Autonomous Programme Structure (Modified) of
F. Y. B. Tech. (Common to All Programmes)
A. Y.: 2019-2020

F. Y. B. Tech. Semester –I

Course Code	Course Title	Teaching Scheme Hours / Week			Examination Scheme			Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Practical / Oral		
BS 1101	Engg. Mathematics - I	3	1	0	50	50	0	100	4
BS 1102	Physics - I	2	1	0	50	50	0	100	3
BS 1103	Chemistry- I	2	1	0	50	50	0	100	3
ES 1101	Basic Electrical and Electronics Engg. - I	3	0	0	50	50	0	100	3
ES 1102	Fundamentals of Programming Language - I	1	0	0	25	0	0	25	1
ES 1103	Engg. Graphics	2	0	0	25	25	0	50	2
ES 1104	Environmental Studies	2	1	0	50	50	0	100	3
BS 1104	Physics and Chemistry Lab - I	0	0	2	25	0	0	25	1
ES 1105	Basic Electrical and Electronics Engg. Lab - I	0	0	2	0	0	25	25	1
ES 1106	Fundamentals of Programming Language - I	0	0	2	0	0	25	25	1
ES 1107	Engg. Graphics Lab	0	0	2	0	0	25	25	1
NC 1101	Value Education	1	0	0	0	0	0	0	0
	Total	**16**	**4**	**8**	**325**	**275**	**75**	**675**	**23**
	Grand Total	**28**			**675**			**675**	**23**

MKSSS's Cummins College of Engineer, 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

BS1101 ENGINEERING MATHEMATICS - I

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

Course Objectives:

Mathematics is a necessary path to scientific knowledge which opens new perspective of mental activity. Our aim is to provide sound knowledge of engineering mathematics to make the students think mathematically and strengthen their thinking power to analyze and solve engineering problems in their respective areas.

Course Outcomes:

1. Solve the system of Linear equations by using the matrix method and apply it to check Linear Dependence, Independence of the vectors.
2. Calculate eigen values, eigen vectors and apply it to diagonalize a matrix.
3. Analyze roots of algebraic equations by applying De Moivre's theorem and analyze the function of complex numbers .
4. Compute power series expansions by using higher order derivatives.
5. Calculate partial derivatives and use to analyze maxima, minima of a given function.

Unit – I: Matrices **(07)**

Matrices, Rank of the matrix, Echelon Form, Normal form, Inverse of the matrix,System of Linear Equations, Linear Dependence and Independence, Linear

Transformations, Rotation and Translation Matrices.

Unit – II: Applications of matrices **(06)**

Eigen Values, Eigen Vectors , Cayley Hamilton Theorem , Diagonalization and applications in finding powers of matrix.

Unit–III: Complex numbers and its applications **(08)**

Argand diagrams, De moivre's theorem and its applications, Hyperbolic Functions, Separation of real and imaginary parts of functions of complex numbers, Inverse Hyperbolic Functions, Logarithm of Complex Numbers.

Unit – IV: Differential calculus **(05)**

Successive Differentiation, Method of finding nth order derivative of functions, Leibnitz theorem, Taylor's series, Maclaurin's Series.

Unit – V: Partial Differentiation **(07)**

Partial Differentiation, chain rule, composite functions, Euler's theorem on homogeneous functions,Total derivatives .

Unit – VI: Jacobian and its applications **(08)**

Jacobian, Chain rule, Partial derivatives using Jacobian, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Text Books:

1. B.S. Grewal, **'Higher engineering Mathematics'**, *Khanna publishers, Delhi(*40th edition),(2008).
2. B. V. Ramana, **'Higher Engineering Mathematics ',** *Tata McGraw Hill Publications* (2007)
3. Erwin Kreyszig ,**'Advanced Engineering Mathematics'** *Wiley Eastern Ltd.*(8th Student Edition)(2004).

Reference Books:

1. C.R.Wylie, L.C. Barrette, **'Advanced Engineering Mathematics',** *McGraw Hill Publi-*

*cations, New Delhi.(*6th edition)(2003)
2. Peter V. O'neil,'**Advanced Engineering Mathematics'** ,Thomson Brooks / Cole, *Singapore (*5th edition) (2007).

BS1102 PHYSICS – I

Teaching Scheme

Lectures: 2 Hrs per week

Tutorial: 1 Hr per week

Credits: 3

Examination Scheme:

In-Semester : 50 Marks

End-Semester: 50 Marks

Course Objective:

1. To introduce undergraduate students Of engineering to the principles, notions, basic physical ideas, mathematical relations and applications of Classical Physics, specifically pertaining to the theories of Electromagnetic Radiation, Optics, Special Relativity
2. To point out some of the contexts in which Classical Physics fails to account for certain experimental observation thereby requiring Quantum Physics to take over

Course Outcomes:

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

1: **Use** the laws of Electrostatics and Electromagnetic Radiation to determine the electric field dueto static and dynamic charge distributions.
2: Apply the laws of physical optics in situations involving interference, diffraction and polarization patterns.
3: Justify the use of the principles of special relativity in situations involving elementary particles.
4: Judge the relevance of quantum mechanical principles and methods in finding out interferometric behavior and allowed energy states of particles with arbitrary spins.

Unit – I: Electromagnetic Radiation and Interference: (4)

Expression for the electric field beyond Coulomb's law; The dipole radiator; Physics of interference – Two dipole radiator

Unit – II: Diffraction and Polarization: (4)

The resultant amplitude due to *n* equal oscillators; Diffraction Grating; The electric vector of light; Birefringence; Polarisers

Unit – III: Capacitance and Dielectrics: (4)

Electrostatic energy; Capacitance of a Parallel-Plate Capacitor; The dielectric constant; The polarization vector

Unit – IV: Special Relativity: (4)

The Lorentz transformation; Slowing of clocks; Contraction of length; Relativistic energy

Unit – V: Quantum Behaviour – I: Particles and Waves: (4)

Experiments with bullets, waves and electrons; The uncertainty principle

Unit – VI: Quantum Behaviour – I: The Magnetism of Matter: (4)

The Precession of atomic magnets; Angular momentum in Quantum Mechanics; The magnetic energy of atoms; Quantized magnetic states

Text Book:

R. P. Feynman, R. B. Leighton and M. Sands, **'The Feynman Lectures on Physics'**, *Pearson Education* (2006)

Reference Books:

1. J. Walker, D. Halliday, R, Resnick, **'Principles of Physics'**, Wiley *Student Edition* (10th Edition)

2. H. Young and Roger Freedman, **'University Physics'**, Pearson Addison Wesley (12th Edition)

BS1103 CHEMISTRY- I

Teaching Scheme: **Examination Scheme:**

Lectures: 2 Hrs/Week In-Semester: **50** Marks

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

Credits: 3

Course Objectives:

The Chemistry course is designed such that the learners develop a sound background of fundamental concepts and principles relevant in the engineering context. The course facilitates undergraduates to learn bonding theories, methods of analysis and evaluate role of chemical substances. They analyze chemical processes related to engineering applications. Also the course inculcates basic problem solving skills involving chemistry principles.

Course Outcomes:

1. State laws, formulae, definitions and properties.
2. Comprehend synthesis procedures and analytical methods in qualitative and quantitative estimation.
3. Apply principles of fundamental chemistry for solving problems.
4. Analyze chemical processes for engineering applications based on chemical reactions and evaluate the role of chemical substances.
5. Critique the effect of different parameters on the properties of chemical substance.

Unit – I: Chemical Bonding **(05)**

Types of bonds - primary & secondary types with examples, hybridization based on valence bond theory, VSEPR theory, molecular orbital theory with respect to bonding in homo and hetero nuclear diatomic molecules.

Unit – II: Water Analysis and purification **(06)**

Chemical Analysis of water hardness, alkalinity and effect of hard water in boilers, Internal

treatment of boiler feed water, water softening techniques (Permutit and Ion exchange method) and membrane based processes.

Unit – III: Electro chemistry **(06)**

(a) Fundamentals of an electrochemical cell, EMF of cell, reference and indicator electrodes, conductance in solution and conductometric titration.

(b) Battery Technology

Primary & secondary cell, battery characteristics, Ni-Cd cell, Lithium-ion battery, rechargeable batteries, Fuel cell technology.

Unit – IV: Instrumental methods of Analysis-I **(04)**

Basic principles,instrumentation and applications of pHmetry, Potentiometry, Chromatography

Unit – V: Coordination Chemistry **(05)**

Introduction,Classification of ligands, naming coordination compounds, Werner and Sidgwick theory, VBT, CFT for Td and Oh complexes. Applications and comparison of VBT & CFT.

Unit – VI: Photochemistry **(04)**

Photochemical reactions, Laws of Photochemistry and quantum yield, energy transfer in photochemical reaction, applications.

Text Books:

1. Arun Bahl & G.D. Tuli,**Essentials of Physical Chemistry,***S.Chand Publications* (2014)
2. S.S. Dara **'Engineering Chemistry'** *S. Chand Publications (2010)*
3. Puri, Sharma, Kalia **'Principles of Inorganic Chemistry'**: *Milestone Publications* (2009)
4. B.S. Chauhan **'Engineering Chemistry'** :*Univ Sc Press.*(third edition)2009
5. Shashi Chawla **'A Text Book Of Engineering Chemistry'**: *Dhanpat Rai & Co.*(2015)

6. Jain and Jain '**A Text Book Of Engineering Chemistry**' *Dhanpat Rai & Co.*
7. Gurdeep Chatwal **'Instrumental methods of Chemical Analysis'** *Himalaya publ.house*

Reference Books:

1. Steven S. Zumdahl, **‘Chemistry concepts and applications’,** *Cengage learning publication* (2009)
2. Ram D. Gupta,**'Hydrogen fuel'***C.R.C.Publications*(2009)
3. Puri, Sharma, Pathania **'Principles of Physical Chemistry'** *: Vishal Publ. Co.*(2015)
4. Robert D. Braun*' **Instrumental methods of analysis'** Pharmamed press* (2010)

ES1101 Basic Electrical and Electronics Engineering - I

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hrs/Week In-Semester: 50 Marks

Credits: 3 End-Semester:50Marks

Course Objectives:

1. To make students familiar with the fundamental concepts of electric and magnetic circuits.
2. To educate the students about the realization of basic theoretical concepts & laws in real physical world.
3. To educate the students about the construction and applications of diode
4. To educate the students about the construction and applications of BJT

Course Outcomes:

After completion of course, students will be able to

1) Determine energy consumption for electro-thermal and electro-mechanical systems as well as analyze the temperature effect on resistance
2) Analyze given magnetic circuit and find circuit parameters
3) Analyze given DC circuit and calculate its parameters
4) Calculate average value and RMS value of sinusoidal and non-sinusoidal AC waveforms.
5) Analyze I-V characteristics of semiconductor diodes and transistors and design simple analog circuits using these devices

Unit – I: Introduction to electrical systems (05)

Review of basic electrical terms, Effect of temperature on resistance, Resistance temperature coefficient, insulation resistance, Work, Power and energy calculations for thermal, mechanical and electrical systems.

Unit – II: DC Networks (07)

Kirchoff's laws, Mesh and Nodal Analysis, Thevenin , Norton and Superposition Theorems, maximum power transfer therom, Network Simplifications using star-delta / delta-star transformations.

