COURSE SYLLABI OF
B.TECH ELECTRONICS AND TELECOMMUNICATION ENGINEERING
(E&TCE)
BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
First Year

1st Semester

THEORY

Code	*Subject*	*L-T-P*	*Credits*
BS1101	Mathematics – I	3-1-0	4
BS1102 Or BS1103	Physic-1 Chemistry-1	3-0-0	3
BE2101 Or BE2102	Basic Electronics Basic Electrical Engineering	3-0-0	3
BE2103 Or BE2104	Thermodynamics Mechanics	3-0-0	3
HM3101	Communicative English	2-0-0	2
BE2105	Programming in 'C'	3-0-0	3
	Theory Credits	18	

PRACTICALS/SESSIONALS

BE7101 Or BE7102	Engineering Drawing Workshop Practice	0-0-3	2
BE7103 Or BE7104	Physics Laboratory Chemistry Laboratory	0-0-3	2
BE7105 Or BE7106	Basic Electronics Laboratory Basic Electrical Engg Lab	0-0-3	2
BE7107	'C' Programming Laboratory	0-0-3	2
HM7101	Communicative English Lab	0-0-3	2
	Credits (Practicals/Sessionals)		**10**

TOTAL SEMESTER CREDITS

28

TOTAL CUMULATIVE CREDITS

28

2nd Semester

THEORY

Code	*Subject*	*L-T-P*	*Credits*
BS1104	Mathematics – II	3-1-0	4
BS1103 Or BS1102	Chemistry-1 Physic-1	3-0-0	3
BE2102 Or BE2101	Basic Electrical Engineering Basic Electronics	3-0-0	3
BE2104 or BE2103	Mechanics Thermodynamics	3-0-0	3
HM3102	Business Comm. In English	2-0-0	2
BE2106	Data structure using 'C'	3-0-0	3
	Theory Credits	18	

PRACTICALS/SESSIONALS

BE7102 Or BE7101	Workshop Practice Engineering Drawing	0-0-3	2
BE7104 Or BE7103	Chemistry Laboratory Physics Laboratory	0-0-3	2
BE7106 Or BE7105	Basic Electrical Engg Lab Basic Electronics Laboratory	0-0-3	2
HM7102	'Business Communicative Lab	0-0-3	2
BE7108	Data structure using 'C' Lab	0-0-3	2
	Credits (Practicals/Sessionals)		**10**

TOTAL SEMESTER CREDITS

28

TOTAL CUMULATIVE CREDITS

28

BS1103 CHEMISTRY – I (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Chemistry.

Course Outcome : At the end of the course, the students will be able to

CO1: Implement the basic concepts of quantum mechanics in chemical bonding

CO2: Utilize the knowledge of rates of reactions and catalysis in electrochemistry applications like measurement of EMF, determination of pH

CO3: Apply the fundamentals of chemical thermodynamics like thermo chemistry, entropy and free energy concept, chemical equilibrium, Maxwell relations to chemical systems.

Topics Covered:

Module – I (To develop basic concepts of quantum mechanics and its applications in bonding)

Structure & Bonding: Dual nature of matter, Schrodinger equation (need not be derived), interpretation of wave functions, molecular orbital theory of diatomic molecules, metallic bonding.)

(No. of Lectures = 7)

Phase rule: Phase diagram of one & two component systems, H2O, S, Cd-Bi and Fe-C systems.

(No. of Lectures = 5)

Solid State: Crystal systems, Bravais lattices, closed packed structures, ionic solids, and crystal defects including Schottky and Frenkel defects.

(No. of Lectures=4)

Module – II (To develop basic concepts about the rates of reactions and catalysis)

1. Reaction Kinetics & Catalysis: Rate law, Order & Molecularity, Determination of order of reaction, Kinetics of Zero, 1st and 2nd order reactions, Collision theory, theory of absolute reaction rates, Energy of activation, Homogeneous & Heterogeneous catalysis (a general idea) (No. of Lectures= 7)

2. Electrochemistry: Electrochemical cells, EMF, Measurement of EMF, Relation between EMF & free energy change of cell reactions, Electrode potentials and measurements with reference to standard hydrogen electrode, calomel electrodes, determination of pH, dry cells, storage cells and fuel cells.

(No. of Lectures= 7)

Module – III (Applications of thermodynamic principles to chemical systems)

1. Chemical thermodynamics: Thermo chemistry, Thermo-chemical calculations based on Hess's law and Born-Haber cycle, second law of thermodynamics, Entropy.

2. The free energy concepts, applications to gases, Gibbs Helmholtz equation, free energy change and criterion of spontaneity and equilibrium of chemical reactions, chemical equilibrium, Maxwell's relations.

(No of Lectures= 9)

Text Books:

1. Physical Chemistry by G.M. Barrow, 6th edition, Tata McGraw Hill, New Delhi.
2. Physical Chemistry by P.W. Atkins, 5th / 6th edition Oxford.

Reference Books:

1. Principles of Physical Chemistry by Puri, Sharma and Pathania.
2. Physical Chemistry by Bahl and Tuli.
3. Engineering Chemistry by Jain and Jain (15th edition).
4. Physical Chemistry-Thomas Engel, Philip Reid by Pearson Education.

BE7104 Chemistry Laboratory (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : 0 **Final Examination:**
Practical : -3 **Credits: 2**

Prerequisite: Chemistry-I

Course Outcome : At the end of the course, the students will be able to:

CO1 : Calculate the amount of sodium hydroxide and sodium carbonate in a mixture; total hardness of water by EDTA method.

CO2 : Estimate calcium in limestone; percentage of available chlorine in a sample of bleaching powder so that they can select proper material for developing a product.

CO3 : Prepare Phenolphthalein, Aspirin; buffer solution and determine the pH of a buffer solution so that they can apply their knowledge to industrial application,

Topics Covered:

(To determine the amount of sodium hydroxide and sodium carbonate in a mixture; total hardness of water by EDTA method. To estimate calcium in limestone; percentage of available chlorine in a sample of bleaching powder. To prepare Phenolphthalein, Aspirin; buffer solution and determination of pH of a buffer solution.)

(Any ten experiments may be done)

1. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
2. Determination of total hardness of water by EDTA method.
3. Estimation of calcium in limestone.
4. Determination of percentage of available chlorine in a sample of bleaching powder.
5. Preparation of Phenolphthalein.
6. Preparation of Aspirin.
7. Preparation of buffer solution and determination of pH of a buffer solution.
8. Standardization of KMnO4 using sodium oxalate.
9. Determination of Ferrous iron in Mohr's salt by potassium permanganate.

