Autonomous Programme Structure of
Third Year B. Tech. Computer Engineering
Academic Year 2018-2019

T. Y. B. Tech. Computer Engineering Semester – I											
Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
CE 3101	Computer Networks	3	1	0	50	50	0	0	100	4
CE 3102	Database Management Systems	3	1	0	50	50	0	0	100	4
CE 3103	Design and Analysis of Algorithms	3	0	0	50	50	0	0	100	3
OEHS 3101	Elective-I	3	0	0	50	50	0	0	100	3
PECE 3101	Programme Elective-I	3	0	0	50	50	0	0	100	3
CE 3104	Database Management Systems Laboratory	0	0	2	0	0	0	25	25	1
CE 3105	Computer Networks Laboratory	0	0	2	0	0	0	25	25	1
CE 3106	Programming Skills Development Laboratory-I	0	0	4	0	0	50	0	50	2
PECE 3102	Programme Elective-I Laboratory	0	0	2	25	0	0	0	25	1
AC 3101	Audit Course	0	0	2	0	0	0	0	0	0
	Total	**15**	**2**	**12**	**275**	**250**	**50**	**50**	**625**	**22**
	Grand Total	**29**			**625**				**625**	**22**

OEHS 3101: Elective-I

1. Entrepreneurship Development
2. Introduction to Digital Marketing
3. Intellectual Property Rights
4. Project Management

PECE 3101: Programme Elective-I
PECE 3102: Programme Elective-I Laboratory

1. Cloud Computing
2. Digital Signal Processing and Applications
3. Statistics for Computer Science
4. Operations Research

AC 3201 -- Audit Course: Employability Skills Development

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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

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 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.


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CE 3102 DATABASE MANAGEMENT SYSTEMS

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

Examination Scheme
In semester : 50 marks
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*, (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)

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), 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

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.


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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 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

PECE 3101 Digital Signal Processing and Applications

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: -

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

Objectives:
To facilitate the learners

1. To learn, understand and analyze signals and systems
2. Understand linear time invariant systems.
3. Study transformed domain representation of signals and systems
4. Understand introduction to design of filters as DT systems and DSP applications in audio processing and image processing

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

1. Apply Concepts of Signals & systems and Discrete-Time Signals & Systems to solve problems
2. Experiment with concept of Frequency analysis of signals
3. Make use of Fast Fourier Transform (FFT), Finite Impulse Response and Infinite Impulse Response algorithms for solving problems
4. Identify Digital Signal Processing cocepts learned in various applications and tools

Unit 1: Introduction to Signals and Systems [07]
Signals, Systems and Signal Processing, Basics elements of digital signal processing, advantages of digital over analog signal processing, Classification of signals, Concept of frequency in continuous time and discrete time signals, Analog to Digital and Digital to Analog conversion, sampling of analog signal, sampling theorem, Quantization, Coding

Unit 2: Discrete-Time Signals and Systems [07]
Discrete-Time signals and basic operations on signals, Discrete-Time systems and classification, Analysis of Discrete-Time linear time invariant systems , convolution, Introduction to Discrete-Time systems described by difference equations

Unit 3: Frequency analysis of signals [07]
Frequency Analysis of Discrete-Time signals, Properties of Fourier transform for discrete time signal, Discrete Fourier Transform and its properties, Linear filtering methods based on Discrete Fourier transform (overlap add, overlap save)

Unit 4: Fast Fourier Transform [07]
Efficient computation of discrete Fourier transform: Fast Fourier Transform (FFT) algorithms, Discrete Computation of Discrete Fourier Transform (DFT), Radix-2 Fast Fourier Transform algorithms, Decimation-In-Time (DIT) Fast Fourier Transform, Decimation-In-Frequency DIF Fast Fourier Transform, Inverse DFT using Fast Fourier Transform and applications

Unit 5: Implementation of discrete time systems [07]
Structure of realization of Discrete Time systems. Basic Structures for Finite Impulse Response (FIR) Systems, direct form realization, cascade form realization, Structure for Infinite Impulse