Unit – III: Electromagnetism and Magnetic Circuits (06)

Magnetic field due to electric current, Force on a current carring conductor, Electromagnetic induction, direction and magnitude of induced EMF, magnetomotive force and magnetic field strength, relative and absolute permeability, reluctance, series and parallel magnetic circuits, magnetic materials and B-H curve, self and mutual inductance, coupling coefficient,energy stored in magnetic circuits.

Unit – IV: Electrostatics and AC fundamentals (06)

A. Electrostatic field, electric flux density, electric field strength, permittivity. Capacitor and capacitance, dielectric strength and breakdown voltage, capacitors in series and parallel,composite capacitors, energy stored in capacitors, charging and discharging of capacitors and time constant

B. Generation of alternating emf, waveform terms and definitions, average value and rms values for sinusoidal and non sinusoidal currents and voltages, phasor representation of an alternating quantity

Unit – V: Diodes and rectifiers (06)

Overview of Semiconductor physics and p-n junction theory, Junction diode, construction and characteristic of p-n junction diode, zener diode, LED, photodiode, Half wave, full wave and bridge rectifiers, need of capacitor filter, rectifier operation with capacitor filter, zener diode as a voltage regulator, block diagram of Regulated power supply

Unit – VI: Junction Transistor Amplifiers (06)

Bipolar junction transistor, Construction of BJT, Types of biasing:-fixed bias and self bias circuit, BJT characteristics for-CE,CB,CC configurations, relationship between α and β, load line for a transistor, application of transistor as a switch and amplifier.

Text Books:

1. Hughes, **'Electrical and Electronic Technology'**, *pearson education*, (9^{th} edition), (2009)

Reference Books:

1. D. P. Kothari and I.J. Nagrath, '**Basic Electrical Engineering**', *McGraw-Hill*, (3^{rd} edition), (2010)
2. A. E. Fitzgerald, A.Grabiel,'**Basic Electrical engineering**',*McGraw-Hill*, (5^{th} edition), (2009)
3. Floyd, '**Electronic Devices and Circuits**', *pearson education, (*7^{th} edition),(2008)

ES 1102 Fundamentals of Programming Languages - I

Teaching Scheme:
Lectures: 1 Hr/Week
Credits: 1

Examination Scheme:
In-Semester: 25 Marks

Course Objectives:

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 will 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 (02)

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 (02)

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 (03)

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 (03)

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 (02) 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 (02)

Introduction to blogging and WordPress : 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)

ES1103 Engineering Graphics

Teaching Scheme: **Examination Scheme:**

Lectures: 2 Hrs/Week In-Semester: 25 Marks

Credits: 2

End-Semester: 25Marks

Course Objectives:

a) To apply theory of projections and standard conventions in engineering drawing.

b) To understand the methods to draw various engineering curves.

c) To develop the visualization and interpretation skills, for the physical objects.

d) To develop free hand sketching skills.

Course Outcomes:

After completing the course students will be able to draw

a) Orthographic projections of an object.

b) Engineering curves by applying the given method.

c) Isometric views and development of surfaces of the given object.

4. 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.*

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

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

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

Reference Books:

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

b) Fredderock E. Giesecke, Alva Mitchell, **'Principles of Engineering Graph-**

ics',*Maxwell McMillan Publishing.*

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

ES 1104 Environmental Studies

Teaching Scheme:

Lectures: 2Hrs/Week

Tutorial: 1Hr/Week

Credits: 3

Examination Scheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Course Objectives:

1. It is an interdisciplinary approach to understand environment.
2. It enhances the ability to understand Environmental Problems.
3. Understand the relevance and importance of natural resources in the sustenance of life on earth and living standard.
4. To develop the ability and understand role of Individual in Environmental Protection

Course Outcomes:

A student should be able to obtain/develop:

1. Develop an understanding of environmental pollutions and hazards due to engineering/technological activities and general measures to control them.
2. Analyse the relationships between environmental laws across multiple sectors (local, state, national and international) Comprehend the importance of ecosystem and biodiversity.
3. Develop an understanding of different natural resources including renewable and non-renewable resources.

4. Identify suitable controlling measures for different types of solid wastes.

5. Improve fundamental knowledge of the inter-relationships between the built environment and natural environment.

6. Discuss an action plan for sustainable alternatives that integrate science, humanities and social perspective

Unit – I: Introduction (05)

Concept of environment and multidisciplinary nature of environmental studies:

a) Definition of Environment, multidisciplinary nature of Environmental Studies, scope, importance of Environment, Public awareness for Environment

b) Concept, Ecosystem characteristics:-Biotic abiotic, functional attributes

c) Energy flow in ecosystem: - Universal and single channel energy flow model, Nutrient Cycling:- Nitrogen cycle, carbon cycle, phosphorus cycle,

d) Concept of biodiversity

Unit – II: Integrated built environment (05)

d) Concept of integrated built environment – natural & man-made.

e) Eco-friendly materials in construction - Introduction, sources, Classification,properties and materials.

f) Principles of Building Planning: - Aspect, prospect, grouping, privacy, roominess, sanitation, orientation, circulation, elegance, economy.

g) Building bye laws (concept):- Building line, control line, set back distance, F.S.I., Built up area.

h) Concept of green building, advantages of green building, Introduction LEED rating system.

Unit – III: Renewable and Non- Renewable resources and it's Conservation (04)

f) Natural resources: Types of Renewable- Forest, water - causes of depletion, Conservation

g) Non-renewable resources, types, method of harnessing energy

Unit – IV: Environmental Pollution (05)

g) Introduction, Classification of pollution - Air and water - sources, causes, effects & remedial measures.

h) Solid waste generation, Collection of solid wastes, processing techniques, E- waste generation and methods of disposal.

i) Role of an individual in prevention of pollution.

Unit – V: Social Issues and Environment (05)

g) Unsustainable to sustainable development, urban problems related to energy, Climate change, global warming, acid rain, ozone layer depletion

h) Water conservation and Rain water harvesting

i) Introduction to Environmental Impact Assessment - Definition, introduction of methods with the help of a case study

j) Environment Protection Act, Forest Conservation Act, Public awareness.

Unit – VI: Smart City (03)

Concept and features of smart city, challenges of urbanization, selection process, strategy

Text books:

5. D.L. Manjunath, 'Environmental Studies', Pearson Education.

6. ErachBharucha, 'Text Book of Environmental Studies', UGC, Universities Press

Reference books:

5. D.K. asthana ,MeeraAsthana, ‘A Text Book Of Environmental Studies’,S.Chand.

6. Dr. J.P. Sharma, ‘Environmental Studies’,University Science Press.

7. Dr. Suresh K. Dhalmeja,‘Environmental Studies’,S.K.Kataria& Sons.

8. Anubha Kaushik, C.P.Kaushik, ‘Perspectives in Environmental Studies’,

New Age International Publishers.

9. Shah, Kale, Patki, ‘Building planning and Built environment’,

Tata McGraw Hill

10. Bukhootsow, ‘Energy policy and planning’,B- Prentice Hall of India New Delhi

BS1104 Physics and Chemistry Lab – I

Teaching Scheme	Examination Scheme
Practical: 2 Hrs/Week	In-Semester: 25
Credits: 1	

1: **Record** the observations as per the least counts of measuring instruments and carry out plotting and necessary calculations pertaining to the optical, electromagnetic and thermal systems.
2: Analyze the plotted data and experimental findings with the corresponding theoretical physical models pertaining to the optical, electromagnetic and thermal systems.
3: Analyze the sources of errors and arrive at conclusions pertaining to the behavior of optical, electromagnetic and thermal systems
4: Determine quality parameters of water such as hardness, alkalinity etc
5: Use of instrumental techniques in quantitative estimations like conductometry, pH metry, potentiometry.
6: Select appropriate quantitative analysis for estimation of different parameters of the substance.
7: Interpret the significance of a technique and specific role of reagent in qualitative and quantitative analysis.

List of Experiments:

Physics
1. Michelson Interferometer
2. Specific heat of substance
3. Hall Effect
4. Balmer Series and Emission Spectra
5. Zeeman Effect (Demo)

Chemistry
1. Qualitative & quantitative Analysis of alkali /alkaline earth metals using Flame Photometry.
2. Colorimetric verification of Beer-Lambert's law.
3. Determination of molecular weight of polymer using Ostwald Viscometer.
4. Proximate analysis of coal.

ES 1105 Basic Electrical and Electronics Engineering Lab-I

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs./Week	Practical Exam: 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. Analyse the performance of Transistor in CE configuration
5. Write techinical 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 responce of CE amplifier.

ES 1106 Fundamentals of Programming Languages Lab - I

Teaching Scheme:
Practical: 2 Hrs/Week
Credits: 1

Examination Scheme:
Practical: 25 Marks

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:
Students 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)

ES1107 Engineering Graphics Lab

Teaching Scheme:

Practical: 2 Hrs/Week

Credit: 1

Examination Scheme:

Practical: 25 Marks

Course Objectives:

Students will be able to

1. Apply theory of projections and standard conventions in engineering drawing.
2. Understand the methods to draw various engineering curves.
3. Develop the visualization and interpretation skills for the physical objects.
4. Develop free hand sketching skills.

Course Outcomes:

After completing the course students will be able to

Identify applications of engineering curves and draw the curves.

Understand and draw orthographic projections and isometric views of an object.

Draw the development of lateral surfaces of solids.

Create free hand sketches of the machine elements.

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.

NC 1201 Value Education

Teaching Scheme: **Examination Scheme:**

Lectures: 1 Hr /Week In-Semester: Nil

Tutorial: Nil End-Semester: Nil

Credits: Nil

Course Objectives:

1. To make understand importance of values in human behavior.
2. To understand adjustments required in one self and others to uphold values in society.
3. To understand importance of values in Family Life.
4. To understand ethics required by professionals in work place.

Course Outcomes:

1. Students will appreciate importance of values in all walks of life.
2. To develop women professional with strong ethics and above all be a good human being.
3. To help students to develop their own value system and action plan based on it.
4. To understand the impact of the Moral role of students in nation building and being a responsible citizen.
5. Understand effects of Global issue like Terrorism, Environment, different cultures etc.

Unit – I: Values and Self Development (03)

Value Education – Definition - relevance to present day - Concept of Human Values - self introspection - Self esteem.

Unit – II: Family values (03)

Components, structure and responsibilities of family - Neutralization of anger - Adjustability- Threats of family life - Status of women in family and society - Caring for needy and el-

derly -

Time allotment for sharing ideas and concerns.

Unit – III: Ethical values (03)

Professional ethics - Mass media ethics- Advertising ethics -Influence of ethics on family life -
psychology of children and youth – Leadership qualities - Personality development.

Unit – IV: Social values (03)

Faith, service and secularism - Social sense and commitment -Students and Politics -Social awareness, Consumer awareness, Consumer rights and responsibilities - Redressal mechanisms

Unit – V: Effect of international affairs on values of life/ Issue of Globalization (03)

Modern warfare -Terrorism. Environmental issues - mutual respect of different cultures, religions
and their beliefs.