10. Determination of partition coefficients of iodine between benzene and water.
11. Determination of rate constant of acid catalysed hydrolysis reaction.
12. Determination of concentration of a coloured substance by spectrophotometer.
13. Determination of dissolved Oxygen in a sample of water.
14. Determination of Viscosity of a lubricating oil by Red wood viscometer.
15. Determination of Flash point of a given oil by Pensky_Marten's flash point approach.

BS1102 PHYSICS – I (MANDATORY)

Lecture: - 3 3 hrs/ Week **Internal Assessment:** 30
Tutorial: - 0 **Final Examination:** 70
Practical: - 0 **Credits:** 3

Pre-requisites: Basic Physics knowledge of 10+2 level

Course Outcomes: At the end of the course, the students will be able to :

CO1 : Solve basic problems on calculation of Oscillation frequency, waves and Interference and apply the knowledge in transmission.

CO2 : Apply concepts of beam, superposition of beams, coherent and incoherent superposition to electromagnetic field theory.

CO3 : Calculate wave length of light by analyzing interference, diffraction and polarization phenomenon.

Topics Covered:

Module - I (15 hrs)

Unit- I Oscillation and Waves

The aim of this unit is to familiarize the students with basic features of different oscillatory systems waves in general. The topics included in this unit should be treated qualitatively.

(a) Oscillatory systems: Simple harmonic oscillation, damped harmonic oscillation, forced vibration, resonance, coupled oscillation. 3 hrs

(b) Waves as periodic variation quantity in space and time, wave equation, Reflection and transmission of waves at boundary of two media. 3 hrs

Unit - 2 Interference

The principle of superposition of waves is extended to the interference of light of waves. Some systems for production of observable interference patterns are covered.

(a) Superposition of waves: Two beam superposition, Multiple-beam superposition, coherent and incoherent superposition. 2 hrs

(b) Two source interference pattern, Intensity distribution, Biprism, Determination of wavelength of light. Newton's rings: Determination of wavelength of light, refractive index of liquid. 2hrs

Unit -3 Diffraction

Diffraction of light waves at some simple obstacles are to be covered in this unit. Both Fresnel and Fraunhofer pattern are included.

(a)Huygen's principle, Fresnel and Fraunhofer diffraction, zone plate. 2 hrs

(b) Fraunhofer diffraction due to a single slit, Plane transmission grating- diffraction spectra, determination of wave length of light. 3hrs

Module : II (11 hour)

Unit- 4 Polarization

The unit covers elementary features of polarization of light waves.

(a) Polarization of transverse waves, plane, circular and elliptically polarized light. Polarization by reflection, refraction and scattering. 2 hrs

(b) Double refraction; Nicol prism, Quarter - wave plate, half- wave plate- construction and use. 2 hrs

(c) Production and analysis of circular and elliptically polarized light, Optical rotation (Only concepts) 1 hrs

Unit - 5 Electromagnetism

Student will be familiarized with some basic used in vector calculus prior to development of Maxwell's electromagnetic wave equations. No proof of theorems and laws included in this unit expected- statement and interpretation should sufficient.

(a) Vector calculus: gradient of scalar field, divergence, curl of vector field (Only Physical significance) Gauss divergence theorem, Stoke's theorem, Green's theorem (Only Statements) 2 hrs

(b) Gauss's law of electrostatics in free space and in a medium (Only statements) electric displacement(D)magnetic Induction (B), Amperes circuital law (Only statements), displacement current, Faraday's law of electromagnetic induction(Only statements). 2 hrs

(c) Maxwell's electromagnetic equation in differential form and in integral form(Only statements). Electromagnetic energy density, poynting vector, poynting theorem, vector potential and scalar potential, electromagnetic wave equation for E and B, transverse nature of EM waves. 2 hrs

Module III (10 hours)

Unit - 6 Quantum Physics

This unit deals with elementary concepts of quantum physics formulation to deal with physical systems.

(a) Need for Quantum physics-Historical overviews, Particle aspects of radiation Black body radiation, photoelectric effect, Compton scattering, pair production. (No derivations), Wave aspect of particles- matter wave, de Broglie Hypothesis, Heisenberg Uncertainty principles- Statement, Interpretation and example. - 3 hrs

(b) Basic features of Quantum mechanics- Transition from deterministic to probabilistic, States of system- Wave function, probability density, superposition principle, observables and operators, expectation values. Schrodinger equation Time dependent and time independent, wave packets. 4 hrs

Unit - 7 Application of Quantum Mechanics

This unit deals with applications of quantum Mechanics to specific one-dimensional

problems (Sketch, Schrodinger equation for different regions, Boundary conditions, final expressions and physical interpretations only, no derivations).
Free particles- continuous states, Potential steps- Reflections, transmissions, Potential Barrier-Tunneling, Infinite deep potential well-energy eigen values, eigen functions. 3 hrs

Text Books :

1. Engineering Physics by D.R. Joshi, Mc Graw Hill
2. Engineering Physics by H.K. Malik and A.K. Singh, Mc Graw Hill. Reference Book:
1. Quantum Mechanics by Powel & Craseman.
2. Optics- A. K. Ghatak
3. Electricity & Magnetism: E.M. Purecell
4. Introduction to Electrodynamics- David J. Griffiths, PHI Publication
5. Concepts of Modern Physics - Arthur Beiser.
6. Engineering Physics- K.P. Mishra and P. Pattojoshi, Scitech Pub.
7. Concepts in Engineering Physics-I Md. N. khan, Alok Publication.
8. Physics-I for engineering degree students-B.B. Swain and P.K.Jena.
9. An Introduction to Machanics by D. Klippner & R. Kolenkow, TMH

BE7103 PHYSICS LABORATORY (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Physics I

Course Outcome: At the end of the course, the students will be able to:

CO1 : Measure various physical parameters like young's modulus, rigidity modulus, surface tension, thermal conductivity, Hall Effect so that they can select proper material before developing an effective module.

CO2 : Measure wave length of light by various methods and determine the grating element of a diffraction grating

CO3 : Apply the knowledge on characteristics curve of PN junction Diode, BJT and RC circuit in designing various electrical and electronics circuits.

CO4 : Apply the fundamental knowledge of power source and output impedance to design and manage the power sources for electrical and electronics devices.

Topics Covered:

A Student is expected to perform ten experiments from the list given below.

1. Determination of Young's modulus by Searle's methods.
2. Determination of Rigidity modulus by static methods.
3. Determination of surface tension by capillary rise method.
4. Determination of acceleration due to gravity by Bar / Kater's pendulum.
5. Determination of thermal conductivity by Lee's method.
6. Determination of wave length of light of light by Newton's rin apparatus.
7. Determination of grating element of a diffraction grating.

