using one way and two-way switches.
3. To determine current using the superposition theorem.
4. To determine current using Thevenin's theorem.
5. To determine phase angle of L-C-R series circuit.
6. To perform load test on single phase transformer to determine regulation and efficiency.
7. To determine output voltage and ripple voltage of half wave, full wave rectifier with center tap transformer and bridge rectifier with and without filter.
8. Assemble and build simple DC regulated power supply.
9. To determine frequency response of CE amplifier.
10. Assemble and build half adder & full adder circuits.

20ES02: Fundamentals of Programming Language-1

Teaching Scheme:
Lecture: 1 Hr/week

Examination Scheme:
End-Sem: 25 Marks
Credits: 1

Course Objectives:

To facilitate the learners:

1. To learn the fundamentals of building blocks of computer system.
2. To develop problem solving ability by developing an algorithm, flowchart for given problem.
3. To implement the logic / solution for a given problem using a programming language.
4. To understand the decision and iteration interpretation in a programming language.

Course Outcomes:

By taking this course, the learner will be able to:

1. Illustrate the use of algorithms, flow charts and components of computer system.
2. Demonstrate the use of appropriate control structure for program development.
3. Make use of variables, data types, operators, expressions, strings and arrays for program development.
4. Solve the given problem using functions.

Unit 1: Introduction **(2)**

Introduction to components of a Computer System, types of programming languages.
Introduction to Algorithm: As flow chart, pseudo code, as a program.

Unit 2: Fundamentals of Procedural Programming Language **(1)**

Keywords, Identifiers, Constants and Variables, concept of memory, Structuring procedural program using exemplary language such as C.

Unit 3: Data Types and operators **(2)**

Data types, Typecasting, variable scope, Operators, Basic Input and Output Operations, Expressions and Precedence of Operators.
Illustration using real life examples and use cases.

Unit 4: Control Structures **(2)**

Selection (if-else ladder), Iteration (for loop, while loop).
Illustration using real life examples and use cases.

Unit 5: Arrays and String **(2)**

Introduction to linear structure (Arrays) and Strings,String functions
Illustration using real life examples and use cases.

Unit 6: Functions **(2)**

Use of function for modularization, Parameter passing.
Illustration using real life examples and use cases.

Text Books:-

1) Kernighan and Ritchie, The C programming language (2nd edition)., Prentice Hall of India, 1988.
2) G. Dromey, How to Solve it by Computer , Prentice-Hall Inc., Upper Saddle River , NJ, 1982.
3) Yashwant Kanetkar, Let's C , Allied Publishers, 1998.

Reference books:-

1) Reema Thareja, Introduction to C programming , Oxford University Press (2nd edition), 2015.
2) Alan R. Feuer, The C Puzzle book , Pearson, 1999

Maharshi Karve Stree Shikshan Samstha's
Cummins College of Engineering for Women, Pune
(An autonomous Institute affiliated to Savitribai Phule Pune University)
Department of Computer Engineering

20ES02L: Fundamentals of Programming Language -1 Lab

Teaching Scheme:
Practical: 2 Hr/week

Examination Scheme:
In-Sem: 25 Marks
Credits:1

Course Objectives:

To facilitate the learners:
1. To learn the fundamentals of C programming for logic building.
2. To implement a solution of given problem using appropriate data type, operators of C language.
3. To understand the decision and iteration interpretation in a programming language.
4. To implement the logic using arrays, strings, functions and structures of C programming language.

Course Outcomes:

By taking this course, the learner will be able to:
1. Apply logic development skills to solve simple real life problems.
2. Implement, test and execute developed logic or algorithm to C program using appropriate data type and operators.
3. Implement the given problem using appropriate control structures available in C language.
4. Implement different functions for a problem to construct a modular solution.

Following example list of problems are grouped into A, B and C, with increasing levels of difficulty and understanding. Group A problem statements address the concepts of constant, variable, data type, operator and expressions. Group B problem statements address the concept of control structures and Group C includes problems which can be solved using functions and string concepts along with the concept covered in Group A and Group B.

Assignments can be framed and expanded in such a way that it explores concepts, language constructs, logic of solution and simple application. Students will be encouraged to solve open problems in different domains. Course tutor will set up assignments to challenge students through code debugging, code improvisation and code transformation. Course tutor will appropriately adopt assignments on similar lines as the examples shown here.

Instructors can conduct a total of 10 assignments . Four assignments from Group A, four assignments from Group C and two assignments from Group C.

Example List of Assignments

(Minimum 10 assignments to be implemented, covering maximum Four from each Group. Assignment number 9,10,11 from Group C can be considered as extra assignments. Students can explore more on C constructs to implement these assignments.) :-

Group A

Group A problem statements address the concepts of constant, variable, data type, operator and expressions.

1) Write C programs for basic problems Engineering Mathematics and Physics like area calculation, sine wave calculation, speed calculation, determine type of triangle, verify pythagoras theorem etc.
2) Write a C program to convert feet to inches, convert inches to centimeters, and convert centimeters to meters. Write a program that prompts a user for a measurement in feet and converts and outputs this value in meters. Facts to use: 1 ft = 12 inches, 1 inch = 2.54 cm, 100 cm = 1 meter.
3) Write a C program to swap 2 numbers.
4) Write a C program to convert Kilograms to grams, convert grams to milligrams and vice versa.

) Write a C program to convert Dollar to Rupees, convert Euro to Rupees, and vice versa.
) Write a C program for temperature conversion Degree to Fahrenheit and vice versa.
) Write a C program to convert specified days into years, weeks and days.
) Write a C program that accepts three integers and finds the maximum of three.

Group B

Group B problem statements address the concept of control structures such as for loop, while loop.

1) Write C program to calculate Least common multiple (LCM) and Greatest Common Divisor (GCD) of given number.

2) Write a C program to check whether the given number is prime or not.
3) Write a C program to print a given pattern.
4) Write a C program to obtain the first 25 numbers of a Fibonacci sequence. In a Fibonacci sequence the sum of two successive terms gives the third term. Following are the first few terms of the Fibonacci sequence: 1 1 2 3 5 8 13 21 34 55 89...
) Write a C program for simple interest and compound interest calculation.

Group C

Group C includes problems which can be solved using functions and string concepts along with the concepts covered in Group A and Group B.

1) Write a C program to swap 2 integers using user defined functions (call by value, call by reference).
2) Write a program in C to compute the factorial of the given positive integer using function.
3) Write a menu driven program to perform following operations using Array of integers like (accept, display, sum of all numbers, search a number, maximum and minimum of number).
4) Write a menu driven program to perform string operations.
) Write a program in C to compute addition / subtraction / multiplication of two matrices.
) Write a C program to perform employee operations such as accept, display, search by name, search by number, update a record. Explore the possibility of modularity for implementation.
) Write a C program to perform bank account related operations such as accept, display, withdraw and deposit money, check balance.
) A string is provided from the user. Calculate the total number of characters in the string and the total number of vowels in the string with the number of occurrences in the string.
) For a class an examination is conducted and the results for the students of all the 5 subjects are recorded. Write a C program to display the record of students. On the basis of the record compute:
   i. The average score of class
   ii. Highest score and lowest score of class
   iii. Marks scored by most of the students
   iv. List of students who were absent for the test
10) Write a menu-based modular program in C to perform following operations for complex numbers:
   i. reading a complex number
   ii. writing a complex number
   iii. addition of two complex numbers

iv. subtraction of two complex numbers
v. multiplication of two complex numbers

11) Two friends issued 5 books each from the library, Write a program in C to compute set operations
   i. List of all books with them
   ii. List common titles with them
   iii. List of books with friend1 but not with friend 2

Engineering Graphics (20ES04)

Teaching Scheme	**Examination Scheme**
Theory: 2 Hrs/week	In semester: 50 Marks
Tutorial: 1 Hr/week	End semester: 50 Marks
Credits: 3	

Course Objectives:

1. To develop the visualization and interpretation skills for the physical objects.
2. To provide the basic knowledge and develop the skills for creating 2 D drawings.
3. To provide the basic knowledge and develop the skills for creating Isometric views.
4. To familiarize about the development of solids.
5. To familiarize the construction and applications of Engineering Curves.

Course Outcomes:

After completing the course students will be able to draw

1. Orthographic and sectional orthographic projections of an object
2. Isometric views of the given object
3. Development of surfaces of the given object
4. Engineering curves by applying the given method

Unit – 1 **Introduction**	Layout and sizes of drawing sheets, drawing instruments, types of lines used in drawing practice, dimensioning systems, representation of tolerances, standard codes by B.I.S (SP-46). **(Not for Examination)**	**(01 Hr.)**
Unit – 2 **Orthographic Projection**	Theory of projections, methods of obtaining orthographic views, sectional orthographic projections, Missing views.	**(08 Hrs.)**
Unit – 3 **Isometric Views**	Isometric axes, Isometric scale, isometric projections and views, construction of isometric view from given orthographic views.	**(08 Hrs.)**
Unit – 4 **Development of Solids**	Parallel line development, radial line development, methods to transfer points for development of prisms, pyramids, cylinder and cone.	**(05 Hrs.)**
Unit – 5	Construction of ellipse, parabola, hyperbola, involute, cycloid,	**(06 Hrs.)**

Engineering Curves	Archimedean spiral, helix on cone and cylinder.

Text Books:

1. N. D. Bhatt and V. M. Panchal,**'Engineering drawing, plane and solid geometry'**, *Charotor Publication House.*
2. 2) R. K. Dhawan,**'A text book of Engineering Drawing'**, *Pearson Education Inc*.
3. 3) P.S. Gill, **'Engineering Graphics'**, *Kataria and sons Publications.*
4. 4) M. L. Dabhade, **'Engineering Graphics'**, *Vision Publications.*

Reference Books:

1. Warren J. Luzzader, **'Fundamentals of Engineering Drawing'**, *Prentice Hall of India, New Delhi.*
2. Fredderock E. Giesecke, Alva Mitchell, **'Principles of Engineering Graphics'**,*Maxwell*
3. Dhananjay A. Jolhe, **'Engineering Drawing'**, *Tata McGrawHill Publishing Co. Ltd.*

Engineering Graphics Lab (20ES04L)

Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/week	In Semester: 25 marks
Credits: 1	

Course Objectives:

To familiarize student about

1. Advantages of using software for Engineering drawing
2. 2-D drafting using a software
3. 3-D modeling using a software
4. 3-D printing technology

Course Outcomes:

After completing the course using a software package students will be able to

1. Draw orthographic projections of a given component
2. Draw Isometric projections of a given component
3. Draw development of solids
4. Draw free hand sketches of the machine elements

Part I **Introduction to 2-D Drafting using a drafting software** **(20 Hrs.)**

- Orthographic Projections
- Isometric Projections
- Development of surfaces of solids
- Free hand sketching of standard machine elements

Part II **Demonstration of 3-D Modeling and 3-D Printing** **(08 Hrs.)**

Creating a 3-D model of a simple component using a solid modeling software and manufacture using a rapid prototyping technique.

Text Books:

1. N. D. Bhatt and V. M. Panchal,‘*Engineering drawing, plane and solid geometry’*, Charotor Publication House.
2. M.L.Dabhade, **‘Engineering Graphics’**, *Vision Publications.*
3. Bethune, J.D., “*Engineering Graphics with AutoCAD 2013*”, PHI Learning Private Limited, Delhi, 2013

20ES05

Fundamentals of Programming Language-2

Teaching Scheme:
Lecture: 3 Hr/week

Examination Scheme:
In-Sem: 50 Marks
End-Sem: 50 Marks

Credits: 3

Course Objectives:

To facilitate the learners:

1)To understand and apply object-oriented principles for application development.
2)To develop programming applications using Java.
3)To make use of class, object, constructor.
4)Learn programming construct of Java.

Course Outcome:

By taking this course, the learner will be able to:

1) Demonstrate and Make use of object-oriented principles for effective programming.
2) Construct readable and maintainable code using polymorphism.
3) Apply object oriented concepts of class, object creation and constructor for program development.
4) Apply principles of code-refactoring and efficient code reuse for problem solving.

Unit-I : Introduction to Object Oriented Programming Paradigm (5)

Role and need of programming languages, characteristics of a good programming language, introduction to various programming paradigms. Need of object-oriented paradigm, basic concepts of object oriented programming (OOP), benefits of OOP. General characteristics for OOP, Object oriented concepts: Class, Object, abstraction, encapsulation, polymorphism, and inheritance.
Illustration through real life examples and use cases

Unit-II : Introduction to Java Programming Language (6)

History of Java, Features of Java, Java and Internet, Java virtual machine, First java Program, Command line arguments, Java Programming elements: Data types, Control Structures, Encapsulation, Abstraction and Polymorphism, Class, object, constructor
Illustration through real life examples and use cases

Unit-III : Polymorphism (5)

This keyword, static method, function overloading, argument passing, constructor overloading.
String and Array's in Java, Java Collection Framework – Arraylist, HashSet
Illustration through real life examples and use cases

Unit-IV: Inheritance **(6)**

Types of inheritance, base class and derived class, access specifiers, method overriding.
Illustration through real life examples and use cases

Unit-V: Abstract Class, Interfaces and Packages **(6)**

Abstract class, interfaces, run time polymorphism. Creating and importing packages.
Illustration through real life examples and use cases

Unit-VI: Exception Handling in Java **(5)**

Errors and Exceptions, Types of exceptions, try, catch, throw, throws and finally keywords, Build-in exceptions, creating and using custom exceptions.
Illustration through real life examples and use cases

Text Books:

1. Herbert Schilt, "JAVA Complete Reference", Tata McGraw Hill, (9thEdition), (2014)
2. Eckel B., "Thinking in Java", Pearson Education, (3rd Edition)

Reference Books:

1. Kathy Sierra & Bert Bates, "Head First Java", Oreilly publication,(2nd Edition) (2009)
2. Barry Burd "Beginning Programming with Java for Dummies", Oreilly publication, (5th Edition) (2017)
3. Paul Deital and Harvey Deital,"Java How to program", Prentice Hall Publication,(9th Edition) (2011)

20ES05L

Fundamentals of Programming Language Lab-2

Teaching Scheme:
Practical: 2 Hr/week

Examination Scheme:
In-Sem: 25 Marks
Credits: 1

Course Objectives:
To facilitate the learners:

1) To explore the principles of object oriented programming
2) To apply object oriented programming concept for developing applications using Java
3) To make use of class, object and constructor for coding basic object oriented program
4) To handle built-in and user defined exceptions

Course Outcome:
By taking this course, the learner will be able to:

1) Develop basic object oriented program using class, object and constructor
2) Develop readable and reusable code using inheritance and polymorphism
3) Make use of exceptions using inbuilt classes and user defined exceptions
4) Develop application using object oriented programming language Java to solve given problem

Example List of assignments:-

Group A:.Assignment to write program in OO language to understand concept of data abstraction and encapsulation

1. Write a MyDate class which has attributes as day, month and year. Create five objects of MyDate and display them.
2. Design a user defined abstract data type ‘Complex' in Java. Write a program to perform arithmetic operations of two complex numbers.
   A complex number has a real part and an imaginary part.
   a) Given the values of real part and imaginary part of a complex number, the magnitude of the complex number can be calculated as square root of the sum of squares of real part and the imaginary part.
   b) The argument of the complex number can be calculated as tan inverse of ratio of imaginary part(numerator) and real part(denominator)
   c) The complex number can be added to another complex number and the answer of the addition is a complex number. When one adds two complex numbers, the real parts of each of the complex numbers is added which becomes a real part of the answer and imaginary part of each complex number is added together which becomes imaginary part of the answer. Both these results are real and imaginary parts for a complex number which is the answer of the addition complex conjugate of the complex

number can be calculated by negating the imaginary part of the complex number

d) The complex number can be subtracted from another complex number and the answer of the subtraction is a complex number.

e) When one subtracts a complex number from the other, the real part one complex number is subtracted from the other and the result becomes a real part of the answer and imaginary part of one complex number is number is subtracted from the other and the result of subtraction becomes imaginary part of the answer. Both these results are real and imaginary parts for a complex number which is the answer of the subtraction.

3. Create a student result database in Java. Calculate the grades of students. Decide criteria for best student and short-list students who satisfy the criteria.
   a) A student has a rollNo, name, marks in five courses and a grade. A student list has many students. If a student has grade equal or beyond 8, he is considered as a top band student.
   b) Create at least ten students. From these, find all such students which satisfy the criteria of top band student. Create a list of such students and display the students in the list.

4. A circle has a radius. Its area can be calculated. The area is a double number. Its perimeter can be calculated as $2\pi r$. The perimeter is a double number. Given two circles one can find out which is large and which is small.
   Create two circles c1 and c2 with radius as 10 and 7 respectively. Calculate the area and perimeter of each. Compare two circles with each other and display which is large and which is small.
5. Write a JAVA program to perform String operations using String/StringBuffer class
   a) Write a program that reads a word and then prints the first character,the last character, and the characters in the middle. For example, if the input is Cummins ,the program prints C s ummin.
   b) Write a program that reads a name (such as Ranbeer Rishi Kapoor) and then prints a monogram consisting of the initial letters of the first, middle, and lastname (such as RRK).

Group B:Assignment to write program in OO language to understand concept of class inheritance and polymorphism.

1. Implement Java program to calculate area and perimeter of various shapes-circle, triangle and rectangle.
2. Create an application like book shop and maintain the inventory of books that are being sold at the shop
3. Find appropriate class hierarchy, polymorphic behavior in applications like banking and implement it.
4. Model the HRD application using the concepts of inheritance, interface, polymorphism

5. A company has many employees. An employee has employee Id, basic salary, house rent allowance, dearness allowance, profession tax and total salary. An employee has an address. The address has apartment number, apartment name, road and PIN code. The total salary of an employee is the summation of basic salary, house rent allowance which is 20 percent of basic salary, dearness allowance which is 45 percent of basic salary. The take home salary is calculated after deducting profession tax from which is 7 percent of basic salary from the total salary.
   When an employee is appointed, he is assigned with an employee Id and basic salary. One can ask for total salary of the employee and take-home salary of the employee. Identify a class/classes from the above statement, identify the attributes, the data types, the behaviour. Test your program for ten employees
   Display all the details of the employees as per id and as per pin code.
   Display take home salary for all the employees, display the tax to be deducted across all employees.
6. Reading material has title and price. A book is a reading material. It has ISBN number. A magazine is a reading material, it has month of issue. A CD is a reading material, it has duration in minutes. Represent the above description as a generalization, specialization tree. Identify the parent class, its attributes, child class and their attributes. Write all of them clearly.
7. A vehicle has engine no and chassis number. It can be locked, unlocked. Every vehicle is movable (interface). It can be started, stopped, turned, accelerated, turned, and decelerated.
   A car is a vehicle. It has steering. An airplane is a vehicle. It has wings. A boat is a vehicle. It has propeller.

Group C: Assignment to write program in OO language to understand concept of exception handling

1) Write a program to catch various in-built exceptions(try, catch and finally block)

2) Create User defined exception to check the specific conditions for systems like recruitment etc and throw the exception if the criterion does not met in Java.

3) Consider student data consist of fields such as roll number, name, and marks of various subjects. Write a program using inbuilt and user defined exceptions to avoid invalid entry.

20ES05M Engineering Mechanics

Teaching Scheme:
Lectures: 2 Hrs/Week
Tutorial: 1 Hr/Week
Number of Credits: 3

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks

Course Objectives:

1. To familiarize the concepts of equilibrium and friction.

2. To study and analyze the motion of moving particles and bodies**.**

Course Outcomes:

After completion of this course, students will be able to

CO1: Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.

CO2: Co-relate real life applications to specific type of friction and estimate required force to overcome friction.

CO3: Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation.

CO4: Analyze particles in motion using force and acceleration, work-energy and impulse-momentum principle.

Course Contents:

Unit – I: Rigid body: Statics **(06)**

Equivalent force systems, Equations of equilibrium, free body diagram, reactions. Static, intermediately and partial constraints, Two and three force systems.
Structures: 2D truss, method of joints, method of selection. Frame, beams, types of' loading and supports. Shear force and bending moment diagrams.

Unit – II: Friction **(03)**

Dry friction (static and kinetic) wedge friction, disk friction, belt friction, journal bearings, wheel friction and rolling resistance.

Unit – III: Center of Gravity and Moment of Inertia **(04)**

First and second moment of inertia and mass. Radius of gyration, parallel axis theorem, product of inertia, rotation of axes and principal M.I. by direct method. Composite bodies.

Unit – IV: Kinematics of Particles **(04)**

Rectilinear motion, curvilinear motion, rectangular, normal-tangential, polar, cylindrical co-ordinates, relative and constrained motion, space curvilinear motion.

Unit – V: Dynamics of Particles **(03)**

Force, mass and acceleration, work-energy, impulse-momentum principle, impact of bodies.

Unit – VI : Kinetics of Rigid Bodies **(04)**

Translation, fixed axis rotation, general planner motion, work-energy, power, potential energy, impulse-momentum and associated conservation principle, Euler equation of motion and its applications.

Text Books :

1. R. C. Hibbeler, 'Engineering Mechanics (statics and Dynamics), 12th Edition, *Pearson publication*.

Reference Books:

1. Timoshenko and Young, 'Engineering Mechanics', *Tata Mc-Graw Hill*, New Delhi.
2. Mclean, and Nelson, 'Theory and problems of Engineering Mechanics (Statics and Dynamics)', *Schaum Series*.
3. Beer and Johnson, 'Vector Mechanics for Engineers-Dynamics' *McGraw Hill Education.*
4. 'Engineering Mechanics (Statics and Dynamics)', Dorling Kindersley (India) Pvt. Ltd. *Pearson Education.*
5. Dr.R.K.Bansal , Sanjay Bansal, 'A Text book of Engineering Mechanics', *Lakshmi publications*.

20ESO5ML Engineering Mechanics Lab

Teaching Scheme | **Examination Scheme**

Practical: 02 Hrs /Week | In-Semester: 25 marks

Credits: 1

Course Objective: To demonstrate the basic principles of Engineering Mechanics namely Engineering Statics and Engineering Dynamics.

Course Outcomes: At the end of the course the student will be able to.

CO1: Verify law of Force Polygon and law of moments.

CO2: Determine mechanical advantage, Velocity ratio and efficiency of a screw jack.

CO3: Evaluate co-efficient of friction between two different materials.

CO4: Determine 'mechanical advantage, velocity ratio and Mechanical efficiency.

Course Contents: List of Experiments

1. To verify the law of force polygon.
2. To verify the law of moments using parallel force apparatus. (simply supported type).
3. To determine the co-efficient of friction between wood and various surface (like leather, wood, aluminum) on an inclined plane.
4. To find the forces in the members of jib crane.
5. To determine the mechanical advantage, velocity ratio and mechanical efficiency of a screw jack.
6. To determine the mechanical advantage, velocity ratio and mechanical efficiency of the wheel and axle.
7. Verification of force transmitted by members of given truss.
8. To verify law of moments using bell crank lever.
9. To find the C.G. and Moment of Inertia of an irregular body experimentally and verify using computational method.

20ES06L GEO-INFORMATICS LAB

Teaching Scheme:
Practical : 2 Hr/Week

Examination Scheme:
Practical/Oral: 25 Marks
Credits: 1

Course Objectives:

1. To learn basics about the Geodata & GIS software.
2. To introduce students basics of spatial data and its creation.

Course Outcomes:

A student should be able to:

1. Interpret satellite images and their characteristics with the use of software features.
2. Apply basic data visualization concepts for identification of physical features
3. Create aspatial attribute data and relate with spatial data
4. Create and use vector layer and relate with attribute data

A)Remote Sensing Lab

1. Observation of feature details seen in images of different resolutions, 3D visualization of aerial photograph using Stereoscope.
2. Visual Interpretation of multi spectral and Panchromatic image

B) GIS Lab

3. Exploring Google Earth
   - Locating a place
   -Layers
   -Display Controls
   -Changing coordinate system
   -Adding place marks
   -Saving KMZ/ KML files
4. Open source software of GIS
   -Understanding QGIS interface
   -Different types of file formats
5. Working with Data
   -Adding Vector data/ Raster Data
   -Display Controls
6. Point, Line, Polygon feature,
   -Feature selection/deselection
7. Layers, Properties of layers, Feature Symbology
8. Querying data -Aspatial and Spatial Query

9. Digitization of map, Creating layers

C)**GPS Lab-** Liner data collection using GPS
References- Learning QGIS packt publishing by Anita Gaser

20ES07 Technical Skill Development Laboratory

Scheme:

Practical: 2 Hrs/Week In-Semester:25 Marks

Course Objective: Student will able to learn

1. To identify tools, work material and measuring instruments useful forassembly dissemble of products and different machining operations
2. To handle tools and instruments and use them to prepare joints of specificshape and size.
3. To install software and Operating system on computers

Course Outcome: Student will able

1. To select suitable tools for assembly- dissemble a product.
2. To produce joints using materials of specific shape and size by a suitable setof operations and check the accuracy of shape and dimensions using measuring instruments
3. To install operating systems and software on computers

Content:

Sr. No		Hrs
1	Use of measuring devices and instruments : Vernier Calliper, Micrometer, Digital Multi-meter, Tachometer, Lux meter etc.	2
2	Assembly -disassembly of products: Electric Iron, Water Purifier, Fan, Mixer Grinder etc.	4
3	Use of joining methods: Soldering and Welding.	4
4	Study and Hands on different day to day machining operations: such as drilling, tapping PVC pipe fitting, hacksaw cutting and filing.	2

5	Use of Machine Tool (Lathe machine)	6
6	Basic troubleshooting computer System in Hardware and Software. Installing and Uninstalling software's (OS 4 APPS) Computer system security aspects (Physical and logical)	6

**NOTE: Practical No. 5 is For Mechanical Engineering Branch and Practical No. 6 is for COMP/IT/E&TC/INSTRU Branch

Text Books:

I. Elements of Mechanical Engineering - Hajra Choudhury & others, Media Promoters 2010.
2. The Elements of Workshop Technology - Vol I & Il, SK. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, I Ith edition 2001 others, Media Promoters and Publishers, Mumbai.

Reference:

I. Workshop manual prepared by Department of Mechanical Engineering.

PECE 3201Data Management, Protection and Governance

PECE 3201 Data Management, Protection and Governance

Teaching Scheme

Lectures: 3 Hrs/Week

Examination Scheme

In Semester: 50 marks

End Semester: 50 marks

Credits: 3

Course Objectives:

To facilitate the learner to –

1. Get acquainted with the high-level phases of data life cycle management.
2. Acquire knowledge about the various aspects of data storage, data availability, data protection.
3. Gain exposure to various solutions/reference architectures for various use-cases.
4. Understand the technical capabilities and business benefits of data protection.

Course Outcomes:

By taking this course, the learner will be able to –

1. Understand the data management world, challenges and best practices.
2. Compare various concepts and technologies for enabling data storage and high availability.
3. Illustrate various types of data threats and approaches to ensure data center security.
4. Explain the various concepts related to data protection.
5. Outline different standards for compliance and governance of data.
6. Understand various approaches for designing data intensive enterprise applications and industry standard solutions in data management.

Unit 1: Introduction to data life cycle management (DLM) **(06)**

- Goals of data life cycle management
- Challenges involved
  - Volume of data source
  - Ubiquity of data locations
  - User demand for access
- Stages of data life cycle - creation, storage, usage, archival, destruction
- Risks involved without DLM, benefits, best practices

Unit 2: Data storage and data availability **(08)**

- Storage technology
  - Hard Disk Device (HDD), Solid State Devices (SSD), memory devices
  - Data access - block, files, object
  - Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage
  - Storage virtualization technologies - RAID level, storage pooling, storage provisioning
  - Advance topics in storage virtualization – storage provisioning, thin-provisioning
  - Cloud storage – S3, glacier, storage tiering
- High Availability
  - Introduction to high availability
  - clustering, failover, parallel access

Unit 3: Data Threats and Data center security **(07)**

- Type of Threats
  - Denial of Service (DoS), man in the middle attacks
  - Unintentional data loss
  - Repudiation
  - Malicious attacks to steal data
- Introduction to Ransomware
- Understanding, Identification and Threat modelling tools
- Security
  - Authorization and authentication - access control, Transport Layer Security (TLS), key management, security in cloud
  - Design and architecture considerations for security

Unit 4: Introduction to data protection **(08)**

- Introduction
  - Need for data protection
  - basic of back-up/restore
- Snapshots for data protection, copy-data management (cloning, DevOps)
- De-duplication
- Replication
- Long Term Retention - LTR
- Archival
- Design considerations
  - System recovery
  - Solution architecture
  - Backup v/s Archival
  - media considerations and management (tapes, disks, cloud)
  - challenges with new edge technology (cloud, containers)

Unit 5: Data regulation, compliance and governance **(06)**

- Regulations requirements and Privacy Regulations
  - The Health Insurance Portability and Privacy Act of 1996 (HIPPA)
  - PII (Personally Identifiable Information)
  - General Data Protection Regulation (GDPR)
- Information Governance
  - Auditing
  - Legal Hold
  - Data classification and tagging (Natural Language Processing)
- India's Personal Data Protection bill

Unit 6: Applications uninterrupted **(07)**

- Understand data management aspects of traditional and new edge applications
- Reference architecture/best practices *(pick 2-3 case studies from below topics)*
  - Transactional Databases (Oracle, MySQL, DB2)
  - NoSQL Databases (MongoDB, Cassandra)
  - Distributed applications (micro service architectures)
  - Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes
  - Multi-Tiered applications
  - ETL workloads
  - Data analytics (AI/ML)

Textbooks:

1. Robert Spalding, **'Storage Networks: The complete Reference'**.
2. Vic (J.R.) Winkler, **'Securing The Cloud: Cloud Computing Security Techniques and Tactics'**, Syngress/Elsevier - 978-1-59749-592-9

Reference Books:

1. Martin Kleppmann, **'Designing Data-Intensive Applications'** , O'Reilly

Web References:

https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html

https://searchstorage.techtarget.com/definition/data-life-cycle-management

https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/

https://www.bmc.com/blogs/data-lifecycle-management/

https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/

https://medium.com/jagoanhosting/what-is-data-lifecycle-management-and-what-phases-would-it-pass-through-94dbd207ff54

https://www.spirion.com/data-lifecycle-management/

https://www.bloomberg.com/professional/blog/7-phases-of-a-data-life-cycle/

https://www.datacore.com/storage-virtualization/

https://www.veritas.com/content/dam/Veritas/docs/solution-overviews/V0907_SB_InfoScale-Software-Defined-Infrastructure.pdf

https://www.veritas.com/solution/digital-compliance

https://www.veritas.com/solution/data-protection

https://www.veritas.com/gdpr

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please visit our website.

OE4101 Open Elective I

COMPUTER GRAPHICS

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:

Facilitate the learners –

1. To understand basic concepts of computer graphics.
2. To understand and apply various Computer Graphics Algorithms of scan conversion, polygon filling, clipping, projection.
3. To learn 2-D and 3-D transformations.
4. To learn Computer Graphics techniques of shading, hidden surfaces and curves .
5. To get exposure on animation concept and tool to develop an animation

Course Outcomes:

By taking this course, the learner will be able to –

1. Develop logic to perform basic graphic operations.
2. Compare polygon filling and clipping algorithms.
3. Apply mathematics and logic for 2-D and 3-D transformations and projections.
4. Apply the concepts related to Hidden surfaces,curves,fractals and shading
5. Apply basic concepts of animation to design an animation program.

Unit – I: Basics of Computer graphics **(08)**

Introduction to computer graphics and applications, Basics of Graphics systems, lines, line segments, vectors, pixels and frame buffers, Aspect ratio, Resolution , Raster scan & random scan display
DDA and Bresenham's line drawing algorithms, Bresenham's circle drawing algorithm, Line styles- thick line drawing, dotted lines drawing
Display file structure, algorithms and display file interpreter. Primitive operations of display files

Unit – II: Polygons and Clipping algorithms **(06)**

Introduction to polygon, types of polygon , Inside-outside tests, polygon filling algorithms-flood fill, seed fill, scan line fill
Introduction to window and view-port, viewing transformations, 2-D line clipping: Cohen – Sutherland line clipping algorithm, Polygon clipping: Sutherland Hodgeman algorithm, generalized clipping

Unit – III: 2D and 3D Transformations **(08)**

2D Transformation: Introduction, Translation, Scaling, Rotation, Reflection and shear, homogeneous coordinate system ,representation of transformation matrices in homogeneous form, 3D Transformation: Introduction to 3-D geometry, translation, scaling, rotation
Projections: parallel and perspective projections and its types

Unit –IV: Hidden surfaces algorithms and shading **(08)**

Hidden Surfaces: Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter),Area subdivision (Warnock), BSP tree, and Scan line
Illumination Models: Light Sources, Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model Shading Algorithms: Halftone, Gauraud and Phong Shading.