Text Books:

1. Chakraborty, S.K., **'Values and Ethics for Organizations Theory and Practice'**, *Oxford
University Press, New Delhi*, (2001)

Reference Books:

1. T. Anchukandam and J. Kuttainimathathil (Ed) 'Grow Free Live Free', ***Krisitu Jyoti***

F. Y. B. Tech. Semester –II									
Course Code	Course Title	Teaching Scheme Hours / Week			Examination Scheme			Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Practical / Oral		
BS 1201	Engg. Mathematics - II	3	1	0	50	50	0	100	4
BS 1202	Physics - II	2	1	0	50	50	0	100	3
BS 1203	Chemistry - II	2	1	0	50	50	0	100	3
ES 1201	Basic Electrical and Electronics Engg. - II	3	0	0	50	50	0	100	3
ES 1202	Fundamentals of Programming Language - II	1	0	0	25	0	0	25	1
ES 1203	Basic Mechanical Engg.	3	0	0	50	50	0	100	3
ES 1204	Engg. Mechanics	2	1	0	50	50	0	100	3
BS 1204	Physics and Chemistry Lab - II	0	0	2	25	0	0	25	1
ES 1205	Basic Electrical and Electronics Engg. Lab - II	0	0	2	0	0	25	25	1
ES 1206	Fundamentals of Programming Language - II	0	0	2	0	0	25	25	1
ES 1207	Engg. Mechanics Lab	0	0	2	0	0	25	25	1
ES 1208	Workshop Practice – I	0	0	2	0	0	25	25	1
	Total	**16**	**4**	**10**	**350**	**300**	**100**	**750**	**25**
	Grand Total	**30**			**750**			**750**	**25**

MKSSS's Cummins College of Engineering for Women 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

BS1201 Engineering Mathematics-II

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hrs/Week In-Semester: 50 Marks

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

Credits: 4

Course Objectives:
Mathematics is a necessary path to scientific knowledge which opens new perspective of mental activity. Our aim is to provide sound knowledge of engineering mathematics to make the students think mathematically and strengthen their thinking power to analyse and solve engineering problems in their respective areas.

Course Outcomes: Students will be able to
1. Solve first order first degree DE, apply it to model and solve simple engineering problems like R-C circuit, conduction of heat etc.
2. Apply Beta, Gamma, Error function and Leibnitz's rule of DUIS to solve integration of univariate function
3. Identify the characteristics of the given function and trace the curve.
4. Integrate multivariate functions over the given region and apply the knowledge to find area, volume, mass, density etc.
5. Obtain Fourier series of given periodic function; Find nth harmonics for given data.

Course Contents:

Unit – I: First order first degree Differential Equation (07)

Definition, Order and degree of Differential Equation, Formation of differential equation, solutions of differential equation, Exact differential equation, Linear differential equation and equations reducible to these types.

Unit – II: Applications of Differential Equations (05)

Applications of differential equations to engineering problems: simple electrical circuits, applications of chemical engineering, applications of mechanical engineering and applications of physics.

Unit – III: Integral Calculus (07)

Special Functions:-Gamma Function, Beta Function, Error function. Differentiation Under integral sign (Leibnitz's rule). Curve tracing of Cartesian form, polar form.

Unit – IV: Multiple Integrals (08)
Transformation of Co-Ordinate systems Spherical, Polar and Cylindrical, Double and Triple integrals with limits, Double and Triple integrals without limits. Dirichlet's theorem.

Unit – V: Applications of Multiple Integrals (06)

Area of cartesian curves, Area of polar curves, Volume of solid, Mass of plane lamina, Mass of solid.

Unit – VI: Fourier Series and Harmonic Analysis (09)

Definition of Fourier series, Dirichlet's conditions, full range Fourier series, half range Fourier Sine series, half range Fourier Cosine Series, Practical Harmonic analysis and applications to problems in Engineering.

Text Books:

1. B.S. Grewal, 'Higher engineering Mathematics', Khanna publishers, Delhi (40th edition), 2008 .

2. B. V. Ramana, 'Higher Engineering Mathematics ',Tata McGraw Hill Publications, (2007)

Reference Books:

1. C.R.Wylie, L.C. Barrette, 'Advanced Engineering Mathematics', McGraw Hill Publications, New Delhi.(6th edition),(2003)

2. Peter V. O'neil, 'Advanced Engineering Mathematics', Thomson Brooks / Cole, Singapore (5th edition), (2007).

3. Erwin Kreyszig, 'Advanced Engineering Mathematics' ,Wiley Eastern Ltd.(8th Student Edition), (2004).

BS 1202 PHYSICS– II

Teaching Scheme:

Lectures: 2Hrs/Week

Tutorial: 1Hr/Week

Credits: 3

Examination Scheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Course Objective:

The objective of this course is to provide an 'algorithmic' introduction of the basic principles of Quantum Physics to the first year students of engineering. Throughout the course, the applications of Quantum Physics will be discussed by emphasizing the laws of combining 'probability amplitudes'. This will be done through several case studies and experimental situations.

Course Outcomes:

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

1: **Apply** the laws of combining probability amplitudes for obtaining intensity distributions of ensembles of identical microscopic systems.
2: Differentiate between domain – specific nature of probability amplitudes in elementary quantum mechanical situations.
3: Justify the use of the laws of combining probability amplitudes in situations involving photons and two – state and multi – state quantum systems.

Unit – I: Probability Amplitudes: (4)

The laws for combining amplitudes; The two-slit interference patter; Scattering from a crystal

Unit – II: Identical Particles: (4)

Bose particles and Fermi particles; Case studies involving use of the exclusion principle

Unit – III: The Dependence of Amplitudes on Time: (4)

Stationary states; Potential energy and energy conservation; The precession of a spin-half particle

Unit – IV: The Hamiltonian Matrix: (4)

Resolving state vectors; How state changes with time; Hamiltonian Matrix

Unit – V: Two-state Systems and Single Qubit Logic Gates: (4)

Experiments with bullets, waves and electrons; The uncertainty principle

Unit – VI: Band Theory of Solids and Semiconductor Physics: (4)

States for an electron in a lattice; Electrons and holes in semiconductors; The Hall effect; Rectification at a semiconductor junction; The transistor

Text Book:

R. P. Feynman, R. B. Leighton and M. Sands, **'The Feynman Lectures on Physics'**, *Pearson Education* (2006)

Reference Books:

1. J. Walker, D. Halliday, R, Resnick, **'Principles of Physics'**, Wiley *Student Edition* (10^{th} Edition)
2. H. Young and Roger Freedman, **'University Physics'**, Pearson Addison Wesley (12^{th} Edition)

BS-1203 Chemistry II

Teaching Scheme:

Lectures: 2 Hrs/Week

Tutorial: 1 Hr/Week

Examination Scheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Credits: 3

Course Objectives:

The Chemistry course is designed for the learners to develop a sound background of fundamental concepts and principles relevant in the engineering context. The course facilitates undergraduates to evaluate the role of chemical substances in different methods of preparation and analysis.They analyze chemical processes related to engineering applications. Also the course inculcates basic problem solving skills involving chemistry principles.

Course Outcomes:

By taking this course, the students will be able to

CO1: Apply spectral and analytical techniques for chemical analysis.

CO2: State laws, definitions and identify physical parameters affecting composition of systems.

CO3:Elucidate on structure and synthesis of materials.

CO4: Evaluate types, factors, mechanisms related to corrosion and its preventive methods.

CO5: Analyze materials for their properties and applications such as fuel or speciality materials.

Unit – I: Instrumental methods of Analysis II (04)

Basic principles, theory, instrumentation and applications of Uv-Vis Spectrophotometry; Flamephotometry.

Unit – II: Polymer Chemistry (07)

Basic terms, molecular weight determination, types of polymerization and its mechanism (free radical and ionic), compounding of plastics, Speciality polymers, Recycling of polymers

Unit – III: Chemistry of fuels (09)

Calorific value, Bomb & Boys' calorimeter, Proximate and Ultimate analysis of coal, Crude

oil: refining, knocking, alternate fuels, rocket propellants, Combustion: calculation of air required for combustion.

Unit – IV: Corrosion **(04)**

Dry and wet corrosion mechanism, types, factors affecting corrosion, Protection against corrosion: Cathodic and anodic protection, powder coating and metallic coatings.

Unit – V: Phase Rule **(03)**

Gibbs Phase Rule, one Component system- Water system, Sulphur system, Two component system- (Pb-silver alloy). Applications and limitations of phase rule.

Unit – VI: Nanomaterials **(03)**

Introduction to nanomaterials, synthesis by top down and bottom up methods, properties and typical applications of nanomaterials.

Text Books:

1. Arun Bahl and G.D. Tuli, **'Essentials of Physical Chemistry'**, (2014/2016)
2. S.S. Dara **'Engineering Chemistry'** *S.Chand Publications* (2010)
3. Puri, Sharma, Kalia **'Principles of Physical Chemistry'** *Milestone Publication* (2009)
4. B.S. Chauhan **'Engineering Chemistry'** *Univ Sc Press.*(2015)
5. Shashi Chawla **'A Text Book Of Engineering Chemistry'** *Dhanpat Rai & Co.* (2015)
6. S.K. Kulkarni **'Nanotechnology: principles and practices'** (2014)
7. Gurdeep Chatwal **'Instrumental methods of Chemical Analysis'** *Himalaya publishing house* (1996)

Reference Books:

1. Ram D. Gupta,**'Hydrogen as a fuel'** *C.R.C.Publication* (2009)
2. Puri,Sharma,Pathania **'Principles of Physical Chemistry'** *Vishal Publishing Co.* (2015-16)
3. **Robert D. Braun 'Instrumental methods of analysis'** ***Pharmamed press*** **(2010)**

ES 1201 Basic Electrical and Electronics Engineering – II

Teaching Scheme:
Lectures: 3 Hrs/Week
Credits: 3

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

Pre-requisite : Semiconductor physics

Course Objectives:
1. To make students familiar with the fundamental concepts of AC circuits
2. To familiarize the students with three phase supply
3. To develop a clear understanding of operation and application of transformer
4. To make students familiar with Digital Circuits
5. To introduce Basics operational amplifier (IC 741) and its applications

Course Outcome:
Having successfully completed this course, the student will be able to:
1. Analyze and determine parameters of single phase AC circuit.
2. Quantify parameters of single phase transformer related to its operation and use .
3. Develop applications of logic gates for building combinational and sequential circuits.
4. Build simple linear and non-linear circuits using operational amplifier.
5. Analyze characteristics of different power devices and transducers.

Unit I: **AC Circuits** **(08)**
Behavior of pure R,L,C in ac circuits,Series and parallel RL, RC and RLC circuits, concept of Impedance and admittance, power triangle and power factor.Resonance in series and parallel RLC circuit, Three phase voltage generationand waveform, star and delta balanced systems. Relationship between phase and line quantities, phaser diagram, power in a three phase circuit.

Unit II : Single phase Transformers **(07)**
1 Φ transformer: concept, types, working, ideal transformer, practical transformer, equivalent circuit, phasor diagram, efficiency and regulation calculations. Introduction to three phase transformer.

Unit III: Digital Electronics **(07)**
Binary number systems and binary arithmetic, basic gates, implementation of basic gates using universal gates, Boolean algebra, standard representation of logic functions (SOP and POS forms), Introduction of Combinational logic circuits like multiplexer ,demultiplexer ,half adder and full adder, Introduction of Sequential logic circuits like flip- flops (SR, D), counters and shift registers.

Unit IV: OPAMP **(07)**
Introduction to operational amplifiers, opamp configurations, modes and parameters, Negative feedback concept and applications like comparators, summing amplifiers, integrators and differentiators.

Unit V: POWER DEVICES **(07)**

Construction, characteristics and turn on mechanism of SCR, two transistor analogy of SCR, concept of line and forced commutation. Introduction to phase control concept. Construction, characteristics of IGBT and MOSFET.