8. Plotting of characteristic curves of a PN junction diode.
9. Plotting of characteristic curves of BJT.
10. Varification of laws of verification of strings using sonometer.
11. Determination of wavelength of laser source by diffraction rating methods.
12. Study of Hall effect.
13. Study of RC circuit
14. Study of a power source-output impedance
15. Study of a photoemission

BE2104 Mechanics (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Physics and Mathematics

Course Outcome: At the end of the course, the students will be able to:

CO1 : implement the basic concepts of Force (Concurrent & parallel), composition and resolution of forces to determine the method of projection, method of moment and friction.

CO2: Apply the knowledge of moment of inertial in solving different problems related to stress, deflection etc.

CO3: Analyze and perform calculations for mechanics of rigid bodies, such as trusses and frames.

CO4: Formulate equations of motion using concept of momentum, work, energy and Newton's laws of motion.

Topics Covered:

Module I (13 Hours)

Concurrent forces on a plane – Composition and resolution of forces and equilibrium of concurrent coplanar forces, Method of projections, Methods of moment, Friction.

Parallel forces in a plane- Two parallel forces, General case of parallel forces, Center of parallel forces in a plane and center of gravity- centroids of composite plane figure and curves, Distributed parallel forces in a plane. General case of forces in a plane- composition of forces in a plane and equilibrium of forces in a plane.

Module II (13 Hours)

Plane trusses- method of joints and method of sections, Principle of virtual work – equilibrium of ideal systems.

Moments of Inertia- Plane figure with respect to an axis in its plane and perpendicular to the plane- parallel axis theorem, Moment of Inertia of material bodies.

Rectilinear Translation- Kinematics- Principles of Dynamics- D'Alemberts Principles.

Module III (14 Hours)

Momentum and impulse, Work and Energy- impact

Curvilinear translation- Kinematics- equation of motion- projectile- D'Alemberts Principle in curvilinear motion, Moment of momentum, Work- Energy in curvilinear motion.

Kinetics of Rotation of rigid body .

Text Books:

1. Engineering Mechanics by S Timoshenko, D.H Young and J.V. Rao, Revised 4th edition (Special Indian Edition), McGraw Hill.

Reference Books:

1. Fundamental of Engineering Mechanics(2nd Edition) by S. Rajesekharan & G. Sankara Subramanium, Vikash Publishing House Pvt. Ltd.
2. Engineering Mechanics by Shames and Rao, Pearson Education.
3. Engineering Mechanics, Statics and Dynamics by Boresi and Schmidt, Thomson.
4. Engineering Mechanics by I.S.Gunjal, Laxmi publications.
5. Engineering Mechanics by K.L.Kumar, Tata McGraw Hill
6. Engineering Mechanics by Kumaravelan, Scitech

BE2103 Thermodynamics (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Physics and Mathematics

Course Outcome: At the end of the course, the students will be able to :

CO1 : Apply the basics of thermodynamics in measurement of temperature, pressure, calibration of thermometer

CO2 : Apply the laws of thermodynamics to control volumes, nozzle, diffuser, compressor, turbine, and throttling devices.

CO3 : Apply the laws of thermodynamic to real time application such as Air compressors, steam power plant, Refrigerators and Heat pump, I.C. Engines.

Topics Covered :

Module-I (9 hours)

1. Basic concepts and definition: Scope of Thermodynamics, Macroscopic and Microscopic approaches; Definition of Fixed mass (closed systems) and Control volume(open system), Properties (extensive and Intensive), State and its representation on a property diagram, Process and its representation, Cyclic process (or cycle) and its representation, Characteristics of properties (point and path function);Reversible and Irreversible

processes; Thermal, mechanical and Chemical equilibrium, Thermodynamic equilibrium, Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of thermometers, the ideal gas temperature scale, Measurement of pressure, Bourdon pressure gage and manometers, gage and absolute pressure.

2. Ideal gages and their P-V-T relations, Gas mixtures

3. Energy Transfer: Work Transfer (definition and calculation), Different modes of work, Displacement Work for various process, Heat Transfer; Modes of heat transfer, Basic laws in conduction, convection and radiation, combined modes of heat transfer with examples.

Module-II(13 hours)

4. First Law of Thermodynamics:

i. Formal statement (using cyclic processes), First law for processes of fixed masses(closed systems) and introduction of internal energy as a thermodynamics property, Introduction of enthalpy as a thermodynamic property; Definition of specific heats and their use in calculation of internal energy and enthalpy with emphasis on ideal gages.

ii. Application of First Law to control volumes; Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger.(only steady flow need be considered)

5. Second Law of Thermodynamics: Kelvin- Planck and Clausius statements of Second Law, Reversible and irreversible engines and their efficiency, Entropy concepts and the principle of entropy increase.

Module-III(13 hours)

7. Properties of pure substances:
p-v, p-T, T-S, h-S diagram for steam, different types of steam, Introduction to steam tables with respect to specific volume, pressure, temperature, enthalpy and entropy

8. Application of thermodynamics:
Air compressors, steam power plant, Refrigerators and Heat pump, I.C. Engines (Brief Description of different components of above mentioned systems and working principles with Schematic diagram only)

Text Books:

1. Engineering Thermodynamics by P.K.Nag, Publisher: TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education

Reference Books

1. Engineering Thermodynamics by Van Wylen and Sontang, John Wiley
2. Engineering Thermodynamics by M.Achuthan, Publisher: PHI
3. Applied Thermodynamics by Eastop and McConkey, Publisher: Pearson
4. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher. PHI
5. Engineering Thermodynamics by Russel and Adebiyi, publisher, Oxford
6. Steam Tables in SI Units by Ramalingam, Scitech.

BE7101 Engineering Drawing (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Basic Mathematics knowledge of 10+2 level

Course Outcome: At the end of the course, the students will be able to

CO1 : Apply the principle of Sheet Lay-out & Sketching, Projection, Intersection of surfaces, and Sectional Views of solids, to design and develop a product.

CO2 : Implement the Computer Aided Drafting to design and represent geometrical construction of various materials.

Topics covered :

(Sheet Lay-out & Sketching, Line Drawing, Lettering & Dimensioning; Concept of Orthographic Projection, First-angle Projection, Projections of Points, Projection of straight line, Projection of planes, Projection of Solids, Intersection of surfaces, Development of surfaces, Isometric Projection, Sectional Views of solids, Full section, Introduction to computer-Aided Drafting.)