Unit – V : Curves, surfaces and fractals **(06)**

Curves and Surfaces: Cubic splines, Bezier, B-splines Fractals:Introduction,Classification, Applications, Fractal generation

Unit – VI: Segment and Animation **(06)**

Introduction to segment , Segment table, operations on segment, display file used for segment, Introduction to animation, Animation languages, design of animation sequences, Methods of controlling animation, basic rules of animation, case study -Animation tool

Text books:

1. S. Harrington, **'Computer Graphics',** *McGraw-Hill Publications (*2nd Edition*)* , (1987), ISBN 0 – 07 –100472 – 6
2. D. Rogers, **'Procedural Elements for Computer Graphics'**, *Tata McGraw-Hill Publication* (2nd Edition) ,(2001), ISBN 0 – 07 – 047371 – 4.
3. D. Hearn, M. Baker, **'Computer Graphics – C Version'** ,*Pearson Education* (2nd Edition), (2002), ISBN 81 – 7808 – 794 – 4.

Reference books:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, **'Computer Graphics Principles and Practice'**, *Pearson Education*(4nd Edition), (2008), ISBN 978-81 – 317 – 0505 – 6.
2.D. Rogers, J. Adams, **'Mathematical Elements for Computer Graphics',** *Tata McGraw-Hill Publication*(2nd Edition) , (2002), ISBN 0 – 07 – 048677 – 8.
3. Donald Hearn and M Pauline Baker, Warren Carithers,**'Computer Graphics with OpenGL',** *Pearson Education* (4th Edition) ,ISBN 978-93-325-1871-1
4.F.S. Hill Jr, Stephen M.Kelley,'Computer Graphics Using OpenGL' , *PHI*(3rd Edition), (2009),ISBN 978-81 – 317 – 2414 – 9.

Online/Web/Other References:

1. NPTEL series – https://onlinecourses.nptel.ac.in/noc21_cs97
Prof. Samit Bhattacharya, IIT Guwahati

20ECAI 01: Mathematics for Artificial Intelligence

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial:1 Hour / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Course Objectives:

1. To interpret the types and operations on matrices and various methods of solving systems of linear equations
2. To recognize the concepts of vector space, linear independence, basis, dimension and its applications
3. To explore probability to analyze and test data
4. To explore statistical methods to analyze and test data
5. To learn multivariate calculus

Course Outcomes:
After completion of the course, students will be able to

1. Determine and analyze transformations of matrices and apply multiple methods to solve the systems of linear equations
2. Apply and analyze the concepts of vector space and subspace
3. Apply probability and Statistical methods for Data Analysis
4. Apply multivariate calculus to solve given problems

Unit I: Linear Algebra (08)
Scalars, Vectors, Matrices and Tensors, Rank of a matrix, use of echelon form and canonical form of a matrix to find rank, Inverse matrix to solve system of linear equations, Types of Matrices, classification of real and complex matrices, trace, quadratic form, Lower-Upper decomposition (LDU).

Unit II: Vector Spaces (09)
Vector Space, vector sub-space, basis and dimension, Linear dependence and independence of vectors, orthogonality, Orthogonal Projections, Gram-Schmidt orthogonalization Procedure, Eigen values and Eigen vectors, Principal Component Analysis (PCA), Singular Value Decomposition (SVD).

Unit III: Probability and Random Variables (10)
Probability, conditional probability, marginal probability, Bayes‟ theorem, Maximum Likelihood Estimation (MLE), Maximum A Posteriori estimation (MAP), Random variables, variance, expectation, Probability density function, histogram, Cumulative distribution function, standard probability density functions, probability distributions.

Unit IV: Multivariate Calculus (09)
Differential and Integral Calculus, Partial Differentiation, chain rule, Vector-Values Functions, Gradient, Jacobian and Hessian approach.

Reference Books:

1. Howard A, Chris R, **"Elementary Linear Algebra Applications Version"**, *Wiley-India*, (10th Edition), (2016).
2. Gilbert Strang, **"Linear Algebra and its Applications"**, (4th Edition), (2008), (10th Indian reprint), (2011) *Cengage Learnin.*
3. David C. Lay, **"Linear Algebra and Its Application"**, *Pearson Education*, (3rd Edition), (2002).

4. P. Z. Peebles, **“Probability, Random Variables and Random Signal Principles”**, *Tata McGraw- Hill*, (4th Edition), (2013).
5. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, **“Mathematics for Machine Learning”**,*Cambridge University Press*, (1st Edition), (2020).
6. Seymour Lipschutz, Marc Lars Lipson, **“**Linear Algebra**”**, Schaum's Outline, *McGraw-Hill*, (4th Edition), (2009).
7. S. M. Ross, **“**Introduction to Probability and Statistics for Engineers and Scientists**”**, *Academic Press*, (3rd Edition), (2005).

20ECAI 03 Fundamentals of Artificial Intelligence

Teaching Scheme Examination Scheme

Lectures: 3 Hrs / Week — In Semester: 50 Marks

End Semester: 50 Marks

Credits: 3

Course Objective:

1. To explain the basics of Artificial Intelligence (AI)
2. To introduce various types of algorithms useful in AI
3. To explain the concepts of machine learning, pattern recognition and their applications in the field of AI
4. To explain the code of ethics for AI

Course Outcomes:

After completion of the course, students will be able to

1. Explain the components of intelligent agents and expert systems
2. Apply knowledge representation techniques and problem solving strategies to AI applications
3. Explain and analyze the search and learning algorithms
4. Describe the code of ethics for the AI systems

Unit I : Basics of AI (04) Categories of AI, applications of AI, intelligent agents, agents and environments, good behavior, the nature of environments, structure of agents.

Unit II : Problem Solving and Constraint Satisfaction Problems (07)

Problem solving agents, searching for solutions, uninformed search strategies, Informed search strategies, heuristic function, local search algorithms and optimistic problems, optimal decisions in games, Alpha Beta Pruning, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP.

Unit III : Knowledge Representation (07)

Logic, Propositional logic, First order logic, Knowledge engineering in first order logic, inference in first order logic, prepositional versus first order logic, forward chaining, backward chaining, resolution, knowledge representation, uncertainty and methods, Bayesian probability and belief network, probabilistic reasoning, Bayesian networks, inferences in Bayesian networks.

Unit IV : Learning **(06)**

Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Statistical learning methods, Learning with hidden variable, EM algorithm, Neural networks

Unit V : Expert Systems **(07)**

Introduction to Expert System, Architecture and functionality, Examples of Expert system, Basic steps of pattern recognition system, Feature Extraction- Principal Component Analysis, Linear Discriminant Analysis, Object Recognition- Template Matching theory, Prototype Matching Theory, Pattern Mining.

Unit VI: Code of Ethics for AI **(05)**

Privacy and Surveillance, Manipulation of Behavior, Opacity of AI Systems, Bias in Decision Systems, Human-Robot Interaction, Automation and Employment, Autonomous Systems, Machine Ethics, Artificial Moral Agents Privacy.

Reference Books:

1. Stuart Russell, Peter Norvig, **'Artificial Intelligence", A Modern Approach '**, *Pearson Education/Prentice Hall of India,* (3rd Edition), (2010)
2. Elaine Rich, Kevin Knight and Shivshankar Nair, **'Artificial Intelligence'**, *Tata McGraw Hill,* (3rd Edition), (2009)
3. Paula Boddington**, „Towards a Code of Ethics for Artificial Intelligence",** *Springer international Publishing***,** (1st Edition), (2017)
4. Nils J. Nilsson, **'Artificial Intelligence: A new Synthesis'**, *Morgan Kaufmann Publishers,* (1st Edition) (1998)
5. George F. Luger, **'Artificial Intelligence: Structures and Strategies for Complex Problem Solving ',** *Pearson Education,* (6th Edition), (2008)
6. NPTEL Lectures on AI : http://nptel.ac.in/courses/106105077/

7. https://plato.stanford.edu/entries/ethics-ai/

8. https://intelligence.org/files/EthicsofAI.pdf

20ECAI 04 Machine Learning

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: 50Marks

End-Semester: 50 Marks

Credits: 3

Course Objectives:

1. To learn machine learning paradigms used for regression and classification.
2. To analyze various machine learning algorithms.
3. To know use of software tools for implementation of machine learning algorithms

Course Outcomes:

After completion of the course, students will be able to-

1. Make use of the software tool to handle univariate and multivariate data.
2. Apply suitable data pre-processing and data visualization method to interpret data and select suitable features.
3. Compare and contrast different supervised and unsupervised machine learning techniques with their advantages and limitations.
4. Select a suitable classifier to build classification and recognition system.
5. Apply various dimensionality reduction methods to extract important features from the input data.
6. Apply various machine learning techniques for real-world prediction, classification and clustering problems.

Unit – I: Foundations of Machine learning (07)

Machine-Learning Problem, Designing a learning system, Examples of Machine Learning, Machine Learning Applications across different industries, Types of machine learning. Basic concepts in machine learning- parametric and non-parametric methods, Overfitting and Underfitting, Bias and Variance, Optimization and Cost function, Performance measures.

Tools for ML, Python essentials: Editors, Primitive Data types, Data structures, Numpy, Scipy, Pandas, Matplotlib, Scikit-learn.

Unit –II: Data Interpretation (10)

Machine learning pipeline, Feature Engineering for ML, Data types- numerical and categorical, Data wrangling- filtering, pre-processing, typecasting, transformation, feature selection, Data visualization- Descriptive statistics, Frequency tables, Creating graphs, Data analysis- Univariate and Bivariate analysis, Statistical methods- Central tendencies and variance, Boxplot, Outliers; Applications of ML in Predictive modelling.

Unit – III: Supervised learning **(10)**

Two-class and Multiclass learning problems, Regression- linear and logistic, Model selection and generalization, Outlier detection, Cross Validation. Classification, K-Nearest Neighbour algorithm, Support Vector Machines, Decision trees, Random Forests; Naïve Bayes classifier, Neural Networks, Applications of ML in Classification.

Unit – IV: Unsupervised learning **(09)**

Dimensionality reduction- Principal Component Analysis (PCA), Independent Component Analysis (ICA), Singular Value Decomposition (SVD); Clustering: k-Means, Mean-shift, Hierarchical Clustering, Expectation–Maximization (EM) using Gaussian Mixture Models (GMM), Applications of ML in Clustering.

Reference Books:

1. Christopher Bishop, '**Pattern Recognition and Machine Learning'**, *Springer*, (1st Edition), (2007).

2. Tom Mitchell, '**Machine Learning'**, *McGraw Hill Education Ltd., Ed*., (1st Edition), (2013).

3. Ethem Alpaydin, '**Introduction to Machine Learning**', *MIT Press*, (2nd Edition), (2010).

4. Kevin Murphy, '**Machine Learning: A Probabilistic Perspective'**, *MIT Press*, (1st Edition), (2012).

5. Andreas C. Miller and Sarah Guido, '**Introduction to Machine Learning with Python- A Guide for Data Scientists**', *O'Reilly Media, Inc*., (1st Edition), (2017).

20PEECAI 01 Digital Image Processing

Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs /Week In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:
1. To understand image fundamentals and mathematical operations performed on images
2. To learn image enhancement techniques
3. To understand different image segmentation techniques
4. To study image Representation and Description techniques
5. To study applications of image processing and AI applications of Image Processing

Course Outcomes:
After completion of the course, students will be able to
1. Describe image processing fundamentals and implement basic mathematical operations on digital
images
2. Apply image enhancement techniques in spatial and frequency domain
3. Implement segmentation techniques
4. Implement and analyze feature extraction and feature description techniques
5. Apply image processing and AI techniques to develop different applications

Unit I: Digital Image Fundamentals (03)
Elements of visual perception, Human Visual system, Image sensing and acquisition, image sampling
and quantization, Basic relationship between pixels, neighbors of a pixel, Types of images, Color
models – RGB, CMY, YIQ, HSI, Statistical parameters.

Unit II: Image Enhancement (04)
Image Enhancement: Spatial domain methods, intensity transformations, histogram processing, Spatial filtering - smoothing filter, sharpening filter. Frequency domain filtering: low pass filtering, high pass filtering.

Unit III: Image Segmentation (10)
Thresholding, histogram based segmentation, Edge based segmentation, Clustering, Region growing,
region splitting, watershed algorithm.

Unit IV: Image Feature Detectors and Descriptors (10)
Corner detectors, blob detector, SIFT, HOG, GLCM.

Unit V: Applications of Image Processing (09)
Face detection using Viola Jones algorithm, QR code recognition, Applications of AI in Image restoration, photo editing, old image colouring.

Reference Books:
1. R.C. Gonzalez, R.E. Woods, „Digital Image Processing‟, Pearson Education, (3rd Edition), (2014)
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar „Digital Image Processing‟, McGraw-Hill, (1st Edition), (2009)
3. K. Jain, „Fundamentals of Digital Image Processing‟, Prentice Hall, (3rd Edition), (2004)
4. W.K. Pratt, „Digital Image Processing‟, John Wiley & sons, (3rd Edition), (2006)
5. Narendra Kumar Kamila, „Handbook of Research on Emerging Perspectives in Intelligent Pattern Recognition, Analysis and Image Processing‟, IGI Global, (1st Edition), (2016)

M. Tech (E&TC)

Semester and Year: 1st sem 2021-22

Fundamentals of Artificial Intelligence Lab (20ECAI 03L)

List of Experiments

Course Outcomes	
CO1	**Explain the components of intelligent agents and expert systems.**
CO2	**Apply knowledge representation techniques and problem-solving strategies to AI applications.**
CO3	**Explain and analyze the search and learning algorithms**
CO4	**Describe the code of ethics for the AI systems**

Sr. No.	Title
1	Implement Tic-Tac-Toe game
2	Implement water Jug problem
3	Implement Breadth first search algorithm
4	Implement Depth first search algorithm
5	Implement A-star algorithm
6	Implement Forward Chaining for Knowledge Representation
7	Implement Ensemble Learning Algorithms (Bagging and Boosting)
8	Study and implementation of ML algorithm on Weka tool
9.	Study on Code of Ethics for AI

Dr. Mrudul Dixit

Dr. Prachi Mukherji
HOD

20ECAI 04L MACHINE LEARNING LAB

Teaching Scheme			**Examination Scheme**
Practical: 2 Hours/Week			**Practical**:25 Marks
			Credits: 1

Course Objectives:

1.	To explain the basics of Python Programming Language
2.	To learn the concepts of Machine Learning (ML) for data visualization and analysis
3.	To examine ML techniques for regression and prediction problems
4.	To apply ML algorithms for classification and clustering problems

Course Outcomes:

After completion of the course, students will be able to

CO1	Apply Python programming for reading and visualizing real-world data
CO2	Analyze clean data by preprocessing raw data and perform descriptive statistical computations
CO3	Develop an algorithm to apply regression analysis on real world datasets
CO4	Analyze performance of classification and clustering algorithms on real world datasets
CO5	Examine dimensionality reduction on various types of data

List of Experiments:

1.	A) Introduction to Python programming, and editors, B) Visualize the given data using various plotting techniques
2.	A) Calculate the central tendencies for the given data and select the suitable measure to describe the data, B) Calculate the dispersion and select the suitable measure of dispersion
3.	Apply data preprocessing, data cleaning on the given .csv data using Pandas
4.	Perform regression analysis on the randomly generated data/ real-world data
5.	Apply SVM on real-world dataset, perform classification and evaluate the performance
6.	Implement k-Nearest Neighbor and Naive Bayes on Iris dataset and compare performance
7.	Perform dimensionality reduction on the given data using Principal Component Analysis
8.	Apply unsupervised learning to perform clustering on the given dataset

20PEECAI01AL Digital Image Processing lab

Sr. No.	Title
1	To create a digital image using matlab
2	To perform colour model conversions using matlab
3	To perform Histogram Equilization using python
4	To apply smoothing filters on images using python
5	To perform segmentation using edge detection using python
4	Image segmentation using thresholding
5	To perform a) Image segmentation using k-means algo b) Harris corner detection c) HOG feature detection d)GLCM of an image
6	(Continued) To perform a) Image segmentation using k-means algo b) Harris corner detection c) HOG feature detection d)GLCM of an image
7	Mini project to develop an application in DIP
8	Mini project to develop an application in DIP

20ECAI 05 Natural Language Processing

Teaching Scheme: Examination Scheme:
Lectures: 3 Hrs/Week In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 3

Course Objectives:
1. To understand various aspects of Natural Language Processing
2. To learn Phonological, Morphological, Syntactic and Semantic processing
3. To understand issues related to ambiguity of Natural Language
4. To understand the advanced applications of Natural Language Processing

Course Outcomes:
After completion of the course, students will be able to
1. Explain the importance of Natural Language Processing
2. Identify the fundamental concepts and techniques of Natural Language Processing
3. Analyze ambiguous structure of Natural Language
4. Summarize the advanced applications of Natural Language Processing

Unit I: Introduction to Natural Language Processing Fundamentals of Phonetics (09)
The Study of Language, Evaluating language Understanding Systems, Different levels of Language Analysis, Speech Sounds and Phonetic Transcription, Articulatory Phonetics, Phonological Categories and Pronunciation Variation, Phonetic Features

Unit II: Fundamentals of Syntax (09)
The elements of Noun Phrases, Verb Phrases, Adjective Phrases, Adverbial Phrases and

SimpleSentences, Grammars and Sentence Structure, Construction of a Good Grammar, A Top-DownParser, A Bottom-Up Chart Parser, Top-Down Chart Parsing, Part-of-Speech Tagging.

Unit III: Fundamentals of Semantics and Discourse (10)
Word Senses, Relations between Senses, WordNet, Word Sense Disambiguation, The Need forDiscourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense and Aspect, Managingthe Attentional Stack, Concept of Pragmatics.

Unit IV: Applications of Natural Language Processing (08)
Machine Translation, Sentiment Analysis, Question Answering Systems, Cross LingualInformation Retrieval, Natural Language Interface to Database, Extractive and AbstractiveSummarization Systems, Indian Language WordNets.

Reference Books:
1. Jurafsky, David, James H. Martin, „Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‟, Pearson Education Limited, Dorling Kindersley(India) Pvt. Ltd., (2014)
2. James Allen, „Natural Language Understanding‟, Pearson Education Limited, Dorling indersley (India) Pvt. Ltd. (Indian Subcontinent Version)(2007)
3. Manning, Christopher D., Hinrich Schütze, „Foundations of Statistical Natural Language Processing‟, Cambridge Publication,(1999)
4. Steven Bird, ewan Klein, and Edward Loper, „Natural Language Processing with Python‟, O’Reilly Media, (2009)

20ECAI 06 Data Analytics

Teaching Scheme: Lectures: 3 Hrs/Week
Credits: 3

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks

Course Objectives:

1. To understand the concepts, challenges and techniques of Big Data and Big Data Analytics
2. To introduce the concepts of Hadoop, Map Reduce framework and "R" for Big Data Analytics
3. To teach students to apply skills and tools to manage and analyze Big Data

Course Outcomes:

After completion of the course, students will be able to

1. Design and manage a Big Data application using Hadoop technology framework
2. Collect, manage, store, query and analyze various forms of Big Data using Map-Reduce and other Big Data tools
3. Apply Big Data Analytics tools for business decisions and strategy definition
4. Implement solutions to some of the open Big Data problems using R
5. Compare various Data Analytic Methods and trends

UNIT I: Introduction (06)

Database Management Systems, structured data, SQL, Big data overview, characteristics of Big Data, applications of Big Data, Unstructured data, NOSQL, advantages of NOSQL, Comparative study of SQL and NOSQL.

UNIT II: Big Data Architecture, Hadoop (06)

Challenges enabling real time big data processing, Hadoop – Introduction, building blocks of hadoop, Installing and configuring Hadoop.

UNIT III: MapReduce Fundamentals (06)

Components of Hadoop, HBASE, HIVE, Map Reduce Working, the Mapper and Reducer, InputFormats and OutputFormats, Introduction to HBASE, Sqoop, Spark.

UNIT IV: Big Data Analytics (06)

Data Analytical architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach, Data Analytic Life Cycle: Discovery, Data preparation, Model planning, Model Building, Communicate results, Operationalize, Case Study: Global Innovation Network And Analysis (GINA).

UNIT V: Analytics using R (06)

R Fundamentals: Math, variables, strings, vectors, factors, vector operations, Data structures in R: Arrays and amp, Matrices, lists, data frames, R programming fundamentals: Conditions and loops, functions in R, Objects and Classes, Working with data in R: Reading CSV and Excel files, reading text files, writing and saving data objects to file in R.

UNIT VI: Data Analytic Methods and Trends (05)

Statistical Methods, Machine learning methods – supervised, unsupervised, Recommendation systems, Big data visualization, Open source Tools / Techniques / Languages (R, Python)

Reference Books:

1. Vignesh Prajapati, "**Big Data Analytics with R and Hadoop**", *Packt Publishing*, (November 2013)

2. "**Data Science and Big Data Analytics**", *Wiley*, (1st Edition), (January 2015)

3. Abraham Silberschatz, Henry Korth, S. Sudarshan, "**Database Systems Concepts**", *McGraw Hill Education (India) Pvt Ltd,* (6th Edition), (December 2013)

4. Arvind Sathi, "**Big Data Analytics: Disruptive Technologies for Changing the Game**", *MC Press* (November 2012)

5. Viktor Mayer-Schonberger, Kenneth Cukier, "**Big Data: A Revolution that will transform how we live, work, and think**", *Hodder and Stoughton*, (October 2013)

6. J. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "**Big Data for Dummies**", *John Wiley & Sons, Inc.* (1st Edition), (April 2013)

7. Tom White, "**Hadoop: The Definitive Guide**", *O'Reilly*, (3rd Edition), (June 2012)

20ECAI 07 Artificial Intelligence in Wireless Communications

Teaching Scheme:
Lectures: 3 Hrs/Week

Examination Scheme:
In-Semester: **50**Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. To understand the cognitive radio systems in wireless communication
2. To understand artificial intelligence techniques applied in Wireless Communications
3. To understand functions of the software defined radio.
4. To understand multi-objective optimization of Radio Resources.

Course Outcomes:

After completion of the course, students will be able to

1. Describe Cognitive radio architecture, Cognitive engine design and its components
2. Discuss artificial intelligence techniques applied in Wireless Communications
3. Interpret basics of Software Defined Radio
4. Discuss Multi-objective Optimization of Radio Resources.
5. Analyse an algorithm to perform the multi-objective analysis.

UNIT I: Overview of Cognitive Radio and the Cognitive Engine: **(07)**

Concept of Cognitive Radio, Cognitive Radio history. The Cognitive Engine: Cognitive Radio Design, Cognitive Engine Design, Component Descriptions – Sensors, Optimizer, Decision Maker, Policy Engine, Radio Framework, User Interface, Cognitive Controller Configuration.

UNIT II: Artificial Intelligence in Wireless Communications: **(07)**

Artificial Intelligence Techniques- Neural Networks, Hidden Markov Models (HMM), Fuzzy Logic, Evolutionary Algorithms, Case-Based Reasoning

UNIT III: Overview and Basics of Software Defined Radios: **(07)**

Background, Benefits of Using SDR, Problems Faced by SDR, GNU Radio Design - The Universal Software Radio Peripheral, The USRP Version 2, Flow Graphs, Parallel Programming in GNU Radio, Flow Graph for Simulation and Experimentation.

UNIT IV: Optimization of Radio Resources: **(07)**

Objective Space, Multi-objective Optimization: Objective Functions, Bit Error Rate (BER), Bandwidth (Hz), Spectral Efficiency (bits/Hz), Interference, Signal to Interference Plus Noise Ratio (SINR), Throughput, Power, Computational Complexity. Multi-objective Optimization: A Different Perspective, Multi-objective Analysis- Utility Functions, Population-Based Analysis

UNIT V: Genetic Algorithms for Radio Optimization: **(08)**

Example: The Knapsack Problem, Multi-objective GA, Wireless System Genetic Algorithm –Details of Chromosome Structure, Objective Function Definition, Optimal Individual Selection.

REFERENCES BOOKS:

1. Thomas W.Rondeau and Charles W. Bostian, **'Artificial Intelligence in Wireless Communications'**, *Artech House*, (1st Edition), 2009
2. Joseph Mitola III, **'Software Radio Architecture: Object-Oriented Approaches To Wireless System Engineering'**, *John Wiley & Sons Ltd.*, (1st Edition), 2000
3. Simon Haykin, **'Cognitive Radio: Brain –Empowered Wireless Communications'**, *IEEE Journal on Selected Areas in Communications*, (Feb 2005)
4. D. E. Goldberg, **'Genetic Algorithms in Search, Optimization, and Machine Learning, Reading',** *MA: Addison-Wesley,* (1st Edition), 1989

20ECAI 08 Deep Learning

Teaching Scheme:

Lectures: 3 Hrs./Week

Examination Scheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Credits: 3

Course Objectives:

1. To learn basics of neural networks and deep learning.
2. To understand training of deep neural networks and L-layers.
3. To know various CNN architectures and perform transfer learning.

Course Outcomes:

After completion of the course, students will be able to-

1. Apply modern software tools and libraries for deep learning to train on large data.
2. Build and train L-layer deep neural network.
3. Make use of hyperparameter tuning and regularization methods for optimized model performance.
4. Design a convolutional neural network for image recognition, classification applications.
5. Apply transfer learning to train deep neural network for real-world applications.
6. Evaluate the performance of trained models using cost function and cross validation.

Unit – I: Introduction to Deep learning (08)

Machine learning Vs. Deep learning, Feedforward neural networks, Multi-layer perceptron (MLP), Shallow neural networks and Deep neural networks, Activation functions, Gradient descent and Backpropagation algorithm, Deep learning frameworks (Keras, TensorFlow, PyTorch, Caffe, Theano), Tensor representation, Building neural network architecture using TensorFlow; Role of GPU in deep learning.

Unit –II: Tuning Deep Networks (10)

L-Layers of Deep NN, Effect of adding hidden layers, Preparation of dataset, Bias and Variance, Dataset Augmentation, Overfitting, Regularization, Dropout, Early Stopping, Parameter Tying and Parameter Sharing, Weight initialization, Learning rate, ReLU and Softmax Function, Stochastic Gradient Descent (SGD), Batch and Mini Batch, Optimizers- Momentum, RMSProp, Adam; Cost functions.

Unit – III: Convolutional Neural Network **(10)**

Convolutional Neural Network (CNN) architecture, Building blocks of CNN, Convolution operation and layer, Kernels and Filters, Pooling layer, Stacking of layers, Vanishing/Exploding Gradients, Training of CNN, Accuracy and loss, Cross-validation, Image classification examples using Deep Convolutional Neural Network.

Unit – IV: Transfer learning and Applications of Deep learning **(08)**

Understanding and visualizing Convolutional Neural Networks, Modern CNN architectures- LeNet, AlexNet, VGG, GoogleNet, Inception, ResNet, U-Net; Transfer learning from modern CNN architectures.

Deep learning for medical image interpretation, Deep learning for computer vision- object detection and recognition, Deep learning for sequence data and text data- Introduction to RNN, LSTM.

Reference Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, **'Deep Learning'**, *MIT Press*, (1^{st} Edition), (2016).

2. Francois Chollet, **'Deep Learning with Python',** *Manning Publications,* (1^{st} Edition), (2018).

3. Phil Kim, '**MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence'**, *Apress*, (1^{st} Edition), (2017).

4. Josh Patterson and Adam Gibson, '**Deep Learning- A Practitioner's Approach**', O'Reilly Media, (1^{st} Edition), (2017).

5. Laurene Fausett, **'Fundamentals of Neural Networks: Architectures, Algorithms and applications'**, *Pearson Education*, (1^{st} Edition), (2008).

20ECAI 09 Research Methodology

Teaching Scheme: Examination Scheme:

Tutorial: 1 Hr /Week In-Semester: 25Marks

Credits: 1

Course Objectives:

1. To understand basic concepts of research and research methodology
2. To understand principles behind Research Problem formulation
3. To study Instrumentation schemes for Data collection
4. To prepare a research/ project proposal

Course Outcomes:

After completion of the course, students will be able to

1. Formulate Research Problems
2. Design and Analyze schemes for Data collection
3. Write research proposals
4. Write Technical Papers

Unit I: Research Problem (03)

Research and research problem, sources of research problem, criteria / Characteristics of a good research problem, Literature Review, Scope and objectives of research problem, Hypothesis its importance and construction, Selecting a sample.

Unit II: Data Collection Design (03)

Data Collection, Form design and Data processing.

Unit III: Research Proposal (04)

Developing a Research Proposal and writing a research report. Format of research proposal, Individual research proposal, Institutional proposal, Report writing, Technical Paper writing.

Reference Books:

1. S. Melville, W. Goddard, „Research Methodology: An introduction for Science & Engineering students‟, Juta and Company ,(1st Edition), (1996)

2. R. Kumar, „Research Methodology: A Step by Step Guide for Beginners‟, Pearson Education, (2nd Edition), (2005)

3. Dr. C. R. Kothari, „Research Methodology: Methods and Techniques‟, New Age Publication, (2nd Edition), (2010)

4. R. Panneerselvam, „Research Methodology‟, PHI Learning, (2nd Edition), (2014)

20PEECAI 02 Computer Vision

Teaching Scheme:
Lectures: 3 Hrs./Week

Examination Scheme:
In-Semester: **50**Marks
End-Semester: **50** Marks
Credits: **3**

Course Objectives:

1. To understand computer vision fundamentals and applications
2. To understand feature detection, matching and image recognition applications
3. To learn image segmentation, motion estimation, activity recognition tasks

Course Outcomes:

After completion of the course, students will be able to-

1. Describe the computer vision system and its applications
2. Identify image features and apply feature detection and matching methods
3. Detect objects and pedestrian for autonomous vehicles
4. Apply image segmentation techniques for medical imaging applications
5. Apply motion estimation algorithms to detect and track motion in video
6. Build a computer vision system for gesture recognition

Unit I: Computer Vision for Autonomous vehicles **(09)**

Self-Driving cars, Advanced Driver Assistant System- Tasks and Challenges, Case study- Lane detection, Pedestrian detection from the road scene..

Unit II: Computer Vision for Disease Diagnosis **(09)**

Medical imaging- X-ray, CT and MRI; Case study- Medical image segmentation for Tumour detection, Tumour classification as cancerous or non-cancerous.

Unit III: Computer Vision for Video Surveillance **(10)**

Surveillance and vision based tasks, Foreground-Background Separation, Background Subtraction and Modelling, Motion tracking- Optical Flow. Case study- Human activity recognition.

Unit IV: Computer Vision for Gesture Recognition **(08)**

Human Computer Interaction (HCI), Hand gestures, Detection- color and shape features, Tracking, feature matching, Gesture Recognition system using Convolutional Neural Networks.

Reference Books:

1. Richard Szeliski, „Computer Vision: Algorithms and Applications‟, Springer-Verlag London Limited, (1 st Edition), (2011)
2. D. A. Forsyth, J. Ponce, „Computer Vision: A Modern Approach‟, Pearson Education, (1^{st} Edition), (2003)
3. L. G. Shapiro, George C. Stockman, „Computer Vision‟, Prentice Hall, (1 st Edition), (2001)
4. E. Trucco, A. Verri, „Introductory Techniques for 3-D Computer Vision‟, Prentice Hall (1^{st} Edition), (1998)
5. 5. M. Shah, “Fundamentals of Computer Vision,” Online book (1997)

20ECAI 05L Natural Language Processing Lab

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral: 25 Marks
Credits: 1

Course Objectives:

1. Understand stages of Text pre-processing
2. Describe Sequential networks
3. Implement language models

Course Outcomes:

After completion of the course, students will be able to

1. Describe the fundamental concepts and techniques of natural language processing.
2. Apply preprocessing techniques to text
3. Describe parsing techniques for text processing
4. Apply sequential network for language modeling

List of Experiments:

1. To apply Tokenization for a given sentence by using the NLTK library
2. Apply NLTK pos tag for sample text
3. Apply TF-IDF vectorization for a given text
4. Apply the word2vec model for a given text
5. Implement sequential network

Case studies:

6. Time series forecasting
7. Language models

20ECAI 06 Data Analytics

Teaching Scheme: Lectures: 3 Hrs/Week
Credits: 3

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks

Course Objectives:

1. To understand the concepts, challenges and techniques of Big Data and Big Data Analytics
2. To introduce the concepts of Hadoop, Map Reduce framework and "R" for Big Data Analytics
3. To teach students to apply skills and tools to manage and analyze Big Data

Course Outcomes:

After completion of the course, students will be able to

1. Design and manage a Big Data application using Hadoop technology framework
2. Collect, manage, store, query and analyze various forms of Big Data using Map-Reduce and other Big Data tools
3. Apply Big Data Analytics tools for business decisions and strategy definition
4. Implement solutions to some of the open Big Data problems using R
5. Compare various Data Analytic Methods and trends

UNIT I: Introduction (06)

Database Management Systems, structured data, SQL, Big data overview, characteristics of Big Data, applications of Big Data, Unstructured data, NOSQL, advantages of NOSQL, Comparative study of SQL and NOSQL.

UNIT II: Big Data Architecture, Hadoop (06)

Challenges enabling real time big data processing, Hadoop – Introduction, building blocks of hadoop, Installing and configuring Hadoop.

UNIT III: MapReduce Fundamentals (06)

Components of Hadoop, HBASE, HIVE, Map Reduce Working, the Mapper and Reducer, InputFormats and OutputFormats, Introduction to HBASE, Sqoop, Spark.

UNIT IV: Big Data Analytics (06)

Data Analytical architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach, Data Analytic Life Cycle: Discovery, Data preparation, Model planning, Model Building, Communicate results, Operationalize, Case Study: Global Innovation Network And Analysis (GINA).