Unit VI: Transducers **(06)**

Introduction to Transducers, selection of transducers, classification of transducers. Types of transducers such as LVDT, RTD, Thermistor and strain gauge.

Text Books:-

Hughes,"Electrical & Electronic Technology", *Pearson Education, 9th Edition*

Reference Books:-

1. AP Malvino & Donald Leach,"Digital Principles and Applications", *McGraw Hill Education, 4th edition*

2. Floyd ,"Electronic Devices and Circuits", *Pearson Education India, 8th edition*

3. H.S. Kalsi "Electronic Instrumentation",*TMH publication,2nd edition*

4. Jacob Millman & C C Halkais, Chetan parikh,"Integrated Electronics", *TMH, 2nd edition*

5. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", *Tata McGraw- Hill, 3rd Edition.*

ES 1202 Fundamentals of Programming Languages - II

Teaching Scheme:
Lectures: 1 Hr/Week
Credits: 1

Examination Scheme:
In-Semester: 25 Marks

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 will 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 (03)
Concept of Function, Function declaration, Function definition, Function Call, Return statement, Passing parameters: Call by value, Recursion

Unit – II: Strings (02)
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 (02)
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 (02)
Introduction to Structures: Declaring Structure and Structure Variables, Initializing Structure, Accessing members of Structure

Unit – V: Unions, Enumeration Data types (02)
Declaring Union and its members, Accessing members of Union, Enumeration Types

Unit – VI: Mobile application Development (02)
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)

ES1203 Basic Mechanical Engineering

Teaching Scheme:

Lectures: 3Hrs/Week

Credits: 3

ExaminatioScheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Course Objectives:

a) To provide an overview of mechanical engineering systems (Power plant, Manufacturing plant, Maintenance systems, transmission systems).

b) To enable students to understand terminology used in Mechanical engineering with its significance.

c) To make student understand concept of Mechatronics System.

Course Outcomes:

a) The student will be able to differentiate between major areas like Design, Manufacturing and Thermal in mechanical industries while addressing a problem.

b) The student will be able to select an appropriate sector while finding solution to a problem.

c) The student will be aware of avenues available while choosing career opportunities in mechanical engineering Industry.

d) Understand the underlying principle of energy conversion systems and power plants, power producing and Power absorbing devices.

e) Students will be able to identify Mechatronics System and its components.

Unit – I: Introduction to basic mechanical engineering (06)

Industry overview-Comparison between process, product and service industry. Work environment for Mechanical industries, role of a mechanical engineer, ethics, professional hazards and safety concerns in mechanical industry. Typical manufacturing method of a product.

Unit – II: Introduction to thermal engineering (08)

Thermodynamic system, properties, states, process, cycle, first law of thermodynamics, application of first law to open and closed systems,second law of thermodynamics, conceptual difference between heat engine, heat pump and refrigerator, significance of efficiency and co-efficient of performance. Numerical on appropriate topics.

Unit – III: Power producing devices and power absorbing devices (08)

Power producing devices-Internal combustion engines and turbines, power plants.

Power absorbing devices-Centrifugal pumps, reciprocating units, vapour compression refrigeration, air conditioning systems.

Energy management system-fluctuations in demand-supply of energy,need of power grid, concept of energy audit.

Unit – IV: Introduction to design engineering

Introduction to engineering materials, elements and principles of engineering design, basic procedure, Basic requirement, standards in design, aesthetic and ergonomic considerations in design.

Basic machine elements, shaft, key, coupling, bearing, clutch and brake.

Mechanical drives, belt, chain and gear.

Unit – V: Introduction to manufacturing (08)

Operation on different machine tools, lathe, Milling, Drilling.

Joining of metals, welding-gas and arc, TIG, MIG, Soldering, brazing.

Hot and cold working-Forging, rolling, extrusion.

Unit – VI: Introduction to Mechatronics (06)

Definition(S) of Mechatronics, Mechatronics system Components, Levels of Mechatronics system, Examples of Mechatronics (products and systems in manufacturing), Advantages of Mechatronics with Traditional Systems.

Text Books:

a) C.P. Aurora, '**Thermodynamics'**, *Tata McGraw Hill education*, (2001).

b) BasantAgarwal, C.M Agarwal, '**Basic Mechanical Engineering'**, *Wiley Ind. Pvt. Ltd*.

c) V B Bhandari, **'Design of Machine Elements'**, *Tata McGraw Hill*, (2nd edition), (2007).

d) S. K.HajraChoudhury, S.K.Bose, A.K.HajraChoudhury, **'Elements of workshop technology, volume I and II',** *Media promoters and publishers pvt. Ltd*(7th edition).

e) W.Bolton, '**Mechatronic-a multidisciplinary approach',** *Prentice Hall*, (4th edition), (2009).

f) Class room notes.

Reference Books:

a) Moran, Shapiro, Boettner, Bailey, '**Principles of engineering thermodynamics'**, *Wiley*, (7^{th} edition).

b) Rayner Joel, '**Basic engineering thermodynamics'**, *Addison-Wesley*, (5^{th} edition).

c) Y. A. Cengel and M. A. Boles, '**Thermodynamics, an Engineering Approach**', (4th edition).

d) S.S. Rattan, '**Theory of Machine'**, *McGraw Hill*, (4^{th} edition).

e) B.S. Raghuwanshi, '**A course in workshop technology'**, *DhanpatRai&co*.

f) Kalpakjian, Schmid, **'Manufacturing engineering and technology**', *Pearson*, (4^{th} edition).

7. Nptel course112105127/1, 112105127/2

ES 1204 Engineering Mechanics

Teaching Scheme:

Lectures: 2Hrs/Week

Tutorial: 1Hr/Week

Credits: 3

Examination Scheme:

In-Semester: **50** Marks

End-Semester: **50** Marks

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)

1. 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.
2. Introduction to force in a space, problems on resultant of concurrent force system
3. 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)

1. 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)

2. Problems on Reactions & analysis of beams
3. 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)

2) 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.

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

Unit – V: Curvilinear Motion (05)

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

2) 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)

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

2. 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:

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

BS 1204 Physics Chemistry Lab – II

Teaching Scheme:

Lectures: 2Hrs/Week

Tutorial: 1Hr/Week

Practical: 2 Hrs/Week

Credits: 1

Examination Scheme:

In-Semester: **25** Marks

1: **Record** the observations as per the least counts of measuring instruments and carry out plotting and necessary calculations pertaining to solid state physics, atomic and molecular system.
2: Analyze the plotted data and experimental findings with the corresponding theoretical physical models pertaining to solid state physics, atomic and molecular system.
3: Analyze the sources of error and arrive at conclusions pertaining to the behavior of solid state physics, atomic and molecular system.
4: Determine the molecular weight of a given polymer by viscometry.
5: Evaluate a solid fuel sample for its quality by proximate analysis.
6: Implement spectral analysis for a given chemical compound.

List of Experiments:

Physics

1. Michelson Interferometer
2. Specific heat of substance
3. Hall Effect
4. Balmer Series and Emission Spectra
5. Zeeman Effect (Demo)

Chemistry

1. Qualitative & quantitative Analysis of alkali /alkaline earth metals using Flame Photometry.
2. Colorimetric verification of Beer-Lambert's law.
3. Determination of molecular weight of polymer using Ostwald Viscometer.
4. Proximate analysis of coal.

ES 1205 Basic Electronics and Electrical Engineering Lab- II

Teaching Scheme: **Examination Scheme:**

Laboratory: 2 Hrs/Week End-Semester:25 Marks

Credits: 1

Pre-requisite : Instruments ,Electronics and electrical components,semiconductor physics.

Course Objectives:

3. To make students familiar with the fundamental concepts of single phase AC circuits
4. To make students familiar with three phase supply
5. To demonstrate working of single phase transformer
6. To explain combinational logic circuits
7. To introduce Basics operational amplifier (IC 741) and its applications

Course Outcome:

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

3. Apply fundamental concepts of single phase and three phase AC circuits.
4. Test performance parameters of single phase transformers.
5. Implement basic analog and digital circuits.
6. Verify characteristics of SCR and transducer.

List of Practicals:-

1. Performance analysis of L-C-R series circuit .
2. Load test on single phase transformer for determination of voltage regulation.
3. Performance analysis of 3 phase AC circuit.
4. Analysis of summing amplifier and difference amplifier using OPAMP.
5. Design and implementation of half adder and full adder circuits.
6. Illustrate effect of variation of displacement on output voltage of LVDT.
7. Verification of static characteristics of SCR.
8. Soldering Techniques (any small circuit like clippers, clamper, circuits using basic gates).

ES 1206 Fundamentals of Programming Languages Lab - II

Teaching Scheme:
Practical: 2 Hrs/Week
Credits: 1

Examination Scheme:
Practical: 25 Marks

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:
Students 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.

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:

Lectures: 2 Hrs/Week

Tutorial: 1 Hr/Week

Credits: 1

Examination Scheme:

In-Semester: 25 Marks

No. of Experiments:

Part A-Experiments (any 7 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.

Part B- Graphical analysis -(Any one)

1. To find resultant of force system.
2. To find support reactions of simple beam.

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 (06)

- 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:

1. Choudhary, Hajara**'Elements of Workshop Technology**', Media Promotors& Publishers, (1997).
2. Raghuvanshi B.S. "Workshop Technology" Vol. I &II,DhanpatRai& Sons, (1998).
3. H.S. Bawa'Workshop Technology' Vol.-I by, TMH Publications, New Delhi, (2009).
4. Gupta and Kaushik "Workshop Technology: Vol. – I by, New Heights,(1999).

Reference Books:

1. Chapman W.A. J and Arnold E. '**Workshop Technology-part I**' Viva low priced Student, (1998).

Autonomous Program Structure
Second Year B. Tech. Third Semester
(Instrumentation and Control)
Academic Year: 2017-2018 Onwards

Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In sem	End sem	Oral	Practical		
IN2101	Sensors and Transducers I	3	1	0	50	50	0	0	100	4
IN2102	Basic Instrumentation	3	0	0	50	50	0	0	100	3
IN2103	Linear Integrated Circuits	3	1	0	50	50	0	0	100	4
IN2104	Digital Techniques	3	1	0	50	50	0	0	100	4
BSIN2101	Engineering Mathematics-III	3	1	0	50	50	0	0	100	4
IN2105	Programming Practice	0	0	2	25	0	0	0	25	1
IN2106	Sensors and Transducers I lab	0	0	2	0	0	0	25	25	1
IN2107	Basic Instrumentation lab	0	0	2	25	0	0	0	25	1
IN2108	Linear Integrated Circuits lab	0	0	2	0	0	0	25	25	1
IN2109	Digital Techniques lab	0	0	2	0	0	0	25	25	1
Total		15	4	10	300	250	0	75	625	24
Grand Total		29			625				625	24

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

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 characteristics of different sensors and transducers.
2. compare features of different sensors and transducers.
3. select sensors and transducers for particular applications.
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 instruments.
2. Select instrument with appropriate characteristics for given application.
3. Design circuits for extending the range of various analog instruments..
4. Analyze the performance of various instruments.

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. Analyze AC and DC characteristics of op-amp
2. Select suitable op-amp for given application.
3. Design different circuits using op-amp.
4. Evaluate 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. Apply code conversion technique for various number systems.
2. Apply various reduction techniques to logic circuits.
3. Design counters, multiplexers, demultiplexers using various building blocks.
4. Analyze designed combinational and sequential digital circuits.