Response (IIR) systems: Direct-Form Structures, Cascade form Structure, Parallel-Form Structure, Filter as Discrete Time system: FIR, IIR, Digital filter realization

Unit 6: DSP applications and tools [07]

DSP in Speech Processing: Sound Quality Versus Data rate, High Fidelity Audio, Companding, Speech Synthesis and Recognition, DSP applications in Image Processing: Image Foundation and Display: Digital Image Structure, Other Image Acquisition and display, Brightness and Contrast Adjustments, Grey Scale Transforms

Text Books:

1. Proakis J., Manolakis D., **'Digital signal processing'**, *Pearson Education*, ISBN 9788131710005 (4th Edition) (2011)
2. Steven W. Smith, **'The Scientist and Engineer's Guide to Digital Signal Processing'**, *California Technical Publishing*, 2nd Edition, ISBN 0-9660176-6-8 (2nd Edition) (2014)

References:

1. Simon Haykin, Barry Van Veen, '**Signals and Systems'**, *John Willy and Sons* (6th Edition) (2014)
2. Babu R., '**Digital Signal Processing'**, 4th Edition, *Scitech Publications*, ISBN 978-81-8371-081-7 (6th Edition) (2010)
3. Mitra S., '**Digital Signal Processing: A Computer Based Approach'**, *Tata McGraw-Hill*, 1998, ISBN 0-07-044705-5 (3rd edition) (2014)
4. Ifeachor E. C., Jervis B. W., '**Digital Signal Processing: A Practical Approach'**, *Pearson-Education*, (2nd Edition) (2002)

Elective II- PECE 3101
Statistics for Computer Science

Teaching Scheme
Lectures: 3 Hr/Week

Examination Scheme
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. Select statistical inferential techniques 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-nailed and one-nailed 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

PECE 3101 Operations Research

Teaching Scheme
Lectures: 3 Hrs /week

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

Prerequisite: Discrete Mathematics (20CE 303)

Course Objectives:
To facilitate the learners to :

1. Identify and characterize situations in which Linear Programming technique can be applied.
2. Derive feasible and optimal solution for Transportation and Assignment Problem.
3. Apply various methods to select and execute various optimal strategies of decision making and to win the game
4. Understand Queuing system model.

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

1. Apply Linear Programming technique for Operations Research problem
2. Solve Transportation and Assignment Problem
3. Evaluate different methods to compute value of game and decision making
4. Make use of Queuing theory to solve problems

Unit 1: Introduction to Operations Research (06)
A Quantitative Approach to Decision Making, History, Definitions, Features, Approach to Problem Solving. Overview of models and Modelling, Advantages of Model Building, Methods and Methodology, Advantages, Opportunities, features of solutions and Applications of Operations Research.

Unit 2: Linear Programming (08)
Structure of linear programming model, advantages, limitations, application areas, General mathematical model, Guidelines of model formulation, examples of linear programming model formulation, Graphical and Simplex method of Linear Programming.

Unit 3: Transportation and Assignment Problem (07)
Introduction, Mathematical formulation of transportation and assignment problem, initial basic feasible solution, testing for optimality, Modified distribution method, methods of solving assignment problem, unbalanced transportation and assignment problem. Case study : Dispatch model of Amazon and Swiggy

Unit 4: Decision Theory (07)

Introduction, steps in decision making, Types of decision making environments, Decision making under Uncertainty, Decision making under Risk.

Unit 5: Game Theory (07)

Introduction, Two-person Zero-Sum Games, Pure Strategy (Games with Saddle Point), Mixed Strategy (Games without Saddle point), The rules of Dominance.

Unit 6: Queuing Theory (07)

Introduction, The structure of queuing system, Performance measure of queuing system, Probability distributions in queuing systems, Classification of queuing models, Single server M/M/1:∞/FCFS exponential service queuing model.

Text books:

1. J K Sharma, 'Operations Research: Theory and Applications', Trinity Press, (5th Edition),(2013), ISBN: 978-9350-59336-3.
2. P Sankara Iyer, 'Operations Research', Sigma Series, Tata McGraw Hill Publication Private Limited, (4 th Reprint), (2012), ISBN: 978-0-07-066902-4.