UNIT V: Analytics using R (06)

R Fundamentals: Math, variables, strings, vectors, factors, vector operations, Data structures in R: Arrays and amp, Matrices, lists, data frames, R programming fundamentals: Conditions and loops, functions in R, Objects and Classes, Working with data in R: Reading CSV and Excel files, reading text files, writing and saving data objects to file in R.

UNIT VI: Data Analytic Methods and Trends (05)

Statistical Methods, Machine learning methods – supervised, unsupervised, Recommendation systems, Big data visualization, Open source Tools / Techniques / Languages (R, Python)

Reference Books:

1. Vignesh Prajapati, "**Big Data Analytics with R and Hadoop**", *Packt Publishing*, (November 2013)

2. "**Data Science and Big Data Analytics**", *Wiley*, (1st Edition), (January 2015)

3. Abraham Silberschatz, Henry Korth, S. Sudarshan, "**Database Systems Concepts**", *McGraw Hill Education (India) Pvt Ltd,* (6th Edition), (December 2013)

4. Arvind Sathi, "**Big Data Analytics: Disruptive Technologies for Changing the Game**", *MC Press* (November 2012)

5. Viktor Mayer-Schonberger, Kenneth Cukier, "**Big Data: A Revolution that will transform how we live, work, and think**", *Hodder and Stoughton*, (October 2013)

6. J. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "**Big Data for Dummies**", *John Wiley & Sons, Inc.* (1st Edition), (April 2013)

7. Tom White, "**Hadoop: The Definitive Guide**", *O'Reilly*, (3rd Edition), (June 2012)

20ECAI 08L DEEP LEARNING LAB

Teaching Scheme			**Examination Scheme**
Practical: 2 Hours /Week			Practical: 25 Marks
			Credits: 1

Course Objectives:

1.	To apply python programming for implementing Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN)
2.	To learn deep learning frameworks and Python libraries used for deep learning
3.	To apply ANN, CNN and RNN algorithms to solve real-world problems

Course Outcomes:

After completion of the course, students will be able to-

CO1	Train neural networks and apply hyperparameter tuning for deep neural networks
CO2	Select and apply a suitable Convolutional Neural Network architecture to solve real-world image classification, object recognition problems
CO3	Develop an algorithm for text processing and time series prediction using Recurrent Neural Networks and Long Short-Term Memory
CO4	Analyze performance of deep learning models using different evaluation metrics

List of Experiments:

1.	Develop a neural network model (Feed-forward/Perceptron neural network) and apply the model for class prediction problem
2.	Develop a multi-layer feed-forward neural network to solve binary classification problem
3.	Analyze neural network performance through visualization
4.	Develop a multi-layer feed-forward neural network to solve multi-class classification problem
5.	Develop an algorithm and write a program for object recognition using Convolutional Neural Network (CNN)
6.	Develop an algorithm and write a program for IMDb review classification using RNN and LSTM
7.	Mini Project on Applications of CNN: Image classification/ Object recognition/ Image segmentation
8.	Mini Project on develop an application for Semantic segmentation/ Face recognition/ Object detection using transfer learning
9.	Mini Project on applications of RNN and LSTM for Image captioning/ Sentiment analysis/ Stock prediction

20AC 01 Soft Skills and Business Communication

Teaching Scheme: Practical: 2 Hrs/Week

Examination Scheme:

In-Semester: Nil

End-Semester: Nil

Credits: Nil

Course Objectives:

1. To develop team spirit, leadership and professionalism.
2. To focus on over all personality development.
3. To develop right attitudinal and behavioral aspects, and build the same through activities.
4. Possess right professional and social ethical values.
5. To make student confident in communicating in Business environment.
6. Improve their fluency in English language.

Course Outcomes:

After completion of the course, students will be able to

1. Communicate, interact and present his ideas to other professionals.
2. Explain role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.
3. Develop right attitudinal and behavioral aspects, and build the same through activities.
4. Develop right professional and social ethical values.
5. Overcome apprehension of communicating in professional environment.
6. Language proficiency will enable student to present ideas, applications and reports effectively in oral and written communication.

Unit I: Self-Awareness & self-Development (03)

Self Assessment, Self Appraisal, SWOT, Goal setting -Personal &career-Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting. b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

Unit II: Communication Skill (06)

Importance of communication, types, barriers of communication, effective communication.

Speaking Skills– Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.

Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening.

Group Discussion- characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.

Presentation skills- planning, preparation, organization, delivery.

Written Skills– Formal & Informal letter writing, Report writing, Resume writing- Sentence structure, sentence coherence, emphasis. Paragraph writing, Letter writing skills-form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Unit III: Corporate/ Business Etiquettes. (02)

Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting-Understand the importance of professional behavior at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment), Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

Unit IV: Interpersonal relationship (03)

Team work, Team effectiveness, Group discussion, Decision making - Team Communication Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity. Unit V: Leadership skills (01) Leaders‟ role, responsibilities and skill required- Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other

People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.

Unit VI: Other skill (03)

Time management-The Time management matrix, apply the Pareto Principle (80/20Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say “no” to time wasters, develop your own individual plan of action.

Stress management- understanding the stress & its impact, techniques of handling stress

Problem solving skill, Confidence building Problem solving skill, Confidence building.

Reference Books:

1. S. Kumar, S.Pushpalata, „Communication Skills‟, Oxford University Press, (1 st Edition), (2011)

2. K. Mohan, M. Banerji, „Developing Communication Skill‟ , McMillan India Ltd, (1 st Edition), (2011)

3. S. Sweeney, „English for Business Communication‟ Cambridge University Press,(1st Edition), (2013)

4. B. K. Mitra, „Personality Development and Group Discussions‟, Oxford University Press, (1st Edition),(2010)

5. S. Napoleon Hill „Think and Grow Rich‟, Ebury Publishing,(1 st Edition), (1937)

PEINA 2101 A Safety and Automation Systems

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/Week	In Sem: 50 Marks
	End Sem: 50 Marks
	Credit: 3

Course Objectives:
1. To make the students aware of basic concepts of safety instrumented system,
2. To make the students aware of standards
3. To make the students aware of risk analysis techniques.

Course Outcomes: The student will be able to
1. Differentiate between process control and safety control and identify the role of safety instrumented system in the industry.
2. Identify and analyse the process hazards.
3. Select the Safety integrity level.
4. Analyze the performance of different logic system technologies and field devices with optimum risk levels.

Unit I: Introduction [6 Hrs]
Safety Instrumented System (SIS) - need, features, components, difference between basic process control system and SIS, Risk: how to measure risk, risk tolerance, Safety integrity level, safety instrumented functions, review of Standards and Regulations related to Safety,

Unit II: Safety Life Cycle [6 Hrs]
Hazard and risk analysis, allocation of safety functions to protective layers, develop safety requirements specification, SIS design & engineering, installation commissioning and validation, operations and maintenance, modifications, decommissioning.

Unit III: Determining the Safety Integrity Level (SIL) [6 Hrs]
Evaluating Risk, Safety Integrity Levels, SIL Determination Method: As Low As Reasonably Practical (ALARP), Risk matrix, Risk Graph, Layers of Protection Analysis (LOPA)

Unit IV: Technology Selection [6 Hrs]
Covers the safety requirements specification (SRS) and the pros and cons of pneumatic, relay and microprocessor logic systems, PLC systems for safety system development. Issues Relating to Field Devices: importance of field devices: impact of field devices such as sensors, final elements on system performance.

Unit V: Reliability of SIS [6 Hrs]
Covers reliability issues and helps make sense of the minimum hardware fault tolerance requirement, Likelihood analysis: estimation and statistical analysis, fault propagation, event tree analysis and fault tree analysis, Quantitative layer of protection analysis: multiple initiating events, estimating initiating event frequencies and IPL failure probabilities

Unit VI: Case Study [6 Hrs]
The safety life cycle and its importance, furnace/fired heater safety shutdown system, scope of analysis, define target SILs, develop safety requirement specification (SRS), SIS conceptual design, lifecycle cost analysis, verification of SIL satisfaction, detailed design, installation, commissioning and pre-start-up tests, operation and maintenance procedures.

Reference Books:

1. Paul Gruhn and H Jarry L. Cheddie, “Safety Instrumented systems: Design, Analysis and Justification”, ISA, 2nd edition, 2006.
2. Dr. Eric W Scharpf, Heidi J Hartmann, Harlod W Thomas, “Practical SIL target selection: Risk Analysis per the IEC 61511 Safety Lifecycle”, exida, 2012.
3. Ed Marszal, Eric W Scharpf, “Safety Integrity Level Selection”, ISA.

OEHS2101B Elective III Industrial Safety Engineering
(Online NPTEL Swayam)

Teaching Scheme
Lecture : 3 Hrs/week

Examination Scheme
In semester : 50 marks
End semester : 50 marks
Credits : 3

Course Objectives:
Students are expected to –

1. Understand criticality of safety in industrial environment
2. Understand concept and application risk, safety and reliability
3. Understand accident root cause analysis
4. Understand of the key elements of various safety standards

Course Outcome:

1. Students will be capable to do critical examination of factory premises from safety point of view.
2. Students will be capable to do carry out risk and safety analysis
3. Students will be able to analyse root cause analysis of accidents.
4. Students will be design safety provisions confirming to various standards.

Course Content:

Unit 1: Introduction to Industrial Safety
Introduction, key concepts, terminologies, and safety quantification, safety by design,
Fault tree and event tree analysis (qualitative & quantitative)
Unit 2: Risk Assessment and Analysis
Bow-tie and quantitative risk assessment (QRA), safety function deployment, Safety vs reliability – quantification of basic events (repair to failure, repair-failure-repair, and combined processes),
Safety vs reliability – quantification of basic events
Unit 3: Systems Safety Analysis
Systems safety quantification (e.g., truth tables, structure functions, minimal cut sets)
Human error analysis and safety
Unit 4: Investigation of Accidents
Accident investigation and analysis, Application of virtual reality
Unit 5: Safety Standards
OSHAS 18001 and OSHMS

Books:

1. Probabilistic Risk Assessment for Engineering and Scientists, Komamoto and Henley, IEEE Press, 1995.
2. Industrial Accident Prevention, Heinrich et al., McGraw Hill, 1980.
3. Techniques for safety management - A systems approach, Petersen D, ASSE 1998.

OE2101 Introduction to Composites
(NPTEL Swayam Online)

Teaching Scheme
Swayam Online

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Course Objectives:

1. To understand a perspective utilization and processing of composite materials
2. To analyze short fiber reinforced composites
3. To analyze lamina of long fiber reinforced composite material at micro and macro level
4. To analyze the laminated composite material at macro level

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Define need, utilization of class of composite material, its constitution, list its application fields along with fabrication process
2. Analyze short fiber reinforced composites
3. Analyze long fiber reinforced composite lamina at micro and macro level
4. Analyze the laminated composite material at a macro level using classical lamination theory

Course Content:

1: Intro and terminology
2: Concept Review
3: Fibers
4: Matrix materials
5: Short fiber composites
6: Short fiber composites
7: Orthotropic lamina
8: Orthotropic lamina
9: Orthotropic lamina
10: Composite laminates
11: Composite laminates
12: Composite laminates

References:

1. Analysis and Performance of Fiber Composites, Agarwal, B. D. and Broutman, L. J., John Wiley & Sons.
2. Mechanics of Composite Materials, Jones, R. M., Mc-Graw Hill.
3. Engineering Mechanics of Composite Materials, Daniel, I. M. and Ishai, O., Oxford University Press.

PEIT 3101 Computer Graphics and Animation

Teaching Scheme:
Lectures: **3** hrs/week

Examination Scheme:
In-Semester: **50** marks
End-Semester: **50** marks
Credits: **3**

Prerequisites: Basics of Programming, Essential mathematics in geometry and trigonometry, Vectors and Matrices

Course Objectives:
Familiarize students with
1. Basic concepts of computer graphics
2. Basic primitives and objects in computer graphics
3. Various methods and techniques used in computer graphics
4. Applications of computer graphics in animation and gaming

Course Outcomes:
Students should be able to
1. Identify geometrical formulas and algorithms to draw computer graphics primitives
2. Use mathematics to transform computer graphics objects
3. Apply various techniques to achieve desired image manipulation.
4. Design algorithmic logic to solve complex problem like gaming

Unit – I Basic Concepts (07)
Introduction: Basics of graphics systems, Raster scan & Random scan displays, basic display processor. **Display Files**: display file structure, algorithms and display file interpreter. Primitive operations.
Plotting Primitives: Scan conversions, line segments, vectors, pixels and frame buffers, vector generation. **Introduction to OpenGL:** Basic OpenGL syntax, display-window management using GLUT, functions.

Unit – II Drawing and Filling Graphics Primitives (07)
Line and Circle drawing Algorithms: DDA, Bresenham's, Midpoint.
Character Generation: Stroke Principle, Starburst Principle, Bit map method, aliasing and anti-aliasing
Polygon: Polygon and its types, inside test, polygon filling methods: Seed fill, Scan Line, Flood fill and Boundary fill

Unit – III Geometric Transformations (07)

2D Geometric Transformations: Translation, scaling, rotation, reflection, shearing, matrix representation and homogeneous coordinate system, Composite transformations

3D Geometric Transformations: Translation, scaling, rotation, rotation about X, Y, Z and arbitrary axis reflection about XY, YZ, XZ and arbitrary plane.

Unit – IV Segments, Windowing and Clipping (07)

Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility

Windowing: Concept of window and viewport, viewing transformations

Line Clipping: Cohen Sutherland Method, Midpoint subdivision method

Polygon Clipping: Sutherland Hodgman method for clipping convex and concave polygon

Unit – V Shading and Animation (07)

Shading: Halftoning, Gouraud and Phong Shading

Computer Animation: Design of Animation sequences, General Computer Animation functions, Computer Animation Languages, Key-frame Systems, Motion Specifications.

Unit – VI Gaming (07)

Gaming platforms: Graphics Memory Pipeline, Block diagram of NVIDIA workstation and i860 Introduction to OpenGL ES

Interactive Graphics & usage of the tools of computer graphics: 3D Studio and Maya

2D games : Snake game

Text Books

1. D. Hearn, M. Baker, “Computer Graphics with OpenGL”, 4th Edition, Pearson Education, 2014,ISBN 978-93-325-1871-1
2. S. Harrington, “Computer Graphics”, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.

Reference Books

1. D. Rogers, “Procedural Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.
2. J. Foley, V. Dam, S. Feiner, J. Hughes, “Computer Graphics Principles and Practice”, 2nd Edition,Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
3. D. Rogers, J. Adams, “Mathematical Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
4. Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum’s Series outlines
5. F.S. Hill JR, “Computer Graphics Using Open GL”, Pearson Education
6. Samuel R. Buss, “3D Computer Graphics”, Cambridge University Press

PEIT 3106 Computer Graphics Laboratory

Teaching Scheme: **Examination Scheme:**

Practical: **2** hrs/week Oral: **25** marks

Credits: 1

Prerequisites: Basics of Programming, Data Structures, Algorithms, Geometry, Trigonometry, Vectors and Matrices

Course Objectives:

Familiarize students with

1. Various methods and techniques used in computer graphics
2. Applications of computer graphics in animation and gaming

Course Outcomes:

Students should be able to

1. Apply mathematics and algorithms to draw computer graphics primitives.
2. Apply graphics data manipulation in an application.
3. Implement programs using different computer graphics algorithm.
4. Make use of OPEN GL to implement programs

List of Assignments

1 Get Familiar with basic OpenGL environment, display-window management using GLUT, OpenGL functions.

2 Write a function in OpenGL on Linux Platform to draw a Line using DDA/ Bresenham's Line Drawing Algorithm. Call the Function to draw any pattern consisting at least 10 function calls.

3 Write a function in OpenGL on Linux Platform to draw a circle using Midpoint Circle Drawing Algorithm. Call this function at least 6 times to draw any pattern. User should only give centre coordinates and radius. Rest should be drawn automatically

4 Write a program in OpenGL on Linux Platform to draw chess board using any Line drawing algorithm and fill alternate blocks using flood fill algorithm

5 Write a program in OpenGL on Linux Platform to draw a flag using any Line drawing algorithm and fill it using scanline polygon filling algorithm.

6 Write a program in OpenGL on Linux Platform to for drawing a polygon and perform following 2DTransformations on Triangle.

Translation,Scaling, Rotation

7 Write a program in OpenGL on Linux Platform to clip a Line using Cohen Sutherland Outcode Method.

8 Write a program in OpenGL on Linux Platform to clip a Polygon using SutherlandHodgman Polygon Clipping.

9 Write a program in OpenGL on Linux Platform to animate a scene for “Moving Car”.

10 Write a program to design a game using computer graphics basic techniques and OpenGL

20AC301A Leadership and Personality Development			
Teaching Scheme			**Examination Scheme**
Practicals: 1 Hour / Week			NA
			Credits: Nil

Course Objectives:

1.	Be aware of various aspects of personality and its traits
2.	Study different techniques for personality development and leadership
3.	Understand leadership skills, styles and its traits
4.	Appreciate leaders or role models from different walks of life and learning of leadership from their example

Course Outcomes:

After completion of the course, students will be able to

CO1	Develop the Self-awareness in aspects of goals, values, emotions and self-image
CO2	Apply techniques for interviews, team building, time management and stress management
CO3	Recognize the leadership skills, traits, inspiring role models and examples
CO4	Understand ethical aspects and dilemma, social issues and commitments

Module I:	**Personality Development**	**(5)**

Personality- Introduction, definition

Self-awareness and SWOT, self-image and personal branding

Individual personality attributes and their characteristics such as Maturity, achievement-oriented, intellectual, emotional, physical attributes.

Personal traits (such as time management, ethics, integrity, values, attitude, responsibility)

Personality and Behaviour - factors determining work performance (like Self-esteem, Goal setting, Introversion, extroversion), Temperaments (like optimistic, confident)

Activities/Sessions:

- Know each other/Icebreaker – Introduction
- Self-awareness: Values, strengths and Weakness (SWOT analysis)

- SWOT analysis matrix and test
- Personality traits, Attributes, Emotional Intelligence
  - Big Five Personality traits(OCEAN)
- Self-Image / Personal branding
  - Activities: Presentation, Discussion

Module II:	**Leadership Development**	**(9)**

Definition and characteristics of leadership

Leadership skills-Technical, human, conceptual

Leadership styles - Autocratic, participative, free-rein

Important leadership traits - communication skills, interpersonal skills, team building, mental strength, self-confidence and self-assurance, empathy and listening skills

Leadership and stress management, time management

Leadership and Social/Societal Commitments

Activities/Sessions :

- Communication for Leadership
  - Public speaking, active listening, extempore speaking
- Leadership Characteristics and how they define leaders
  - Presentation, examples, discussions, leadership Books
- Role Models, Inspirational Leaders and Learning
  - Leaders from different walks of life
  - Biographical examples
- Time management: What, personal time management strategies
- Leadership and Women : Strengths and Traits, Examples
- Ethics : Introduction, professional ethics, ethical dilemma:
  - Presentation, Videos
- Leadership and Social/Societal Commitments:
  - Examples / Role models
- Team Building: Teams, types, diversity, effective teamwork
  - Games
  - case studies
- Stress management: What, Why it is needed and How to manage stress
  - Presentation
  - Techniques, demonstrations

References:

1.	Personality Development and Soft skills, Barun Mitra, Oxford university press, 2013
2.	Professional Ethics, R. Subramanian, Oxford university Press, 2013

3.	Leadership and Personality Development, Vishwanath Joshi, Symbiosis Centre for Distance Learning, 2014
Additional Reading:	
1	Organizational Behaviour, Dr. S. S. Khanka, S. Chand Publishing (for Conflict management, Decision making, Morale, Motivation)
2	How To Win Friends and Influence People in digital Age - Dale Carnegie
3	Autobiographies (Examples) - Mahatma Gandhi, Elon Musk, Steve Jobs

20AC301B Professional Ethics and Etiquette

Teaching Scheme			**Examination Scheme**
Practicals: 1 Hours / Week			NA
			Credits: Nil

Course Objectives:

1.	To learn the rules of good behaviour for today's most common social and business situations, including the common courtesies of life.
2.	To imbibe basic knowledge to make informed ethical decisions when confronted with problems in the working environment.
3.	To develop an orientation towards business etiquette and the proper etiquette practices for different business scenarios.
4.	To learn the etiquette requirements for meetings, entertaining, telephone, and Internet business interaction scenarios.

Course Outcomes:

After completion of the course, students will be able to

CO1	Summarize the importance of professional ethics at the workplace
CO2	Apply ethics in different professional situations
CO3	Practice appropriate etiquette in the working environment and day to day life
CO4	Practice etiquette in the global corporate context

Unit I:	**An Overview of Ethics**	**(2 hr)**

What are Ethics? Definition of Ethics. The Importance of Integrity. The Difference between Morals, Ethics, and Laws.

a) Activity: Interviews:- Students are assigned the task of interviewing someone they think is ethical or has integrity. Students should ask the person about a difficult decision they made, and report back to the class about the interview. If this exercise is used, it is important to discuss privacy and confidentiality with students and talk about whether the person interviewed wants to remain anonymous or not.

Engineering Ethics: Purpose of Engineering Ethics-Professional and Professionalism,

b) Activity: 'Thinking like an engineer' Review

Review the article "Thinking like an Engineer", on the explosion of the space shuttle Challenger and start a group discussion with the students on the political sensitivity of the investigation into the explosion and the urge to cover it.

Professional Roles to be played by an Engineer

c) Case study: The aim of this exercise is to introduce codes of ethics or codes of conduct to the student. Present some examples, highlighting the different components and how they fit together. The students are split up into small groups to analyse examples of codes and identify their main components. Then the lecturer asks the students to present their findings to the class.

Unit II:	**Ethics in the Business World**	**(4 hrs)**

Understanding ethics in the Business World:

a) Activity: Mapping business contributions to the Sustainable Development Goals (SDGs). This exercise seeks to familiarize students with the United Nations' Sustainable Development Goals (SDGs). The lecturer can get the class, individually or in small groups, to develop an understanding of the SDGs and of potential contributions and impact that businesses may have. The aim of the exercise is not that students present a comprehensive assessment of business contributions to SDGs but rather that they understand the concept and can make use of the SDGs as a framework for responsible and ethical business conduct.

Ethical Considerations in Decision Making.

a) Activity: Ethical Dilemma

   Situations are given situations in which students have to analyse the dilemma and make a decision. Such As :

   - Taking credit for others' work.
   - Offering a client a worse product for your own profit.
   - Utilizing inside knowledge for your own profit

Ethics in multiple fields like Information Technology, Medicine, Finance, Artificial Intelligence and Recent Issues, Podcast from Carnegie Institute of Ethics.
Discussion on current Issues like vaccine Distribution in the world.

Common Ethical Issues

b) Activity: The TED Talk "Wiring a Web For Global Good" is shown to the students. After watching the video, they are asked to discuss what an Ethics of Care approach tells us about how to balance the needs of vulnerable others with the need to provide for ourselves and our dependents.

Ethics Concerning the environment and Safety of Workers and Society:

c) Presentation on Bhopal Gas Tragedy (or similar cases).

Unit III:	Business Etiquette	(3 hrs)
Business Etiquette, The ABC's of Etiquette, Developing a Culture of Excellence, The Principles of Exceptional Work behaviour, The Role of Good Manners in Business, Making Introductions and Greeting People: Greeting Components, The Protocol of Shaking Hands, Introductions, Introductory Scenarios, Addressing Individuals Meeting and Boardroom Protocol: Guidelines for Planning a Meeting, Before the Meeting, On the Day of the Meeting, Guidelines for Attending a Meeting. a)Activity: Guest lecture from Industry for Etiquette Training b) Activity: Videos on YouTube concerning Greeting, Conversation and Body Language		
Unit IV:	**Professional Etiquette**	**(3 hrs)**
Professional Etiquette, Dining Etiquette, Involuntary Awkward Actions, How to Network, Networking Etiquette, Public Relations Office (PRO)'s Etiquette, Technology Etiquette : Phone Etiquette, Email Etiquette, Social Media Etiquette, Video Conferencing Etiquette, Interview Etiquette, Dressing Etiquettes : for Interview, offices and social functions. a) Activity: Videos on YouTube concerning dressing and Indian Values b) Activity: Videos on YouTube concerning Technology Etiquette		
References		

1. George Reynolds, Ethics in Information Technology, Cengage Learning,

2. Charles E Harris, Micheal J. Rabins, Engineering Ethics, Cengage Learning, 4th Edition.

3. PSR Murthy, Indian Culture Values and Professional Ethics, BS Publications, 2nd Edition.

4. Business Etiquette in Brief by Ann Marie Sabath, Adams Media Corporation, South Asian Edition, 1st Edition.

20AC401 Employability Skills Development			
Teaching Scheme			**Examination Scheme**
Practicals: 2 Hours / Week			NA
			Credits: Nil

Course Objectives:

1.	To encourage the all-round development of students by focusing on soft skills and logical skills.
2.	To develop and nurture the soft skills of the students through individual and group activities.
3.	To develop quantitative proficiency needed for employability
4.	To enhance logical reasoning ability of students.
5	To make them aware of data interpretation skills.
6	To enhance the aptitude skills of students necessary for getting employed and being successful in a profession.

Course Outcomes:

After completion of the course, students will be able to

CO1	Evaluate their own strengths & weaknesses
CO2	Effectively communicate through verbal/oral communication and prepare themselves for interview skills, group discussion, etc.
CO3	Solve quantitative ability questions without using calculators.
CO4	Demonstrate the essential logical reasoning ability
CO5	Exhibit their data interpretation skills and be ready for facing interviews

Unit I:	**Self – Awareness and Self Development**	**(2)**

Self – assessment, self-appraisal, SWOT Analysis, Goal setting, Self-esteem. Personal Goal setting

Unit II:	**Communication Skills**	**(4)**

Resume Writing, Application writing, Elevator speech, Group Discussion: Characteristics, Subject knowledge, Oral and leadership skills, Team management, Strategies, Individual contribution and

Consistency.		
Unit III:	**Presentation Skills and Mock Interviews**	**(4)**
Presentation Skills: Planning, Preparation, Organization, Delivery, Interview Skills: Speaking skills, Building confidence level.		
Unit IV:	**Arithmetical Ability**	**(4)**
Divisibility and Remainder Theorem, Surds and Indices, Ratio proportion, Profit and Loss, Number series, AP, GP, HP, Equations, Simple Interest and Compound Interest.		
Unit V:	**Quantitative Ability**	**(7 hr)**
Time and Work, Speed, Distance, Time, Boats and Trains, Mixtures/ Allegations, Area and Volume, Permutation and Combination, Probability.		
Unit VI:	**Logical Ability**	**(3 hrs)**
Clocks and Calendars, Relation and Age, Verbal and non-verbal Reasoning, Data Interpretation.		

Text Books:	
1	A Complete textbook on Soft Skills, by Peeta Bobby et al Vardhan, ASIN : B08C9ZGH47, ISBN-10 : 938948457X, ISBN-13 : 978-9389484571, Publisher : KANISHKA PUBLISHERS (1 January 2020)
2	Dr. R.S. Aggarwal, “Quantitative Aptitude”, S. Chand Publication(revised Edition 2017)
Reference Books:	
1	“Test of Reasoning”, Jaikishan and Premkishan, Revised Edition (9th), Arihant Publication
2	Abhijeet Guha, “Quantitative Aptitude for Competitive Exams”, McGraw-Hill Education
3	Soft Skills for Everyone 2E, Jeff Butterfiled, ISBN: 9788131514672, Edition: 1st
Online Resources:	
1	https://www.indiabix.com/
2	https://www.careerride.com/
3	https://www.aptitude-test.com/

20CE 302 Data Structures

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	In Semester: 50 Marks
Tutorial: 1 Hour / Week	End Semester: 50 Marks
	Credits: 4

Course Objectives:

To facilitate the learner to

1. Learn and understand representation, implementation and applications of data Structures
2. Choose and apply linear and non linear data structures for developing solutions for solving problems in various domains.
3. Demonstrate ability to use stack and queue data structures to solve problem
4. Understand and apply the concepts of hashing.
5. Analyze algorithms using time complexity analysis

Course Outcomes:

After completion of the course, students will be able to

1. Apply appropriate data structure to construct efficient algorithms to approach the problems.
2. Distinguish between various linear data structures based on their representations and applications.
3. Apply principles of data structures- stack and queue to solve computational problems.
4. Apply non linear data structures –Trees and Graphs to solve a problem.
5. Apply the concept of Hashing techniques for solving a problem.
6. Analyze algorithms using time and space complexity

Unit I: Introduction to Algorithms; Sorting and Searching (07)

Introduction to Algorithms, Pseudo code, Abstract Data Types (ADT): e.g. Arrays as ADT, Introduction to Data Structures, Frequency Count, Analyzing Algorithm using Frequency count, Time complexity of an Algorithm, Asymptotic notations, Best, Worst and Average case analysis of an Algorithm. Sorting: Bubble sort, Insertion sort, Quick Sort.
Searching: Linear Search, Binary Search. Time complexity analysis of sorting and searching

Algorithms. Case study: Timsort

Unit II: Linked List **(07)**

Concept of Linked List, Comparison of Sequential and Linked Organizations, Linked List using Dynamic Memory Management, Linked List as an ADT, Singly Linked List , Doubly Linke List, Circular Linked List operations. Time complexity analysis of Linked List operations.
Case study: Garbage collection

Unit III: Stack and Queue **(07)**

Stack as an ADT, Representation and Implementation of Stack using Sequential and Linked Organization, Applications of Stack- Simulating Recursion using Stack, Arithmetic Expression Conversion and Evaluation. Queue as an ADT, Representation and implementation of Linear Queue, Circular Queue, Priority Queue .Time complexity analysis of Stack and Queue operations. Time complexity analysis of algorithms using stack and queue data structures.
Case study: Priority queue in bandwidth Management

Unit IV: Trees **(08)**

Introduction to Non Linear Data Structure, Binary Trees, Types of Binary Trees, Properties of Binary Trees, Binary Tree as Abstract Data Type, Representation using Sequential and Linked Organization, Binary Tree creation , Recursive and Non Recursive Tree Traversals, Binary earch Tree and its operations, B Tree, Heap as ADT.
Case study: expression tree, Heap as priority queue.

Unit V: Graphs **(07)**

Basic Terminologies, Storage Representation, Graph Traversals, Graph as Abstract Data Type, Spanning Trees, Minimum Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Single Source Shortest Path Algorithm. Time complexity analysis of graph algorithms.
Case study: Google maps.

Unit VI: Hashing **(06)**

General idea of Hashing, Hash Table, Hash function, Rehashing, Issues in Hashing, Collision Resolution Strategies: Linear Probing, Open addressing and Chaining. Time complexity analysis of hashing techniques.
Case study: Telephone dictionary.

Text Books:

1. Sartaj Sahani, "Data Structures, Algorithms and Applications in JAVA", Universities Press (2 nd edition).

2. Robert Lafore, "Data Structures Algorithms in JAVA", Techmedia,(1 st edition).
3. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications ,(2 nd edition).

Reference Books:

1. Yedidyah Langsam, Moshe J Augenstein, Aron M Tenenbaum, "Data Structures using C and C++" , Pearson Education, (2 nd edition).
2. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, (2 nd edition).
3. Brassard and Bratley, "Fundamentals of Algorithmics", Prentice Hall India/Pearson Education, (2 nd edition) .
4. M. Weiss, "Data Structures and Algorithm Analysis in JAVA", Pearson Education (3rd edition), (2012).
5. Goodrich, Tamassia, Goldwasser, "Data Structures and Algorithms in JAVA", Wiley publication, (6th edition).
6. R. Gillberg, B. Forouzn, "Data Structures: A Pseudocode approach with C", Cenage Learning, (2 nd edition).

Online/Web/Other References:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. http://web.stanford.edu/class/cs166/

Suggestive List of the Tutorial Assignments:

Following list of tutorials can be considered as guideline for designing tutorials:
Every student should perform 12 to 14 tutorials which will cover topics of all units mentioned in the syllabus of Data Structures. Tutorial assignments will enhance the understanding of the concepts of problem solving, algorithms and data structures. Students will perform practice exercise on data representation and corresponding implementation of the data structures. Students will get opportunity to develop their logic building abilities.

Following list of tutorials can be considered as guideline for designing tutorials:

1. Demonstration of a program implementation and execution using eclipse tool.
2. Design an algorithm for simple problems like GCD calculation, power calculation etc.
3. Calculate frequency count, time complexity of sample algorithmic constructs.
4. For given algorithms of array operation, write equivalent JAVA code.
5. Practice exercise on sorting and searching algorithms for set of predefined inputs.
6. Calculate time complexity of sorting algorithms using concept of frequency count.
7. Create a linked list and write algorithms for traversal, delete a node, add a node operations on a list.
8. Create a doubly or circular linked list and write algorithms for traversal, delete a node, add a node operations on a list.
9. Solve brain teaser based on recursive code snippets.
10. Demonstration on debugging techniques.
11. Select appropriate data structures and design algorithmic solution to given application.
12. Solve puzzles based on queue data structure
13. Practice exercise on creating binary tree and perform recursive and non recursive traversal of binary tree on given data
14. Creating binary search tree for given data and perform inorder, preorder, postorder traversal.
15. Practice exercise on searching and deleting data values from given binary search tree.
16. Design a solution for "company survey" about its products in an area. Choose the appropriate algorithm to complete the survey within short period and cover all houses under that area. Give justification for your answer and also analyze your algorithm for time complexity
17. Visualize various data structures using open source tools
18. Given the input data and hash function , show the result using hashing methods .
19. Use different hashing functions to hash given values.