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)

BSIN2101: Engineering Mathematics-III

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

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

Prerequisite:
1. Basics of integral and multiple integral.
2. Beta function, Gamma function.
3. Partial fractions.
4. First order linear differential equation.
5. Basics of vector algebra, basics of solid Geometry

Course Objectives:
Mathematics is a necessary path to scientific knowledge which opens new perspective of mental activity. Our aim is to provide sound knowledge of engineering mathematics to make the students think mathematically and strengthen their thinking power to analyse and solve engineering problems in their respective areas.

Course Outcomes: The student will be able to
1. Formulate higher order Linear Differential Equations and apply to solve engineering applications.
2. Obtain Fourier and Laplace Transforms of various functions and apply it to solve integral equations and differential equations.
3. Obtain Z transforms and inverse Z transforms for various sequences and apply it to solve difference equations. Relate Z and Laplace Transforms.
4. Interpret and evaluate results in Vector Calculus and apply it to obtain work done, surface integrals.
5. Analyse and apply concepts of basic probability and probability distributions.

Unit 1: Higher Order Linear Differential equation and application (08)
Higher order linear differential Equation with constant coefficients, complementary function, particular integral, general method, short cut methods, Method of variation of parameter. Cauchy's and Legendre's D.E., Modelling of electrical circuits.

Unit 2: Fourier Transform (06)
Fourier integral theorem, , Fourier transform, Fourier Sine transform, Fourier Cosine transform, Inverse Fourier Transform.

Unit 3: Laplace Transform (08)
Definition of Laplace, Inverse Laplace transforms, Properties and theorems, LT of standard functions, LT of some special functions viz. periodic, unit step, unit impulse, application of LT for solving Linear Differential Equations, electrical circuits.

Unit 4: Z- Transform (06)
Definition, standard properties, Z- Transform of standard sequences, Inverse Z – Transform using standard results, Inversion integral method, solution of difference equation, introduction to relation between Z-transform and Laplace transform.

Unit 5: Vector Calculus (08)
Physical interpretation of vector differentiation, vector differential operator, Gradient, Divergence,

Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, vector identities, Line integral, surface integral.

Unit 6: Probability and Probability Distribution (06)
Theorems on probability, Random Variables – Discrete & continuous, Mathematical expectations, Probability density functions, Standard Distributions – Binomial, Poisson, Normal, Chi-square distribution

Text Books:
1. B. V. Ramana, 'Higher Engineering Mathematics', *Tata McGraw Hill Publications,* (2007).
2. B.S. Grewal, 'Higher Engineering Mathematics'*, Khanna publishers, Delhi(*40th edition), (2008)
3. S.C. Gupta, V. K. Kapoor, 'Fundamental of Mathematical Statistics', S. Chand & Sons (10threvised edition), (2002).

Reference books:
1. C.R.Wylie, L.C. Barrette, 'Advanced Engineering Mathematics', McGraw Hill Publications, New Delhi (6th edition), (2003).
2. Erwin Kreyszig, 'Advanced Engineering Mathematics',*Wiley Eastern Ltd.*(8th Student Edition), (2004).
3. Peter V. O'neil, 'Advanced Engineering Mathematics', *Thomson Brooks / Cole, Singapore* (5th edition), (2007).

List of Tutorials:
1. Examples on vector differentiation, gradient , divergence and solenoidal field.
2. Examples on curl, irrotational field, directional derivatives &vector identities.
3. Examples on line integral, work done Green's lemma.
4. Examples on Stoke's theorem and Gauss divergence theorem.
5. Examples on shortcut methods for finding PI
6. Examples on general method and method of variation of parameters
7. Examples on finding solution of simultaneous DE, symmetric DE
8. Examples on Finding LT using standard functions and properties
9. Examples on special functions and using special functions.
10. Examples on inverse LT and applications.
11. Examples on finding FT and Fourier integral theorem.
12. Examples on Fourier sine transform and Fourier cosine transform and inverse FT
13. Examples on ZT of standard sequences and finding ZT using properties
14. Examples on inverse ZT

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. Generate algorithm and flow chart for given problem statement.
2. Apply the appropriate control loop along with array/ structure/ function for logic development.
3. Implement the devloped 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 using functions.
2. Sring 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. Identify instruments required for finding the characteristics of the given sensor..
2. Construct the connection diagram for plotting the characteristics of given sensor/ transducer.
3. Plot and verify the characteristics of given sensor/transducer..
4. Analyze the performance characteristic of sensors/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
Practical: 2 Hr/week

Examination Scheme
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. Design different measurement meters based on the given range and parameter.
4. Analyse the performance of various measuring instruments.

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 designed circuit.
3. Design and implementation of series and shunt type ohmmeter using PMMC ammeter and compare the measured unknown resistance values with the color code.
4. Design of Wheastone's Bridge for measurement of unknown resistance and calculate the sensitivity 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 its performance.
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 given signals.
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 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 conversion.
2. Select appropriate components and implement in hardware and software..
3. Compare 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.

Autonomous Program Structure
Second Year B. Tech. Fourth Semester
(Instrumentation and Control)
Academic Year: 2017-2018 Onwards

Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In sem	End sem	Oral	Practical		
IN2201	Sensors and Transducers II	3	1	0	50	50	0	0	100	4
IN2202	Electronic Instrumentation & System Design	3	1	0	50	50	0	0	100	4
IN2203	Analytical Instrumentation	3	0	0	50	50	0	0	100	3
IN2204	Control Systems I	3	1	0	50	50	0	0	100	4
HS2201	Principles and Practices of Management	3	0	0	50	50	0	0	100	3
IN2205	Sensors and Transducers II lab	0	0	2	0	0	0	25	25	1
IN2206	Electronic Instrumentation & System Design lab	0	0	2	0	0	0	25	25	1
IN2208	Analytical Instrumentation	0	0	2	25	0	0	0	25	1
IN2209	*Lab Practice I	0	0	2	25	0	0	0	25	1
AC2201	Self-Expression	0	0	2	0	0	0	0	0	No Credits
Total		15	3	10	300	250	0	50	600	22
Grand Total		28			600				600	22

*IN2209 - Lab Practice I: Practical based on Circuit Theory and Applied Biology should be conducted.

AC2201 – Audit Course: Self Expression

1. Art and Craft
2. Basic Photography
3. Contemporary Dance
4. Film Appreciation
5. English Communication
6. Theatre

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IN2201: Sensors and Transducers II

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

Examination Scheme
In Semester: 50 marks
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. Delinate working of different sensors/transducers for measurement of various parameters.
2. Compare features of different sensors/transducers.
3. Identify various blocks required for designing signal conditioning circuits for sensor / transducer.
4. design signal conditioning circuit for sensors/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. Select appropriate testing and measuring instrument for given application.
2. Choose ADC and/or DAC for given application.
3. Develop signal conditioning circuits using application ICs
4. Apply design concepts of PCB for given application

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

IN2203: Analytical Instrumentation

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 marks
End Semester: 50 marks
Credit: 3

Prerequisite:
Basics of Optics and sensors

Course Objectives:
1. To understand laws of photometry
2. To interpret instrumentation required for all types of spectroscopy
3. To learn separation methods such as chromatography and mass spectroscopy
4. To apply various principles for analysing different samples using suitable analytical technique

Course Outcome: The student will be able to
1. Select analyzing technique for given application.
2. Compare various sources and detectors in various types of spectroscopic techniques.
3. Compare various analytical techniques for qualitative analysis.
4. Select suitable analytical technique for sample analysis.

Unit 1: Overview and Introduction **(06)**
Introduction to Analytical methods and its classification, electromagnetic spectrum
Basics of spectroscopy: Laws of Photometry, components of optical systems (source, wavelength selector, detectors, signal processor, readout device), single beam and double beam Instrument

Unit 2: Molecular Spectroscopy **(08)**
Electronic transition: UV-Visible spectroscopy, Fluorimeters and Phosphorimeters
Nuclear transition: Nuclear Magnetic Resonance (NMR) spectrometry
Vibratinal transition: IR spectroscopy

Unit 3: Atomic Spectroscopy **(06)**
Atomic absorption spectroscopy: Principle, Hollow cathode source, Types, working, Background correction methods
Atomic emission spectroscopy: Principle, Sources (AC & DC Arc Excitation, Plasma Excitation), Types, working and Flame photometer

Unit 4: Separative Methods **(06)**
Components of mass spectrometry, Mass analyser types, Quantitative analysis of mixtures
Chromatography: Fundamental of chromatographic separation, Gas chromatography, High Performance Liquid Chromatography

Unit 5: Gas analyzers **(05)**
Oxygen analyzer, carbon dioxide analyzer, Hydrocarbon Analyzers

Unit 6: Radio chemical Instrumentation **(05)**
X-ray spectrometry: X-ray Diffractometer, Bragg's law, Instrumentation for X-ray spectrometry
Radiation detectors: Ionisation chamber, Geiger-Muller counter, proportional counter, scintillation counters

Text Books:

1. Willard, Merritt, Dean, Settle, Instrumental Methods of Analysis, CBS Publishers. & Distributors, New Delhi, 7th ed.
2. Skoog, Holler, Nieman, Thomson Principles of Instrumental Analysis, Books-cole Publications, 5th ed.

Reference Books:

1. Khandpur R. S., Handbook of Analytical Instruments, Tata McGraw–Hill Publications, 3rd ed.
2. Ewing Galen W., Instrumental Methods of Chemical Analysis, McGraw-Hill Book Company, 5th ed.
3. Braun Robert D., Introduction to Instrumental Analysis, McGraw-Hill Book Company.
4. Sherman R.E., Analytical Instrumentation, ISA Publication

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. Represent the various given system in suitable mathematical form.
2. Construct transfer function of given system.
3. Analyze the given system in time and frequency domain.
4. Evaluate the stability performance of given system.

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
Practical: 2 Hr/week

Examination Scheme
Practical: 25 marks
Credit: 1

Course Outcomes: The student will be able to
1. Delinate working of different sensors / transducers for measurement of various parameters.
2. Construct the connection diagram for plotting the characteristics of given sensor/ transducer.
3. Design signal conditioning 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. Test various signals and circuits using testing/ measuring instruments.
2. Verify the performance characteristics of a given system.
3. Design signal conditioning circuits by selecting appropriate application IC for given application.
4. Implement and test the designed circuits.

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. Operate various analytical instruments with necessary safety precaution.
2. Select appropriate analytical instrument for sample analysis based on application.
3. Test samples using various analytical instruments.
4. Analyze the sample constituents of given mixture.