Reference Books:

1. S D Sharma, 'Operations Research', Kedar Nath Ram Nath Publication, (15th Edition),(2009), ISBN: 978-81-224-2288-7.
2. Gupta Prem Kumar and Hira D.S., 'Problems in Operations Research', S Chand Publication, (2012), ISBN: 978-8121909686.
3. Hamdy A. Taha, 'Operations Research', Pearson Education, (8 th Edition), (2012), ISBN: 978-81-317-1104-0.

PECE 3102 Cloud Computing Laboratory

Teaching Scheme
Practical: 2 Hrs/week

Evaluation Scheme
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 Digital Signal Processing Laboratory

Teaching Scheme **Examination Scheme**

2 Hrs/week **Term work– 25 Marks**

Credits: 1

Course Objectives:

To facilitate the learners to:

1. Experiment basics of Digital Signal Processing and Application
2. Understand and draw signals and perform operations on it
3. Experiment process of convolution and difference equation.
4. Understand representation of signal in frequency domain

Course Outcome:

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

1. Experiment with digital representation of a given signal
2. Experiment with operations on signals
3. Experiment with concept of magnitude-phase plot
4. Build Fast Fourier Transform algorithms

Example list of Assignments:

Group A: (Mandatory)

1. Write a program to understanding MatLab programming environment
2. Write a program to generate Periodic and signals
3. Write a program to generate samples of Periodic and Aperiodic signals and verify Nyquist Theorem
4. Perform operations on discrete signals
5. Find the output of a given system for given input sequence using linear convolution

Group B: (Any Three)

1. Find the output of a given System described by given Difference Equation and initial condition for a given input sequence
2. Write a program to plot the magnitude and phase response of a given system (given: h(n): impulse response of system S) (Observe the frequency response, compare the frequency response of a system (filter) for different lengths h(n) i.e. filter coefficients)
3. Compute N point DFT using linear transformation matrix
4. Find FFT of a given signal

Group C: (Any One)

1. Design of IIR filter for given specifications using Bilinear Transformation (Program should work for different types of filter specifications i.e LPF, HPF, BPF etc and for different transfer functions of an analog filter)
2. Perform circular convolution of two sequences

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.

PECE 3102: Operations Research Elective-II Lab

Teaching Scheme
Practical: 02 Hrs/Week

Examination Scheme
In Semester: 25
Credits: 01

Course Objectives:

To facilitate the learners -

1. Identifying Linear Programming techniques as operation research tool
2. To derive a feasible and optimal solution for the Transportation and Assignment Problem.
3. To analyze various methods to select optimal strategies of decision making
4. To apply queuing system model for practical applications

Course Outcomes:

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

1. Apply Linear Programming model to solve Operations Research problems
2. Solve Transportation and Assignment Problem
3. Analyze different strategies for decision making
4. Choose appropriate queuing models for practical application

Assignment statements

Group A

1. Exploring capabilities of Operations Research tools.
   Download and identify features of following tools
   a. https://www.solver.com/powerful-tools-operations-research-analysts
   b. https://support.sas.com/rnd/app/or/DA.html

2. Formulation of Linear Programming Problem
   A farmer owns 200 Cows that consume a minimum 90 Kg. of special feed daily. The feed is prepared as a mixture of Corn and soybean meal with following compositions

   The dietary requirements of the Cows are as follows:
   1. At most 1% calcium
   2. At least 30% protein
   3. At most 5% fibre

   Formulate the problem as a Linear programming Model
3. Solving Linear programming problem
   A chemical company produces four different chemicals (A, B, C and D) using two

different reaction processes (1 and 2). For each hour that Process 1 is run, it yields 400 lbs. of A, 100 lbs. of B and 100 lbs. of C. For each hour that Process 2 is run, it yields 100 lbs. of A, 100 lbs. of B and 100 lbs. of D. The marketing department has specified that the daily production should be (1) no more than 500 lbs. of B and 300 lbs. of C, and (2) at least 800 lbs. of A and 100 lbs. of D.

a) Formulate the above as linear program, sketch the feasible region and compute the values of all variables at each of its extreme points.