Text Books:

1. Engineering Drawing by N.D.Bhatt & V.M.Panchal, Charotar publishing House, Anand
2. Engineering Drawing with an Introduction to AutoCAD by Dhanjay A. Johle, Tata McGraw Hill

Reference Books:

1. Machine Drawing by Junarkar, Pearson Education.
2. Machine Drawing (Includes AutoCAD) by Ajeet Singh, Tata McGraw Hill.
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson Education.
4. Text Book on Engineering Drawing by Narayana / Kannaiah, Scitech.
5. Engineering Drawing by Shah and Rana, Pearson Education
6. Engineering Drawing and Graphics using AutoCAD by T.Jeyapoovan, Vikas Publishing
7. Engineering Drawing and Graphics by K.Venugopal, New Age International.

References

1. Elements of Workshop Technology, Vol. I and II by Hajra choudhary, Khanna Publishers
2. Workshop Technology by WAJ Chapman, Viva Books
3. Workshop Manual by Kannaiah/ Narayana, Scitech

BE7102 Workshop Practice (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Mechanics

Course Outcome: At the end of the course, the students will be able to

CO1 : industry ready by exposing them to fitting practice and welding practice such as Gas welding and Electric arc welding practice.

CO2: Able to apply the fundamentals of different machining such as cylindrical turning , thread cutting in lathe, shaping and milling to design and develop various product as required by the customers and they will be industry fit.

(Know basic workshop processes. Read and interpret job drawing. Identify, select and use various marking, measuring, holding, striking and cutting tools & equipments. Operate, control different machines and equipments. Inspect the job for specified dimensions. Produce jobs as per specified dimensions. Adopt safety practices while working on various machines.)

Topics covered :

Fitting Practice: Use of hand tools in fitting, preparing a male and female joint of M.S. or making a paper weight of M.S.

Welding Practice : Gas welding & Electric Arc welding Practice. A joint such as a Lap joint, a T-joint or a Butt joint is to be prepared or to make furniture.

Machining:

(i) Stepped cylindrical Turning of a job and Thread-cutting in lathe.
(ii) Shaping
(iii) Milling

BE2101 - Basic Electronics (3 – 0 – 0) Theory

Lecture: 3 **Internal Assessment:30**
Tutorial: -0 **Final Examination: 70**
Practical: -0 **Credits: 3**

Prerequisite: Basic Knowledge of +2 Physics and Mathematics I

Course Outcome: At the end of the course, the students will be able to :

CO1 : Apply the fundamentals of signals to analyze the signal in DSP and Communication Engineering.

CO2: Apply concepts of semiconductor materials and the mechanism of current flow in semi-conductors, Diode operation and switching characteristics, Operation of BJT and OPAMPS in designing different electronics circuits.

CO3 : Implement the principle of Feedback Amplifiers and Oscillator to design different oscillator and amplifier circuits of desired frequency and gain.

CO4 : generate and measure different signals like sine wave, square wave, triangular wave and different signal parameters like frequency, amplitude, phase etc.

CO5 : Apply the basic knowledge of Digital Electronics, Boolean Algebra & Combo Circuits in designing of combinational and sequential Digital circuits.

(To understand the concepts of: semiconductor materials and the mechanism of current flow in semi-conductors; Diode operation and switching characteristics; Operation of BJT and OPAmps; Feedback Amplifiers and Oscillators; The working principle of CRO;

Topics Covered:

MODULE – I (11 hours)

To have a basic knowledge of number conversion, Digital Gates, Boolean Algebra & Combo Circuits

1. Introduction to Electronics: Signals, Frequency spectrum of signals, Analog and digital signals, Amplifiers, Digital logic inverters. (1.1 to 1.4 and 1.7 of Sedra and Smith) (1 Lectures)
2. The Operational Amplifier (Op-Amp): The ideal Op-Amp, Inverting and non-inverting configurations, Difference amplifier, CMRR, Application of Op-Amp (Instrumentation amplifier, Summing amplifier, Integrator and Differentiator). (2.1 to 2.4 and 2.8 of Sedra and Smith) (3 Lectures)
3. Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Diode clipper and clamper circuits, Light emitting diodes. (3.7, 3.2, 3.4 to 3.6 and 3.8 of Sedra and Smith) (4 Lectures)
4. Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Current-voltage characteristics of BJT, BJT as an amplifier and as a switch. (5.1 to 5.3 of Sedra and Smith) (3 Lectures)

MODULE – II (11 hours)

5. Bipolar Junction Transistors (BJTs): BJT Circuits at DC, Biasing in BJT amplifier circuits, Small Signal Operation of BJT: Simplified hybrid-π model and its application to single stage BJT amplifiers (Common-Emitter, Common-Base and Common-Collector configurations). (5.4 to 5.7 of Sedra and Smith) (4 Lectures)
6. Feedback Amplifiers and Oscillators: General feedback structure, Properties and advantages of negative feedback, Basic principles of sinusoidal oscillators, The Barkhausen criterion, Op-Amp Oscillator circuits (Wien-Bridge oscillator, RC phase-shift oscillator and Crystal oscillator). (8.1, 8.2 and 13.1 to 13.3 of Sedra and Smith) (4 Lectures)
7. Electronic Instruments: Basic principle of Oscilloscope, Function of the sweep generator, Block diagrams of oscilloscope, Simple CRO, Measurement of frequency and phase by Lissajous method, Application of oscilloscope for measurement of voltage, period and frequency, Block diagram of standard signal generator, AF sine and square wave generator, and Function generator.(7.2 to 7.5, 7.20,7.26, 7.30, 8.5, 8.7 and 8.8 of Kalsi) (3 Lectures)

MODULE-III (10 hours)

Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic. (1.2, 1.3 and 2.2 to 2.4 of Floyd and Jain) (2 Lectures)

8. Logic Gates and Boolean Algebra: The inverter, The AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table. (3.1 to 3.6 , 4.1 to 4.7 of Floyd and Jain) (4 Lectures)
9. Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of combinational logic, The universal properties of NAND and NOR gates, Basic adders, Multiplexers and Demultiplexers., Elementary treatment of Latches, Basic concepts of Memory (RAMs) (5.1 to 5.4, 6.2, 6.4, 6.8, 6.9, 7.1 and 10.2 of Floyd and Jain) (4 Lectures)

Text Books:

1. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001.
2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books:

1. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092 (Selected Portions).
2. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky,Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.
3. Electronics Principles (7th Edition), Albert Malvono and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi.