20. Construct a Btree of order 3 by inserting numbers of given data
21. Practice exercise on Dijkstra's algorithms.
22. Practice exercise on graph MST algorithms.
23. Practice exercise on Heap data structures.

20CE 302L Data Structures Laboratory

Teaching Scheme	**Examination Scheme**
Practical : 4 Hrs/Week	In Semester : 25 Marks
	Practical : 25 Marks
	Credits: 2

Prerequisite:
1. 20ES05 Fundamentals of Programming Language
2. 20ES05L Fundamentals of Programming Language Laboratory

Course Objectives:

To facilitate the learner to

1. Develop algorithmic foundations to solve problems.
2. Select and use appropriate data structure for a given problem statement.
3. Analyze algorithms using time complexity.
4. Implement small application using data structures.

Course Outcomes:

After completion of the course, students will be able to

1. Select appropriate data structure for given problem.
2. Develop the solution for the given problem using programming language.
3. Analyze solutions using time complexity.
4. Design a small application using data structure.

Preamble:

The laboratory assignments are designed in a set of group A, B and C such that students will be able to design and implement solution for a given problem using various data structures. Motivation here is that students should be able to code the basic algorithm and select appropriate data structure to implement the solution of given problem. Faculty members are encouraged to expand problem statements with variations. Assignments can be framed and expanded in such a way
that it explores concepts, logic of solution and simple application. Students will be encouraged to solve open problems in different domains. Faculty will appropriately adopt assignments on similar lines as the examples shown here.

Group B assignments are designed in such a way that students will choose appropriate data structures to implement solution of a given problem. Some assignments of group A are designed to make students able to implement Abstract Data Type of a data structure and use it for a given application. Faculty members should choose the assignments from group A such a way that all the units of the syllabus of Data Structures are covered. In group C assignments students will design an algorithmic solution for selected problem using concepts covered in the subject Data Structures.

The laboratory assignments of group A and B are to be submitted by student individually using C++/JAVA object oriented programming language. Group C assignments may be performed in a group of 2 to 4 students from the same batch. For each assignment program code with sample output is to be submitted as a soft copy.

Suggestive List of Assignments

Group A : (Any Six)

1. In a group of M persons, some people can speak English and some people can speak French. Implement program to find and display-
   1. People who speak either English or French or both.
   2. People who speak both English and French.
   3. People who speak only English not French.
   4. Remove the person from the group.
2. Consider students marks of specific subject are to be stored using Array as ADT. Implement operations to summarize/ analyze the marks of the subjects.
3. Consider a mobile phone stores name and contact number in ascending order. Write program to search a contact details of specified name.
4. Consider students roll numbers and percentages of SY class are stored. Implement operations to arrange students records in ascending/ descending order based on their marks using various sorting methods.
5. Implement Doubly Linked List as ADT .Use same ADT to simulate Browser URL application.
6. Implement Singly Linked List as ADT. Use same ADT to simulate deck of cards application.
7. A 'concordance List' is an alphabetical list of words that appear in the book. Implement concordance list using ordered Linked List with insertion function that restrict duplicate value to be inserted in the list.
8. Implement Singly Linked List as ADT. Use it to simulate banking operations.
9. Student's information along with their percentage is stored in linked list for every division. Generate a combine list of students which is sorted in descending order based on their percentage.
10. Implement Stack as ADT using linked list or array. Use same ADT to check given expression is well formed parenthesized.
11. Implement Stack as ADT using linked list or array. Use same ADT to evaluate given postfix expression.
12. Implement Priority Queue as ADT using linked list or array. Use ADT to simulate pizza parlor order management.
13. Operating system stores N jobs and processing time require to complete each job in data structure. Design a program to simulate the job execution sequence

14. Implement Queue as ADT . Use Queue ADT to simulate 'waiting list' operations of railway reservation system.
15. Company wants to lease phone lines to connect its offices of different cities, with each other. Company charges different amounts of money to connect different pairs of offices. Solve the problem using graph data structures to connect all offices of a company with a minimum cost.
16. Implement graph as ADT to represent current flow in electrical circuit board.
17. An airport is developing a computer simulation of air traffic control that handles events such as landings and takeoffs. Each event has a time stamp that denotes the time when the event will occur . Develop a code for inserting an event and exacting most recent event and display all events. Use heap as ADT to implement priority queue .
18. Consider players score obtained in game are stored. Find out maximum and minimum score obtained in that game using heap data structure.
19 . Implement binary tree as ADT and use it for simulating operations on employee data.
20. Implement open hashing technique and use it to quickly look up employee's information. Provide facility to insert, display, search record .
21. Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number.
22. Implement dictionary as ADT using hashing technique.

Group B: (Mandatory)

1. Department of Computer Engineering has 'CSI student branch'. Students of second, third and final year can subscribe to membership. Design a system to maintain CSI student branch membership information to add, delete, and modify details of records with ease. Use appropriate data structure.
2 College Library maintains records of books. Book records contain basic information of book. Book records are to be listed in the specific order. List of books of specific author are to be searched. Use appropriate data structure to perform sorting, searching operations of book data effectively.
3. A dictionary t stores keywords and its meanings as a key value pair. Use appropriate data structure that will provide minimum comparisons to find any keyword. Provide facility to adding new keywords, deleting keywords and modifying meaning of keywords.
4. A news paper delivery boy every day drops news paper in a society having many lanes and houses. Design a program to provide different paths that he could follow. Solve the problem by suggesting appropriate data structures. Design necessary classes.

Group C:

1. Design a game like snake and ladder, tic-tac-toe, generating magic square.
2. Design a small application using appropriate data structures to manage library data medical shop data/ College admission data / P.M.P.M.L. bus scheduling data etc.

20CE304L : DIGITAL SYSTEMS LABORATORY

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hours / Week	In Semester(TW): 25 Marks
	End Semester(OR): 25 Marks
	Credits: 1

Prerequisite: Basic Electrical and Electronics Engineering (20ES01)

Course Objectives:

To facilitate the learner to

1. Understand the basic digital circuits and logic design.
2. Apply techniques for designing combinational and sequential circuits.
3. Apply the knowledge to select different digital IC packages as per design specifications.
4. Develop minimum digital systems for simple real time applications.

Course Outcomes:

After completion of the course, students will be able to

1. Apply the knowledge of basic gates to build digital circuits.
2. Make use of available circuit packages to develop combinational circuits.
3. Apply the knowledge of sequential circuits design to model digital systems.
4. Build a small digital system using an emulator tool.

The laboratory work of Digital Systems (20CE304L) Lab is designed to enhance problem solving in digital electronics with the help of Boolean algebra, logic gates, computer number systems, data encoding, combinational and sequential elements. The circuit optimization is introduced using K-Maps. The solution building to real world problems is aimed with the help of circuit packages. Faculty members are encouraged to expand problem assignments with variations for Group B and Group C assignments. Assignments can be framed and expanded to understand the basic concepts, design steps, logic of solution and simple digital application. The students will be also encouraged to experiment open problems with the designs using appropriate emulator tools. Faculty will ratify the assignments on similar lines as examples shown here. Majority of Group A assignments are based on combinational circuits such as code converter, multiplexer, decoder etc. and partially sequential circuits such as Asynchronous and Synchronous counters. Group B assignments are based on sequential circuits such as sequence generator, sequence detector, ASM using flip-flops as well as based on real world application level assignments. Group C assignments are based on implementation of different real time applications based on combinational and sequential circuits.

Suggestive List of Assignments

Group A : **(Perform minimum 6)**

1. Design and implement different logic circuits by using Basic gates and Universal gates.
2. Design and implement code converter circuits e.g. Binary to Gray, BCD to Ex-3 etc.
3. Design and implement circuits using Multiplexer and Decoder.
4. Design and implement a circuit to detect the error in the digital data communication system.
5. Design and implement Binary subtractor using 1’s and 2’s complement method. Use binary adder IC 7483.

6. Design and implement Asynchronous counters using a given flip flop.
7. Design and implement Synchronous counters using a given flip flop.

Group B: (Perform any one assignment each from 1 to 4 and 5 to 8)

1. Design and implement Sequence generator circuit. Check for the lockout condition.
2. Design and implement Sequence detector circuit using Moore and Mealy.
3. Design and implement flip flop conversion circuit.
4. Design and implement a simple ASM chart using a digital circuit.
5. Design and implement a car parking system using Entry and Exit gate, synchronized with each other. Entry gate counter will increment the count for each car entry. When all parking slots are occupied, it should indicate that parking is Full.
6. Design and implement a car parking system using Entry and Exit gate, synchronized with each other. Exit gate counter will decrease the count for each car leaving the gate. When no vehicle is present in the parking slot system, it should indicate Parking is Empty.
7. Design and implement an Ice Cream cup distribution counter based on dozens system. Counter should decrement for each sale of the cup. When a dozen of cups in the box are sold, the counter should indicate the one box is done.
8. Design and implement a packaging counter for 16 items. Counter should increment for each entry of the item in the box. When the box is full, the counter should indicate the box is full and reset itself.

Group C (Perform any one)

Select any open source / freeware tool and design a digital system of your choice.

1. Design a trigger circuit which will activate next circuit after 45 clocks.
2. Design a square wave generator circuit.
3. Build a random sequence generator.
4. Design a decimal adder circuit.
5. Design an octal adder circuit.
6. Design a decimal subtractor circuit.
7. Design a traffic signal controller which can show red signal for 70 sec, yellow signal for 5 sec and green signal for 40 sec.
8. Design a 2 digit traffic signal controller.
9. Design a 2 digit Bank token system.
10. Design a 3 digit Vaccine token system.
11. Design a BCD to 7-Segment display.
12. Design a character to 7-Segment display.

20CE 305L Programming Skills Development - I Laboratory

Teaching Scheme	Examination Scheme
Practical: 4 Hrs/week	In semester: 25 Marks
	Oral: 25 Marks
	Credits: 2

Prerequisites:
1. Fundamentals of Programming Language Lab-I (20ES02L)
2. Fundamentals of Programming Language Lab-II (20ES05L)

Laboratory Objectives:
To facilitate the learners to -
1. Use basics of Python, including working with functions, numbers, lists, and strings.
2. Work with file handling concepts.
3. Use numpy, matplotlib libraries for python applications.
4. Apply object-oriented features to Python code.
5. Create a simple GUI using Tkinter

Laboratory Outcomes:
By taking this course, the learner will be able to -
1. Make use of the basics of Python, including working with functions, numbers, lists, and strings.
2. Implement a python program to work with files.
3. Write basic, object-oriented Python code.
4. Create Python programs using numpy, matplotlib libraries.
5. Build a simple GUI using Tkinter

A large part of 20 CE 306 lab would be for understanding the basic concepts of Python programming and implementation of some real world simple applications. Assignment statements are in brief and should be implemented in the Python programming language. Motivation here is that students should be able to code the basic algorithm and also should be able to make use of built in functions available in different libraries of Python. Faculty members are encouraged to expand problem statements with variations. Assignments can be framed and expanded in such a way that it explores concepts, logic of solution and simple application. Students will be encouraged to solve open problems in different domains. Faculty will appropriately adopt assignments on similar lines as the examples shown here. Group A assignments are based on basics of Python and file handling. Group B assignments are based on object oriented programming, use of Matplotlib and numpy libraries and GUI using Tkinter. Group C assignment is implementation on a mini project.

Suggestive List of Assignments:

CO1: Make use of basics of Python, including working with functions, numbers, lists, and strings.
CO2: Implement a python program to work with files.

Group A: (Mandatory)

1. Assignments to explore Lists, Dictionary and tuples like Create a menu drive Python program with a dictionary for words and their meanings. Write functions to add a new entry (word: meaning), search for a particular word and retrieve meaning, given meaning find words with the same meaning, remove an entry, display all words sorted alphabetically.
2. Assignments to explore String. For Example: Write a function word_lengths that takes a sentence (string), computes the length of each word in that sentence, and returns the length of each word in a list. You can assume that words are always separated by a space character " ".
3. Assignment to display a particular pattern or sequence. For example: Generate a Pascal triangle for n rows
4. Assignment to perform file operations. For example: Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.

CO3: Write basic, object-oriented Python code
CO4: Create Python programs using numpy, matplotlib libraries.
CO5: Build a simple GUI using Tkinter

Group B: (Any four)

1. Assignment based on object oriented principles. For example: Design a student data base in Python using classes and objects to perform the following operations:
    a. add b) delete c) display d) update e) search
2. Implement a Python program to perform operations on arrays and matrices. For example, Matrix multiplication
3. Read data from CSV file and plot it using matplotlib library
4. A picture or image can be represented as a NumPy array of “pixels”, with dimensions H × W × C, where H is the height of the image, W is the width of the image, and C is the number of colour channels. Typically, we will use an image with channels that give the Red, Green, and Blue “level” of each pixel, which is referred to with the short form RGB. You will write Python code to load an image, and perform several array manipulations to the image and visualize their effects.

5. Use Tkinter to build a simple graphical user interface. For example: GUI to maintain a simple phone list.

Group C: Mini Project

Students can choose any problem statement of their choice

For example:

1. Devise a Python program to implement the Rock-Paper-Scissor game.
2. Devise a Python program to implement the Hangman Game.
3. Creating a Calculator with Tkinter

References:

Text Books

1. Kenneth. A. Lambert, “**Fundamentals of Python First Programs**”, Cengage, 2nd Edition, 2019
2. Vamsi Kurama, “**Python Programming: A Modern Approach**”, Pearson, 1st Edition, 2017.

Reference Books:

1. Gowrishankar.S, Veena A, “**Introduction to Python Programming**”, CRC Press, Paperback Edition, 2019.
2. Y. Daniel Liang, “**Introduction to Programming Using Python**”, Pearson, Paperback Edition, 2017.

e-Resources:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf

20CE 402 Database Management Systems

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester: 50 marks
End semester: 50 marks
Credits: 3

Course Objectives
To facilitate the learners to-

1. Design database schema using an entity relationship diagram (ERD) and normalization.
2. Design queries using Structured Query Language (SQL) to retrieve the required data from the database.
3. Understand the storage systems and query processing and optimization concepts.
4. Understand Transaction management in a Database management System.
5. Understand NoSQL Databases to handle unstructured data.

Course Outcomes:
With successful completion of the course, the students will be able to–

1. Design the Entity Relationship diagram for the system / application considering its constraints and design issues.
2. Apply the knowledge of SQL to retrieve the required data from the database.
3. Understand the storage systems and query processing and optimization concepts.
4. Make use of various Transaction management concepts for scheduling concurrent transactions.
5. Apply the knowledge of NoSQL databases to handle unstructured data.

Unit 1: Database Design (10)
Introduction to database management systems, Advantages of a Database Management Systems over file processing systems. Data abstraction, Data Independence, DBMS Architecture.
Database Design - Entity Relationship Diagram (ERD), Converting Entity Relationship Diagram into tables, Extended Entity Relationship (EER) Diagram features, rules for converting EER diagram to tables, Primary key, Foreign key and other Integrity constraints.
Codd's Twelve Rules for Relational DBMS, Normalization.

Unit 2: Relational query languages (8)
Relational algebra, Introduction to Structured Query Language (SQL)
SQL - Data Definition Language (DDL): SQL Data Types, Null values and Literals, Creating, Modifying and Deleting tables. Views and Indexes.
SQL - Data Manipulation Language (DML): Insert, Update, Delete, Select, Set Operations, Joins, Tuple Variables, Nested sub-queries, Query Processing.
PL/SQL (Programming Language SQL): Stored Procedures and Functions, Cursors, Triggers.
SQL - Data Control Language (DCL): Grant and Revoke commands

Unit 3: Storage and Querying (8)
Storage and file systems: Storage and File structure, Files with Fixed / Variable Length Records, Hashed Files; Indexing: Indexed Files, Single Level and Multi Level Indexes, B+ Trees

Query Processing: Overview, measures of query cost, Selection and join operations, Evaluation of expressions, Introduction to query optimization, Estimation, Transformation of Relational expressions, Sort Operation, Impact of Indices on Query Performance;

Unit 4: Transaction management (8)

Transactions, ACID Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict serializability, View serializability, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Need, Locking Methods, Deadlocks, Timestamping methods. Recovery methods: Shadow-Paging and Log-Based Recovery.

Unit 5: Advance topics in Databases (8)

NoSQL Databases

Introduction to NoSQL databases: Structured and unstructured data, NoSQL- Comparative study of SQL and NoSQL databases, Big data. BASE Properties, Types of NoSQL databases- Key-value store – JSON, Document Store – MongoDB: CRUD Operations, Indexing, Aggregation and MapReduce in MongoDB.

Special purpose databases :

Cloud, in memory, Spatial databases etc.

Introduction to data mining and machine learning

Text Books:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, 'Database System Concepts', McGraw Hill, (6 th edition), (2013)
2. Jiawei Han, Micheline Kamber and Jian Pei, 'Data Mining – Concepts and Techniques', Morgan Kaufmann Publishers,(3 rd Edition), (2012)
3. Kristina Chodorow, Michael Dirolf, 'MongoDB: The Definitive Guide' , O'Reilly, (2 nd Edition), (2013)
4. Ramez Elmasri and Shamkant B. Navathe, 'Database Systems',Pearson, (6 th Edition), (2013)

References:

1. Raghu Ramakrishnan and Johannes Gehrke, 'Database Management Systems', McGraw Hill, (3 rd Edition), (2003)
2. C. J. Date, 'An Introduction to Database Systems', Pearson, (8 th Edition), (2006)
3. Thomas Connally, Carolyn Begg, 'Database Systems', Pearson, (4 th Edition), (2012)

20CE 404: Machine Learning

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours / Week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credits: 3

Course Objectives:

To facilitate the learner to

1. Introduce students to the basic concepts and techniques of Machine Learning.
2. Utilize data pre-processing techniques and dimensionality reduction techniques for given data.
3. Become familiar with supervised machine learning algorithms such as regression, classification
4. Become familiar with unsupervised machine learning algorithms such as clustering, association rule mining method
5. Become familiar with Artificial neural networks and its learning algorithms.
6. Evaluate the performance of the designed machine learning model.

Course Outcomes:

After completion of the course, students will be able to

1. Acquire fundamental knowledge of machine learning theory.
2. Make use of data pre-processing and dimensionality reduction technique for given data.
3. Apply supervised machine learning techniques such as classification and regression for problem solving and evaluate the designed technique using performance measures.
4. Solve the problems using various unsupervised machine learning techniques such as clustering and association rule mining
5. Apply the artificial neural network technique to solve the problem.

Unit I: Introduction to Machine learning (6)

Types of Learning: Rote Learning, Learning by General Problem Solving, Concept Learning, Learning by Analogy, learning problems and designing the learning systems, Machine Learning: specTypes of Problems in Machine Learning, Ats of Inputs to Training, Supervised, unsupervised, semi supervised, reinforcement learning, overfitting, underfitting, best practices in machine learning, Intelligent Agents.

Unit II: Data Pre-processing and Dimensionality Reduction (6)

Data cleaning, data integration, data reduction, data transformation and data discretization, curse of dimensionality, Principle Component Analysis, Bias/Variance trade-off.

Unit III: Supervised Learning (12)

Regression: Correlation and regression, line fitting by least square, outliers, linear and multiple regression
Classification: Logistic regression, Nearest Neighbour Classification: K-nn, Introduction to Decision tree and Bayesian Classification

Performance Measures: Confusion matrices, accuracy, sensitivity, specificity, kappa statistics, precision, recall, F-measure, Methods of cross-validation, Types of Errors: RMSE, MSE etc

Unit IV: Unsupervised Learning (10)

Introduction to Clustering methods, k-means clustering, Hierarchical clustering: agglomerative clustering method, decisive clustering method
Market Basket analysis, Apriori Algorithm, Association rule mining, Outlier analysis

Unit V: Introduction to Artificial Neural networks (8)

Supervised learning: McCulloch-Pitts model, Perceptron model, multi-layer perceptron, feed forward networks, Perceptron learning algorithm
Unsupervised learning: Self organizing maps

Text Books:

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that make sense of data", Cambridge University Press, 1st Edition, 2015, ISBN No.: 978-1-316-50611-0
2. Ethem Alpaydin, "Introduction to Machine Learning", PHI, 2nd edition, 2013, ISBN 978-0- 262-01243-0
3. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, 2012, Morgan Kaufmann publishing, ISBN: 978-0-12-381479-1
4. V. Susheela Devi, M. Narasimha Murty, "Pattern Recognition: An introduction", University Press, 2011, ISBN 978-81-7371-725-3

Reference Books:

1. Rodolfo Bonnin, "Machine learning for developers" , Packt publication, 2017, ISBN 978-1-78646-987-8
2. Vinod Chandra S. S., Anand Hareendran S., 'Artificial Intelligence and machine learning', PHI, (2014), ISBN 978-81-
3. Tom M. Michell, 'Machine Learning', McGraw Hill Education, Indian edition 2013, ISBN 978-1-25-909695-2.
4. John Paul Mueller, Luca Massarom, "Machine learning (in python and R) dummies", Wiley publication, 2016, ISBN 978-81-265-63050
5. Manohar Swamynathan, "Mastering Machine learning with python in six steps", Apress

publication, 2018, ISBN 978-1-484-24044-1

Online/Web/Other References:

1. Nptel/coursera courses on Machine Learning

20CE403L OPERATING SYSTEMS LABORATORY

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester (TW): 25 Marks
End Semester(OR): 25 Marks

Credits: 2

Prerequisites:

1. Fundamentals of Programming Language Lab-II (20ES05L)
2. Data Structures and Algorithms (20CE 302)
3. Digital Systems and Computer Organization(20CE 304)

Course Objectives:

To facilitate the learner to

1. Understand the fundamentals of Operating Systems.
2. Understand shell scripting to automate operating system operations.
3. Apply the concepts of Operating System for Process and Memory management.
4. Understand the operations performed by the Operating System as a resource manager.
5. Understand the communication among the processes.

Course Outcomes:

After completion of the course, students will be able to

1. Choose UNIX/Linux Commands for Shell Programming.
2. Make use of different CPU scheduling algorithms.
3. Apply Memory Management algorithms.
4. Implement various disk scheduling algorithms.
5. Explore the Inter-Process Communication concepts.

Suggestive List of Assignments

Group A : (Mandatory)

1. Demonstration of Installation of Linux Operating System.
2. Exploration of Unix/Linux Commands (File, Directory and Process commands).
3. Write a shell script for adding users / groups and modifying permissions of file / directory accordingly.
   Write a program to implement operations on processes using fork and join system calls.

Group B: (Any Four)

4. Simulation of the scheduling algorithms. For example: First Come First Serve (FCFS), Shortest Remaining Time First (SRTF).
5. Simulation of scheduling algorithms. For example: Round-Robin (RR), Shortest Job First (SJF).
6. Simulation of memory allocation strategies. For example: First Fit, Best Fit and Worst Fit.
7. Simulation of Page replacement algorithms. For example: First-In-First-Out (FIFO), Least Recently Used (LRU), optimal page replacement.
8. Simulation of disk scheduling algorithms. For example: First Come First Serve (FCFS), SCAN, Circular – SCAN (C-SCAN), Shortest Seek Time First (SSTF).
9. Write a program to implement Banker's Algorithm for deadlock handling.

10. Write a program to implement Reader-Writer problem using semaphores.

Group C

Case study of various Operating systems services. (Example: Android, RTOS, Linux, IOS, Windows etc.)

20CE 404L: Machine Learning Laboratory

Teaching Scheme
Lectures: 4 Hours / Week

Examination Scheme
In Semester(TW): 25 Marks
End Semester(OR): 25 Marks
Credits: 2

Prerequisite:
1) 20 CE 306 Programming Skills Development-I Laboratory
2) 20ES05 Fundamental of Programming Languages-II

Course Objectives:
To facilitate the learner to
1. Implement some pre-processing operations on given data.
2. Implement supervised machine learning algorithms such as regression, classification.
3. Implement unsupervised machine learning algorithms such as clustering, association rule mining method.
4. Implement artificial neural networks and its learning algorithms.
5. Implement a small machine learning application and evaluate the performance of the designed machine learning model.

Course Outcomes:
After completion of the course, students will be able to
1. Apply pre-processing operations on given data.
2. Apply the classification and regression machine learning techniques to solve the problem.
3. Apply various clustering and association rule mining techniques of machine learning to solve the problem.
4. Apply the artificial neural network technique to solve the problem.
5. Develop small machine learning applications using different techniques.

A large part of 20 CE 406 lab would be for understanding the basic concepts of machine learning and implementation of some real-world simple applications. Assignment statements are in brief and should be implemented in JAVA/Python programming language. Motivation here is that students should be able to code the basic algorithm and also should be able to make use of built-in functions available in different libraries of Java/Python. Faculty members are encouraged to expand problem statements with variations. Assignments can be framed and expanded in such a way that it explores concepts, logic of solution and simple application. Students will be encouraged to solve open problems in different domains. Faculty will appropriately adopt assignments on similar lines as the examples shown here. Group A assignments are on pre-processing data, supervised learning methods such as classification and regression, and simple logic gates implementation using artificial neural network. Group B assignments are on unsupervised learning and Group C assignment is on case study implementation for different application.

Suggestive List of Assignments

Group A : (Mandatory)

1. Explore language used for Machine Learning Python/Java and perform the following operations: Understand the basic functionality, visualization of data. Study the different file format, explore the available data sets and its usage using programming language.

2. Suppose that the data for analysis includes the attribute age: 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. (a) Plot an equal-width histogram of width 10. (b) Sketch examples of each of the following sampling techniques: SRSWOR, SRSWR, cluster sampling, and stratified sampling. Use samples of size 5 and the strata "youth," "middle-aged," and "senior." (c) scale and also normalize the data. Pre-process the given data as given here.

3. BMI and body fat of persons are given. Use this BMI to predict the body fat of a person. Implement predictive modelling using regression analysis using a programming language that you are familiar with such as Java/Python. Fit the model and predict the value for given problem.

4. Data given for the SPEED and AGILITY rating of 20 college athletes and whether they were drafted by professional team. Implement k-nn classification technique of Machine learning using a programming language that you are familiar with such as Java/Python. Compare the performance of classification by changing value of k for the given data.

5. Build the logic gates AND, OR, NOT, NOR, NAND gates using ANN assuming random initialization. Write a program to implement Perceptron learning in an artificial neural network using Java/Python.

Group B: (Any Two)

1. You have a list of shopping items purchased by many people. Find out what are the frequently purchased combination of 2 items. Implement Apriori, a Frequent Pattern Analysis algorithm using Java/Python.

2. One of the earliest and well-known applications of the SOM is the phonetic typewriter of Kohonen. It is set in the field of speech recognition, and the problem is to classify phonemes in real time so that they could be used to drive a typewriter from dictation. The real speech signals obviously needed pre-processing before being applied to the SOM. Simulate this application where 4-dimensional input space is mapped to 2 nodes. Write a program to implement Self Organising Map (SOM) using Java/Python.

3. A Hospital Care chain wants to open a series of Emergency-Care wards within a region. We assume that the hospital knows the location of all the maximum accident-prone areas in the region. They have to decide the number of the Emergency Units to be opened and the location of these Emergency Units, so that all the accident-prone areas are covered in the vicinity of these Emergency Units. The challenge here is to decide the location of these Emergency Units so that the whole region is covered. Implement a K-means clustering algorithm using a programming

language that you are familiar with such as Java / Python. Compare the performance of your algorithm on the dataset by changing input parameter value such as K

Group C

1. Machine learning case study for readily available data sets using the techniques studied, and evaluate the designed and implemented model.

20EC301 Electronic Circuits and Applications

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Course Objectives:

1. To understand semiconductor devices such as JFET and MOSFET, Its characteristics, Parameters and its applications
2. To understand Operational amplifier, Concept, Parameters and applications
3. To understand Linear and non-linear applications of Op-Amp
4. To understand Characteristics of Active filters and Operating principles of PLL

Course Outcomes:
After completion of the course, students will be able to

CO	CO Statement
CO1	Interpret the characteristics of JFET and MOSFET
CO2	Analyze parameters of JFET and MOSFET towards its application as an Amplifier
CO3	Illustrate the significance of internal stages of Op-Amp, Interpret and calculate performance parameters of Op Amp and PLL
CO4	Design and Analyze Linear and Nonlinear applications of Op Amp and Butterworth filters

Unit I: JFET **(07)**
Introduction, Types, Construction of JFET, Characteristics (Transfer and Drain), and working of JFET, Schockley's equation, JFET biasing and DC analysis, JFET as amplifier and its configurations (CS/CD/CG), CS amplifier analysis.

Unit II: MOSFET **(07)**
Two terminal MOS structure, EMOSFET-construction, symbols, Ideal EMOSFET V-I characteristics, Additional MOSFET structures (DMOSFET and CMOS), Non-ideal V-I characteristics of EMOSFET (finite output resistance, body effect, Break down effect, Temperature effect, Short channel effects), MOSFET biasing and DC circuit analysis, MOSFET small signal amplifier (CS configuration).

Unit III: OP-AMP Basics **(07)**
Block diagram of OP-Amp, Differential Amplifier configurations, Symbol and ideal equivalent circuit of Op-Amp, Differential amplifier analysis for dual-input balanced-output configuration, DC and AC characteristics of Op-Amp, Methods for improving CMRR of Differential Amplifier.

Unit IV: Linear Applications of OP-AMP **(08)**
Inverting and Non-inverting amplifier, Voltage follower, Summing amplifier, Difference Amplifier, Instrumentation Amplifiers, Ideal integrator, errors in ideal integrator, Practical integrator, Ideal differentiator, errors in ideal differentiator, Practical differentiator.

Unit V: Non-linear Applications of OP-AMP **(07)**

Comparator, Characteristics of comparator, Applications of Comparator, Schmitt trigger, Square wave generator, Triangular wave generator, Need of precision rectifier, Half wave and Full wave precision rectifiers.

Unit VI: Active filters and PLL **(06)**

First order and second order active LP Butterworth filter, Filter design and frequency scaling, Block diagram of PLL, Characteristics of PLL, Applications of PLL.

Text Books:

1. R.L.Boylestad, L.Nashlesky, **"Electronic Devices and Circuits Theory"**, *Prentice Hall of India,* (11^{th} Edition), (2013).
2. Donald Neaman, **"Electronic Circuit Analysis and Design"**, *Tata McGraw Hill*, (3^{rd} Edition), (2007).
3. Ramakant A. Gaikwad, **"Op Amps and Linear Integrated Circuits"**, *Prentice Hall*, (4^{th} Edition), (2000).
4. Salivahanan and Kanchanabhaskaran, **"Linear Integrated Circuits"**, Tata *McGraw Hill Education*, (1^{st} Reprint 2008).

Reference Books:

1. Sergio Franco, **"Design with Operational Amplifiers and Analog Integrated Circuits"**, McGraw Hill Education, (3^{rd} Edition), (2002).
2. Sedra Smith, **"Microelectronic Circuits"**, Oxford Publications, (5^{th} Edition), (2004).
3. David A. Bell, **"Electronic Devices and Circuits"**, Oxford, (5^{th} Edition) (2008).
4. MillmanHalkias, **"Integrated Electronics- Analog and Digital Circuits and Systems"**, *Tata McGraw Hill,* (2^{nd} Edition) (2010).

Online Resources:

1. https://www.ti.com
2. NPTEL Course **"Analog Electronic Circuits"**
   https://nptel.ac.in/courses/108/105/108105158/
3. NPTEL Course on **"Analog Circuits"**
   https://nptel.ac.in/courses/108/101/108101094/

20EC301L ELECTRONICS CIRCUITS AND APPLICATIONS Lab

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
In Semester: 25 Marks

End Semester: 25 Marks
Credits: 2

Course Objectives:

1. To identify and characterize the device such as JFET and MOSFET. 2. To measure Op-Amp performance parameters and understand the difference between ideal and practical values for different ICs.
3. To design and implement linear and non-linear applications of Op-Amp and verify the functionality

Course Outcomes:

After completion of the course, students will be able to

CO	CO Statement
CO1	Interpret characteristics of JFET and MOSFET
CO2	Design biasing circuits for JFET amplifier and analyze performance of JFET amplifier
CO3	Select an appropriate Op-Amp IC for given application and analyze their performance
CO4	Design Op-Amp based circuits and analyze their performance

List of Experiments:

1. Plot V-I characteristics of JFET.
2. Implement biasing circuits for JFET and verify DC operating point.
3. Implement JFET CS amplifier and calculate A_V, R_i and R_o.
4. Plot V-I characteristics of MOSFET.
5. Measure Op-Amp parameters and compare with the ideal specifications:
   - Input bias current,
   - Input offset current,
   - Input offset voltage,
   - Slew rate,
   - CMRR.
6. Design, Build and Test Integrator for given frequency f_a.
7. Design, Build and Test three Op-Amp Instrumentation amplifier for typical application.
8. Design, Build and Test Schmitt trigger and plot transfer characteristics.
9. Design, Build and Test Square and Triangular waveform generator. 10. Build and Test half and full wave precision rectifier.
11. Simulate JFET CG and CD amplifier.
12. Simulate and verify virtual ground and virtual short concept in inverting and non inverting configuration of Op-Amp.