b) Suppose it costs $4 to run Process for 1 hr., and $2 to run Process 2 for 1 hr. Sketch an isocost line on your graph. Graphically find the optimal production plan, and the optimal cost. Which constraints are active and which ones inactive at the optimum? Compute the slack or excess values for each constraint at the optimum.

c) Repeat (b) but for costs of $5 per hr. for Process 1 and $1 per hr. for Process 2.

d) Suppose that the costs are as in (c) and that each lb. of the chemicals A, B, C and D sell respectively for 1, 5, 5 and 4 cents. What is the optimum solution? If there is more than one optimum solution, characterize the complete set of optimum solutions. What is the optimum value of the objective?

4. Solving Linear programming problem using simplex method and test the results with the help of tools of 1st assignment

$$\textbf{Minimize} \quad Z = -3X_1 + X_2 - 3X_3 - 4X_4$$

$$st \quad X_1 + 7X_2 + 3X_3 + 7X_4 \leq 46$$

$$3X_1 - X_2 + X_3 + 2X_4 \leq 8$$

$$2X_1 + 3X_2 - X_3 + X_4 \leq 10$$

$$X_1, X_2, X_3, X_4 \geq 0$$

Group B

1. Florenzo Foods has a contract to provide cattle feed for four different cattle breeders.

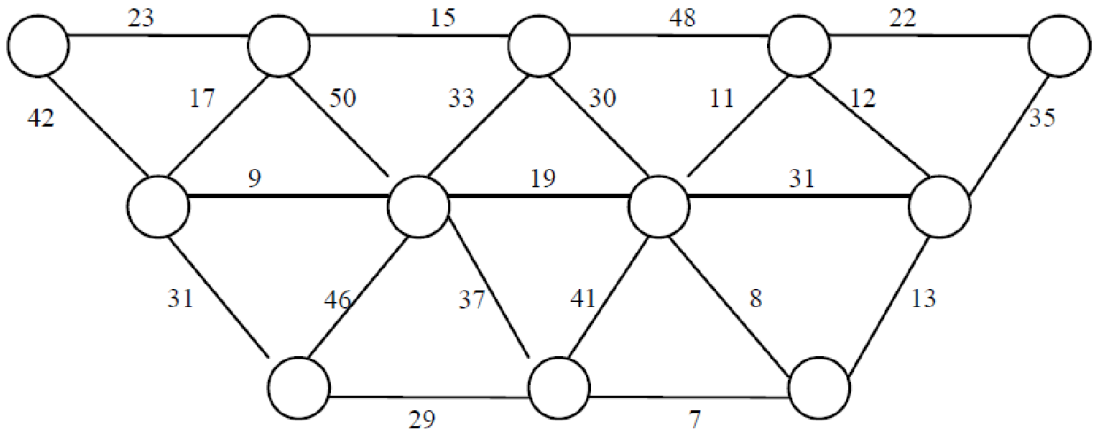
At the end of the week the Breeders A, B, C and D require 1,200; 1,600; 1,000; and 2,600 pounds of feed respectively to be delivered to them. Florenzo has three plants that manufacture feed and each of these has a capacity of 2,400 pounds per week. The cattle feed sells for $20 per pound, and the manufacturing costs are $2 per pound at plant 1 and $3 per pound at plants 2 and 3 which are older plants. Florenzo has already committed to run each plant at full capacity this week, i.e., each of them will produce 2,400 pounds, and any excess feed left over at a plant at the end of the week will incur a cost of $1 per pound for storage. Transportation costs in $ per pound are given in the table below.

	Breeder A	Breeder B	Breeder C	Breeder D
Plant 1	6	7	1	6
Plant 2	5	4	3	1
Plant 3	1	5	7	2

Florenzo is interested in maximizing total profits over the week.

1. Formulate this problem as a balanced transportation problem.
2. Use Excel Solver to solve the resulting LP. What is the value of the optimal total profit?

2. Find the minimum spanning tree for the following Transportation network



3. Exercise and case problems on Decision making
4. Exercise and case problems on Game theory

Group C

1. Exercise to determine the performance measures for M/M/1 queuing model.