BE7105 - Basic Electronics Laboratory (0 – 0 – 3)

Lecture: 0 **Internal Assessment:100**
Tutorial: -0 **Final Examination:**
Practical: -3 **Credits:2**

Prerequisite: Basic Electronics.

Course Outcome: At the end of the course, the students will be able to :

CO1 : Classify the types of components so that they can use the components in designing a circuit.

CO2 : Apply the fundamental knowledge of hardware construction and operating principle of different electronics instruments like CRO, Function Generator to generate and measure different signal parameters like frequency, amplitude, phase etc

CO3 : Apply the knowledge on characteristics of semiconductor devices like diodes and BJT to design, implement and test circuits using diodes, BJTs and OPAMPs

Co4 : Design different combinational and sequential circuits by the use the truth table of different logic gates, MUX, DEMUX

Topics Covered :

(At least 8 experiments including experiments 1 to 7 and any one from experiments 8 to 10)

(To classify the types of components; To familiarize with different signal measuring instruments, semiconductor devices. Designing ability of circuits using semiconductor devices, ICs, different electronics and electrical components)

1. Familiarization of electronic components and devices (Testing of semiconductor diodes and transistors using digital multimeter)
2. Study and use of Oscilloscope, signal generator to view waveforms and measure amplitude and frequency of a given waveform.
3. V-I characteristics of semiconductor diode and determining its DC and AC resistance.
4. Studies on half-wave and full-wave rectifier circuits without and with capacitor filter; recording of the waveforms and measurement of average and rms values of the rectifier output.
5. V-I characteristic of an n-p-n or p-n-p transistor, DC biasing the transistor in common-emitter configuration and determination of its operating point (i.e., various voltages and currents).
6. Studies on Op-Amp applications (Inverting, non-inverting integrating and differentiating configurations); recording of the input-output waveforms.
7. Studies on Logic gates (Truth table verification of various gates).
8. Gain-frequency response studies of a BJT common-emitter RC coupled amplifier.
9. Studies and experiments using MUX-DEMUX ICs.
10. Study on CMOS logic inverter.

BS1101 - MATHEMATICS-I (3-1-0)

(1st SEM)

Lecture: 3 **Internal Assessment:30**
Tutorial: - 1 **Final Examination: 70**
Practical: -0 **Credits: 4**

Prerequisite: Basic Knowledge of +2 Mathematics

Course Outcome: At the end of the course, the students will be able to :

CO1 : Solve different type of differential equations; solve ordinary differential equations by power series method.

CO : Solve different types of engineering (modeling) problems such as :electric circuits, vibration, forced oscillation, radioactive decay, mixing problem, heat problem, escape velocity problem etc which involve forming and solving first and second order ordinary differential equations.

CO3: Solve system of equations using matrices and Eigen value problems.

CO4: Measure the curves by the concept of curvature.

(To get the basic concepts of differential equations, calculus and linear algebra and their applications And modeling of electrical circuits)

Topics Covered:

Module -1 (15 Hours)

Differential Equation: First order differential equations, Separable equation, exact differential equation, linear differential equation, Bernoulli's equation and application to Electrical circuits.

Linear differential equation of second and higher order, Homogeneous equation with constant co-efficient, Euler-Cauchy equations, Solution by undetermined co-effficient, Solutions by variation of parameters, Modeling of electric circuits.

Module-II (15Hours)

Calculus: Asymptote, Curvature
Series solution of differential equations, Power series method, Legendres equation and Lagenders polynomials, Bessels equation, Bessels function and its application.

Module-III (15 Hours)

Linear algebra, Matrices, Vectors, Determinants, System of linear equations, eigen values and eigen vectors, Symmetric and skew-symmetric matrices, Orthogonal matrices, Complex matrices, Hermitian and skew-hermitian matrices, Unitary matrices and similarity of matrices.

Text Books:

1. Differential Calculus by Santi Narayan and Mittal, Chapters 14, 15 Publishers: S. Chand
2. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition

Chapter 1(1.1 to 1.6), Chapter 2(2.1 to 2.12) Chapter 4(4.1 to 4.3, 4.5, 4.6 Chapter 6(6.1 to 6.6) Chapter 7(7.1 to 7.5)

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana Publisher: TMH
2. Mathematical Methods by Potter Goldberg Publisher: PHI

BS1104 MATHEMATICS-II (3-1-0) (2nd SEM)

Lecture: 3 **Internal Assessment:30**
Tutorial: -1 **Final Examination: 70**
Practical: -0 **Credits:4**

Prerequisite: Mathematics I

Course Outcome: At the end of the course, the students will be able to :

CO1 : Apply Laplace transform and its properties to solve certain linear differential equations.

C02 : Apply Fourier series/Fourier transform and its properties to frequency domain analysis of periodic and aperiodic signals.

CO3: Apply the knowledge of vector calculus, gradient, divergence and curl & line, surface and volume integrals to solve gauss theorem and stokes theorem, open surface and close surface.

(To learn about double and triple integration and enable them to handle integrals of higher orders and to know the basics of vector calculus comprising gradient , divergence and curl & line, surface and volume

integrals along with the classical theorems involving them , Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique)

Topics Covered :

Module – I (15 Hours)

Laplace transformation and its use in getting solution to differential equations, Convolution , Integral equations

Fourier series, Fourier expansion of functions of any period, Even and odd functions, Half range expansion

Module – II (15 Hours)

Fourier transform and Fourier Integral, Gamma, Beta functions, error function

Vector differential calculus: vector and scalar functions and fields, Derivatives, Curves, tangents and arc length, gradient, divergence, curl

Module – III (15 Hours)

Vector integral calculus: Line Integrals, Green Theorem, Surface integrals, Gauss theorem and Stokes theorem

Text Book

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition

   Chapter 5(5.1 to 5.7), Chapter 8(8.4, 8.5, 8.9 to 8.11) Chapter 9(9.1 to 9.9) Chapter 10(10.1 to 10.4, 10.8 to 10.10)

Reference Books:

3. Higher Engineering Mathematics by B. V. Ramana Publisher: TMH
4. Mathematical Methods by Potter and Goldberg Publisher: PHI 13

HM 3101 English Communication Skills (2-0-0) (Theory)

Lecture :2 **Internal Assessment:30**
Tutorial : -0 **Final Examination: 70**
Practical : -0 **Credits:2**

Prerequisite: Basic English Knowledge of 10+2 level and ability to communicate in English.

Course Outcomes : At the end of the course, the students will be able to :

CO1: Gain expertise in communication and the factors that influence communication, which will make the students corporate ready to interact with the international world.

CO2: Gain expertise in variety of spoken English so that they can interact with the outside world

CO3: Capable to review the English grammar and will be able to differentiate the different sounds of English.