13. Simulate and verify the response of Differentiator for given frequency f_a. 14. Simulate and verify the response of Ist and IInd order Butterworth low pass filter. 15. Built and Test a small project using Op-Amp IC and suitable discrete components.

20EC303 DATA STRUCTURES & ALGORITHMS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Course Objectives:

1. To recall the primitive data types, concepts of logic building and problem solving
2. To understand data representation, implementation and applications of linear and nonlinear data structures
3. To learn and apply different algorithms on different types of data structures
4. To learn the concept and understand the importance of time and space complexity

Course Outcomes:

After completion of the course, students will be able to:

CO1 Classify and categorize data structures that make up for a programming language

CO2 Infer to the modelled data structures from the premise of the baseline models

CO3 Apply algorithms on linear and non-linear data structures for performing different operations on data

CO4 Categorize the choice of data structures and its memory allocation on the basis of data definition, data access and manipulation

Unit I: Introduction to Data and Data Structures (07)

Concepts and definition of Data, Data type, Data object, Data structures, Searching Methods: Algorithms for Sequential Search, Indexed Sequential Search and Binary Search, Sorting Methods: Algorithms for Selection sort, Bubble sort, Insertion sort, Quick sort, Merge sort, Introduction to Time complexity and Space complexity, Brief overview of the Big Oh and other notations as performance metrics for the algorithms.

Unit II: Pointers, Structures and Functions in C (07)

Pointers: Basic concepts, Pointer declaration and initialization, Scale factor, Pointer to a pointer, Pointers and arrays, Structures in C: Concept, Comparison with arrays as a data structure, Array of Structures, Pointers and Structures, Concept of ordered list and polynomial representation using array of structures. Functions: Type of functions and their categories, Parameter passing by value, Parameter passing by reference, Recursive functions, Bitwise Operators.

Unit III: Linked lists (07)

Concept of Lists, Single linked list: algorithms for Creation, Insertion, Deletion and traversals of above data structure, Concept of Doubly Linked List and Circular Linked List, Applications of Linked lists, Abstract Data Type (ADT), List as an ADT, Generalized Linked List (GLL): Concept, Parenthesized enumeration, Representation of multivariable polynomials using GLL

Unit IV: Modeled Data Structures - Linear (07)

Stacks: Definition and example, Representation using arrays and linked list, Applications of Stacks: Concept of infix, Postfix and Prefix expressions, Algorithm to convert infix expression to a postfix expression, Algorithm to evaluate a postfix expression, Queues: Definition and example, Representation of queue using array and linked list, Concept of Circular queue, Concept of priority queue, Applications of Queue

Unit V: Modeled Data Structures – Non Linear (Trees) (07)

Difference between Linear and Non-linear data structures, Binary Trees (BT): Basic terminology, Types of Binary Trees, Binary Search Tree (BST): Difference between BST and BT. Representation of BST(Static and Dynamic), Algorithms for BST traversals: Preorder, Inorder and Postorder (recursive), Primitive operations on BST: Create, Insert, Delete, Algorithm for Non-recursive in-order traversals for BST.

Unit VI: Modeled Data Structures – Non Linear (Graphs) (07)

Graphs: Concepts and terminology, Types of graphs: Directed graph, Undirected graph, Planar graph, Representation of graph using adjacency matrix, Adjacency list, Traversals: Depth First Search (DFS) and Breadth First Search (BFS). Minimal Spanning Tree (MST): Kruskal"s algorithm, Prim"s algorithm, Algorithm to find the shortest path: Dijktras algorithm

Text Books:

1. Seymour Lipschutz, "Data Structures with C", Schaum"s Outlines, McGrawHill Education (India) Pvt. Ltd, (1st Edition), (2017).
2. E Balgurusamy, "Programming in ANSI C", McGraw-Hill, (8th Edition), (2019).

Reference Books:

1. Yedidyah Langsam, Moshe J. Augenstein, Aaron M.Tenenbaum, "Data structures using C and C++", PHI Publications, (2nd Edition), (2004)
2. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures in C", Universities Press, (2nd Edition), (2008)

Online Resources: 1. NPTEL Course "Programming, Data Structures and Algorithms using C"
https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/

20EC303L DATA STRUCTURES AND ALGORITHMS LAB

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hours / Week	In Semester: 25 Marks Practical:25 Marks **Credits: 1**

Course Objectives

1. To recall the concepts of procedural programming language paradigm
2. To understand the significance of data structures and its use
3. To understand and implement data searching and sorting methods
4. To understand and implement algorithms for solving given problems

Course Outcomes

After completion of the course, students will be able to

CO1 Utilize the principal algorithms of sorting and searching on the given data

CO2 Implement basic linear data structures like arrays, records and linked lists

CO3 Analyze the requirement and implement stacks and queues from the base models

CO4 Build, represent and traverse non-linear data structures

List of Experiments:

1. Write a program to reorder the data using sorting techniques like: bubble, selection, insertion, quick and merge sort.
2. Write a program to locate data using sequential and binary search techniques.
3. Create a database of students using an array of structures with attributes; roll no., name, program, course, marks obtained for different subjects with their total and average. Implement the following operations on the database:
   a) Display the database in a tabular form.
   b) Modify (should be able to modify each field of the database).
   c) Append (add a new record to the existing database).
   d) Search for a particular record from the database.
   e) Sort the records in the database.
4. Write a program to add two polynomials using array of structures. The display should include the polynomials that are added and the resultant polynomial in descending order of the exponents.

5. Write a program to create a singly linked list using dynamic memory allocation functions. Implement the following operations on the linked list:
   a) Display.
   b) Insert a node in the linked list (at front, at end, in the middle).
   c) Delete a node from the linked list (at front, at end, in the middle).
   d) Display the linked list in reverse.
   e) Revert the linked list.
6. Write a program to model an array as a stack (Static implementation of Stack) and perform the following operations on it:
   a) Push
   b) Pop
   c) Display
7. Write a program to model a singly linked list as a stack (Dynamic implementation of Stack) and perform the following operations on it:
   a) Push
   b) Pop
   c) Display
8. Write a program to evaluate a postfix expression using a stack. The input expression should be a postfix one.
9. Write a program to model an array as a queue (Static implementation of Queue) and perform the following operations on it:
   a) Add
   b) Delete
   c) Display
10. Write a program to model a linked list as a queue (Dynamic implementation of Queue) and perform the following operations on it:
    a) Add
    b) Delete
    c) Display
11. Create a Binary Search Tree and perform the following operations on it:
    a) Recursive traversals on the tree (display elements of the tree).
    b) Search a node in the tree.
12. Create a graph and represent it using an adjacency matrix.
    Implement BFS and DFS traversals.

20EC401 DIGITAL ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial:1 Hour/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Prerequisite: 20ES01: Basic Electrical and Electronics Engineering

Course Objectives:

1. To solve the Sum of Products (SOP) and Product of Sum (POS) equations using K-map
2. To design Combinational logic circuits such as Adder, Multiplexer, De-multiplexer, Decoder, Comparator
3. To design sequential circuits like Counters, Shift Registers
4. Study various types of Programmable Logic Devices (PLDs)

Course Outcomes:

After completion of the course, students will be able to

CO1 Illustrate reduction of logical expressions using k-map and realize the functions using logic gates
CO2 Design combinational and sequential digital logic circuits
CO3 Design digital systems using Finite State Machines
CO4 Classify digital logic families and implement combinational logic circuits using PLD

Unit I: Fundamentals of Digital Logic (08)

Number system: Hex Number, Standard representation of logic functions, Truth table, SOP and POS forms, Canonical form, Min and Max terms, Minimization of logical functions up to 4 variables using K-map, Don't care conditions.

Unit II: Combinational Logic Design (08)

Circuit designs using Adders, Subtractors, Code converters, Digital Comparators, Multiplexers, De-multiplexers, Decoders, Encoders, Parity generator and checker, Arithmetic logic unit.

Unit III: Sequential Logic Design (08)

1 bit memory cell, Clocked SR, JK, T, D and MS-JK flip-flop, Use of preset and clear terminals, Excitation table for flip-flops, Conversion of flip-flops, Applications of flip-flops: Registers, Shift registers, Sequence Generators, Counters: Synchronous and Asynchronous counters.

Unit IV: State Machines (10)

Mealy and Moore machines representation, State diagram, State table, State assignment, Design of State Machines using State assignment and State reduction, Design of sequence detector using Finite State Machine (FSM), Applications of FSM**:** Traffic light controller, Lift controller, Vending Machines.

Unit V: Digital Logic Families and Programmable Logic Devices (08)

20EC401 DIGITAL ELECTRONICS

Classification of logic families, Characteristics of digital ICs: Speed of operation, Power Dissipation, Figure of merit, Fan in, Fan out, Current and Voltage parameters, Noise immunity, Operating temperatures and Power supply requirements, Introduction to PLDs and their types: PAL, CPLD and FPGA, Interfacing of TTL to CMOS and CMOS to TTL, Comparison between CPLD and FPGA.

Text Books:

1. R .P Jain, **"Modern digital electronics"**, *TMH Publication*, (3rd Edition), (2007).
2. Anand Kumar, **"Fundamentals of digital circuits"**, *PHI Publication*, (1st Edition), (2001).
3. Stephen D. Brown and Zvonko G Vranesic, **"Fundamentals of Digital Logic with Verilog Design"**, *Pearson Education*, (2nd Edition),(2008).

Reference Books:

1. Wakerly, **"Digital Design Principles and Practices"**, *Pearson Education*, (3rd Edition), (2004).
2. M. Morris Mano, **"Digital Logic and Computer Design"**, *Pearson Education*, (3rd Edition), (2004).

Online Resources:

1. NPTEL Course **"Digital Circuits and Systems"**
   https://nptel.ac.in/courses /117/106 /117106086/

20EC401L DIGITAL ELECTRONICS LAB

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours / Week	In Semester: 25 Marks
	Oral: 25 Marks
	Credits: 1

Course Objectives:

1. To solve the SOP and POS equations using K-map
2. To design different Combinational logic circuits
3. To design different Sequential circuits
4. To study various types of PLDs

Course Outcomes:

After completion of the course, students will be able to

CO1 Design and Implement digital circuits
CO2 Analyze combinational and sequential circuits
CO3 Implement Combinational Logic Circuits using PLDs
CO4 Utilize software tools for the simulation of digital circuits

List of Experiments:

1. Design and implement Full Adder and Full Subtractor circuit using Decoder IC.
2. a) Design and implement 8:1 Multiplexer.
   b) Design and analysis of logic functions using Multiplexer.
3. Design and implement 1- digit BCD adder using IC 7483.
4. a) Design and implement an 8-bit Magnitude comparator using IC 7485.
   b) Design and analyze the 5 bit Magnitude comparator using single IC 7485.
5. a) Design Asynchronous MOD-N counter using IC 7490.
6. a) Design and implement Synchronous Up/ Down counter.
   b) Design and analyze Synchronous MOD-NN up counter.
7. Implement Boolean expression using PLD.
8. Design and simulate Finite State Machines.

20EC402 ANALOG AND DIGITAL COMMUNICATION

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hour / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Prerequisite: 20EC302 Signals and Systems

Course Objectives:
1. To introduce analog modulation and demodulation techniques
2. To study sampling process and pulse analog modulation techniques
3. To explore source coding techniques PCM, DPCM, DM, ADM
4. To explain conversion of digital data to digital signal
5. To explore binary and M-ary digital modulation techniques

Course Outcomes:
After completion of the course, students will be able to

CO1	Interpret generation and detection of Amplitude modulation and Frequency modulation
CO2	Apply sampling process and describe pulse analog modulation techniques with their generation and detection
CO3	Apply source coding techniques and evaluate Bitrate, Bandwidth and Signal-to-noise ratio
CO4	Interpret and apply data formats, Multiplexing, Synchronization and Intersymbol Interference and Matched filter for reliable baseband transmission
CO5	Analyze bandpass modulation techniques and evaluate: Bit rate, Bandwidth and Euclidean distance

Unit I: Analog Modulation (06)
Amplitude Modulation, Types of AM: DSB-SC, SSB-SC, DSB-FC, Spectrum of AM, Modulation Index, Technical AM standards, AM generation and detector, Super heterodyne radio receiver, Angle modulation, Bandwidth of FM, FM generation, FM detectors, FM- Superheterodyne radio receiver.

Unit II: Pulse Analog Modulation (05)
Sampling Process: Sampling theorem (time and frequency domain), Types of sampling, Aliasing, Aperture effect, Pulse analog modulation techniques - PAM, PPM, PWM.

Unit III: Digital Transmission of Analog Signal (08)
Block diagram of digital communication system, Pulse Code Modulation (PCM) Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, Delta Modulation (DM), Adaptive Delta Modulation(ADM), Differential Pulse Code Modulation(DPCM), Adaptive Differential Pulse-Code Modulation (ADPCM).

Unit IV: Baseband Digital Transmission (08)
Digital Multiplexing: Multiplexers and hierarchies, Data formats and their spectra, Synchronization: Bit Synchronization, Scramblers, Frame Synchronization, Inter-symbol Interference, Equalization, Eye diagram.

Unit V: Bandpass Digital Techniques (09)

Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), M-Ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift Keying (BFSK), M-Ary FSK, Minimum shift keying (MSK), Introduction to GMSK.

Unit VI: Optimal Reception of Digital Signal (06)

Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver, Error probability for BASK, BPSK and BFSK.

Text Books:

1. George Kennedy, **"Electronic Communication Systems"**, *McGraw-Hill*, (5th Edition), (2013).
2. Simon Haykin, Michael Moher, "**Communication Systems**", *Wiley*, (5th Edition), (2009).
3. Donald L. Schilling, GoutamSaha, Herbert Taub, "**Principles of Communication System**", T*ata McGraw-Hill Education Pvt. Ltd,* (4th Edition), (2015).

Reference Books:

1. B.P Lathi, **"Modern Digital and Analog Communication Systems"**, Oxford University Press, (3rd Edition), (2003).
2. Bernard Sklar, **"Digital Communications Fundamentals and Applications"**, *Prentice Hall P T R*, (2nd Edition), (2009).
3. A. B. *Carlson* and P. B. Crilly, **"Communication Systems"**, *McGraw-Hill*, (5th Edition), (2002).
4. T. L. Singal, **"Analog and Digital Communication"**, *Tata McGraw-Hill*, (1st Edition), (2012).

Online Resources:

1. NPTEL Course **"Principles of Communication Systems "**
   https://nptel.ac.in/courses /108/104/108104091/
2. NPTEL Course **"Principles of Digital Communications"**
   https://nptel.ac.in/courses /108/101/10810113/

20EC402L ANALOG AND DIGITAL COMMUNICATION LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25 Marks
Oral :25 Marks
Credits: 1

Course Objective

1. To demonstrate generation and detection of AM and FM signals
2. To comprehend PCM, DM, ADM waveform coding techniques
3. To observe data format along with spectral analysis
4. To explore binary and M-ary shift keying techniques

Course Outcome

After completion of the course, students will be able to

CO1	Measure and calculate modulation index, spectrum of AM and FM signal
CO2	Measure and compare bit-rate, signal-to-noise ratio, quantization error of waveform coding techniques
CO3	Plot and analyse spectrum of data formats
CO4	Measure and compare bandwidth, and bit-rate of digital modulation techniques
CO5	Interpret communication standards for analog and digital techniques with technical presentation

List of Experiments:

1. Measure modulation index and observe waveforms of AM and FM (generation and detection)
2. Simulate Super heterodyne radio receiver for FM on suitable software
3. For the given kit measure Bit-rate, Signal to noise ratio and Quantization error for PCM
4. Measure and plot slope overload and Granular noise in Delta modulation and ADM
5. Measure spectrum of BFSK signal
6. Measure and compare bit rate and bandwidth of BPSK and QPSK signals
7. Interpret spectral analysis of line codes (NRZ, RZ, Polar RZ, Bipolar (AMI), Manchester) generated on the given kit
8. Simulate and compare error probability for Binary and M-ary Shifting keying
9. Seminar presentation on Communication Standards

20EC403 MACHINE LEARNING WITH PYTHON

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: 20BS01 Linear Algebra and Univariate Calculus, 20BS03 Multivariate Calculus, 20BSEC301 Calculus and Probability

Course Objectives:
1. To explain the basics of Python Programming Language
2. To discuss and describe the concepts of Machine learning (ML)
3. To apply ML algorithms on real world datasets for regression and prediction
4. To apply and analyse ML algorithms on real world datasets for classification and clustering

Course Outcomes:
After completion of the course, students will be able to
- CO1 Apply Python for problem solving in ML applications
- CO2 Explain the concepts of ML along with parametric and non parametric models
- CO3 Apply and implement ML algorithms to solve classification, regression and clustering problems
- CO4 Analyze performance of ML algorithms

Unit I: Python Fundamentals and Libraries (08)
Data Types, Operators, Indexing and Slicing, Strings, Lists, Arrays, Tuples, Conditional statements, Control Flow, Sets, Dictionaries, Arithmetic and Boolean Operations, Data frames, Python editors, Python libraries: Numpy, Matplotlib, Scikit learn, Pandas.

Unit II: Fundamentals of Machine Learning (08)
Basic concepts in machine learning, Parametric and non-parametric modeling, Overfitting and Underfitting, Feature selection, Dimensionality reduction techniques- PCA, LDA; Training, Testing and Validation errors, Confusion matrix and Evaluation Parameters.

Unit III: Regression (09)
Introduction to Regression, Simple linear regression, Multiple linear regression, Non-Linear Regression, Evaluation metrics in regression models.

Unit IV: Classification (09)
Introduction to Classification, K-Nearest Neighbours, Decision Trees and Random Forest Algorithm, Logistic Regression, Logistic regression vs Linear regression, Support Vector Machine, Introduction to Bayesian probability, Naive Bayes algorithm, Evaluation metrics in classification.

Unit V: Clustering (08)

Introduction to Clustering, K-Means Clustering, Hierarchical Clustering and Density-Based Spatial Clustering of Applications with Noise (DBSCAN) Clustering.

Text Books:

1. Vinod Chandra S. S., Anand Hareendran S., "**Artificial Intelligence and Machine learning**", *PHI*, (1st Edition) (2014).
2. U. Dinesh Kumar and Manaranjan Pradhan, "**Machine Learning using Python**", *John Wiley & Sons* (1st Edition), (2020).
3. Mark Lutz, "**Programming Python",** *O'Reilly Media, Inc.,* (4th Edition), (2010).
4. Ethem Alpaydın "**Introduction to Machine Learning**", *The MIT Press*, (2nd Edition), (2010).
5. Christopher Bishop, "**Pattern Recognition and Machine Learning**", *Springer,* (1st Edition), (2007).

Reference Books:

1. Chris Albon, **"Machine Learning with Python Cookbook",** *O'Reilly Media*, Inc., (1st Edition), (2018).
2. Aurélien Géron, **"Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow",** *O' Reilly Media, Inc.*, (2nd Edition), (2019).
3. Kevin Murphy, **"Machine Learning: A Probabilistic Perspective",** *MIT Press*, (1st Edition), (2012).

Online Resources:

1. NPTEL Course on **"Machine Learning"**
   https://nptel.ac.in/courses/106/106/106106202/
2. NPTEL Course on **"Introduction to Machine Learning"**
   https://onlinecourses.nptel.ac.in/noc21_cs85/preview
3. NPTEL Course on **"Introduction to Machine Learning"**
   https://onlinecourses.nptel.ac.in/noc21_cs70/preview

20EC403L MACHINE LEARNING WITH PYTHON LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25 Marks
Oral:25 Marks
Credits: 1

Course Objectives:

1. To explain the basics of Python Programming Language
2. To apply the concepts of Machine Learning (ML) for data visualization and analysis
3. To apply ML algorithms for regression and prediction problems
4. To apply ML algorithms for classification and clustering

Course Outcomes:

After completion of the course, students will be able to

CO1 Apply Python programming to read and visualize datasets

CO2 Develop an algorithm and write program for solving regression from real world applications

CO3 Develop an algorithm and write program for classification of data from real world applications

CO4 Develop an algorithm and write program using clustering algorithms

List of Experiments:

1. A) Introduction to Python and Python libraries.
   B) Download/Access and read datasets (Kaggle) in Python.
2. Write a program in Python for data visualization and calculate statistical summary.
3. Develop an algorithm and solve real world regression/prediction problems using ML techniques such as linear regression.
4. Develop an algorithm and solve real world regression/prediction problems using ML techniques such as logistic regression.
5. Develop an algorithm and solve real world problems using Naive bayes Algorithm / SVM
6. Develop an algorithm and solve real world problems using Decision tree / Random Forest Algorithm.
7. Develop an algorithm and solve real world problems using K-means clustering algorithm.
8. Develop an algorithm and solve real world problems using Hierarchical clustering algorithm.

20EC404L EMBEDDED SYSTEM LAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
In Semester: 25 Marks
Practical :25Marks
Credits: 2

Course Objective

1. To develop hardware interfacing skill
2. To develop software skill in embedded domain
3. To develop skill of designing embedded system using sensors
4. To explore students to development tools required for embedded system

Course Outcome

After completion of the course, students will be able to

CO1 Implement given problems using development tools required for embedded system
CO2 Develop program for on chip peripheral
CO3 Develop program for externally interfaced peripheral device
CO4 Design microcontroller-based system using sensors

List of Experiments:

1. Interfacing LEDs with different patterns (GPIO)
2. Interfacing switch, LED, relay and buzzer (GPIO)
3. Interfacing Stepper motor (GPIO)
4. Develop the program to generate different waveforms using DAC.
5. Write program to transmit and receive data serially
6. Interfacing LCD Display.
7. Interface ADC and display the data on LCD as well as on serial port.
8. Interface LM 35 sensor to internal ADC and display the value on LCD.
9. Toggle GPIO port with fixed time interval using On-chip timer (without interrupt).
10. Toggle GPIO port with fixed time interval using On-chip timer (with interrupt).
11. DC Motor Speed Control using PWM.
12. Interface following sensors to ADC of microcontroller.
    1. Accelerometer
    2. Gas sensor
    3. Temperature and Humidity sensor DHT-11
13. OPEN ENDED PROBLEM : Interface
    1. Float sensor
    2. Gyro sensor
    3. IR sensor for counting movement or open and close the door using DC motor

20EC404L EMBEDDED SYSTEM LAB

Teaching Scheme	**Examination Scheme**
Practical: 4 Hours / Week	In Semester: 25 Marks
	Practical :25Marks
	Credits: 2

Course Objective

1. To develop hardware interfacing skill
2. To develop software skill in embedded domain
3. To develop skill of designing embedded system using sensors
4. To explore students to development tools required for embedded system

Course Outcome

After completion of the course, students will be able to

CO1 Implement given problems using development tools required for embedded system
CO2 Develop program for on chip peripheral
CO3 Develop program for externally interfaced peripheral device
CO4 Design microcontroller-based system using sensors

List of Experiments:

1. Interfacing LEDs with different patterns (GPIO)
2. Interfacing switch, LED, relay and buzzer (GPIO)
3. Interfacing Stepper motor (GPIO)
4. Develop the program to generate different waveforms using DAC.
5. Write program to transmit and receive data serially
6. Interfacing LCD Display.
7. Interface ADC and display the data on LCD as well as on serial port.
8. Interface LM 35 sensor to internal ADC and display the value on LCD.
9. Toggle GPIO port with fixed time interval using On-chip timer (without interrupt).
10. Toggle GPIO port with fixed time interval using On-chip timer (with interrupt).
11. DC Motor Speed Control using PWM.
12. Interface following sensors to ADC of microcontroller.
    1. Accelerometer
    2. Gas sensor
    3. Temperature and Humidity sensor DHT-11
13. OPEN ENDED PROBLEM : Interface
    1. Float sensor
    2. Gyro sensor
    3. IR sensor for counting movement or open and close the door using DC motor

20EC405 OBJECT ORIENTED PROGRAMMING

Teaching Scheme	Examination Scheme
Lecture: 3 hours/week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credits: 3

Prerequisite: 20ES05 Fundamentals of Programming Language II

Course Objectives:

1. Recall the concepts and techniques of the OOP paradigm
2. Understand and utilize commonly used classes and object as superclass
3. Develop ability to understand and use interfaces, enums and Java collection framework
4. Understand the importance of streams, APIs and the concept and usage of multithreading

Course Outcomes:

After completion of the course, students will be able to

CO1	Utilize common Java constructs such as Interfaces, Enums, Lambdas, Streams and built-in classes such as String, Arrays to develop programs
CO2	Analyze the application requirement and choose appropriate collection from Java Collections Framework for storing data
CO3	Apply the concepts of multithreading
CO4	Analyze the design requirement and identify the appropriate design pattern to be applied

Unit I: Classes and Objects

Basics of stack, heap, memory allocation (objects/primitives and instance/local variables). Nested classes, Inner classes, Method local classes, Anonymous classes, Object as superclass: Object class methods, importance and implementation of to String(), equals(), hashCode() methods, Immutability of objects, Wrapper classes like Byte, Double, Float, Integer, Long, Short, Autoboxing and unboxing. Commonly used classes: String, StringBuilder, Objects, Arrays, Math.

Unit II: Interfaces, Enums and Annotations

Interfaces: Defining an Interface, Implementing an Interface, Using an Interface as a Type, Common interfaces: Comparable, Comparator, Iterable, Iterator, Runnable, Enums: Declaring Enum, adding fields to Enum, Enum class in Java, Built in methods, Abstract method implementations in Enum, Annotations: Basics, Declaring annotation type, Predefined annotations, Annotation processing overview.

Unit III: Generics and Collections

Generics: Introduction to generics, Generic types, Generic methods, Bounded type parameters, generics and inheritance, Wildcards, Java Collection Framework (JCF): Introduction to JCF, Structure of JCF (program to interface, use of generics, Collection interface), Commonly used collections with implementations: Features, Methods offered and complexity analysis for: List (ArrayList, LinkedList), Set (HashSet, LinkedHashSet, TreeSet), Map (HashMap, LinkedHashMap, TreeMap), Queue (ArrayBlockingDeque, Priority Queue), Exploration of Javadocs to understand interface and implementations.

Unit IV: Java 8 Useful Features

Java 8 interfaces: Default and Static Methods, Lambdas, Method references, Streams: Introduction, Examples, Intermediate operations: filter, Map, Flat Map, Distinct, Limit, sorted, Terminal operations: for Each, to Array, Collect and reduce, Date Time APIs: Problems with existing Date and Calendar, Local Date, Local Time, Local Date Time, Zoned Date Time, Period and Duration.

Unit V: Multithreading

Multithreading vs multiprocessing, Thread, Runnable, memory model (Thread stack, frames, method stacking, stack overflow), Need for synchronization: race conditions, Happens before guarantee, Examples, Use of atomic classes, Deadlock, Starvation, Use of volatile, Publisher/Subscriber model: wait, notify/notify all.

Unit VI: Design Patterns

Purpose of using design patterns, types of design patterns: Creational, Structural, Behavioral, Common design patterns such as: singleton, Factory, Builder, Proxy, Façade, Observer, Model View Controller (MVC).

Text Books:

1. Herbert Schilt, **"JAVA Complete Reference"**, *Tata McGraw Hill*, (9th Edition), (2014).
2. Eckel B., **"Thinking in Java"**, *Pearson Education*, (3rd Edition), (2017).

Reference Books:

1. Joshua Bloch,**"Effective Java"**, Addison-Wesley Professional, (3rd Edition), (2017).

Online Resources:

1. NPTEL Course **"Programming in Java"** https://nptel.ac.in/courses/106/105/106105191/

20EC405L OBJECT ORIENTED PROGRAMMING LAB

Teaching Scheme	Examination Scheme
Practical: 2 Hours / Week	In Semester: 25 Marks Practical: 25 Marks **Credits: 1**

Course Objectives

1. To recall the concepts and techniques of the OOP paradigm
2. To utilize the commonly used classes and object as super class
3. To implement interfaces, enums and the Java collection framework
4. To understand the importance of streams, APIs and the concept and usage of multithreading

Course Outcomes

After completion of the course, students will be able to

CO1 Develop Java programs using common Java constructs

CO2 Develop Java programs by applying appropriate design pattern

CO3 Analyse the application requirement and write programs using appropriate collection from Java Collections Framework

CO4 Apply the concept of multithreading to solve given problems

List of Experiments:

1. Write a program to explore Object class methods (toString, equals, hashcode)
   a. Create an Employee class with fields first name and last name.
   b. Create and print Employee class objects.
   c. Create multiple Employee class objects and compare whether they are equal or not.
2. Declare an interface and create an anonymous class that implements it.
3. Write a program to create a Person class with fields; first name and last name and getter setters. Modify it to make it immutable. In the Person class, add a field of type Address, which has fields as city and pin code with getters and setters. Prove that the Person class is now mutable. Modify the classes such that Person becomes immutable again.
4. Write a program to concatenate two strings e.g. “hello” and “world” and check if the result of concatenation equals “helloworld” (using equals() and ==). Trim the strings to get the two strings back.
5. Write a program to declare an Enum representing days of the week. Add fields to indicate the day name and number. Print the days using values().
6. Write a program to implement basic arithmetic calculator using Enum. Calculator should support operations: addition, subtraction, multiplication and division.
7. Create a set of movies (Movie class having name and imdb rating). Print the list of movies in the ascending order of their names. Now print the movies in descending order of imdb rating, using comparator interface.

8. Create a list of names of your friends. Check if a name of a friend is present in the list. Remove a name from the list and add another. Print the list to see where the added name is appearing in the list.

9. Dissecting equals and hashcode contract - Create 4 objects from a student class (which has name and roll number as fields). All objects should have the same name and roll numbers. Add the objects to a set when – (i) the class does not have equals and hashcode overridden (ii) when the class has these methods overridden. Inspect what happens in these two cases and justify the contract.

10. Create a map of device ids and subscribers associated with it. Create a list of all device ids associated with a subscriber.

11. Given a stream of amplitude values of a sampled signal (as a List), filter out the samples having amplitudes above and below the threshold values (upper threshold: 4.5V and lower threshold: 0.5V). These filtered samples are to be passed through the multiplier system (multiplication factor = 2). Create a list of signal values at the output of the multiplier system. Find min and max amplitudes in the result.
    Example:
    Input: {0.45, 1.0, 2.2, 3.5, 4.7, 5.0, 0.21, 1.2}
    Output: {2.0, 4.4, 7.0, 2.4}
    Min: 2.0, Max: 7.0

12. Write a program to demonstrate deadlock using two threads and two locks. Hint: Threads need to acquire locks in opposite order.

13. Write a Maven project to generate a QR code. Hint: Use QRGen (https://github.com/kenglxn/QRGen) as dependency.

20IN303L Analog and Digital Electronics Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In Semester: 25 Marks
Practical: 25 Marks
Credit: 1

Course Outcomes: the student will be able to
1. Verify and compare the performance characteristics of different configurations of OPAMP.
2. Design and implement linear and non-linear circuits using OPAMP.
3. Select appropriate components for given application
4. Design and test signal conditioning circuits for industrial application.

List of Practical Assignments:

(Any 3 from)
1. Measurement of CMRR, Slew rate and output offset voltage.
2. Verification of gain for inverting and non- inverting amplifier.
3. Designing and implementation of Instrumentation amplifier using IC LM324.
4. Designing and implementation of Wien bridge oscillator.
5. Designing and implementation of Comparator, Schmitt trigger and Zero Crossing Detector.

(Any 1 from)
1. Designing and implementation of buzzer using LM555.
2. Designing and implementation of flasher light using LM555
3. Designing and implementation of porch-light control unit using LM555

(Any 2 from)
1. Study and implementation of logic circuit using Mux/Demux
2. Study and implementation of Johnson and Ring Counter using D-FF IC 7474 or Shift Register IC 7495
3. Study of Presettable Up/Down Counter using IC 74193.
4. Design of Non Sequential Counter using flip –flop ICs.

(Any 2 from)
1. Implementation of running light using shift register
2. Alarming annunciator circuit using Mux. for 3 conditions stated in process
3. Implementation of digital timer using IC 74193
4. Simulation of Digital Clock using digital ICs

Or similar type of practical assignments based on the course contents

20IN304 Programming Practice Lab

Teaching Scheme:
Practical: 4 Hrs/week

Examination Scheme:
In Semester: 25 Marks
Practical: 25 Marks
Credit: 2

Course Outcomes: the student will be able to
1. List and identify the steps for the given problem statement.
2. Apply different programming tools for logic development.
3. Implement the developed logic in the given programming language.
4. Develop and design appropriate programs for practical applications.

List of Practical Assignments-:
Group A: [Any 3 minimum]
1. Write a Python program to enter marks of five subjects and calculate total and percentage.
2. A. Write a Python program to swap two numbers/digits in a number.
   B. Write a python program to find the greatest number among three given numbers by using ternary operator.
3. Write a Python program to perform the sum of digits of a 3 digit number.
4. Write a Python program to calculate DA and HRA on the following conditions
   Enter basic salary as user input user.