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. Analyze circuit using different circuit analysis techniques.
2. Record and analyse physiological parameters.
3. Analyse the characteristics of power electronics components.
4. 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

Autonomous Program Structure
Third Year B. Tech. Fifth Semester
(Instrumentation and Control)
Academic Year: 2018-2019 Onwards

Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In Sem	End Sem	Oral	Practical		
IN3101	Embedded System Design	3	1	0	50	50	0	0	100	4
IN3102	Control Systems II	3	1	0	50	50	0	0	100	4
IN3103	Control System Components	3	0	0	50	50	0	0	100	3
OEHS3101	Open Elective I	3	0	0	50	50	0	0	100	3
PEIN3101	Programme Elective I	3	0	0	50	50	0	0	100	3
IN3104	Embedded System Design lab	0	0	2	0	0	0	25	25	1
IN3105	Control Systems II lab	0	0	2	0	0	0	25	25	1
IN3106	Control System Components lab	0	0	2	25	0	0	25	25	1
PEIN3102	Programme Elective I lab	0	0	2	0	0	25	0	25	1
IN3107	Lab Practice II	0	0	2	25	0	0	0	25	1
AC3101	Audit Course I	0	0	2	0	0	0	0	0	0
Total		15	2	12	300	250	25	75	625	22
Grand Total		29			625				625	22

OEHS 3101: Open Elective I	PEIN 3101: Programme Elective I PEIN 3102: Programme Elective I Lab
1. Entrepreneurship Development	1. Optoelectronic Instrumentation
2. Introduction to Digital Marketing	2. Fundamentals of Biomedical Instrumentation
3. Intellectual Property Rights	3. Power Electronics and Drives
4. Project Management	4. Mechatronics

AC3101 : Audit Course: Employability Skills Development

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IN3101: 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. 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 embedded system using AVR micro-controller and arduino system.

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

IN3102: Control Systems-II

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

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

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 compensator, 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: The student will be able to

1. Investigate the system requirements both in time and frequency domain.
2. Compare to choose the suitable compensator.
3. Choose appropriate control structure and determine the controller tuning parameters.
4. Design control system using modern control theory.

Unit 1: Fundamentals of Compensator & Compensator Design by Root Locus Approach (06)
Need of compensator, types of compensator (series, feedback and feed forward), Types of series compensator (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.

Unit 2: Compensator Design: (08)
Compensator design using root locus approach. Frequency response of lag, lead and lag-lead compensating networks. Compensator design using Bode plot approach.

Unit 3: Basics of Control Actions and Controller Tuning (06)
Control actions: ON/OFF, Proportion, Proportional + Integral, Proportion plus integral plus derivative, Controller tuning methods.

Unit 4: Controller Design Analytical Approach (06)
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.

Unit 5: Analysis of Control System in State Space (08)
State transition matrix, concept of controllability: definition, derivation for the necessary and sufficiency condition for complete state controllability, controllability matrix and concept of observability: definition, derivation for the necessary and sufficiency condition for complete state observability, observability matrix.

Unit 6: Design Concepts in State Space (08)
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.

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.

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.

List of Tutorials:

1. Effect of addition of poles and zeros on system’s transient and steady state performance.
2. Mathematical modeling of electrical lag, lead and lag-lead compensator.
3. Analysis of effect of proportional, Integral and derivate control actions.
4. Design of PI, PD and PID controllers using root locus and frequency response approach.
5. Design of controller using direct synthesis approach for system with and without dead time.
6. Computing complete state controllability and complete state observability for given system.
7. Computation of State feedback controller via pole placement.
8. Computation of full order state observer.
9. Design of optimal state regulator for minimizing given performance index using reduced matrix Riccati equation.

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. Analyse the working of different types of ac motors, electrical, pneumatic and hydraulic 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 components like 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)**

Comparison of hydraulic systems with other systems. Hydraulic supply, hydraulic pumps, hydraulic components actuator (cylinder & motor) and hydraulic valves. Standard symbols for developing hydraulic circuits. Different Hydraulic Circuits (Meter in, Meter out, Reciprocating, speed control, sequencing of cylinders, direction control etc). Construction, working & applications of: 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”, Butterworth Heinemann Ltd
5. B.G. Liptak, “Process Control, Instrument Engineering Hand book”, Butterworth-Heinemann Ltd

Reference Books:

1. Pneumatics, Festo Didactic
2. Hydraulics, Festo Didactic

PEIN3101A: Optoelectronic Instrumentation

Teaching Scheme
Lecture: 3 Hr/week

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

Prerequisites: Fundamentals of light

Course Objectives:
1. To study various optical sources, detectors and components
2. To understand the basics of LASER and its types
3. To learn basics of Fiber Optics and types of Fiber Optic cables

Course Outcomes: The student will be able to
1. select suitable optical components for various applications.
2. compare various types of LASER and fiber optic cables.
3. select suitable type of LASER and/ or fiber optic cable for different applications.
4. design an optical measurement system for the required application.

Unit 1: Optical Sources and Detectors **(07)**
Electromagnetic spectrum, Photometry and Radiometry, LED – construction, working and structures, quantum detectors - CCD device, photo-diode; GOD-POD and Hexakinese methods for Blood Glucose estimation

Unit 2: Optical Components **(08)**
Gratings [Diffraction grating and its types], Lenses, Polarizer [Linear- Absorptive, beam splitting; Circular] – working principle and overview of its types, Beam Splitter, OTDR, Power meter
Basic principles of Holography, hologram

Unit 3: LASER Basics **(07)**
Basic properties of LASER light, single mode operation, stabilization, mode locking, Q-switching, Applications of LASER

Unit 4: Types of LASER **(08)**
Semiconductor, Gas – He, Ne, Krypton; Chemical, Solid state – Ruby, NdYAG; Tunable Laser

Unit 5: Fiber Optics **(06)**
Plane, circularly and elliptical polarized light, Brewster angle, Total Internal Reflection, losses in optical fiber – bend loss, splice loss, attenuation, Applications of Fiber Optics

Unit 6: Fiber Optic Cables and Sensors **(06)**
Fiber Optic cables - Simplex, Duplex, Fibre optic ribbon, loose tube, Distribution, Break-out; Extrinsic and Intrinsic Fiber Optic Sensors

Text Books:
1. J. Wilson, Optoelectronics, Prentice-Hall of India
2. Amar Ganguly, Optics and Optoelectronics, Narosa Publications, New Delhi
3. John M. Senior, Optical Fiber Communications, Prentice Hall of India,3rd edition

Reference Books:
1. Silvano Donati, Electro-Optical Instrumentation, Pearson Education, Inc.,2004
2. Optical Fiber Sensors, John Dakin and Brian Culshaw, Artech house, 1997

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 the characteristics of bio-signal generated during the funtioning of an organ.
2. Compare to select sensor for acquisition of bio-signals.
3. Analyze the various bio-signals recovered using different biomedical instruments
4. Design bio-signal conditioning circuits by considering safety aspects.

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 to select various power circuits and motors for suitable applications.
3. develop controlling circuits for various design stages.
4. design the suitable controlling circuit for given application

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

PEIN3101D: Mechatronics

Teaching Scheme
Lecture: 3 Hr/week

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

Prerequisites: Basic Electronics, Basic Mechanical Engineering

Course Objectives:

1. To discuss the concepts and key elements of Mechatronics system.
2. To explain principles and characteristics of Sensors and Transducers.
3. To describe working principle of Hydraulic and Pneumatic systems and applications.
4. To give examples of applications of Mechatronics Systems.

Course Outcomes: The students will be able to

1. Identify role of Mechatronics Systems in Modern Automation.
2. Identify key elements of Mechatronics System and its representation in terms of block diagram.
3. Classify sensors and transducers according to their applications.
4. Design signal conditioning circuits for given sensors/transducers.
5. Delineate the working of Hydraulic and Pneumatic components.
6. Interface Hydraulic/Pneumatic system components for a given task.

Unit 1: 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 2: 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 3: 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 4: 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 5: 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 6: 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 Education,* (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,* (2th 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/

IN3104: 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. Program microcontroller using assembly languange and C programming.
2. Select appropriate peripheral for given application.
3. Configure the peripherals in different modes.
4. Debug the developed program / given problem staement.

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

IN3105: Control Systems-II Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Practical: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. Investigate and interpret the system requirements both in time and frequency domain.
2. Design the compensator in time and frequency domain
3. Design the control structure and determine the controller tuning parameters
4. Apply the concepts of modern control theory for controller design

List of Experiments:

1. Introduction to soft computing tools for design and analysis of compensator/controllers.
2. Design and performance analysis of lead / lag compensator using root locus approach.
3. Design and performance analysis of lead / lag compensator using Bode plot approach.
4. Tuning (Ziegler-Nicholas closed loop method) and performance analysis of P, PI and PID controllers for given plant transfer function.
5. Tuning (Ziegler-Nicholas and Cohen-Coon open loop method) and performance analysis of P, PI and PID controllers for given plant transfer function.
6. Simulation and performance analysis of a state feedback controller.
7. Simulation and performance analysis of full order state observer.
8. Case study of design, simulation and Real-time implementation of controller.

IN3106: Control System Components Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
In Semester: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. Test various pneumatic and hydraulic components like alarm annunciator, DCV, etc
2. Select electrical, hydraulic and pneumatic components to solve a given problem.
3. Develop various electrical wiring diagram and hydraulic, pneumatic circuits for the given application 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.

PEIN3102A: Optoelectronic Instrumentation Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. compare to select appropriate optical component for the defined application.
2. identify various optical instruments required for measurement of various optical parameters.
3. interpret the characteristics of different LASER sources
4. test the specifications of the given optical fiber

List of Experiments:

1. Study of various types of optical sources – halogen, incandescent, sodium vapour
2. To obtain current-intensity plots of different red, green and blue LEDs
3. Study of working of polarizer and lenses with different sources
4. To plot the line spectra of Neon lamp using a monochromator
5. Measurement of current-intensity relationship of Laser diode
6. Study of working of any 2 types of LASER
7. To study the optical characteristics of an optical fibre using OTDR
8. To measure optical power of source using power-meter

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. Operate biomedical instruments to record bio-signals
2. Analyze the biosignals acquired by biomedical instruments.
3. Design and implement various signal conditioning circuits for bio signal processing considering safety aspects.
4. Use modern hardware and software tools for biosignal acquisition.

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
Practical: 2 Hr/week

Examination Scheme
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

PEIN3102D: Mechatronics Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to,

1. measure load, velocity, flow and level using analog and digital sensors.
2. interface sensors with data acquisition system and monitor data trending.
3. interface components of electro-hydraulic or electro-pneumatic and hydraulic or 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 System Component to actuate single acting and double acting actuators.
7. Interface electro-hydraulic system components to actuate single acting and double acting actuators.
8. Interface pneumatic system components to actuate single acting and double acting actuators.
9. Interface electro- pneumatic system components to actuate single acting and double acting actuators.
10. Design and Implement Mechatronics system for any application.

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. Able to develop the algorithm to implement mathematical solutions of any engineering problem
2. Solve non linear and differential equation using modern computer languages.
3. Apply numerical integration methods to solve problems
4. Apply numerical differentiation methods to solve problems

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.