(To understand the importance of communication and the factors that influence communication, to review the English grammar and to differentiate the different sounds of English**)**

Topics covered :

Module-I The elements of communication (6 hours)

1.1 the importance of communication through English at the present time

1.2 the process of communication and factors that influence communication : sender, receiver, channel, code, topic, message, context, feedback, 'noise', filters and barriers

1.3 the importance of audience and purpose

1.4 the information gap principle : given and new information ; information overload

1.5 verbal and non-verbal communication : body language

1.6 comparing general communication and business communication

Module-II The sounds of English (14 hours)

2.1 vowels, diphthongs, consonants, consonant clusters

2.2 the International Phonetic Alphabet (IPA) ; phonemic transcription

2.3 problem sounds

2.4 syllable division and word stress

2.5 sentence rhythm and weak forms

2.6 contrastive stress in sentences to highlight different words

2.7 intonation : falling, rising and falling-rising tunes

2.8 varieties of Spoken English : Standard Indian, American and British

(**Note :** This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible.)

Module-III Review of English grammar (10 hours)

3.1 stative and dynamic verbs

3.2 the auxiliary system ; finite and non-finite verbs

3.3 time, tense and aspect

3.4 voice: active and passive

3.5 modality

3.7 negation

3.8 Interrogation ; reported and tag questions

3.9 conditionals

3.10 concord

3.11 Phrasal verbs

(Note The teaching of grammar should be treated as a diagnostic and remedial activity and integrated with communication practice. The areas of grammar in which errors are common should receive special attention when selecting items for review. Teaching need not be confined to the topics listed above.)

Books recommended:

1. An Introduction to Professional English and Soft Skills by B.K.Das et al., Cambridge University Press. (Facilitated by BPUT). 14

HM 7101 Communicative English Lab -I (0-0-3) (1ST Sem)

Lecture :0 **Internal Assessment:100**
Tutorial : 0- **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Communicative English

Course Outcome: At the end of the course, the students will be able to :

CO1: Develop communication skill by finding out the correct pronunciation of words with the help of a dictionary, listening with a focus on pronunciation to match the international era.
CO2: Practice pronunciation by reading aloud to make clear conversation.
CO3: Reduce grammatical mistakes by writing short paragraphs on given topics
CO4: Make drafting, request letters, applications etc
CO5: Become a good leader and team player by developing their soft skill & communication skill

(To understand the principle of Sheet Lay-out & Sketching, Projection, Intersection of surfaces, Sectional Views of solids, To Introduce Computer Aided Drafting.)

Topics covered:

Lab sessions will be devoted to practice activities based on all three modules of theory.

a. Phonemic transcription 5 hours

Students will be trained to find out the correct pronunciation of words with the help of a dictionary, to enable them to monitor and correct their own pronunciation.

i. Transcription of words and short sentences in normal English orthography (writing) Into their IPA equivalents;
ii. Transcription of words presented orally;
iii. Conversion of words presented through IPA symbols into normal orthography
iv. Syllable division and stress marking (in words presented in IPA form)

b. Listening 10 hours

i. Listening with a focus on pronunciation (ear-training) : segmental sounds, stress, weak forms, intonation

Students should be exposed, if possible, to the following varieties of English during listening practice : Standard Indian, British and American.

c. Speaking 15 hours

I. Pronunciation practice (for accent neutralization), particularly of problem sounds, in isolated words as well as sentences
ii. Practising word stress, rhythm in sentences, weak forms, intonation
iii. Reading aloud of dialogues, poems, excerpts from plays, speeches etc. For practice in pronunciation

d. Grammar and usage 12 hours

The focus will be on the elimination of common errors. Some writing activities (e.g. writing of short paragraphs on assigned topics) can be used to identify these errors.

Project Work

Students will be required to produce and submit by the end of Semester 1 a 350-500 word project report on a topic of their choice. The project should involve data collection, analysis and reporting. Ten marks (out of the 100 marks allocated for the Lab test) will be set apart for the project. 15

HM3102 Business Communication (2-0-0) (2nd Sem.)

Lecture: 2 **Internal Assessment:30**
Tutorial: -0 **Final Examination: 70**
Practical: -0 **Credits: 2**

Prerequisite: Basic English knowledge of 10+2 level and good English writing and speaking skill.

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the elements of business communication for oral presentation, interviews, group discussions and preparing of memos, reports, and abstracts.

CO2: develop reading and writing skills which will help them making predictions, note making and drafting, understand the writer's point of view,

CO3: Become a good leader and team player by developing their soft skill

(Understating the elements of business communication. Enhancing the reading and writing capabilities. Developing soft skill quality to become a good leader and team player.)

Topics Covered :

Module - I The Elements of Business Communication (10 hours)

1.1 Patterns of communication in the business world: upward, downward, Horizontal, grapevine etc
1.2 Internal and external channels of communication; formal and informal Channels.
1.3 Introduction to cross-cultural communication.

1.4 Avoiding gender, racial and other forms of bias in communication
1.5 Common forms of oral and written communication in the business world:
Oral presentations, interviews and group discussions
Memos, reports, summaries and abstracts, e-mails

Module-II Reading and writing (15 hours)

2.1 the importance of developing reading skills
2.2 the sub-skills of reading :

a. understanding the main idea and supporting details
b. reading between the lines : inferential reading
c. understanding the writer's point of view
d. making predictions
e. guessing the meanings of unfamiliar words
f. skimming and scanning
g. note-making

2.3 the importance of writing skills
2.4 the differences between speech and writing
2.5 the qualities of effective writing : coherence, cohesion, logical structuring and organization, clarity of language, stylistic variation etc.
2.6 the writing process : pre-writing, drafting, re-writing

Module -III Soft skill development (5 hours)

4.1 soft skills: becoming a good leader and team-player
4.2 inter-relating soft skills and communication skills

Books recommended:

1 Business Communication Today by Bovee et al (Pearson)
2 Business Communication by Meenakshi Raman and Prakash Singh (Oxford)
3 Crash Course in Personal Development by Brian Clegg (Kogan Page)
4 Activities for Developing Emotional Intelligence by Adele B.Lynn (HRD Press)
5 Lateral Thinking by Edward De Bono (Penguin) 16

HM 7102 Business Communicative Lab (0-0-3) (2nd Sem)

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Business Communication in English and Communicative English Lab

Course Outcome: At the end of the course, the students will be able to :
CO1: Communicate orally in social and work related situations;

CO2: Narrate or report an event; making/accepting requests,expressing gratitude, asking permission, suggestion, advising, making a proposal to cope up with corporate environment and become a good leader.