Salary	*DA as per salary*	*HRA as per salary*
<=2000	*10%*	*20%*
>2000	*20%*	*30%*
&&		
<=5000		
>5000	*30%*	*40%*
&&		
<=10000		
>10000	*50%*	*50%*

5. Write a Python program to find out the average and median among three given numbers.

Group B: [Any 5 minimum]
6. Write a Python program to print all alphabets (Capital and small) using while loop
7. Write a Python program to find the sum of all even numbers between 1 to n.

8. Write a Python program to find the sum of the first and last digit of the entered number.
9. Write a Python program to check whether the entered number or string is palindrome or not.
10. Write a Python program to print the following pattern 2 3 5 7 11 13… till 100
11. Write a Python program to find the power of a number using a for loop.
12. Write a Python program to find all factors of a number.
13. Write a Python program to find the sum of all prime numbers between 1 to n.

Group C: [Any 4 minimum]

14. Write a Python program to get a string made of the first 2 and the last char from a given string. For eg: Input : beautiful Expected Output : bel
15. Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '#', except the first char itself. For eg: Input: abracadabra Expected Output : abr#c#d#br#
16. Write a Python program to add 'ing' at the end of a given string (length should be at least 3). If the given string already ends with 'ing' then add 'ly' instead. If the string length of the given string is less than 3, leave it unchanged. For eg: Input: test Expected Output: testing If the Input : testing Expected Output: testingly
17. A.Write a Python program to get the largest number from a list
    B. Write a Python program to multiply all the items in a list.
18. Write a program to remove all the duplicate elements from the list.
19. Write a Python program to count the number of strings where the string length is 4 or more and the first and last character are the same from a given list of strings.

Group D: [Any 4 minimum]

20. Write a Python program to find common items from two lists.
21. Write a Python script to add a key to a dictionary.
22. Write a Python program to concatenate following dictionaries to create a new one. d1={1:110, 2:210}
d2={3:301, 4:401}
d3={5:5010, 6:6010}
23. A.Write a Python program to check if a given key already exists in a dictionary.
B. Write a Python script to print a dictionary where the keys are numbers between 1 and 10 (both included) and the values are squares of keys.
24. A.Write a Python program to sum all the items in a dictionary.
    B. Write a Python program to remove a key from the given dictionary.
    D = {'a':9,'b':8,'c':7,'d':6}
25. A.Write a Python program to sort a dictionary by key.
    B. Write a Python program to remove duplicate values from the Dictionary.
26. Write a program to determine the occurrence of numbers in a list of numbers.

20IN401 Fundamentals of Computer Networks

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 3

Prerequisites: -

Course Objectives:

1. To define computer networks and describe their purpose
2. To understand the types and components of networks
3. To understand the functions of each layer in a network

Course Outcomes: the students will be able to

1. Identify components and methods in networks
2. Compare the functions of layers in a network
3. Identify models and issues in networks
4. Compare protocols and standards

Unit 1: Introduction to Computer Networks (08)

Type of Networks LAN, WAN, MAN, Ad-hoc Networks. Networking Topologies: Bus, Mesh, Star, Ring and Hierarchical. Types of Connection- Point to Point, Point to Multi Point, Network Standards. Network components: Switches, Routers, Hubs, Gateways, Repeaters, Modems, Cables, NIC and access points.

Unit 2: Network Models and Physical Layer (08)

ISO-OSI 7-layer model, Functions of each layer, TCP/IP model.
Protocol Data Units, encapsulation and decapsulation
Digital modulation and multiplexing methods: FDM, TDM, PCM, FSK, GFSK, Spread Spectrum Technique
Transmission Media: Twisted pair cable, coaxial cable, Fiber Optic cable

Unit 3: Data Link Layer (08)

Data Link Layer Design Issues, Error Detection and Error Correction, Medium Access Control Sub layer, Ethernet MULTIPLE ACCESS PROTOCOLS, ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols

Unit 4: Ethernet Basics (06)

Ethernet Basics, Collision Domain, Broadcast Domain, CSMA/CD, Half- and Full-Duplex Ethernet, Ethernet at the Data Link Layer, Ethernet Addressing, Ethernet Frames, Channel Bonding, Ethernet at the Physical Layer.

Unit 5: Network Layer (06)

IP Addressing, Communication from Host to Host, Network Layer Protocol, Packaging the Transport Layer PDU, IPv4 and IPv6 Packet Header, Comparison of IPv4 and IPv6, Subnetting, Static Routing, Dynamic Routing, Routing Protocols
Introduction to NFV (Network Function Visualization)

Unit 6: Protocols and QoS framework in Networks **(06)**
UDP, HTTP, FTP, SMTP and equivalent
Internet QoS: Introduction, Architecture, Traffic Policing, Traffic Shaping, Traffic Scheduling, Integrated and Differentiated Service Architecture
Network Security

Books:

1. Mark A. Dye, Rick McDonald, Antoon W. Rufi, "Network Fundamentals", Cisco Press, 2008
2. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw- Hill, Publications, 2017.
3. William Stallings "Data and computer communication", Pearson, 10th Edition, 2015
4. Kurose, Ross "Computer Networking a Top Down Approach Featuring the Internet",6th edition (March 5, 2012), Pearson , ISBN-10: 0132856204.
1. Andrew S. Tenenbaum, "Computer Networks", 5th Edition, PHI, ISBN 81-23- 2175-8

20IN402 Control Systems

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In Semester: 50 Marks
	End Semester: 50 Marks
	Credit: 3

Prerequisites: Basics of Linear Algebra and Laplace Transform

Course Objectives:
1. Understand the basic components of control system and types of control systems.
2. Learn and develop the relationship between system input and output.
3. Learn to develop systems mathematical models.
4. Understand the basic mathematical tools for analysis of control systems.

Course Outcomes: students will be able to
1. Analyze & predict systems behavior based on time and Frequency Domain Analysis.
2. Design Control System that meets design specifications.
3. Develop a Mathematical Model of the Control System.
4. Compare the Classic Control System with the Modern Control System.

Unit 1: Introduction to Control System (07)
Introduction and brief classification of Control System, Representation of Electrical, Mechanical, Electromechanical, Thermal and Pneumatics Control System with Differential Equations, Concept of Transfer Function

Unit 2: Transfer Function, Block Diagram Algebra & Signal Flow Graph (08)
Representation of Electrical and Mechanical Control System with Force to Voltage and Force to Current Analogy, Block Diagram Algebra, Signal Flow Graph

Unit 3: Time Domain Analysis (07)
Standard Test Signal, Dynamic Error Constants, First and Second Order System and Its Response to the Standard Test Signals, Time Domain Specifications, Static Error Constants – kv, kp, ka and ess.

Unit 4: Stability Analysis (07)
Concept of Stability in S – Domain, Concept of Relative Stability and Absolute Stability, Classification of Stability, Stability Analysis by Routh Hurwitz Criteria.

Unit 5: Frequency Domain Analysis (07)
Introduction to Bode Plot, Bode Plot, Nyquist Plot, Nyquist Stability Criterion, Gain and Phase Margins, Robustness.

Unit 6: Compensation Techniques (06)

Introduction to Compensation, Compensation via Root Locus, Compensator Configurations, Commonly used Compensators, Effect of Adding Poles and Zeros to Root Locus.

Text Books:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th Edition, 2009.
2. B. C. Kuo, "Automatic Control Systems", John Wiley and Sons, 8th Edition, 2003.
3. K. Ogata, "Modern Control Engineering", 4th Edition, Pearson Education.
4. D. Roy Choudhury, "Control System Engineering", PHI.

Reference Books:

1. N. K. Sinha, "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
3. M. N. Bandyopadhyaya, "Control Engineering, Theory & Practice", PHI.
4. Norman Nise, "Control System Engineering", 3rd Edition, John Wiely and Sons.
5. R.C. Dorf & R.H. Bishop, "Modern Control System", 11th Edition, Pearson Education.
6. Graham C Goodwin, Stefan F. Graebe, Mario E. Salgado, "Control System Design", PHI.
7. Christopher T. Kilian, "Modern Control Technology Components & Systems", 3rd Edition, Cengage Learning.
8. Ajit K. Mandal, "Introduction to Control Engineering", New Age International.
9. R. T. Stefani, B. Shahian, C. J. Savant and G. H. Hostetter, "Design of Feedback Control Systems", Oxford University Press.
10. Samarjit Ghosh, "Control Systems Theory and Applications", Pearson Education.

IN403 Microcontroller Techniques

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/week	**In Semester: 50 Marks**
Tutorial: 1 Hrs/week	**End Semester: 50 Marks**
	Credits: 4

Prerequisites:
1. Concepts of Digital Electronics
2. Hexadecimal number systems and their arithmetic/ logical operations
3. Basics of C programming

Course Objectives:
1. To introduce the architecture and features of microcontrollers
2. To provide an understanding of hardware and software design and integration for Microcontroller based system development
3. To develop small application system with AVR microcontroller.

Course Outcomes: The students will be able
1. Select appropriate features of AVR microcontroller for given application.
2. Identify detailed hardware structure and software model of the AVR for the given application.
3. Develop configuration of on-chip peripherals.
4. Design microcontroller based system

Unit I: Introduction to 8 bit microcontrollers (6 Hours)
Microprocessors and Microcontroller architecture, Overview, Family and Features of AVR ATMega8535, Concepts of Memory (RAM and ROM), Buses, AVR Pin diagram, AVR Memory Organization, Program Counter and Program ROM space

Unit II: Architecture and Programming -I (6 Hours)
A. Microcontroller Application Development Tools: Simulator, Emulator, ISP, Cross assembler
B. AVR architecture, Programming techniques for ATMega8535, data types, writing loops and subroutines in C, Time Delays, logic operations, data conversion and memory allocation in C.
C. System Clock and Clock Options, Reset Sources

Unit III: Architecture and Programming -II (6 Hours)
A. AVR Port Structure, Alternate Port Functions, I/O configurations, I/O Port programming and Bit manipulations in C
B. Introduction to interfacing display and keyboard
C. Watch Dog Timer and Stack Memory concepts and use
D. AVR Fuse bits

Unit IV: Integrated Timers and Counters (6 Hours)
A. 8 bit Timer/ Counter 0 with PWM, Modes, Prescaling and Programming in C
B. 16 bit Timer/ Counter 1, Modes, Prescaling and Programming in C
C. Input Capture and Wave generation using timers

Unit V: Interrupts and ADC (6 Hours)
A. External and Internal Interrupts, Programming, Configuring and Priority
B. ADC Features, Operation, Programming and Configuring
C. Introduction to sensor interfacing

D. Power Management in AVR microcontrollers

Unit VI: Other integrated features **(6 Hours)**

A. Introduction to serial interfaces: SPI, I^2C and USART

B. Introduction to RS232C, RS485

C. Introduction to Features and capabilities of Arduino Systems

Text Books:

1. 'The AVR microcontroller and Embedded Systems Using Assembly and C', Mazidi, Naimi, Naimi, Prentice Hall
2. 'Arduino, the complete beginners guide', Bryon Francis
3. 'Embedded Systems, Architecture Programming and Applications', Raj Kamal, McGraw Hill
4. ‘Programming And Customizing The AVR Microcontroller’, Dhananjay Gadre, Tata McGraw Hill Publishing Company Limited

Reference Books:

1. Datasheet of AVR ATMega8535
2. Microchip AVR Microcontroller Primer Programming and Interfacing’, Steven Barett, Daniel Pack, Third Edition, Morgan & Claypool Publishers
3. AVR Programming: Learning to Write Software for Hardware, Elliot Williams, Maker Media Inc.

List of Tutorials:

1. Arithmetic and logical operations with Hexadecimal numbers
2. Numericals on data conversion and memory address calculation
3. AVR Fuse bit selections for different cases
4. Study the Stack pointer and Program counter in Branch transfer instructions
5. Calculation of timer register values for timer 0 in Normal and CTC mode
6. Calculation of timer register values for timer 1 in Normal and CTC mode
7. Calculations for configuration of ADC and interpretation of result
8. Understanding configuration registers for interrupts and configuration for the given problem statement
9. Calculation of register values for various baud rates of USART
10. Case study using Arduino system

20IN404 Power Electronics and Drives

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/week	In Semester: 50 Marks
Tutorial: 1 Hr/week	End Semester: 50 Marks
	Credit: 4

Prerequisites: Linear Integrated Circuits and Digital Electronics

Course Objectives:

1. To understand and analyze different power electronic devices.
2. To study different special purpose integrated circuits.
3. To use different control methodologies based on different applications.
4. To use the knowledge to understand and solve practical problems.

Course Outcomes: the students will be able to

1. List and Define characteristics of different power devices.
2. Compare and select various power circuits and motors for suitable applications.
3. Develop controlling circuits for various design stages.
4. Design and construct the suitable controlling circuit for given applications.

Unit 1: Introduction to Power Devices (08)

SCR, TRIAC, DIAC, Power MOSFET, UJT, SCR gate triggering and commutation circuits

Unit 2: Phase Controlled rectifiers (07)

Single Phase and Three Phase controlled rectifiers, (Half wave, full wave and bridge Configuration) with resistive and inductive load with freewheeling diode.

Unit 3: Choppers and Inverters (08)

Choppers: Principle, Working, Classification, Thyristor choppers- Jones Chopper, Morgan Chopper, Chopper controlling strategies.
Inverters: Classification, Single Phase half bridge and full bridge Inverters, PWM Inverters
Uninterruptible Power Supply (UPS): Principle, Construction, Working, Types, Application

Unit 4: Electric Machines (07)

DC Motors - Principle, Construction, Working, Types, Characteristics, efficiency and Applications
Stepper Motors - Principle, Construction, Working, Types, Characteristics and Applications
Induction Motor - One phase and three phase

Unit 5: Protection Devices (07)

Starters for motors, circuit breakers, fuses, over voltage and over current protection circuits for power devices, cooling mechanism for power devices

Unit 6: Controllers for AC Loads (05)

Solid state relays, Firing angle control, AC Synchronous motor drive, Variable frequency drive (VFD)

Text Books:

1. M.D. Singh, K. B. Khanchandani, 'Power Electronics', 2nd edition, McGraw Hill Company

2. B. L. Theraja and A. K. Theraja, S. Chand &Sons, "A textbook of Electrical Technology", Volume-II, AC & DC Machines

Reference Books:

1. P. C. Sen,' Power Electronics', TMH, 2007
2. Mohamad Rashid,' Power Electronics', PHI, 2ndedition, 2004
3. G.K.Dubey, Power semiconductor controlled drives, Prentice Hall- 1989
4. Bhag S. Guru, Huseyin P. Hiziroglu,"Electric Machinery and Transformers", Third Edition, Oxford University Press
5. Krishnan, Electrical Motor Drives, PHI-2003

Tutorials:
Minimum 8 assignments based on the course contents

20IN 405 Unit Operations

Teaching Scheme:
Lecture: 3 Hr/week
Tutorial: 1 Hr/week

Examination Scheme:
In Semester: 50 Marks
End Semester: 50 Marks
Credit: 4

Prerequisites: Sensors and transducers

Course Objectives:
1. To learn various Unit Operations used in Industry.
2. To describe various equipment involved in various unit operations.
3. To understand different renewable and non-renewable energy sources

Course Outcomes: the student will be able to
1. Delineate the working of various process equipment used for mass transfer, heat transfer, fluid transfer.
2. Compare various process equipment used in specific unit operations.
3. Select unit operation and related instruments for a given application.
4. Analyze various industries like dairy, pharmaceutical, sugar, etc by identifying various process units and unit operations

Unit 1: Unit Operations and Fluid Transportation **(08)**
A. Introduction, Flow of incompressible fluids through pipes, transportation and metering of fluids, Pipes, Fittings, Valves, Pumps, Fans, Blowers, Compressors, Feeders, Dampers
B. Fluids filtration, solids fluidization

Unit 2: Unit Operations in Chemical Engineering **(08)**
A. Gas absorption and liquefaction, refrigeration
B. Mechanical processes: including solids transportation, crushing and pulverization, screening and sieving
C. Separation and mixing of fluids

Unit 3: Heat Transfer Operations **(08)**
A. Principles of heat flow in fluids, Heat transfer to fluids without phase change, Heat Transfer to fluids with phase change
B. Heat Exchange Equipment: Heat Exchangers, Condensers, Boilers and Calandria, Evaporators, Cooling towers

Unit 4: Mass Transfer Operations and Introduction to Energy Sources **(06)**
A. Distillation: Flash and Continuous, Multi component Distillation, Leaching and Extraction
B. Drying of Solids and liquids, Crystallization
C. Energy Sources and their classification
D. Introduction to Power generation

Unit 5: Boiler Ancillaries **(06)**
A. Types of boilers like FBC, CFBC, DIPC, Fluidized Bed, boiler safety parameters

B. Instrumentation for Boiler, water treatment, electro-static precipitator, soot blower, economizer, deaerator, super heater, chemical dosing systems, air preheater, coal and ash handling systems, fuel storage and distribution, Bag House Filters.

Unit 6: Unit Operations in Process Industry (06)

Study of Processes and Unit Operations applied to process industry, viz. sugar, paper and pulp, Dairy, Pharmaceutical, and Fertilizer

Text Books:

1. Unit Operations in Chemical Engineering by McCabe, W.L., Smith, J.C., and Harriot P., McGraw-Hill VII Edn. 2004.
2. Perry, "Chemical Engineer's Handbook", McGraw Hill, 1984.
3. Non-conventional energy resources by B. H. Khan, McGraw Hill, New Delhi.
4. Renewable energy Technology. Chetan Singh Solanki, Prentice Hall Publication.

Reference Books:

1. Process Control, B.G. Liptak
2. Solar Energy, by S. P. Sukhatme, Tata McGraw Hill, New Delhi.
3. Nonconventional Energy Sources. G. D. Rai, Khanna Publication.
4. M. G. Rao and Misting, "Outline of Chemical Technology", Second Edition, East West, 1973.
5. Leverspel O., "Chemical Reaction Engineering", Second Edition Willey Eastern Pvt Ltd

Tutorials:

Minimum 8 assignments based on the course contents

20IN402L Control Systems Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme
In Semester: 25 Marks
Practical: 25 Marks
Credit: 1

Course Outcomes: Students would be able to

1. Test the System Response for the various Standard Test Signals
2. Analyse Transient Response of the System
3. Analyse Frequency Response of the System
4. Design compensator using Root Locus Method

List of Practical Assignments:

1. Formation and Study of Standard Test Signals.
2. Response of First/Second Order System to Standard Test Signals.
3. Transient Response of a System.
4. Analysis of Time Domain Specifications of a Control System.
5. Analysis of Stability in Frequency Domain using Bode Plot.
6. Analysis of Stability in Frequency Domain using Nyquist Plot.
7. Analysis of Stability using Root Locus.
8. Design and Performance Analysis of Lead/Lag Compensator using Root Locus.

Or similar type of practical assignments based on the course contents

20IN403L Microcontroller Techniques Lab

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme:
In Semester: 25 Marks
Practical: 25 Marks
Credit: 1

Course Outcomes: The students will be able
1. Program microcontroller using C programming
2. Select appropriate peripheral for given application
3. Configure the peripherals in different modes
4. Debug the developed program / given problem statement

List of Practical Assignments (any 8):

1. Introduction and familiarization with programming environment of AVR
2. Arithmetic and Logical Operations in AVR
3. Bit wise operations and Port pin manipulations
4. Data Conversion Programs in C
5. Square wave generation using software delay
6. Square wave generation using hardware delays with polling and interrupts
7. Event counter using timer
8. Frequency measurement using time period method
9. Analog input measurement using ADC
10. Interfacing of LCD display
11. Introduction to Arduino system Programming

Or similar type of practical assignments based on the course contents

20IT 301 Data Structures

Teaching Scheme:
Lectures: 3 hours/week
Tutorial : --

Examination Scheme:
**In-Semester : ** 50 Marks
End-Semester : 50 Marks
Credit : 3

Prerequisites: Fundamentals of Programming Language

Course Objectives:
Familiarize students with

1. Linear & non-linear data structures
2. Iterative & recursive function implementations
3. Symbol table & hashing techniques
4. Algorithm analysis using time & space complexity

Course Outcomes:
Students should be able to

1. Apply appropriate programming language constructs to develop logical steps for solving a real world problem.
2. Analyze algorithmic complexities of an algorithm.
3. Select appropriate linear & nonlinear data structure to solve a given problem.
4. Apply different hashing techniques.

Unit – I Introduction to Data Structures 5 Hours
Concept of problem solving, Revision: Concept of data types, operators, control structures, functions, arrays and collections.
Introduction to Data Structures: Types of data structures, Abstract Data Types

Unit – II Introduction to Analysis of Algorithms 7 Hours
Concept of algorithm, characteristics of algorithms, pseudo code. Analysis of algorithm: frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Best, Worst and Average case analysis of algorithm.
Sorting algorithm : Bubble sort, Searching algorithm : Linear search, Binary search

Unit – III Linked List 7 Hours
Concept of linked organization, singly linked list, doubly linked list, circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, comparison of a sequential and linked memory organization, concept of Generalized Linked List, polynomial representation using GLL.

Unit – IV Stack & Queue 8 Hours

Concept of stack, stack as ADT, Implementation of stack using array and linked organization, stack as data structure, use of stack- Recursion, expression conversion & evaluation
Concept of queues as ADT, Implementation using array and linked organization. Priority queue.

Unit – V Trees 8 Hours

Concept of non-linear data structure, Trees and binary trees-concept and terminology. Binary tree as an ADT., Expression tree. Conversion of general tree to binary tree. Recursive and non-recursive algorithms for binary tree traversals, Binary search trees, Threaded binary tree.

Unit – VI Hash Tables 7 Hours

Symbol Table: Symbol Table, Huffman's algorithm
Hash table: hashing function, collision resolution techniques- linear probing, rehashing, chaining without replacement and chaining with replacement.

Text Books

1. R. Gilberg, B. Forouzan, "Data Structures: A pseudo code approach with C", Cenage Learning
2. Cay S. Horstmann, "Big Java: Early Objects", John Wiley

Reference Books

1. E. Horowitz, S. Sahani, "Fundamentals of Data Structures", Computer Science Press
2. Alfred Aho, John Hopcroft, Jeffrey Ullman, "Data Structures & Algorithms", Pearson Publication
3. Robert Lafore, "Data Structures and Algorithms in Java", Sams Publication

20IT 302 Discrete Mathematics

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: 1 hours/week

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 4

Prerequisites: Basic Mathematics
Course Objectives:
Familiarize students with
1. Sets and propositions to gain knowledge to formulate and solve problems.
2. The concept of relations and functions.
3. Graph and Tree terminologies and models to be applied in real life problems.
4. The basics of algebraic structures and its applications along with number theory.

Course Outcomes:
Students should be able to
1. Analyze logical propositions.
2. Prove mathematical theorems
3. Apply algebraic techniques on discrete mathematics and algorithms
4. Evaluate the combinatorial problems

Unit I: Sets and Propositional logic **7 Hours**
Sets: Sets, Combinations of Sets, Venn diagram, Finite and Infinite Sets, Countable Sets, Multisets, Principle of Inclusion and Exclusion, Mathematical Induction.
Propositions: Propositions, Logical Connectives, Conditional and Bi-conditional Propositions, Logical Equivalence, Validity of Arguments by using Truth Tables, Predicates and Quantifiers, Normal forms. Applications of Sets and Propositions

Unit II: Relations and Functions **7 Hours**
Relations: Relations and their properties, n-ary relations and their applications, representing relations, closures of relations, equivalence relations, partial orderings, Lattices, Chains and AntiChains.
Functions: Functions: Functions, Composition of Functions, Invertible Functions, and Pigeonhole Principle.

Unit III: Graphs **7 Hours**
Graphs and Graph Models, Graph Terminology and Special Types of graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Unit IV: Trees **7 Hours**
Introduction to Trees, Applications of Trees: Introduction, Binary search trees, Prefix codes, Tree Traversal: Preorder, in-order and post-order traversals, Minimum Spanning Trees: Introduction, Prim's algorithm, Kruskal's algorithm.

Unit V: Groups and Rings **7 Hours**

Group Theory: Groups, subgroups, generators and evaluation of powers, cosets and lagrange's theorem, permutation groups and burnside's theorem, isomorphism and automorphisms, homomorphisms and normal subgroups, rings, integral, domain and fields.

Unit VI: Counting **7 Hours**

Combinatorics: Rules of Sum and Product, Permutations, Combinations. Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Information and Mutual Information, Applications of Combinatorics and Discrete Probability.

Text Books:

1. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", 4th Edition, McGraw-Hill
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", & 7th edition, McGraw-Hill

Reference Books:

1. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, "Discrete mathematical structures", 6th edition, Prentice Hall of India
2. Edgar G. Goodaire, Michael M. Parmenter, "Discrete Mathematics with Graph Theory", 3rd Edition, Pearson Education
3. Tremblay J. S., "Discrete mathematical structures with application", 3rdEdition, Tata McGraw Hill 4. Lipschutz Seymour, "Discrete mathematics", 4th Edition, Tata McGraw-Hill

20IT 303 Digital Electronics and Computer Architecture

Teaching Scheme:
Lectures: 3 hours/week

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Prerequisites: Basic Electrical and Electronics Engineering
Course Objectives:
Familiarize students with
1. Basic digital design techniques
2. Design and implement of combinational and sequential logic circuits
3. Fundamental working of Computer Systems
4. Architecture and features of a microprocessor

Course Outcomes:
Students should be able to
1. Comprehend basic binary arithmetic and codes
2. Design simple combinational logic circuits using reduction techniques
3. Design simple Sequential logic circuits
4. Explain Architectural details of a microprocessor
5. Explain Memory management and Interrupts of a microprocessor

Unit – I: Number System **7 Hours**

Introduction to Boolean algebra and Number Systems. Signed Binary number representation and Arithmetic: Signed & True Magnitude, 1's complement, 2's complement representation and arithmetic.

Codes: BCD, Excess-3, Gray code, Binary Code and their conversion.

Logic minimization: Representation of truth-table, Simplification of logical functions, Minimization of SOP and POS forms, don't care Conditions, K-Maps.

Unit – II: Combinational Logic Design **7 Hours**

CLC design using SSI chips – Code converters, Adder, Subtractor, n bit Binary adder, Introduction to MSI functions & chips - Multiplexers, Decoder / Demultiplexer, Encoder, Binary adder.

CLC design using MSI chips – BCD & Excess 3 Adder and Subtractor

Unit – III: Sequential Logic Design **7 Hours**

Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch.

Flip- Flops: Design, truth table, excitation table of SR, JK, D, T flip flops. Study of flip flops with asynchronous and synchronous Preset & Clear, conversion from one type to another type of flip flop.

Application of flip-flops – Counters- asynchronous, synchronous and modulo counters. Study of modulus n counter ICs & their applications to implement mod counters.

Unit – IV: Sequential Logic Design **7 Hours**

Registers- Buffer register, shift register types - SISO, SIPO, PISO & PIPO, applications of shift registers - ring counter, twisted ring counter, Sequence generators using counters & shift register, Sequence Detectors using Mealy and Moore model

Unit – V: Processor Architecture **7 Hours**

Introduction to 8086: internal Architecture, generation of physical address, minimum/maximum mode, study of 8086 supporting chips 8288(Latch), 8284(Clock Generator), 8286(trans receiver), 8288(Bus controller), Timing diagram read Write machine cycle.

Unit – VI: Assembly Language Programming and Interrupt Structure **7 Hours**

Introduction to assembly language programming- Instruction Descriptions, Assembler Directives addressing modes, Examples of programming, Procedures and Macros. Interrupt Structure, Interrupt service routine, Interrupt vector table, hardware and software interrupts, INTR, NMI, Interrupt response, Execution of ISR, Priorities of interrupt

Text Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4
2. Douglas Hall, "Microprocessors and Interfacing, Programming and Hardware", McGraw-Hill, ISBN: 0–07–100462–9Book 2

Reference Books:

1. Malvino Leach, "Digital Principles and Applications", Tata Mc-Graw Hill, (5th Edition)
2. 8086 Intel Manual

Web References:

1. NPTEL Series: Digital Systems Design, Prof. Roychoudhary, IIT Kharagpur
2. NPTEL NOC:Microprocessors and Microcontroller, Prof. Santanu Chattopadhyay, IIT Kharagpur
3. NPTEL NOC:Microprocessors and Interfacing, Prof. Shaik Rafi Ahamed, IIT Guwahati

20IT 304 Network Fundamentals

Teaching Scheme:
Lectures: 3 hours/week
Tutorial : 1

Examination Scheme:
**In-Semester : ** 50 Marks
End-Semester : 50 Marks
Credit : 4

Prerequisites: NA

Course Objectives:
Familiarize students with
1. OSI and TCP/IP models
2. Various media access schemes
3. Error detection and control mechanisms
4. IP addressing

Course Outcomes:
Students should be able to
1. Differentiate between OSI and TCP/IP models
2. Analyze the different types of network delays in packet-switched networks
3. Differentiate between data link layer services and multiple access techniques.
4. Design the IP addressing scheme for a small network.

Unit – I Introduction 7 Hours
The Architecture of the Internet, Layering and encapsulation, LAN, WAN, MAN, Networking Devices, Network Topologies Point to Point, Point to Multipoint Topologies.

Unit – II Communicating over the Network 7 Hours
The platform for communications, Protocols, OSI Model, TCP/IP Model, Protocol Data Units and Encapsulation, Comparison between OSI and TCP/IP Model, Network Addressing.

Unit – III Network Layer 7 Hours
IP Addressing, Network Layer Protocol, IPv4, Subnetting, Static Routing, Dynamic Routing and IPv6

Unit – IV Ethernet 7 Hours
Transmission media (Guided and Unguided), Performance (Bandwidth, Throughput, latency and BDP), Digital Modulation and Multiplexing.

Unit – V Physical layer 7 Hours
The Role of Physical Layer, Theoretical Basis for data communication, Digital Modulation and Multiplexing, The Public Switched Telephone Network and Cable Television, Internet over Cable

Unit – VI **Data Link Layer** **7 Hours**

Data Link Layer Design Issues, Sliding Window Protocol, Error Correction and Detection, Medium Access Control Sublayer, Carrier Sense Multiple Access Protocols.

Text Books

1. Mark A. Dye, Rick McDonald, Antoon W. Rufi, ‘Network Fundamentals, Cisco Press (2008)
2. Behrouz Forozoun , ‘Data Communications and networking’ McGraw Hill Education (5E)

Reference Books

1. Andrew S. Tannenbaum, David J. Weatherall ‘Computer Networks’, Pearson (5thedition), (2011)
2. Jim Kurose, Keith Ross “Computer Networking: A Top Down Approach ” Pearson (7th edition) (2016)

20IT 301L Data Structures Laboratory

Teaching Scheme:
Practical : 4 hours/week

Examination Scheme:
In-Semester : 25 Marks
Practical : 25 Marks
Credit : 2

Prerequisites: Fundamentals of Programming Language
Course Objectives:
Familiarize students with
1. Linear data structures to solve real world problems
2. Non-Linear data structures to solve real world problems
3. Hashing techniques
4. Debugging of different codes & detect logical errors

Course Outcomes:
Students should be able to
1. Make use of linear data structures to solve a given problem
2. Make use of nonlinear data structures to solve a given problem
3. Utilize appropriate hashing techniques to solve a given problem
4. Test the program for multiple inputs

Suggested List of Laboratory Assignments
The laboratory assignments are designed in a set of group A, B and C such that students will be able to design and implement solution for a given problem. The laboratory assignments of group A, B and C are to be implemented using JAVA object-oriented programming language. Group A assignments are mandatory. Group B assignment is mandatory & may be performed in a group of 2 to 4 students. Group C assignments are extra assignments.