Autonomous Program Structure
Third Year B. Tech. Sixth Semester
(Instrumentation and Control)
Academic Year: 2018-2019 Onwards

Course Code	Course Title	Teaching Scheme			Examination Scheme				Marks	Credit
		Hours/Week								
		Lecture	Tutorial	Practical	In Sem	End Sem	Oral	Practical		
IN3201	Process Loop Components	3	0	0	50	50	0	0	100	3
IN3202	Digital Signal Processing	3	1	0	50	50	0	0	100	4
IN3203	Unit Operations	3	1	0	50	50	0	0	100	4
PEIN3201	Programme Elective II	3	0	0	50	50	0	0	100	3
PEIN3202	Programme Elective III	3	0	0	50	50	0	0	100	3
IN3204	Process Loop Components lab	0	0	2	0	0	0	25	25	1
IN3205	Digital Signal Processing lab	0	0	2	0	0	0	25	25	1
PEIN3203	Programme Elective III lab	0	0	2	0	0	25	0	25	1
IN3206	Seminar on Mini Project	0	0	4	25	0	0	25	50	2
AC3201	Audit Course	0	0	2	0	0	0	0	0	0
Total		15	2	12	275	250	25	75	625	22
Grand Total		29			625				625	22

PEIN 3201: Programme Elective II	PEIN 3202: Programme Elective III PEIN 3202: Programme Elective III Lab
1. Environmental Instrumentation	1. Embedded Product Design
2. Reliability Engineering	2. Advanced Biomedical Instrumentation
3. MEMS	3. Computer Organization
4. Internet of Things (IoT)	4. Robotics
5. Swayam Online Course	

AC 3201: Audit Course: Employability Skills Development

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

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 applying the fundamentals of process control.
2. Compare to select appropriate process loop components for given application.
3. Analyze the performance of the system with respect to the configuration and tuning of process control components
4. Develop PLC programs 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 valve accessories like volume boosters, pressure boosters, solenoid valves, air lock, limit switches, hand wheel, positioners (Need, applications, types, effect on performance of control valve). Construction, 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" CRC Press, 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. Identify types of digital signal and system based on the characteristics of different digital signals and systems
2. Apply Z Transform to find the solution of finite difference equation.
3. Analyze discrete time systems using Fourier Transform to find the frequency characteristics
4. Design FIR filters using the principles of digital signal processing for various applications.
5. Design IIR filters using the principles of digital signal processing for various applications.

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. Delineate the working of various of various process equipments used for mass transfer, heat transfer, fluid transfer.
2. Compare various process equipments 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 (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

PEIN3201A: Environmental Instrumentation

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 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 student will be able to
1. identify the Instrumentation related to Environment.
2. analyze various aspects of disaster management and ecosystem
3. Select various sensors and instruments for measurement of weather parameters and water analysis.
4. Assess the impact of pollution to provide instrumentation solutions for it.

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)

PEIN3201B: Reliability Engineering

Teaching Scheme
Lecture: 3 Hr/week

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

Prerequisite: Engineering Mathematics

Course Objectives:
1. To know the basic principles of Reliability engineering
2. To know how to apply probability concepts in reliability
3. Apply the knowledge to system requirements, design and testing, with real world examples

Course Outcomes: The student will be able to
1. Identify different methods of failure.
2. calculate MTTF, MTBF, failure rate and hazard rate.
3. apply different probability methods to Reliability.
4. Apply various reliability testing methods

Unit 1: Fundamental Concepts of Reliability (08)
Introduction, concepts, terminologies and definitions of reliability engineering, Interrelationship of safety, quality and reliability, life characteristic phases, Product liability - Significance, importance of reliability, Introduction to maintainability, availability.
Concepts of Failure, failure density, failure Rate, hazard rate, probability distribution function. Modes of failure, Mean Time To Failure (MTTF), Mean Time Between Failure (MTBF)

Unit 2: Probability Concepts (08)
Basic probability concepts, Laws of probability, Introduction to independence, mutually exclusive, conditional probability, Discrete and continuous probability distributions, Comparison of probability distributions binomial, normal, lognormal, Poisson, Weibull, exponential, Standard deviation, variance, mean, mode and Central Limit Theorem.

Unit 3: System Reliability (06)
Analysis of series, parallel, mixed configuration systems, Concept of k-out of n structure, Conditional probability method, delta-star method for conditional probability analysis, Tie-set and Cut Set method

Unit 4: System Reliability Analysis (06)
Reliability Improvement, Redundancy, element redundancy, unit redundancy, standby redundancy types of standby redundancy, parallel components, single redundancy, multiple redundancies, Introduction to Reliability allocation.

Unit 5: Reliability in Design (08)
Reliability techniques - Failure mode, effects analysis (FMEA),Failure mode, effects and criticality analysis (FMECA) - Case Studies, Basic symbols, Fault Tree construction and analysis, Monte Carlo Simulation.

Unit 6: Reliability Testing (06)
Introduction to reliability testing, Stress strength interaction, Introduction to Markov model testing for Reliability and Durability - Accelerated Life Testing and Highly Accelerated Life Testing (HALT), highly accelerated stress Screening (HASS).

Text books:

1. S S. Rao, Reliability Based Design, McGraw Hill Inc. 1992
2. L.S.Srinath, Reliability Engineering, EWP , 4th Edition 2011

Reference books:

1. Chandrupatla, Quality and Reliability in Engineering Cambridge Uni. Press, India
2. Alessandro Birolini, Reliability Engineering Theory and Practice, Springer
3. Dr. Robert B. Abernathy, the New Weibull Handbook.
4. Bryan Dodson, Dennis Nolan, Reliability Engineering Handbook, Marcel Dekker Inc, 2002

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: Design and 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

PEIN3201D: 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. Justify selected protocols for typical applications.
4. Analyze IOT solutions apllied to various industrial 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. Configure circuits for interfacing analog and digital input devices to microcontrollers.
2. Configure circuits for interfacing analog and digital output devices to microcontrollers.
3. Configure power optimization modes in embedded microcontrollers.
4. Design embedded product for the given 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 various biomedical instrumentation involved in surgery, treatment and ICU.
2. Select appropriate biomedical instruments like laser, endoscopy for treatment and surgery.
3. Identify various controls of advance biomedical instruments.
4. Develop biomedical instrument specifications 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

PEIN3202C: 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 to
1. Illustrate functionalities of operating system.
2. Compare various standards related to computer communication
3. Develop queries for data base management systems.
4. Compare to classify 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.

PEIN3202D: Robotics

Teaching Scheme
Lecture: 3 Hr/Week

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

Prerequisite: Basics of Mechatronics

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: The student will be able to

1. Identify application of robotics for industrial automation
2. classify robotic systems based on joint and arm configuration
3. Select sensors and actuators for robots
4. Compute forward and inverse kinematics of robot and trajectory planning

Unit 1: Introduction to Robotics **(08)**

Definition of robotics ,components of Robot system-(manipulator, controller, sensors, power conversion unit etc.), Classification of robots based on co-ordinate systems, Degrees of freedom, links and joints ,progressive advancements in robots, Present trends and future trends in robotics.

Unit 2: Dynamics and Kinematics **(10)**

Dynamic constraints, velocity and acceleration of moving frames, robotic mass distribution and inertia, tension, Newton's equation, Euler equation, dynamic modelling of robotic manipulators. Homogeneous co-ordinate system, homogeneous co-ordinate vector operations. Co-ordinate reference frames, homogeneous transformation and manipulator orientation relative points reference frames, forward solutions: link co-ordinate frames, D-H matrix, Inverse or back solutions, techniques of using direct and geometric approach.

Unit 3: Robotic End Effectors, Sensors and Actuators **(08)**

Different types of grippers: vacuum and other methods of gripping, sensors used in robots, internal and external sensors, position, relocking and acceleration sensors, proximity sensors, force sensors, touch slip laser range tinder, camera and robot vision, overview of actuators: electric, pneumatic and hydraulic actuators.

Unit 4: Trajectory Planning and Control of Manipulators **(08)**

Trajectory Planning: Joint space techniques and Cartesian space techniques, control of manipulators, On-off trajectory, relocking and acceleration profile, Cartesian motion of Manipulator, joint interpolated control, Jacobean in terms of D-H Matrix, obstacle avoidance, basic control system, control loops of Robotic system

Unit 5: Robotics and Industrial Automation **(08)**

Programming Methods, Robot language, need for Automation, Robotics Intelligence and Tasking,

MEMS introduction and working principle, Nano Robots. Applications of Robotics: Application manufacturing: Material Transfer – Material handling, loading and unloading processing – spot and continuous arc welding and spray painting – Assembly Inspection, Robot Application in Medical, Industrial and Security.

Text Books:

1. Fundamentals of Robotics: Analysis and Control-*Robert schilling* ,PHI, New Delhi
2. Robotic Engineering-*Klafter, Thomos, Negin*, PHI, New Delhi

Reference Books:

1. Fundaments of Robotics-*T.C. Manjunath*,Nandu Publishers,Mumbai
2. Robotics and Control-*R.K.Mittal, I.J.Nagrath*, TMH,New Delhi
3. Mems and Microsystems Design and manufacture-*HSU*,TMH,New Delhi

4. Fu, Gonzales and Lee, Robotics McGraw Hill

IN3204: Process Loop Components Lab

Teaching Scheme
Practical: 2 Hr/week

Examination Scheme
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 test and measuring instruments
2. Find the characteristics of various process control components like transmitter, converter, control valve etc.
3. Configure, tune and test various process control components like transmitter, controller, control valve 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
Practical: 2 Hr/Week

Examination Scheme
Practical: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. Implement various DSP operations like convolution, auto correlation using Matlab.
2. Implement different transforms applied to signals using Matlab.
3. Design and implement IIR and FIR filters for bandpass, bandstop, lowpass and highpass filters in Matlab.
4. Analyze the magnitude and phase characteristics of Digital Filters.

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 given sequences.
8. Write a Program to obtain the DFT of the given sequences and plot its magnitude and phase spectrum.
9. Write a Program to design and implement FIR filters using difference windowing methods.
10. Write a Program to design and implement IIR filters (Using Butterworth or Chebyshev approximations).

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. Test the developed analog interfacing circuits for sensors and actuators.
2. Test the developed digital interfacing circuitds for sensors and actuators
3. Design embedded system for given product specifications by selecting appropriate electronic hardware.
4. Implement the designed embedded system.

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

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. Identify various biomedical instrumentation involved in surgery, treatment and ICU
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

PEIN3203C: Computer Organization Lab

Teaching Scheme
Practical: 2 Hr/Week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. Implement various CPU scheduling algorithms in Matlab.
2. Develop queries or handling database.
3. Create their own test plan as a part of software development lifecycle.
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

PEIN3203D: Robotics Lab

Teaching Scheme
Practical: 2 Hr/Week

Examination Scheme
Oral: 25 Marks
Credit: 1

Course Outcomes: The student will be able to

1. Identify the mechanical configuration of robot manipulator
2. Perform kinematic analysis of robot manipulator
3. Simulate the given application of robot
4. develop program to perform specified task through a robot

List of Experiments:

1. To build robot arms using mechanical components and applying motor drives.
2. To build robot for given configuration and degree of freedom.
3. Motion of robot for each degree of freedom. Teaching a sequence to robot using Teach Pendent.
4. To perform pick and place operation using Simulation and Control Software.
5. Robot path planning using Simulation and Control Software.
6. 2D Simulation of 3 Degree of Freedom arm.
7. Direct Kinematics analysis of 4-axis robot using Software.
8. Use micro-controller program to use different sensors and further move model robot.

IN 3206: Seminar on Mini Project

Teaching Scheme
Practical: 4 Hr/Week

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

Course Outcomes: The student will be able to

1. Identify and define with proper study, problem statement related to industry, healthcare, society,laboratory.
2. Design various stages to solve the identified problem.
3. Implement and test the developed design or system or prototype.
4. Prepare and present technical documentation of the developed system.

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.