CO3: Develop writing skills by using principles of "Process Writing"; and achieve soft skills through activities.

(Know basic workshop processes. Read and interpret job drawing. Identify, select and use various marking, measuring, holding, striking and cutting tools & equipments. Operate, control different machines and equipments. Inspect the job for specified dimensions. Produce jobs as per specified dimensions. Adopt safety practices while working on various machines.)

Topics covered :

a. **Communication Practice 30 hours**

i. Speaking : oral communication in social and 10 hours
work-related situations, e.g.:
Greeting an acquaintance/ friend, introducing oneself, introducing a friend to another friend, breaking off a conversation politely, leave-taking;
making and responding to inquiries; expressing an opinion;
expressing agreement/ disagreement, contradicting/ refuting an argument;
expressing pleasure, sorrow, regret, anger, surprise, wonder, admiration, Disappointment etc.
Narrating or reporting an event;
Describing people, objects, places, processes etc.
Ordering / directing someone to do something
Making requests; accepting / refusing a request
Expressing gratitude; responding to expressions of gratitude
Asking for or offering help; responding to a request for help
Asking for directions (e.g. how to reach a place, how to operate a device etc.) and giving directions
asking for and granting/ refusing permission
prohibiting someone from doing something
suggesting, advising, persuading, dissuading, making a proposal
praising, complimenting, felicitating
expressing sympathy (e.g. condolence etc.)
Complaining, criticizing, reprimanding

ii. **Reading 10 hours**
Students will be given practice in reading and comprehending 6-8 simple passages of 100-300 words each, on topics of general as well as professional interest. The texts will be supported by suitable exercises designed to foster comprehension skills and vocabulary enrichment, together with study skills (note making) and reference skills (using a dictionary).
Practice will be provided in the important sub-skills of reading which are introduced in Module 2 of the theory component.

iii. **Writing 10 hours**
Writing short paragraphs on given topics or topics of one's choice; social and business letters; reports; applications ; resumes ; summaries

The principles of 'Process Writing' should be used to teach writing skills.
i pre-writing : generating ideas, brain-storming, idea mapping, outlining
ii writing : generating a first draft ; reviewing, redrafting, editing
iii post-writing : making a presentation ; discussion and feedback, preparing the final draft

b. Soft skills practice 10 hours
Activities designed to highlight leadership and 'team' skills ; Group discussion

BE 2102 - BASIC ELECTRICAL ENGINEERING (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : -0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Physics and Mathematics

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of source of electrical energy, meaning of electrical quantities and the behavior of circuit elements used in all the electrical networks for further studies in engineering.

CO2: Implement the basic and underlying principles of Electrical circuits, Electro-mechanical devices used for Generation in Transmission, Distribution, Utilization and Measurement of electric energy.
CO3: Design and analyze AC , DC and magnetic networks
CO4: Apply the principle of operation of induction motor and different measuring instruments to measure the different electrical parameters in industrial application.
CO5: Apply the concept of power systems, Transmission/Distribution and utilization of Electrical energy in industrial application

This is a foundation course aimed at explaining the basic and underlying principles of Electrical circuits, Electro-mechanical devices used for Generation, Transmission, Distribution, Utilization and Measurement of electric energy.

(To explain the basics and underlying principles of Electrical circuits, Working principle of DC Generator, DC Motor, AC Machines, Three phase power and Transmission and Distribution of power, Utilization and Measurement of electric energy.)

Topics Covered:
MODULE-I (12 Lectures)

1. **Introduction**: Ideal and Practical Sources, Source Conversion, Induced EMF, Energy Stored in Inductor & Capacitor, Electric Power. (1)
2. **DC Networks**: Laws and Theorems applicable to DC networks (KCL & KVL, Node voltage & Mesh current analysis, Delta-Star & Star-Delta conversion, Superposition principle, Thevenin & Norton theorem), Transients in R-L and R-C circuits with DC excitation. (4)
3. **Magnetic Circuits**: Introduction to Electromagnetism, B-H curve, Permeability, Reluctance, Solution of simple magnetic circuits, Hysteresis and Eddy current loss. (3)
4. **D.C. Machines**: Construction, Classification and Principle of operation of DC machines, EMF equation of DC generator, Speed Equation of DC Motor. (3)

MODULE-II (12 Lectures)

5. **Single-Phase AC Circuits**: Single-phase EMF Generation, Waveform and Phasor representation, Average and Effective value of sinusoids, Peak factor & Form factor, Complex Impedance and Power using j-operator, Power factor. (5)
6. **Three-Phase AC Circuits**: Comparison between single-phase and three-phase systems, Three-phase EMF Generation, Line and Phase quantities in star and delta networks, Power and its measurement in three-phase balanced circuits. (3)
7. **Single-Phase Transformers**: Construction and principle of operation, EMF Equation, Transformation ratio, Practical and Ideal transformers, Transformer losses, Brief idea on transformer phasor diagram and transformer rating. (3)

MODULE-III (12 Lectures)

8. **Induction Motors**: Introduction to Three-phase and Single-phase Induction Motors, Concept of Slip, Slip-Torque characteristics (no derivations). (2)
9. **Measuring Instruments**: Introduction, PMMC Ammeters and Voltmeters with extension of range, Moving-Iron Ammeters and Voltmeters, Study of Digital Voltmeters and Multi-meters, Dynamometer type Wattmeter, Energy meter. (6)
10. **Power Systems**: Brief idea about various generating plants (Thermal, Hydel, and Nuclear), Transmission, Distribution and Utilization of Electric Energy. (3)

Text Books:

1. Prasanta Kumar Satpathy, “Basic Electrical Engineering”, Oxford University Press (Printed in India), First Published-2008, Second Impression-2008.

Reference Books:

1. Hughes, “Electrical & Electronic Technology”, Ninth Edition (Revised by J Hiley, K Brown, and I Smith), Pearson Education, First Impression-2007.
2. Nagsarkar & Sukhija, “Basic Electrical Engineering”, Oxford University Press (Printed in India), First Published-2005, Third Impression-2006..
3. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice-Hall of India, 2nd Printing-2006.

BE 7106 BASIC ELECTRICAL ENGINEERING LABORATORY (0-0-3)

Lecture :0
Tutorial : -0
Practical : -3

Internal Assessment:100
Final Examination:
Credits:2

Prerequisite: Basic Physics and Mathematics knowledge of 10+2 level.