Group A
1. Operations on set
   a) Use Java Collection Framework - Set - addAll (union), retainAll(intersection), removeAll(symmetric difference)
   b) Without using Java Collection Framework - union, intersection, difference, symmetric difference

2. Operations on linked list
   a) Use Java Collection Framework - LinkedList - add, add(index, element), addFirst, addLast, clear, get, getFirst, getLast, remove, removeFirst, removeLast
   b) SLL - Without using Java Collection Framework - add, add(index, element), addFirst, addLast, clear, get, getFirst, getLast, remove, removeFirst, removeLast, reverse
   c) DLL - Without using Java Collection Framework - add, add(index, element), addFirst, addLast, clear, get, getFirst, getLast, remove, removeFirst, removeLast, reverse

3. Operation on stack
   a) Use Java Collection Framework - Stack - push, pop, peek, empty
   b) Without using Java Collection Framework - Stack - push, pop, peek, empty - implement stack as ADT
   c) Using the stack ADT - implement expression conversion algorithms - infix_to_postfix, infix_to_prefix, postfix_to_infix, prefix_to_infix

4. Operations on queue
   a) Use Java Collection Framework - LinkedList - add, remove, poll, peek, element
   b) Use Java Collection Framework - PriorityQueue - add, remove, poll, peek, element
   c) Without using Java Collection Framework - add, remove, peek - implement queue as ADT
   d) Using the queue ADT - implement priority queue - patient treatment, vehicle traffic management

5. Operations on binary search tree
   a) Use Java Collection Framework - TreeMap
   b) Implement binary search tree and perform the following operations - Insert, Delete, Search, Display, mirror image, display level-wise

6. Construct an expression tree from a postfix expression and perform recursive and non-recursive traversals – inorder, preorder and postorder

7. Operation on hash table
   a) Use Java Collection Framework - HashMap
   b) Implementation of Hash table using array and handle collisions using Linear probing, without replacement without chaining, without replacement with chaining, with replacement without chaining, with replacement with chaining, chaining using linked list

Group B (Any 1)

Design a mini project which uses the different data structures with or without Java Collection Framework. Few suggested assignments:

1. Library management system
2. Blood bank management system
3. Student Attendance management system

Group C (Extra)

1. Implement Huffman coding
2. Implement Heap sort
3. Implement optimal binary search tree
4. Implement threaded binary tree

Text Books

1. R. Gilberg, B. Forouzan, “Data Structures: A pseudocode approach with C”, Cenage Learning

2. Cay S. Horstmann, “Big Java: Early Objects”, John Wiley

Reference Books

1. E. Horowitz, S. Sahani, “Fundamentals of Data Structures”, Computer Science Press
2. Robert Lafore, “Data Structures and Algorithms in Java”, Sams Publication
3. William J. Collins , “Data Structures and the Java Collections Framework”, John Wiley

20IT 303L Digital Electronics and Computer Architecture Laboratory

Teaching Scheme:
Practical: 2 hours/week

Examination Scheme:
In-Semester: 25 marks
Oral: 25 marks
Credits: 1

Prerequisites: Basic Electrical and Electronics Engineering
Course Objectives:
Familiarize students with
1. Basic digital Integrated Circuits (IC)
2. Analyze and Test basic digital circuits
3. Writing Assembly Language Program
4. Executing Assembly Language Program

Course Outcomes:
Students should be able to
1. Use appropriate IC's for designing simple digital circuits
2. Implement and test simple digital circuits for various inputs.
3. Use the processor instructions to write basic assembly language programs
4. Apply modular programming using assembly level language

Suggested List of Laboratory Assignments
1. Design (truth table, K-map) and implementation of 4 bit BCD & Excess 3 Adder using IC7483.
2. Implementation of logic functions using multiplexer IC 74153 & decoder IC 74138. (Verification, cascading & logic function implementation)
3. Design (State diagram, state table & K map) and implementation of 3 bit Up and Down synchronous Counter using master slave JK flip-flop IC 7476
4. Design and implementation of Mod 'n' counter with IC7490
5. Design (State Diagram, State Table, K Map) and implementation of Sequence Generator.
6. Write Assembly Language Program for addition and subtraction of two 8 bit numbers
7. Write Assembly Language Program for converting two digit BCD number to its equivalent HEX and vice- versa.
8. Write ALP to perform string operations like
    1. Find length of string
    2. Compare two strings
    3. Concatenation of two strings
    4. Reverse string

Text Books:

1. R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4
2. Douglas Hall, "Microprocessors and Interfacing, Programming and Hardware", McGraw-Hill, ISBN: 0–07–100462–9Book 2

Reference Books:

1. Malvino Leach, "Digital Principles and Applications", Tata Mc-Graw Hill,(5th Edition)
2. 8086 Intel Manual

Web References:

1. NPTEL Series: Digital Systems Design, Prof. Roychoudhary, IIT Kharagpur
2. NPTEL NOC:Microprocessors and Microcontroller, Prof. Santanu Chattopadhyay, IIT Kharagpur
3. NPTEL NOC:Microprocessors and Interfacing, Prof. Shaik Rafi Ahamed, IIT Guwahati

20IT 305L Object Oriented Analysis and Design Laboratory

Teaching Scheme:
Practical: 4 hours/week

Examination Scheme:
In-Semester: -- 25 Marks
Practical: 25 Marks
Credits: 2

Prerequisites: Fundamentals of Programming Language 2
Course Objectives:
Familiarize students with
1. Introduction of UML 2.0 diagrams
2. Class modeling of a system
3. State modeling of a system
4. Interaction modeling of a system

Course Outcomes:
Students should be able to
1. Construct class model from a given description of the system
2. Organize the class model in the form of class relationships
3. Build a state model from a given description of the system
4. Develop the code for the state model in an object oriented language
5. Interpret the given problem description as UML diagrams

Implement a mini project using the following steps as guidelines
1. Identify the classes, their attributes and methods for a given system
2. Convert the identified classes in the system to java code.
3. Identify the relationships among the classes, represent those relationships in a class diagram and code the class diagram into a java code
4. Inspect all the classes and identify whether an object of a class changes its state during its lifecycle, draw the state transition using the state diagram for that object
5. Convert the state transitions into java code
6. Inspect the methods of all the classes and show sequence of method calls to achieve a functionality in a sequence diagram
7. Convert the sequence diagram into a java code
8. Save the persistent data into a file and refine your code

Text Books
1. Michael Blaha, James Rumbaugh Object oriented modeling and Design with UML second edition, Pearson

Reference Books
1. Grady Booch, Object Oriented Analysis and Design with applications third edition, Adison Wesley Object Technology Series

20IT 401 Computer Networks

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: --

Examination Scheme:
In-Semester: 50 Marks
End-Semester:50 Marks
Credits: 3

Prerequisite: Network Fundamentals
Course Objectives:
Familiarize students with
1. Routing at the network layer.
2. TCP and UDP key functions at transport layer.
3. Congestion control, fairness and stability of the Internet.
4. Wireless Technologies.

Course Outcomes:
Students will be able to
1. Analyze with different routing protocols.
2. Analyze the usage of various protocols at transport layer
3. Recognize usage of various protocols at application layer
4. Design a LAN with a switch and router.

Unit – I: Internetworking **7 Hours**

Internetworking Basics, OSI Model, Data Encapsulation, Introduction to TCP/IP, the process/Application layer Protocols, The Host-to Host Layer Protocols. The Internet Layer Protocols, Internet Protocol.

Unit – II: Introduction to Routing and Packet Forwarding **7 Hours**

Inside the Router, CPU, NVRAM, Router Interfaces, Routers and the Network Layer, Command Line Interface Configuration and Addressing, Basic Router Configuration, Building the Routing Table, IP Routing, Path Determination and Switching Functions Protocols.

Unit – III: IP Routing **7 Hours**

Routing Basics, Distance vector routing Protocols, Link state routing protocols. Routing Information protocol, Enhanced Interior Gateway Routing Protocol, Open Shortest Path First. Virtual Local area Networks, Network address translation.

Unit – IV: Transport Layer **7 Hours**

Transport layer duties and functionalities, application expectations and IP delivery semantics.
UDP: UDP functionality, UDP Header.
TCP: TCP Features, byte-stream, Connection-oriented, TCP Header Format, 2-way, 3-way Handshake, TCP State Diagram, TCP Sliding Window, Congestion Control Algorithms: Leaky Bucket, Token Bucket, Congestion Avoidance. UNIX Sockets, M/M/1 queue analysis.

Unit – V: Application Layer **7 Hours**

Client/Server Model, Telnet, Domain Name System, File Transfer protocol: FTP, TFTP, HyperText Transfer Protocol, POP3, IMAP, SMTP, E-mail, MIME, Simple Network Management Protocol.

Unit – VI: Wireless Technologies **7 Hours**

Introduction to wireless internetwork, IEEE 802.11, Cellular Technology, WLAN, Internet of Things, Bring Your Own Device. Introduction to android OS.

Text Books:

1. Andrew S. Tennabaum, David J. Weatherall Computer Networks‟**,** Pearson (5th edition), (2011)
2. Behrouz Forouzan ,‟TCP/IP Protocol Suite‟, Mc-Graw Hill, (4th Edition) (2010)

Reference Books:

1. Theodore S. Rappaport, "Wireless Communications**",** Prentice Hall (2nd Edition) (2002)
2. Rick Graziani, Allan Johnson, Routing Protocols and Concepts **,** Cisco Press (2011)

20IT 402 Operating Systems

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: --

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Prerequisites: Data Structures
Course Objectives:
Familiarize students with
1. Basic functions and concepts of operating systems.
2. Mechanisms to handle processes and threads.
3. Principles of concurrency and deadlock.
4. Systems Programming Concepts

Course Outcomes:
Students should be able to
1. Explain concepts of operating system and basic shell scripting.
2. Apply concepts of memory management and file management techniques to solve different Operating Systems problems.
3. Apply appropriate process management and Inter Process Communication techniques to resolve various problems.
4. Explain basic concepts of Systems Programming.

Unit – I Introduction to Operating Systems **7 Hours**
Evolution of Operating Systems, Operating Systems Overview, OS structure, Functions of an OS: Program management, resource management, Protection and Security, PC Hardware and Booting, Shell Scripting, AWK, Sed

Unit – II Memory Management **7 Hours**
Logical Versus Physical Address Space, Swapping, Contiguous memory allocation, Non-contiguous memory allocation, Internal and external fragmentation, Segmentation, Paging, Structure of the Page Table
Virtual Memory: Demand paging, Prepaging, Thrashing, Page replacement algorithms, Translation look-aside buffer (TLB)

Unit – III Process Management **7 Hours**
Process concept, forking and exec, zombies, orphans, demons, context switching, wait, exit system calls, Scheduling: threads and scheduling algorithms, scheduling algorithms (FCFS, SJF, SRTF, Round robin, multilevel queues, feedback queues)
Linux schedulers – CFS

Unit – IV Inter Process Communication and Synchronization **7 Hours**
IPC, Critical Section, Race Condition, context switching, process related system calls, Critical Sections, Peterson's Solution, Bakery Algorithm, Test & Set, Spinlocks, Mutex, semaphores,

producer consumer, dining philosophers. Deadlocks: Ostrich algorithm, banker’s algorithm, deadlock prevention, deadlock detection and recovery

20IT 403 Database Management Systems

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: -

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Prerequisites: Data structures

Course Objectives:
Familiarize students with
1. Concepts and applications of database management.
2. Different models and normalization used for database design.
3. Query languages in databases.
4. Basic issues of database design and utilization.

Course Outcomes:
Students should be able to
1. Build appropriate database schema for the given application.
2. Apply normalization to database design.
3. Make use of query commands and concurrency control protocols.
4. Analyze business decisions related to Database information systems.

Unit – I: Introduction to DBMS **7 Hours**
Database Concepts, Database System Architecture, Data Models, entity, attributes, relationships, constraints, keys, E-R Model, conventions, EER Model, converting ER/EER diagram into tables. Relational Model, Attributes and Domains, Referential Integrities. Relational Algebra: Basic Operations

Unit – II: Relational Algebra and Calculus **7 Hours**
Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison

Unit – III: Database Design and SQL **7 Hours**
Database Design, Functional Dependency, Purpose of Normalization, Data Redundancy, Anomalies. Normal forms 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Introduction to SQL, SQL Data Types, DDL, DML and DCL queries, Views, Indexes, Null handling, Nested Queries. PLSQL. Query optimization

Unit – IV: Database Transactions **7 Hours**
Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability, Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules.

Unit – V: Advanced Database Architectures and Concurrency Control **7 Hours**
Database Architectures, Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Indexing and hashing, Parallel Databases, and Distributed Databases. Concurrency Control, Locking Methods, Deadlocks, Protocols, Recovery Methods

Unit – VI: Data Warehousing and Data Mining **7 Hours**

Data Warehousing, Architecture and features of Data Warehouse, ETL Process, OLAP. Data Mining, Knowledge Discovery, Data Mining techniques, Applications of data mining.

Text Books:

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN- 0-07-120413-X, Sixth Edition.
2. Ramez Elmasri, Shamkant B. Navathe**,** Fundamentals of Database Systems, Pearson Publication, ISBN-13: 978-0-136-08620-8

Reference Books:

1. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81- 317-6092-5.
2. C J Date, An introduction to Database Systems, Addition-Wesley.
3. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rd Edition, 2003.
4. Reema Thareja, Data warehousing, Oxford University Press. ISBN 0195699610.

20IT 404 Human Computer Interaction

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: 1 hours/week

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 4

Prerequisites: Object Oriented Technology.
Course Objectives:
Familiarize students with
1. Basic field of human-computer-interaction study
2. The concept of User centric approach.
3. Applications of human-computer-interaction to real life use cases.
4. Design of effective human-computer-interactions.

Course Outcomes:
Students should be able to
1. Identify the importance of HCI study and principles of User-Centered Design (UCD) approach.
2. Apply interaction design guidelines to a given application.
3. Analyze user interfaces for suggesting improvements.
4. Design prototypes for effective user-interfaces.

Unit – I Introduction 7 Hours
What is HCI? A discipline involved in HCI, Why is HCI study important? The psychology of everyday things, Principles of HCI, User-centered Design and Conceptual Models, Usability, Examples of good and bad HCI.

Unit – II Users and the Interaction 7 Hours
Human perception and memory, Thinking: Reasoning and Problem Solving, Human emotions and Psychology, Individual differences, Stages of action, Models of interaction, Ergonomics, Interaction styles, WIMP Interface, Interactivity, Context of interaction, Paradigms of Interactions.

Unit –III HCI Models 7 Hours
Cognitive models: GOMS Model, Hierarchical task analysis (HTA) model, Linguistic model, Physical and device models, Communication and collaboration models, Knowledge-based analysis.

Unit –IV HCI - Design Rules, Guidelines And Evaluation Techniques 7 Hours
Principles that support usability, Design standards, Design Guidelines, Golden rules, Using toolkits, User interface management System (UIMS), Goals of evaluation, Evaluation Criteria, Evaluation through expert analysis, Heuristics Evaluation through user participation, Choosing an Evaluation Method.

Unit – V HCI - Design Process 7 Hours

The process of design, Goal Directed Design Process, User focus, Scenarios, Navigation Design, Screen Design and Layout, Prototyping techniques, Wire-Framing, Model-View-Controller (MVC) Framework, Visual Interface Design.

Unit – VI Design of Applications 7 Hours

Multi-modal interaction, Website designing, Navigation design for websites, Evaluating a website, Designing for Mobiles, Evaluation for mobile computing, Socio-organizational issues and stakeholder requirements, Ubiquitous Computing with a case study like smart home.

Text Books

1. David Benyon “Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design”, Pearson Education Limited, Third Edition.
2. Alan Dix, “Human Computer Interaction”, Pearson Education. ISBN 978-81-317-1703-5.

Reference Books

1. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Pearson Education Limited, ISBN 978-1-292-03701-1.
2. Donald A. Norman, “The Design of Everyday Things Basic Books”, ISBN 978-0-465-07299-6.
3. Jeff Johnson, “Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines” Elsevier. ISBN 978-0-12-411556-9.
4. Alan Cooper, Robert Reimann, and Dave Cronin, “ About Face 3: The Essentials of Interaction Design”, Wiley Publishing, Inc.
5. Gerard Jounghyun Kim, “Human–Computer Interaction: Fundamentals and Practice” CRC Press. ISBN 978-1-4822-3390-2.
6. Helen Sharp, Jenny Preece, and Yvonne Rogers, “Interaction Design: Beyond Human-Computer Interaction”.

20IT 401L Computer Network Laboratory

Teaching Scheme:
Practical: 2 hours/week

Examination Scheme:
In Semester : 25 marks
Practical : 25 marks
Credit : 1

Prerequisites: Network Fundamentals.

Course Objectives:

Familiarize students with

1. Routing at the network layer and VLANS.
2. TCP and UDP key functions at transport layer.
3. Congestion control, fairness and stability of the Internet.
4. Wireless Technologies.

Course Outcomes:

Students will be able to

1. Configure router with different routing protocols (static and dynamic).
2. Implement a LAN with a switch and router.
3. Implement a VLAN.
4. Build a network.

Group A: Suggested List of Laboratory Assignments (any 5)

1. Build a small network and verify connectivity.
   a. Configure router.
   b. Configure Switch
2. Install Wireshark and view live network traffic with different filters.
3. Configure VLANs and Trunking
4. Configure DHCPv4
5. Socket program
6. Implement a wireless network.

Group B: Implement a mini project on any one of the following topics

1. Implement router-on-a-stick inter VLAN routing
2. Implement Ether channel
3. Implement DHCPv6 or IPv6 on a small network
4. Implement switch security configurations in VLANS.
5. Configure network devices with SSH.
6. Evaluate QoS of a network using NS2 simulation

Text Books

1. Rick Graziani, Allan Johnson, Routing Protocols and Concepts**,** Cisco Press (2011)

Reference Books

1. Andrew S. Tennabaum, David J. Weatherall**,** "Computer Networks**",** Pearson (5th edition), (2011)
2. Behrouz Forouzan , "TCP/IP Protocol Suite", Mc-Graw Hill, (4th Edition) (2010)

20IT 402L Operating Systems Laboratory

Teaching Scheme:
Practical: 4 hours/week

Examination Scheme:
In-Semester: 25 marks
Practical: 25 marks
Credits: 2

Prerequisites: Data Structures
Course Objectives:
Familiarize students with
1. Shell scripting and its importance.
2. Concepts of processes and threads.
3. Concurrency, Synchronization and deadlocks.
4. Basics of Unix commands.

Course Outcomes:
Students should be able to
1. Implement shell program.
2. Implement synchronized processes using multithreading concepts.
3. Apply the concept of deadlock in operating systems in implementation of multiprocessing environment.
4. Design solutions using IPC and synchronization.

Suggested List of Laboratory Assignments
1. Create two virtual machines using Type-2 hypervisor to understand basic virtualization concept.
2. Shell programming.
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
5. Write a C program to implement multithreading.
6. Implement producer-consumer problem using semaphores.
7. Write a C program to simulate the concept of Deadlock using Dining-Philosophers/ Banker's algorithm.
8. Write a C program to implement Inter Process Communication (shared memory or pipes or message queues).

Reference Books:

1. Neil Matthew, Richard Stones,"Beginning Linux Programming", 4th Edition, by Wrox Publication
2. Sumitabha Das, "UNIX, concepts and applications", 4th Edition, Tata McGraw-Hill Education
3. Robert Love, "Linux System Programming", 2nd Edition, O‟Reilly
4. Robert Love, "Linux Kernel Development", 3rd Edition, Pearson
5. Abraham Silberschatz, Pert B. Galvin, and Greg Gagne, "Operating System Concepts", 9th edition, Wiley-India edition

6. Andrew S. Tanenbaum, "Modern Operating Systems", 4th edition, PHI Learning Private Limited, New Delhi
7. William Stallings, “Operating Systems: Internals and Design Principles”, 8th edition, Pearson Education Limited

Other Resources:

1. https://www.vmware.com/support/ace/doc/setpol_vmconfig_ace.html
2. https://www.virtualbox.org/manual/ch01.html
3. https://homepages.uc.edu/~thomam/Intro_Unix_Text/Shell_Prog.html

20IT 403L Database Management Systems Laboratory

Teaching Scheme:
Laboratory: 4 hours/week

Examination Scheme:
In-Semester: 25 marks
Oral: 25 marks
Credits: 2

Prerequisites: Data structures
Course Objectives:
Familiarize students with
1. Implementation of fundamental concepts of database management
2. Use of database management systems.
3. SQL database system and PL/SQL
4. Accessing database using web application..

Course Outcomes:
Students should be able to
1. Make use of database language commands to create a database
2. Manipulate information using sql queries to retrieve useful information.
3. Apply PL/SQL for processing database
4. Use front end tools to design forms, reports and menus

Group A: Introduction to Databases (Study assignment)
1. Study of MySQL Open source software.
2. Discuss the characteristics like efficiency, scalability, performance and transactional properties
3. Install and configure client and server of MySQL.(Show all commands and necessary steps for installation and configuration)
4. Study of SQLite: What is SQLite? Uses of SQLite. Building and installing SQLite

Group B: SQL and PL/SQL (Minimum 6)
1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagrams for the system.
2. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
3. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string.
4. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Use group by and having clauses. Retrieve the data from the database based on time and date functions.
5. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (=some, >=some, <all etc.) and set cardinality (unique, not unique).
6. Write and execute suitable database triggers.
7. Write and execute PL/SQL stored procedure and cursor to perform a suitable task on the database.

Group C: Mini Project / Database Application Development

Student group preferably of size 4 students should decide the statement and scope of the project which will be refined and validated by the faculty. Choose database as per the requirement of the mini project. Draw and normalize the design up to an ER Diagram with normalization in case of back end as RDBMS. Design front end using any open source technology and perform connectivity to the database. Implement suitable database operations along with business logic, validations, reports etc.

Course Name	**Engineering Thermodynamics**	**L**	**T**	**P**
Course Code	**20ME302**	**2**	**1**	**-**
Pre-requisite	Engineering Physics, Engineering Mathematics, Engineering Chemistry	**Syllabus Version**		
		V:1.1		

Course Objectives:

To make students

1. To state and illustrate laws ofthermodynamics
2. To understand concept of entropy andavailability.
3. To get conversant with properties of steam, vapor processes and steamtrap.
4. To analyze the performance of various thermodynamicscycles.

Course Outcomes:

Students will be able to

1. Students will be able to apply laws of Thermodynamics to various processes.
2. Students will understand the concept of entropy and availability.
3. Students will gain the knowledge about steam properties and steamtrap.
4. Students will be able to do performance calculations for various thermodynamic cycles.

Unit :- 1	**Laws of Thermodynamics**	**6 hours**	**CO: 1**

First law of thermodynamics, second law of thermodynamics, zeroth law of thermodynamics. First law applied to closed system and open system, Second law of thermodynamics, Corollaries of Carnot theorem, Second law applied to heat engine, heat pump and refrigeration cycles.

Unit :- 2	**Entropy**	**4 hours**	**CO: 2**

Clausius Inequality, Entropy – a system property, Evaluation of entropy change for solids,

liquids and ideal gases, Principle of increase of entropy- entropy generation.

Unit :- 3	**Properties of Steam**	**5 hours**	**CO: 3**

Formation of steam, Properties of steam, First law applied to steam processes, Steam trap.

Unit :- 4	**Thermodynamic Vapour Cycles**	**5 hours**	**CO: 4**

Carnot cycle, Rankine cycle , Reheat and Regeneration

Unit :- 5	**Thermodynamic Gas Cycles**	**5 hours**	**CO: 4**

Otto cycle, Diesel cycle, Dual cycle

		Total Lab hours:	**25 hours**	

Text Books and Reference Books

1.	Principles of Engineering Thermodynamics- Moran, Shapiro, Boettner, Baily Eighth Edition, Wiley Publication.
2.	P. K. Nag, Engineering Thermodynamics, 5th Edition, Tata McGraw Hill Publications
3.	C.P. Arora, Engineering Thermodynamics, Tata McGraw Hill
4.	S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar, Thermal Engineering, DhanpatRai Publishers
5.	CengelandBoles,„Thermodynamics– AnEngineeringApproach‟,7thEdition,TataMcGrawHillPublication.
6.	Rayner Joel, “Basic Engineering Thermodynamics”, Addison Wesley Longman

Mechanical Engineering Department

Course Code	Machining and Machine Tool Operations (MMTO)	L	T	P
20ME303		**3**	**-**	**-**
Pre-requisite	None	**Syllabus Version**		
		V:1.1		

Course Objectives:

To make students

1. To familiarize with the basic concepts of machining science.
2. To acquaint with various single and multipoint cutting tools designing processes.
3. To make the students understand the economics of machining process

Course Outcomes:

Students will be able to

1. Identify different machining operation requirements for components considering economics of machining.
2. Select an appropriate single or multipoint cutting tool parameter to evaluate cutting force, power, tool life and surface finish for machining operation.
3. Apply features and applications of non-traditional machining processes.
4. Incorporate use of different locating and clamping devices for jigs and fixture design.
5. Understand the need of automation and its use in manufacturing.

Unit/Module: 1	**Machine tools**	**12 hours**	**CO: 1**
Material removing (turning, drilling and milling) & finishing processes (grinding, lapping, honing) process parameters, economics of machining			
Unit/Module: 2	**Metal Cutting Theory**	**10 hours**	**CO: 2**
Single and multipoint cutting tools (hobs and form tools), tool geometry and materials. Theory of chip formation in metal machining, force relationships and the merchant equation, power and energy relationships in machining, Tool life and tool wear.			
Unit/Module: 3	**Non-conventional machining processes**	**7 hours**	**CO: 3**
USM, WJM/WJAM, Chemical Machining, ECM, EDM, LBM, EBM, IBM process parameters and applications.			
Unit/Module: 4	**Jig & Fixture**	**6 hours**	**CO: 4**
Jig, fixtures types (basic and modular) and applications, design of jigs and fixtures.			

Unit/Module: 5	**Automation**	**7 hours**	**CO: 5**
CNC types, systems, codes, manufacturing automation (machining center, FMS).			
	Total Lecture hours:	**42 hours**	
Text Books:			
1.	Fundamentals of modern manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication.		
2.	Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.		
Reference Books:			
1.	Fundamentals of Metal Machining and Machine Tools, Third Edition by Winston A. Knight, Geoffrey Boothroyd, CRC press Taylor and Francis group.		
2.	Jigs and Fixture, P.H. Joshi, Tata McGraw-Hill		
3.	Metal Cutting Principles (2nd Edition), by Milton Clayton Shaw, Oxford University Press.		

Mechanical Engineering Department

Course Code	Strength of Material (SOM)	L	T	P
20ME304		**3**	**1**	**--**
Pre-requisites	Engineering Mechanics	**Syllabus Version**		
		V:1.1		

Course Objectives:

A. Define stresses, strains and elastic constants and evaluate the principal stresses and principal planes
B. Explain basic concepts of shear force and bending-moment.
C. Determine the maximum Bending and shear stress in a given beam.
D. Develop slope and Deflection equations for beams subjected to various loads.
E. Evaluate the buckling strength of columns and torsional strength of circular members

Course Outcomes (CO's):

Students will be able to

1. ***Evaluate*** principal stress and principal strain.
2. ***Draw*** SF and BM diagrams for various beams under different loading conditions.
3. ***Formulate*** the bending and shear stresses equations and be able to draw bending and shear stress diagrams.
4. ***Formulate*** slope and deflection equations for beams subjected to various loads.
5. ***Determine*** torsional strength and buckling strength.

Unit :1	Simple and Compound Stress and Strain	12 hours	CO: 1

Stress, strain, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, and Bulk Modulus. Interrelation between elastic constants, Stress-strain diagram, factor of safety. Stresses and strains in determinate and indeterminate, homogeneous and composite bars under concentrated loads and self-weight. Temperature stresses in simple members, Normal and shear stresses on any oblique plane. Concept of principal planes, derivation of expression for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear. Graphical solution using Mohr's circle of stresses. Principal stresses in shaft subjected to torsion, Bending moment and axial thrust Concept of equivalent torsion and bending moments

Theories of Elastic Failure :-Maximum Principal Stress Theory, Maximum shear stress theory, Maximum distortion Theory, Maximum Strain theory

Unit : 2	Shear Force and Bending Moment Diagrams	8 hours	CO: 2

Shear force and bending moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple, Relationship between rate of loading, shear force and bending moment. Maximum bending moment and position of points of contra flexure.			
Unit : 3	**Bending and Shear Stresses in Beams**	**8 hours**	**CO: 3**
Bending stresses : Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections (rectangular, I,T,C) with respect to centroidal and parallel axes, bending stress distribution diagrams, moment of resistance and section modulus. **Shear stresses:** Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, maximum and average shears stresses, shear connection between flange and web.			
Unit : 4	**Slope and Deflection of Beams.**	**7 hours**	**CO: 4**
Relation between bending moment and slope, slope and deflection of determinate beams, double integration method (Macaulay's method), derivation of formula for slope and deflection for standard cases.			
Unit : 5	**Torsion and Buckling.**	**7 hours**	**CO: 5**
Torsion of circular member: Stresses, strain and deformations in determinate shafts of solid and hollow, homogeneous and composite circular cross section subjected to twisting moment, derivation of torsion equation, stresses due to combined torsion, bending and axial force on shafts. **Buckling of columns:** Concept of buckling of columns, derivation of Euler's formula for buckling load for column with hinged ends, concept of equivalent length for various end conditions, safe load on columns			
	Total Theory Lecture hours:	**42 hours**	

Tutorial Assignments

1.	Solving numerical on simple stress and strains
2.	Analytical and Graphical Solution (Mohr's Circle) for compound stresses.
3.	Drawing SFD and BMD for standard beam and loading conditions.
4.	Determine bending stresses and shear stresses in the beam.
5.	Finding slope and deflection at various locations for standard beam and loading conditions.
6.	Determination and Graphical representation using Python. ***(Any One)*** *a) Determine Principal Stresses, Maximum shear stresses and their locations by plotting Mohr's Circle using Python.* *b) Plot SFD and BMD for a given beam using Python.*

	c) Find Bending/Shear Stresses and plot Bending/Shear Stress distribution using Python.
Text Books:	
1.	Strength of Materials S. Ramamrutham, Dhanpat Rai Pvt. Ltd.
2.	Elements of Strength of Materials, Timoshenko and Young Affiliated East West Press.
3.	Mechanics of Materials S. S. Rattan, TMH Pvt. Ltd.
4.	Mechanics of Structures S. B. Junnarkar, Charotar Publication
5.	S.S Bhavikatti,"Strength of Materials", Third Edition Vikas Publishing house Pvt Ltd, New Delhi.
Reference Books:	
1.	Mechanics of Materials, by Russell C. Hibbeler
2.	Introduction to Mechanics of Solids - by E.P. Popov, Prentice Hall Publication.
3.	Singer and Pytel - Strength of materials - Harper and row Publication.
4.	B.K. Sarkar - Strength of Material - Tata McGraw Hill New Delhi.
5.	Beer and Johnston - Strength of materials - CBS Publication.

Mechanical Engineering Department

Course Code	Computer Aided Machine Drawing (CAMD)	L	T	P
20ME305L		-	-	4
Pre-requisite	Engineering Graphics	Syllabus Version		

Course Objectives:

To make students

1. Conversant with conventional representation of common features and standards
2. Understand the basics of projections and dimensioning techniques
3. Aware of drawing the threaded fasteners and riveted joints
4. Understand the use of dimensional and geometrical tolerances
5. Accustomed to the use of 3-D modeling software
6. Aware of 3-D printing technology

Course Outcomes:

Students will be able to

1. Interpret machine components and represent it through IS conventions
2. Understand the conventional methods of representing threaded fasteners and riveted joints
3. Apply tolerances of size, forms & positions
4. Create 3-D part and assembly model of mechanical system
5. Create manufacturing drawing with all the details
6. Create components using 3-D printing machine

Unit/Module: 1	Conventional Representation	2 hours	CO: 1

Need of graphical language, importance of machine drawing, drafting equipment (from instrument to current software). Principles of drawings: BIS conventions, ISO standards, IS conventions of springs, gear, shaft, pipe, bar, washer, knurling, array of holes, ratchet and pawl angle etc.

Unit/Module: 2	Basics of Projections and dimensioning	2 hours	CO: 5

Projections– dimensioning, relative position of views.

Sectioning– Cutting planes and section, hatching lines, half sections, aligned sections, offset sections, sectioning revolved, removed sections, local sections.

Dimensioning– principle of dimensioning, dimensioning of common features e.g. diameter, radii, chords, arcs, angles, countersunk, counter drilled holes, counter-bore holes, chamfered and countersunk holes on curved surfaces, spot faces, chamfers, tapered features. Addition of letters and symbols, special indications.

Unit/Module: 3	Threaded Fasteners and Riveted joints	2 hours	CO: 2

Threaded Fasteners– Different screw threads, metric and BSW threads, Square thread and multi start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts. **Locking devices–** lock nut-castle nut-Studs-Tap bolt-Machine screws washers- Keys-sunk key-Gib head key. (For a given standard diameter with proportions). **Riveted joints–** Forms and proportions of river heads, Different views of different types of riveted Lap and Butt joints.			
Unit/Module: 4	**Limit, fits, tolerances and Geometrical dimensioning and tolerancing**	**4 hours**	**CO: 3**
Limits, fits and tolerances– tolerancing and limit systems, symbols for tolerances, deviation and fits, method of tolerancing, tolerance grade, fits- system of fits, classification of fits, selection of fits, methods of indicating fits on drawing. **Geometrical tolerance–** Need, geometrical characteristics of symbols, characteristics (such as straightness, flatness, circularity, cylindricity, etc) its symbols and interpretations.			
Unit/Module: 5	**Part Modelling**	**12 hours**	**CO: 4**
Parametric solid modeling - fundamentals, transform the parametric 2-D sketch into a 3D solid, feature operations, Free form feature modeling, design by features, feature recognition.			
Unit/Module: 6	**Assembly Modelling**	**14 hours**	**CO: 4**
Defining relationship between various parts of machine, creation of constraints, and generation of exploded view. Animation of the motions of assembly.			
Unit/Module: 7	**Production Drawing**	**10 hours**	**CO: 5**
Generation of manufacturing drawing from parts and assembly 3-D model with representation of appropriate dimensioning and tolerancing.			
Unit/Module: 8	**Introduction to 3-D printing**	**6 hours**	**CO: 6**
Introduction to use of 3-D printing technology for manufacturing of a component.			
	Total Lab hours:	**52 hours**	

Lab Work

1.	Assignment on drawing IS conventions, threaded fasteners and riveted joints using the basics of projections and dimensioning rules. (to be completed manually)
2.	Assignment on solid modeling of a machine component. (minimum 10 machine components)
3.	Assignment on parametric solid modeling of a machine component using various commands and features of the software. (minimum 2 machine components)
4.	Assignment on assembly modeling using proper mating conditions and generation of exploded view. (minimum 5 assemblies)
5.	Assignment on creating production drawing with the limit, fits and tolerance representation.
6.	Design and Manufacturing of an assembly (4-5 components) using 3-D printing.