Autonomous Program Structure
Final Year B. Tech. Seventh Semester
(Instrumentation and Control)
Academic Year: 2019-2020 Onwards

Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
			Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
IN 4101	Process Instrumentation and Control	3	0	0	50	50	0	0	100	3
IN 4102	Industrial Automation	3	0	0	50	50	0	0	100	3
HS 4101	Management Information system	3	0	0	50	50	0	0	100	3
OE 4101	Open Elective –I	3	0	0	50	50	0	0	100	3
IN 4103	Industrial Automation Lab	0	0	2	0	0	50	0	50	1
IN 4104	Project Phase-I	0	2	14	100	0	50	0	150	9
	Total	**12**	**2**	**16**	**300**	**200**	**100**	**0**	**600**	**22**
	Grand Total	**30**			**600**				**600**	**22**

OE4101: Open Elective-I

A. System Engineering and Management

B. Bio-Informatics

C. Avionics

***List of HS –Courses(Mandatory) Course Code: 4101**

1. E & TC : Mangement for Engineers
2. Comp : Organizational Behavior
3. Instru : Management Information systems
4. IT : Green Computing
5. Mech : Economics for Engineers
6. Advanced Entrepreneurship Development**

**Prerequisite: Basic Course ED

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

IN 4101: Process Instrumentation & Control

Teaching Scheme
Lecture: 3 Hr/week

Examination Scheme
In Semester: 50 Marks
End Semester: 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 multi variable control systems for interacting processes
3. To develop and analyze the control loops for various process applications

Course outcomes: The student will be able to
1. identify the characteristics of given process
2. compare the features of different control strategies
3. select appropriate control strategy for given application
4. develop the instrumentation and control loops for various processes

Unit 1: Multi-Loop Control & Nonlinear Systems (07)
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 2: Multivariable Control (07)
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 3: Heat exchanger and Boiler controls (07)
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 4: Distillation Column control (07)
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 5: Reactor and pumps and compressor control (07)

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 automation project and its documentation.
3. To learn and apply of standards and recommended practices to automation.
4. To understand the activities followed in automation projects.

Course Outcomes: The student will be able to
1. Select appropriate automation tool for the given application.
2. Identify protocols required for the given system.
3. Design a PLC/ DCS based system for the given application.
4. Analyze the safety systems in process industry.

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
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester:50
Marks Credit: 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: The student will be able to
1. Identify the functionalities and use of Management information system in industry.
2. Analyze various factors of Management Information System in organization e.g. sales, profit, digital marketing.
3. Develop various information system like erp, crm, data warehouse, etc
4. Analyze various parameters of technology solutions in any organization.

Unit 1: Introduction to Management Information Systems (06)
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 2: Information System in Business (08)
Introduction to Information System; System Concepts; System & Sub System; System Feedback; Types of Information System; Applications; System Development Life Cycle (SDLC)

Unit 3: Management of Information Systems, Technology, and Strategy (08)
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 4: Systems Analysis and Design (06)
Systems Development Life Cycle - Alternative System Building Approaches - Prototyping - Rapid Development Tools - CASE Tools - Object Oriented Systems

Unit 5: Decision Support Systems (06)
Group Decision Support Systems - Executive Information Systems - Executive Support Systems - Expert Systems and Knowledge Based Expert Systems - Artificial Intelligence

Unit 6: Enterprise Information System (06)
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 4101A: System Engineering and Management

Teaching Scheme
Lecture: 3 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50
Marks 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: The student will be able to
1. Identify different phases of Project Life cycle.
2. Develop documentation for project planning phases like project statement, work distribution, scheduling for the given project.
3. Develop instrumentation detailed instrumentation engineering documents as per standards.
4. Prepare procurement, installation and commissioning document of a given project..

Unit 1: Basic Concept of Project Management (06)
Definition, Types and Life cycle phases of project, Basics of Project management, Project Planning, Scheduling, Cost estimation.

Unit 2: Instrumentation Project Documentation and Standards (08)
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 3: Control Panels and Wiring Documentation (08)
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 4: Procurement Activities (08)
Vendor registration, Tendering and bidding process, Bid evaluation, Purchase orders, contracting,

Unit 5: Installation and testing (06)
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 6: Commissioning Activities (06)
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. Apply basic concepts of bioinformatics to biological data analysis.
2. Classify different types of biological database.
3. Apply various techniques, algorithms and tools to nucleic acid and protien sequence analysis.
4. Apply various techniques, algorithms and tools to used for phylogenetic analysis.

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 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. N.J. Chikhale and Virendra Gomase, 'Bioinformatics- Theory and Practice' (1st Edition)(July 2007)
4. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
5. Bioinformatics Databases: Design, Implementation, and Usage (Chapman & Hall/ CRC Mathematical 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. Relate the concepts of digital electronics to flight instrumentation.
2. Identify instrumentation involved in flight desk and cockpit panels.
3. Identify various equipments and communication techniques used in aircraft
4. Identify specialized systems in avionics such as instrument landing system and electronic war fare.

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. Prepare User Requirement Specification document for given application.
2. Analyze the performance of different controllers for various processes.
3. Implement interfacing of various automation tools using third party software.
4. Develop and implement PLC/ DCS programming for various industrial applications

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
Tutorial: 2 Hr/Week
Practical: 14 Hr/Week

Examination Scheme
In semester: 100 Marks
Oral: 50 Marks
Credit: 9

Course Outcomes: The student will be able to

1. Identify and define technical problem related to various fields.
2. Implement and test the designed stages involved in solving the defined problem statements.
3. Work in a team and abide by the norms of professional ethics.
4. Prepare and present technical documentation of the developed system.

The students are expected to work in suitable size groups. The work contribution of each group member should be apporaching towards the final solution. The work should be completed in the stipulated time.

Autonomous Program Structure
Final Year B. Tech. Eigth Semester
(Instrumentation and Control)
Academic Year: 2019-2020 Onwards

Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Marks	Credit
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
IN 4201	Process Data Analytics	3	0	0	50	50	0	0	100	3
PEIN 4201	Program Elective-I	3	0	0	50	50	0	0	100	3
OE 4201	Open Elective-II	3	0	0	50	50	0	0	100	3
IN 4202	Process Data Analytics Lab	0	0	2	0	0	50	0	50	1
IN 4203	Project Phase-II	0	2	16	100	0	50	0	150	10
IN 4204	Project based Online Course**	2	0	0	50	0	0	0	50	2
	Total	**11**	**2**	18	300	**150**	**100**	**0**	550	22
	Grand Total	**31**			550				**550**	22

****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.**

PEIN 4201: Program Elective-I	**OE 4201: Open Elective-II**
1. Process Modelling and Optimization	1. Instrumentation in Agriculture and Food Industry
2. Digital Control	2. Advanced Digital Signal and Image Processing
3. Building Automation	3. System On Chip
4. Power Plant and Safety Instrumentation	

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

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. Identify the characteristics of learning methods that are used to solve the given problem.
3. Identify the performance parameters of various data analysis techniques.
4. Compare and select various machine learning algorithms for solving given problem.

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", 4th 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.

PEIN 4201A: Process Modeling and Optimization

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 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, Behaviour of firt 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 Optimization (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: Optimization of Unconstrained Functions & Linear Programming (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 Optimization (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 4201B: 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 a given system in various planes S-W-Z and its mapping.
2. analyze stability of a system in S-plane and Z-plane
3. design a 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 4201C: Building Automation

Teaching Scheme
Lectures: 3 Hr/Week

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

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. Investigate the system requirements for developing building automation systems.
2. Compare and choose the suitable building automation systems for the applications.
3. Design building automation system for required application.
4. Evaluate the performance of designed building automation system.

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, CO2%.

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 , 3rd 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 4201D: Power Plants and Safety Instrumentation

Teaching Scheme
Lectures: 3 Hr/Week

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

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 student 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. 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 1: Introduction to thermal power plant **(07)**
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 2: Boiler and Turbine Controls **(07)**
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 3: Application of DCS in Thermal power plant control **(07)**
Automation strategy, Automatic boiler control, diagnostic functions and protection, Electro-hydraulic governor system, Automatic startup system, Distributed control to improve reliability Need of condition monitoring systems, Fault tolerant control system in thermal power plants

Unit 4: Nuclear power plant **(07)**

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 5: Nuclear power plant Instrumentation **(07)**

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 6: Hydroelectric power plant Instrumentation **(07)**

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 sub-station 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 4201A: 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 food 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. Develop various control loops and circuits for greenhouse, dam instrumentation and machines used in agriculture
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, center 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. Agrometeorological instrumentation weather stations, surface flux measurement, soil water content measurement using time‑domain reflectometry(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 1 (C R C SERIES IN AGRICULTURE)", CRC Press; 1 edition (30 June 1988), ISBN-13: 978-084933862

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.

1. Identify types of digital signal and system based on the characteristics of different digital signals and systems
2. Apply Z Transform to find the solution of finite difference equation.
3. Analyze discrete time systems using Fourier Transform to find the frequency characteristics
4. Design FIR filters using the principles of digital signal processing for various applications.
5. Design IIR filters using the principles of digital signal processing for various applications.

Course Outcomes: The student will be able to
1. Apply the basic concepts of Multirate DSP for given application
2. design of 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: Periodogram‐based nonparametric methods: Periodogram, Bartlett's method, Welch's method, Blackman‐Tukey method. Parametric methods for power spectrum estimation: 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. Introduction to image compression.

Text Books:
1. J. Proakis , Charles M. Rader, Fuyun Ling, Christopher L. Nikias, Advanced Digital Signal Processing, (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

OE 4201C: System On Chip

Teaching Scheme
Lectures: 3 Hr/Week

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

Prerequisite: Basics of MEMS
Course Objective: The students will,
1. study the various microfabrication processes and the materials used for microfabrication.
2. learn characterization of MEMS sensors like pressure and gas
3. understand the concept of micro fluidics and micro reactor

Course Outcome: The student will be able to
1. list and define the various microfabrication processes
2. compare to select the materials for micro fabrication
3. design and develop the engineering stages involved in MEMS sensor and microfludics
4. To analyze the performance of the designed MEMS sensor

Unit 1: Microfabrication Process – Lithography **(06)**
Types of Lithography – photo, e-beam, X-ray; Soft Lithography

Unit 2: Microfabrication Process – Direct write, Pattern transfer **(06)**
Direct write – focused ion beam, Laser; Pattern transfer – etching types – wet and dry

Unit 3: Material used for Microfabrication **(07)**
Study of various materials used for micro fabrication – Si, GaAs, Si_3N_4, SiO_2, Au, Pt, Ti; Polymers – PMMA, PTFE, Polyaniline, SU8, Polystyrene, PDMS

Unit 4: Device Engineering I **(06)**
Pressure sensor, Gas sensor – Design, Material selection, Modelling

Unit 5: Device Engineering II **(07)**
Study of microfluidics – definition, techniques involved, advantages and applications; Study of micro reactor – definition, types

Unit 6: Characterization **(06)**
Various principles, tools and methods involved in characterization of MEMS sensors

Text Books:
1. Introduction to Microfabrication by Sami Franssila
2. Foundation of MEMS by Chang Liu 2nd Ed.
3. Fundamentals and Applications of Microfluidics by Nam-Trung Nguyen, Steven T. Wereley 2nd Ed.

Reference Books:
1. Microsystem Design by Stephen D. Senturia

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. Compare standard statistical procedures for data analysis.
2. Select appropriate data analysis techniques and tools for given data.
3. Analyze the given process industry data using various data analysis techniques and tools.
4. Evaluate the data analysis technique and tool used for data analysis.

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 neighbour 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 and define technical problem related to various fields.
2. Implement and test the designed stages involved in solving the defined problem statements.
3. Work in a team and abide by the norms of professional ethics.
4. Prepare and present technical documentation of the developed system.

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.