Text Books:

1.	N. D. Bhat, “Machine Drawing”, Charotor publishing house, Bombay.
2.	R. K. Dhavan, “Machine Drawing”, S. Chand and Company.
3.	N. D. Junnarkar, “Machine Drawing”, Pearson Education.
4.	IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
5.	IS: 696- Code of practice for general engineering drawing B.I.S. Publications.
6.	IS: 2709- Guide for selection of fits, B.I.S. Publications.
7.	IS: 919- Recommendation for limits and fits for Engineering, B.I.S. Publications.
8.	IS: 8000- Part I, II, III, IV, geometrical tolerancing of technical drawing – B.I.S. Publications
Reference Books:	
1.	P. S. Gill, “A textbook of Machine Drawing”, revised edition, K Kataria and Sons, New Delhi, 2008, ISBN 81-85749-79-5.

Course Code	Engineering Metallurgy Lab (EM-L)	L	T	P
20ME301L		-	-	2
Pre-requisite	Engineering Physics, Engineering Chemistry, Engineering mathematics	Syllabus Version		
		V:1.1		

The assessment will consist of two components:

1. Evaluation for performing practical and attending demonstrations in predefined closed system of lab instructions (Demonstration and exercise type of lab activity: **5 marks**)
2. Task based performance (Structured enquiry type and open ended enquiry type of lab activity: **20 marks**)

Course Objectives:

Course prepares students to

1. To provide first-hand experience of facilities for materials property testing and treating.
2. To provide an understanding of structures in material and their relation to properties

Course Outcomes:

Students will be able to.

1. Implement safety measures required in the laboratory
2. Measure mechanical properties and propose testing method for mechanical properties considered in design, quality assurance and servicing of engineering components
3. Inspect components for materials integrity using equipment's in the laboratory.
4. Identify the phases in metals and alloys and measure grain size using metallography techniques to provide interpretation of microstructures and prepare a laboratory report.
5. Specify metals and alloys and find equivalents using standards.
6. Modify properties of steel by modifying microstructure using different heat treatments

Unit/Module: 1	Laboratory safety:	2 hours	CO: 1
Introduction to laboratory and safety			
Unit/Module: 2	**Mechanical Property measurement:**	**6hours**	**CO: 2**
Tension, hardness and Impact tests.			
Unit/Module: 3	**Inspection of Components:**	**2 hours**	**CO: 3**

Non destructive test			
Unit/Module: 4	**Metallography:**	**6 hours**	**CO: 4**
Study of microstructures of ferrous and non ferrous metals and alloys			
Unit/Module: 5	**Metals and alloys specification:**	**2 hours**	**CO: 5**
Study and use standards for specification of metals and alloys.			
Unit/Module: 6	**Modification of material properties:**	**6 hours**	**CO: 6**
Heat treatment of metals and alloys			
	Total Lecture hours:	**24 hours**	

Text Books:

3.	Callister's Material Science and Engineering", W.D. Callister, D.G.Rethwisch, Wiley, 2016, Second edition.
4.	Materials engineering, science, processing and design, Michael Ashby, Hugh Shercliff, David Cebon, Butterworth-Heineman, 2008

Reference Books:

1.	"Properties of Engineering materials", R.A. Higgins, ELBS, Edward Arnold, 1988.
2.	"Material Science & Engineering." Raghavan V., Prentice Hall of India, New Delhi. 2003
3.	"Material selection in mechanical design', Michael Ashby, Butterworth-Heinemann, 3/e, 2005
4	An Introduction to properties, Applications and design, Third edition, Ashby and Jones, Butterworth Heinemann.
5.	Relevant ISO and Indian standards

Mechanical Engineering Department

Course Code	Machining and Machine Tool Operations Lab (MMTO)	L	T	P
20ME303L		-	-	2
Pre-requisite	None	Syllabus Version		
		V:1.1		

Course Objectives:

To make students

1. To familiarize with the basic concepts of machining science.
2. To acquaint with various single and multipoint cutting tools designing processes.
3. To make the students understand the economics of machining process

Course Outcomes:

Students will be able to

1. Identify different machining operation requirements for components considering economics of machining.
2. Select an appropriate single or multipoint cutting tool parameter to evaluate cutting force, power, tool life and surface finish for machining operation.
3. Apply features and applications of non-traditional machining processes.
4. Understand the need of automation and its use in manufacturing.

Lab Work

1.	Demonstration of physical hazards, safety and precautions.
2.	Experimental studies on the cutting tool angle measurement.
3.	Machining of mechanical components using CNC machine (Lathe/Mill/HMC/VMC). Manufacturing drawing with appropriate geometrical and dimensional tolerances, detailed process planning to be included.
4.	Composite job machining involving minimum four operations, employing operations on lathe/CNC, precision turning, screw cutting, boring etc.
5.	Cutting Force in Turning Process-an Experimental Approach by using dynamometers.
	Total Lab hours: **22 hours**

Text Books:

1.	Fundamentals of modern manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication.
2.	Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.

Reference Books:	
1.	Fundamentals of Metal Machining and Machine Tools, Third Edition by Winston A. Knight, Geoffrey Boothroyd, CRC press Taylor and Francis group.
2.	Jigs and Fixture, P.H. Joshi, Tata McGraw-Hill
3.	Metal Cutting Principles (2nd Edition), by Milton Clayton Shaw, Oxford University Press.

S.Y. B. Tech. Mechanical

20ES401 Elements of Electrical and Electronics Engineering

Teaching Scheme
Lectures: 3 Hrs/week
Tutorial :1 Hr/week

Examination Scheme
In Sem : 50 Marks
End Sem :50 Marks
Total Credit: 04

Prerequisites:

- 20ES01 Basic Electrical and Electronics Engineering

Course Objectives:

- To study principle of operation of DC machines and speed control of DC motors
- To understand three phase induction motor working and its applications
- To study Electrical drive system required to drive machines
- To get acquainted with Electric Vehicle (EV) technology and subsystems
- To understand Arduino IDE; an open source platform and its basic programming features
- To interface Atmega328 based Arduino board with different devices and sensors

Course Outcomes:

At the end of this course students will demonstrate the ability to:

- Describe the working principle, characteristics and applications of D.C motor and Induction motor.
- Apply fundamental speed control methods of D.C motor and Induction motor.
- Describe different electrical drive systems and explain emerging technology of Electric Vehicle (EV)
- Explain Microcontroller Architecture of ATMega328 and Arduino IDE
- Interface external peripherals and sensors to ATMega328

Theory Course Contents:

Unit-I: DC Machines (06)

Construction, working principle of DC Machine, emf equation of DC Machine. Working principle of DC motor. Types of DC motor, back emf, torque equation for DC motor, characteristics of DC motor (series, shunt and compound), Braking of D.C. Motor, methods for speed control of DC shunt and series motors, Industrial applications.

Unit - II: Three phase Induction Motor (06)

Constructional feature, working principle of three phase induction motors, types, torque equation, torque slip characteristics, power stages and efficiency. Types of starters, Braking of induction motor, methods of speed control & Industrial applications.

Unit - III: Electrical Drives and Introduction to Electric vehicles (06)

Electrical Drives: Advantages of Electrical Drives, Parts of electrical drives, choice of electric drive, Status of ac and dc drives, Brush less dc motor drives, stepper motor drives, synchronous motor variable speed drive.

Introduction to electric vehicles: Brief history of Electric Vehicle (EV), Components of EV, Benefits of EV Types of EVs such as Battery EV, Hybrid EV, Plug-in EV, Fuel Cell EV and their comparison, Challenges faced by EV technology

Unit IV: Introduction to Microcontrollers (06)

Introduction to microcontroller and microprocessors, role of embedded systems, open source embedded platforms, Atmega 328P-features, architecture, port structure, sensors and actuators, data acquisition systems, introduction to Arduino IDE- features, IDE overview, programming concepts: variables, functions, conditional statements.

Unit V: Peripheral Interface - 1 (06)

Concept of GPIO in Atmega 328P based Arduino board, digital input and output, UART concept, timers, interfacing with LED, LCD and keypad, serial communication using Arduino IDE

Unit VI: Peripheral Interface – 2 (06)

Concept of ADC in Atmega 328P based Arduino board, interfacing with temperature sensor (LM35), LVDT, strain gauge, accelerometer, concept of PWM, DC motor interface using PWM

Text Books:

1. Electrical Machines-D P Kothari and I J Nagrath, Tata McGraw Hill ,Third Edition
2. Electrical Machinery-S.K. Bhattacharya, TTTI Chandigad
3. Fundamentals of Elecrical drives-G K Dubey
4. Ajay Deshmukh-Microcontrollers Theory and Applications, TATA McGraw Hill
5. Arduino microcontroller processing for everyone -Steven F Barret,Morgan and Claypool Publisher.
6. C programming with ardino - Warwick Smith Elektor Publication
7. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press
8. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, 2nd Ed, CRC Press

Reference Books:

1. Electrical Technology- Vol I & Vol II- B. L.Theraja, S Chand Publication Co Ltd.
2. Electrical Technology-Edward Hughes, Pearson Education.
3. Electrical Machines by Ashfaq Husain, Dhanpat Rai & Sons.
4. The 8051 Microcontrollers - Architecture, Programming and Applications by K. J. Ayala,Penram International Publishing(I) Pvt Ltd.
5. Started with Arduino by Massimo Banzi and Michael Shiloh Published by Maker Media, Inc.
6. Getting Started With Arduino: A Beginner's Guide by by Brad Kendall (Author), Justin Pot (Editor), Angela Alcorn (Editor)
7. Arduino Cookbook, 2nd Edition by Michael Margolis published by O'Reilly Media.

Application notes from “ATMEL micro controller data book.

List of Tutorials:

Name of the Tutorial

1 Introduction to Microprocessors and Microcontrollers
2 Case studies on Embedded Systems and Applications.
3 Interfacing of LED with Arduino UNO to observe different patterns of LEDs.
4 Interfacing of LCD with Arduino UNO to display the messages.
5 Display data using serial communication using Arduino UNO.
6 Interfacing of Temperature Sensor LM35 to display temperature.
7 Speed control of DC Motor.
8 Speed control of Induction Motor.

Mechanical Engineering Department

Course Code	Analysis and Synthesis of Mechanisms	**L**	**T**	**P**
20ME401		**2**	**1**	**0**
Pre-requisite	Engineering Mechanics	**Syllabus Version**		
		V:1.1		

Course Objectives:

To make students

1. To understand the fundamentals of Mechanisms.
2. To understand analysis of mechanisms by analytical and graphical methods.
3. To understand dimensional synthesis of mechanisms by analytical and graphical methods.
4. To understand the kinematics of Gears and Gear Trains.
5. To understand fundamentals of friction

Course Outcomes:

Students will be able to

1. Identify the nature of kinematic pair, chains and Mechanism.
2. Construct and analyze velocity and acceleration of Simple mechanism by analytical and graphical method.
3. Do dimensional synthesis of mechanisms by analytical and graphical methods.
4. Evaluate Speed ratio, Torque etc. for Gear and Epi-cyclic Gear train.
5. Fundamentals of Friction.

Unit :- 1	**Fundamentals and Types of Mechanisms**	**6 hours**	**CO: 1**

Kinematic Link, types of links, kinematic pair, types of constrained motion, types of kinematic Chains, types of joints, mechanism , machine, degree of freedom, Kutzbach criterion, Grubler's criterion, Grashoff's law, four bar chain and its inversion, Slider crank and its inversion, double slider crank and its inversion, straight line mechanism, Peaucellier Mechanism, Scott Rusell Mechanism, Grasshopper Mechanism, Watt Mechanism. Steering Gear Mechanism, Condition for correct steering, Davis and Ackermann Steering Gear Mechanism.

Unit :- 2	**Displacement, Velocity, and Acceleration Analysis of Mechanism**	**8 hours**	**CO: 2**

Kinematics of Rigid Bodies: Types of motions, position velocity and acceleration.
Graphical Method-velocity and acceleration polygons for simple mechanisms as well as for the mechanisms involving the Coriolis component of acceleration. ICR Method.

Unit :- 3	**Dimensional Synthesis of Mechanism-Analytical and Graphical Method**	**6 hours**	**CO: 3**
Introduction to Synthesis of Mechanism-Type, number and dimensional synthesis, task of dimensional synthesis, path, function and motion generation(body guidance), precision positions, Chebychev spacing, Mechanical and structural errors. Graphical Method: Two and three position synthesis of four bar and slider crank mechanisms. Analytical Method: Three position synthesis of four bar mechanism using Freudenstein's Equation.			
Unit :- 4	**Kinematics of Gear and Gear Train**	**6 hours**	**CO: 4**
Gear Terminology, law of gearing, forms of teeth, path of contact, arc of contact, Number of pairs of teeth in contact (contact ratio), Interference in involute gears, minimum number of teeth's, terminology in helical gear, Gear Train: types of gear train, Analysis of Epicyclic Gear train.			
Unit :- 5	**Friction**	**4 hours**	**CO: 5**
Laws of Dry Friction, Greasy Friction , film friction, Coefficient of friction, limiting angle of friction, Friction in turning pair, friction circle, , Friction axis of link.			
	Total Theory Lecture hours:	**30 hours**	
Tutorial Assignments			
1.	Fundamentals of Mechanisms and Degree of Freedom of Mechanism		
2.	Mechanisms and Its Inversions		
3.	Planar Kinematics of Rigid body		
4.	Planar Kinematics of Rigid body		
5.	Displacement Analysis of Mechanism: Analytical and Graphical Method		
6.	Velocity and Acceleration Analysis of Mechanism: Analytical and Graphical Method		
7.	Dimensional Synthesis of Mechanism analytical method		
8.	Kinematics of Gears		
9.	Analysis of Epicyclic Gear Train		
Text Books:			
1.	S.S.Rattan, Theory of Machines, Tata McGraw Hill		
2.	Asok Kumar Mallik, Amitabha Ghosh, and Gunter Dittrich. Kinematic analysis and synthesis of mechanisms. CRC Press, 1994.		
Reference Books:			
1.	Thomas Bevan, 'Theory of Machines' CBS Publisher and Distributors, Delhi		

2.	Hartenberg, Richard Scheunemann, and Jacques Denavit. ‘Kinematic Synthesis of linkages’. McGraw-Hill, 1964.
3.	Shiley J. E. and Uicker J.J. , ‘Theory of Machines and Mechanism’, McGraw Hill Inc
4	Ashok G. Ambekar, ‘Mechanisms and Machine Theory’, Prentice Hall,India
5.	Sadhu Singh, ‘Theory of Machines’, Pearson
6.	Hall A. S. ‘Kinematics and Linkage Design’,Prentice Hall
7.	Wilson C.E.,Sandler J.P. ‘Kinematics and Dynamics of Machinery’, Pearson Education
8.	ErdmanA.G. and Sandor G. N. ‘Mechanism Design, Analysis and Synthesis Vol-I, Prentice Hall

<table>
<tr><td>Course Name</td><td colspan="2">Fluid Mechanics</td><td>L</td><td>T</td><td>P</td></tr>
<tr><td>Course Code</td><td colspan="2">20ME402</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>Pre-requisite</td><td colspan="2">Engineering Physics, Engineering Mathematics</td><td colspan="3">Syllabus Version</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3">V:1.1</td></tr>
<tr><td colspan="6">Course Objectives:</td></tr>
<tr><td colspan="6">To make students
1. Applying the mass conservation principle, to engineeringproblems.
2. Applying the momentum and energy equations to engineeringproblems.
3. Evaluating head loss in pipes andconduits.
4. Introduction to formation of boundary layer, drag and lift concept associated withit</td></tr>
<tr><td colspan="6">Course Outcomes:</td></tr>
<tr><td colspan="6">Students will be able to
1. Apply mass conservation principle to the given system.
2. Understand energy conservation principle for fluidflow.
3. Calculate the pressure drop for a given system.
4. Explain the boundary layer formation on the flatplate.</td></tr>
<tr><td>Unit :- 1</td><td>Fundamental Concepts of Fluid Flow</td><td colspan="2">2 hours</td><td colspan="2">CO: 1</td></tr>
<tr><td colspan="6">Fundamental definitions, Flow characteristics, Classification of fluids, Fluid properties</td></tr>
<tr><td>Unit :- 2</td><td>Flow Kinematics</td><td colspan="2">4 hours</td><td colspan="2">CO: 1</td></tr>
<tr><td colspan="6">Equations for acceleration, Continuity equation, Irrotational and rotational flow, Potential and stream functions.</td></tr>
<tr><td>Unit :- 3</td><td>Integral Analysis of Fluid Flow</td><td colspan="2">6 hours</td><td colspan="2">CO: 2</td></tr>
<tr><td colspan="6">Finite control volume analysis (Reynolds Transport Theorem) , Euler and Bernoulli‟s theorems,

Applications, Venturi and Orifice meter, Pitot Tube</td></tr>
<tr><td>Unit :-4</td><td>Pipe Flows</td><td colspan="2">5 hours</td><td colspan="2">CO: 3</td></tr>
<tr><td colspan="6">Types of flow, Reynolds experiment, Laminar flow between parallel plates, Laminar flow in pipes, Turbulent flow in pipes. Darcy-Weisbach equation, Moody diagram, Energy losses in pipelines, Minor losses.</td></tr>
</table>

Unit :- 5	**Differential Analysis of Fluid flow**	**6 hours**	**CO: 2,3**
Introduction to Navier- Stokes equations, Exact solutions for simple cases of flow, Plane Poiseuille flow (Pipe and Channel), Coutteflow,Flow on inclined plane			
Unit :- 6	**Flow past immersed Bodies**	**2 hours**	**CO: 4**
Concepts of boundary layer, Drag and lift on immersed bodies.			
	Total Lab hours:	**25 hours**	

Text Books:

1.	Munson, Okiishi, Young, „Fluid Mechanics", 7th Ed, Wiley, 2016.
2.	Cengel, Cimbala, „Fluid mechanics", Tata Mcgraw hill publishing

Reference Books:

1.	Gupta and Gupta, „Fluid Mechanics", 3rd Ed, New Age publications, 2016.
2.	Kundu, Cohen, Dowling, „Fluid Mechanics", Elsevier India
3.	K. Muralidhar, G. Biswas, „Advance Fluid Mechanics", 3rd Edition, Narosa Publishing House
4.	Fox, Mcdonald, „Fluid Mechanics", 8th Edition, Wiley.

Mechanical Engineering Department

Course Code	Casting, Forming and Joining Processes (CFJP)	L	T	P
20ME403		**3**	**-**	**-**
Pre-requisite	Machining and Machine Tool Operations	**Syllabus Version**		
		V:1.1		

Course Objectives:			
To make students 1. To study basic production processes 2. To study how to select appropriate production processes for a specific application			
Course Outcomes:			
Students will be able to 1. Understand basics of manufacturing, elements of casting, construction of pattern, gating system, different types of casting method and their application. 2. Various welding technologies' fundamentals should be recognized, analyzed, and configured. 3. Analyze principles and working of different forming processes such as sheet metal working, forging, rolling and extrusion. 4. Identify different machining operation requirements for non-metal components.			
Unit/Module: 1	**Metal Casting Processes**	**9 hours**	**CO: 1**
Dispensable and permanent mould processes, Analysis of melting, pouring and solidification phenomena, design of pattern, core, feeder and gating system, Casting defects and inspection.			
Unit/Module: 2	**Joining Processes**	**9 hours**	**CO: 2**
Introduction, Fusion and solid-state welding, Brazing and soldering, Weld joint design, cooling rate, and joint properties, Heat affected zone, Friction stir welding, reduced pressure EB welding, Metal to composite joining, Welding defects and inspection			
Unit/Module: 3	**Bulk Deformation**	**9 hours**	**CO: 3**
Plastic deformation and yield criteria, bulk deformation, cold versus hot working. Analysis (load and force estimation) and defects in deformation processes forging, rolling, drawing and extrusion.			
Unit/Module: 4	**Sheet Metal forming**	**8 hours**	**CO: 3**
Sheet metal shearing, deep drawing, bending and their applications, drawing ratio, forming limit			

<table>
<tr><td colspan="5">diagram and analysis</td></tr>
<tr><td colspan="2">Unit/Module: 5</td><td>Polymer Processing and sustainable manufacturing</td><td>7 hours</td><td>CO: 4</td></tr>
<tr><td colspan="5">Polymer basics, Injection molding process and analysis, Compression molding, Blow molding, Introduction to composite manufacturing, Environmental impact in Micro-device manufacturing, cutting tool sustainability, MQL in Machining.</td></tr>
<tr><td colspan="2"></td><td>Total Lecture hours:</td><td>42 hours</td><td></td></tr>
<tr><td colspan="5">Text Books:</td></tr>
<tr><td>1.</td><td colspan="4">Fundamentals of modern manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication</td></tr>
<tr><td colspan="5">Reference Books:</td></tr>
<tr><td>1.</td><td colspan="4">Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.</td></tr>
<tr><td>2.</td><td colspan="4">Mechanical Engineers' Handbook, Volume 3: Manufacturing and Management, Myer Kutz, Wiley.</td></tr>
<tr><td>3.</td><td colspan="4">Manufacturing processes Vol. 1 and 2, P. N. Rao, Tata McGraw-Hill.</td></tr>
</table>

Mechanical Engineering Department

Course Code	Machine Design	L	T	P
20ME404		**3**	**1**	**-**
Prerequisite	Strength of machine elements (S.O.M.)	**Syllabus Version**		
		V:1.1		

Course Objectives:

To make students

1. To design simple machine elements subjected to static loads.
2. To compute the torque transmission capacity by the given power screw.
3. To analyze the machine elements subjected to fluctuating loads.
4. To apply A.S.M.E. code for shaft design.
5. To calculate the size of a mechanical joint, subjected to eccentric load.
6. To determine the spring dimensions for given requirement.

Course Outcomes:

After successful completion of the course, student will be able to

1. design simple machine elements subjected to static loads.
2. compute the torque transmission capacity by the given power screw.
3. analyze the machine elements subjected to fluctuating loads.
4. apply A.S.M.E. code for shaft design.
5. calculate the size of a mechanical joint, subjected to eccentric load.
6. compute the spring dimensions for given requirement.

Unit/Module: 1	Introduction to design engineering	4 hours	CO: 1

Phases and interactions in design process, design considerations, design tools and resources, design engineer's professional responsibilities, standards and codes, economics aspects.

Unit/Module: 2	Design against static load	6 hours	CO: 1

Modes of failures, combined stresses, principal stresses, failure theories and their selection, design of simple machine elements subjected to static loading.

Unit/Module: 3	Design against fluctuating load	6 hours	CO: 3

Fatigue failure, endurance limit and its modifying factors, endurance strength, design for infinite and finite life for completely reversed and fluctuating loads.

Unit/Module: 4	Design of machine elements-I: Transmission Shafts	6 hours	CO: 4

Shaft design based on strength, deflection considerations, torsional and lateral rigidity, ASME code for shaft design, critical speed of shafts, design of keys and splines.

Unit/Module: 5	Design of machine elements-II: Mechanical Springs and Power Screws	6 hours	CO: 2,6
Stress and deflection analysis of helical springs, design for static and fatigue loading, springs in combination, leaf springs. Torque analysis of power screws, standard threads, thread and collar friction, efficiency and stresses in power screws.			
Unit/Module: 6	**Design of machine elements-III: Mechanical Joints**	**6 hours**	**CO: 5**
Bolts of uniform strength, fastener stiffness and member stiffness, threaded joints subjected to axial loading and eccentric loading in different planes. Strength of butt and fillet welded joints in torsion and bending, sizing of welded joints subjected to direct and eccentric loads.			
	Total hours:	**34 Hours**	

Text Books:

1.	Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Publication Co. Ltd
2.	Spotts M.F. and Shoup T.E. ,"Design of Machine Elements" ,Prentice Hall International.
3.	Black P.H. and O. Eugene Adams ,"Machine Design",McGraw Hill Book Co. Inc.
4.	Willium C. Orthwein,"Machine Components Design",West Publishing Co. and Jaico Publications House.
5.	"Design Data",P.S.G. College of Technology, Coimbatore.
6.	Juvinal R.C,"Fundamentals of Machine Components Design",John Wiley and Sons.
7.	Hall A.S., Holowenko A.R. and Laughlin H.G,"Theory and Problems of Machine Design" , Schaum's Outline Series.
8.	Michael Nikowitz, 'Advanced Hybrid and Electric Vehicles, System Optimization and Vehicle Integration', Springer International Publishing Switzerland 2016.
9.	Iqbal Husain, 'Electric and Hybrid Vehicles, Design Fundamentals', CRC PRESS.

Reference Books:

1.	Bhandari V.B ,"Design of Machine Elements", Tata McGraw Hill Publication Co. Ltd.

Mechanical Engineering Department

Course Code	**Design Lab (ASM & SOM-L)**	**L**	**T**	**P**
20ME405L		**-**	**-**	**2**
Pre-requisite	Analysis and Synthesis of Mechanism, and Strength of Materials	**Syllabus Version**		
		V:1.1		

Course Objectives:

To make students

1. To understand the fundamentals of Mechanisms for Practical Application.
2. To understand dimensional synthesis of mechanisms by graphical methods
3. To understand the Cam jump phenomenon, Epicyclic Gear Train and Gyroscopic principle
4. To determine experimental data include universal testing machines and torsion equipment.
5. To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.

Course Outcomes:

Students will be able to

1. Draw Mechanisms for practical Application
2. To understand dimensional synthesis of mechanisms by graphical methods
3. To understand and perform experiment for Cam Jump phenomenon , Epicyclic Gear Train and Gyroscopic principle
4. Understand the basic concepts of stress, strain, deformation, and material behaviour under different types of loading (axial, torsion, bending).
5. Perform stress analysis and design of beams subjected to bending and shearing loads using several methods.

Lab Work (Any 8)

1.	To draw mechanisms for Practical Application and straight line mechanisms.
2.	To Synthesize the 4-bar mechanism using relative pole method and inversion methods with 3-precision points.
3.	To synthesize the slider crank mechanism using relative pole method and inversion methods with 3-precision points.
4.	Epicyclic Gear Train
5.	Cam Jump Phenomenon
6.	Gyroscopic Principle
7.	Tension test

8.	Compression Test
9.	Direct Shear Test
10.	Bending Test
11.	Torsion Test
12.	Impact test
	Total Lab hours: 18 hours
Text Books:	
1.	S.S.Rattan, Theory of Machines, Tata McGraw Hill
2.	Asok Kumar Mallik, Amitabha Ghosh, and Gunter Dittrich. Kinematic analysis and synthesis of mechanisms. CRC Press, 1994.
3.	Strength of Materials S. Ramamrutham, Dhanpat Rai Pvt. Ltd
Reference Books:	
1.	Thomas Bevan, 'Theory of Machines' CBS Publisher and Distributors, Delhi
2.	Hartenberg, Richard Scheunemann, and Jacques Denavit. 'Kinematic Synthesis of linkages'. McGraw-Hill, 1964.
3.	Mechanics of Materials, by Russell C. Hibbeler
4.	Singer and Pytel - Strength of materials - Harper and row Publication.

Mechanical Engineering Department

Course Code	Design Lab (ASM & SOM-L)	L	T	P
20ME405L		-	-	2
Pre-requisite	Analysis and Synthesis of Mechanism, and Strength of Materials	Syllabus Version		
		V:1.1		

Course Objectives:

To make students

1. To understand the fundamentals of Mechanisms for Practical Application.
2. To understand dimensional synthesis of mechanisms by graphical methods
3. To understand the Cam jump phenomenon, Epicyclic Gear Train and Gyroscopic principle
4. To determine experimental data include universal testing machines and torsion equipment.
5. To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.

Course Outcomes:

Students will be able to

1. Draw Mechanisms for practical Application
2. To understand dimensional synthesis of mechanisms by graphical methods
3. To understand and perform experiment for Cam Jump phenomenon , Epicyclic Gear Train and Gyroscopic principle
4. Understand the basic concepts of stress, strain, deformation, and material behaviour under different types of loading (axial, torsion, bending).
5. Perform stress analysis and design of beams subjected to bending and shearing loads using several methods.

Lab Work (Any 8)

1.	To draw mechanisms for Practical Application and straight line mechanisms.
2.	To Synthesize the 4-bar mechanism using relative pole method and inversion methods with 3-precision points.
3.	To synthesize the slider crank mechanism using relative pole method and inversion methods with 3-precision points.
4.	Epicyclic Gear Train
5.	Cam Jump Phenomenon
6.	Gyroscopic Principle
7.	Tension test

8.	Compression Test
9.	Direct Shear Test
10.	Bending Test
11.	Torsion Test
12.	Impact test
	Total Lab hours: **18 hours**
Text Books:	
1.	S.S.Rattan, Theory of Machines, Tata McGraw Hill
2.	Asok Kumar Mallik, Amitabha Ghosh, and Gunter Dittrich. Kinematic analysis and synthesis of mechanisms. CRC Press, 1994.
3.	Strength of Materials S. Ramamrutham, Dhanpat Rai Pvt. Ltd
Reference Books:	
1.	Thomas Bevan, 'Theory of Machines' CBS Publisher and Distributors, Delhi
2.	Hartenberg, Richard Scheunemann, and Jacques Denavit. 'Kinematic Synthesis of linkages'. McGraw-Hill, 1964.
3.	Mechanics of Materials, by Russell C. Hibbeler
4.	Singer and Pytel - Strength of materials - Harper and row Publication.

Course Name	Fluid Mechanics Lab	L	T	P
Course Code	20ME402L	-	-	2
Pre-requisite	Engineering Physics, Engineering Mathematics	Syllabus Version		
		V:1.1		

Course Objectives:

To make students

1. Applying the mass conservation principle, to engineering problems.
2. Applying the momentum and energy equations to engineering problems.
3. Evaluating head loss in pipes and conduits.
4. Introduction to formation of boundary layer, drag and lift concept associated with it

Course Outcomes:

Students will be able to

1. Students will understand the basic experimental techniques in fluid mechanics.
2. Students will be present the results in the graphical form.
3. Students will able to measure the pressure drop in a pipe determine friction factor.
4. Students will able to understand the process of calibration of flow meters.

Lab Work

1.Measurement of Viscosity and Sp. Gravity

2.Measurement of Pressure and velocity

3.Measurement of coefficient of orifice

4.Verification of Bernoulli's theorem

5.Calibration of Venturi/Orifice meter

6.Flow visualization using Reynolds Apparatus

7.Measurement of coefficient of friction in pipe

8.Verification of momentum equation

9.Project based learning thermal engineering starts

Total Lab hours:- 18 hrs

Text Books:

1.Munson, Okiishi, Young, ‘Fluid Mechanics’, 7th Ed, Wiley, 2016.

2.Cengel, Cimbala, ‘Fluid mechanics’, Tata Mcgraw hill publishing

Reference Books:

1. Gupta and Gupta, ‘Fluid Mechanics’, 3rd Ed, New Age publications, 2016.

2.Kundu, Cohen, Dowling, ‘Fluid Mechanics’, Elsevier India

3.K. Muralidhar, G. Biswas, ‘Advance Fluid Mechanics’, 3rd Edition, Narosa Publishing House
4.Fox, Mcdonald, ‘Fluid Mechanics’, 8th Edition, Wiley.

Mechanical Engineering Department

Course Code	**Machine Shop Lab (MS-L)**	**L**	**T**	**P**
20ME403L		**-**	**-**	**2**
Pre-requisite	Machining and Machine Tool Operations	**Syllabus Version**		
				V:1.1

Course Objectives:

To make students

1. To study basic production processes
2. To study how to select appropriate production processes for a specific application

Course Outcomes:

Students will be able to

1. Understand basics of manufacturing, elements of casting.
2. Various welding technologies' fundamentals should be recognized, analyzed, and configured.
3. Analyze principles and working of different forming processes.
4. Identify different machining operation requirements for non-metal components.

Lab Work

1.	A demonstration of any one welding technique out of TIG/ MIG/Resistance/Gas welding. A job drawing to be prepared by an individual institute with details of welding process parameters with weld joint design such as edge preparation, type and size of electrode used, welding current, voltage etc.
2.	Demonstration of the usage of Digital Manufacturing tools for process simulation of manufacturing processes like casting, forging, sheet metal (free / open-source software)
3.	Manufacturing of Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques.
4.	Demonstration on any one plastic component like bottle, bottle caps, machine handles etc. by injection moulding process/ by additive manufacturing process.
5.	Demonstration on grinding operations, measurement of surface roughness produced and estimation of machining time.
6.	Composite job machining involving minimum four components, employing operations on lathe, precision turning, screw cutting, boring etc. and involving the use of milling and grinding operations. Raw material selection and / estimation, process planning and sales presentation.

	Total Lab hours:	**22 hours**	

Text Books:

1.	Fundamentals of modern manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication
Reference Books:	
1.	Manufacturing, Engineering and Technology SI, Serope Kalpakjian, Steven R. Schmid, Prentice Hall.
2.	Mechanical Engineers' Handbook, Volume 3: Manufacturing and Management, Myer Kutz, Wiley.
3.	Manufacturing processes Vol. 1 and 2, P. N. Rao, Tata McGraw-Hill.