Course Outcome: At the end of the course, the students will be able to :

CO1: Determine the characteristics of various electrical devices like induction motors, generators, incandescent lamps, transformers so that they will be able to apply the knowledge in electrical circuits and appliances.

CO2: Test the star-delta starter and to determine the current, voltage and power in RLC circuit and apply the knowledge for the operation and excitation of electrical circuits and motors

C03: Connect and test single phase energy meter, three phase induction motor and apply the knowledge in industrial application.

Topics covered :

Select any 8 experiments from the list of 10 experiments:

(To study the characteristics of various electrical devices like DC motor and generator, induction motors and generators, incandescent lamps and transformers. To connect and test single phase energy meter, three phase induction motor.)

1. Connection and measurement of power consumption of a fluorescent lamp.
2. Measurement of armature and field resistances of a DC compound machine.
3. Starting and speed control of a DC shunt motor by (a) field flux control method, and (b) armature voltage control method.
4. V-I characteristics of incandescent lamps and time-fusing current characteristics of a fuse.
5. Connection and testing of a single-phase energy meter.
6. Starting of three-phase induction motor by star-delta starter.
7. Determination of open circuit characteristics (OCC) of DC shunt generator.
8. Calculation of current, voltage and power in series R-L-C circuit excited by single-phase AC supply and calculation of power factor.
9. Calculation of no load losses of a single-phase transformer.
10. Study of single-phase induction motors/ fan motors.

BE2105 PROGRAMMING IN 'C' (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : -0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Mathematics and Programming

Course Outcome: At the end of the course the students will be able to

CO1: Apply the knowledge of structured programming approach to design structured programs using functions, arrays, pointers;

CO2: Develop the logical concept using the conditional/relational/logical/arithmetic/assignment operators

CO3: Apply structures and I/O handling to develop their programming skills

(To explain the details of structured programming approach; To design structured programs using functions, arrays, pointers; To enhance the programming skill of the students using structures and I/O handling)

Topics Covered:

Module – I [12 Hours]

Algorithm, flowchart, Structured Programming Approach, structure of C program (header files, C pre-processor, standard library functions, etc.),identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation. Input-output statements, statements and blocks, if and switch statements, loops:-while, do-while and for statements, break, continue, goto, programming examples.

Module – II [12 Hours]

Designing structured programs: - Functions, parameter passing, storage classes- extern, auto, register, static, scope rules, user defined functions, recursive functions. Arrays- concepts, declaration, definition, accessing elements, and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory management functions, command line arguments,

Module – III [12 Hours]

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, C program examples. Input and output – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling, C program examples.

Text Books:

1. Balagurusamy : "C Programming" Tata McGraw-Hill
2. P. Dey & M. Ghosh, "Computer Fundamental & Programming in C"- Oxford University Press
3. Deitel -"C How to programme" PHI publication/ Pearson Publication

Reference Books:

1. Y. Kanitkar – "Let us C" BPB Publisher
2. H. Schildt – "C the complete Reference" McGraw-Hill
3. Schaum Series- "C Programming" - Gotterfried

BE7107 'C' PROGRAMMING LAB (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Basic Knowledge of +2 Mathematics and Programming

Course Outcome: At the end of the course, the students will be able to :

CO1: Write C programs to perform various operations like generating Fibonacci series, generating prime numbers, factorials;
CO2: Solve Towers of Hanoi problem;
CO3: Perform operations on matrices to remove complexity of a program

Topics covered :

(Minimum 10 programs to be done covering 8 Experiments)

Able to write basic C programs to perform various operations like generating Fibonacci series, generating prime numbers, factorials; To solve Towers of Hanoi problem; To perform operations on matrices.

Experiment No. 1

(To find the sum of individual digits of a positive integer)

a) Write a C program to find the sum of individual digits of a positive integer.

(To perform various operations like generating Fibonacci series)

b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

(To generate all the prime numbers between 1 and n)

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Experiment No. 2

(Calculate the Sum of a series)

a) Write a C program to calculate the following Sum:

Sum=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!

b) Write a C program to find the roots of a quadratic equation.

Experiment No. 3

(To find both recursive and non-recursive functions)

a) Write C programs that use

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

(To solve Towers of Hanoi problem)

iii) To solve Towers of Hanoi problem.

Experiment No. 4

(To find both the larges and smallest number in a list of integers)

a) Write a C program to find both the larges and smallest number in a list of integers.

(To perform operations on matrices.)

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Experiment No. 5

(To perform the operations)

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Experiment No. 6

a) Write a C program to construct a pyramid of numbers.

b) Write a C program to count the lines, words and characters in a given text.

Experiment No.7

(Representation complex number using a structure)

a) Write a C program that uses functions to perform the following operations:

i) Reading a complex number

ii) Writing a complex number

iii) Addition of two complex numbers

iv) Multiplication of two complex numbers.

(Note: using a structure.) 21

Experiment No. 8

(The file transfer of numbers.)

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

Book:- PVN. Varalakshmi, Project Using C Scitech Publisher

BE 2106 DATA STRUCTURE using 'C' (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Programming in C

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the storage structure of arrays, stacks and queues to design and develop a program

CO2: Apply the concept of Dynamic storage management such as garbage collection and compaction and trees to tree terminology, binary tree, binary search tree and its manipulation

CO3: Apply different types of sorting and searching techniques such as bubble, selection, insertion, quick, merge, heap, radix sort to different search method such as hashing and has functions.

(Write programs in 'C ' using different types of data structures. Understand concepts of arrays, pointers, link list, stacks, queues, trees, and graphs. Use proper data structures for particular problem. Develop efficient software using various data structures.)

Topics Covered :

Module – I

[12 hours]

Introduction to data structures: storage structure for arrays, sparse matrices, Stacks and Queues: representation and application. Linked lists: Single linked lists, linked list representation of stacks and Queues. Operations on polynomials, double linked list, circular list.

Module – II

[12 Hours]

Dynamic storage management-garbage collection and compaction, infix to post fix conversion, postfix expression evaluation. Trees: Tree terminology, Binary tree, Binary search tree, General tree, B+ tree, AVL Tree, Complete Binary Tree representation, Tree traversals, operation on Binary tree-expression Manipulation.

Module –III
[12 Hours]
Graphs: Graph terminology, Representation of graphs, path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Warshall's algorithm (shortest path algorithm.) Sorting and Searching techniques – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort, Heap sort, Radix sort. Linear and binary search methods, Hashing techniques and hash functions.

Text Books:

1. Gilberg and Forouzan: "Data Structure- A Pseudo code approach with C" by Thomson publication
2. "Data structure in C" by Tanenbaum, PHI publication / Pearson publication.
3. Pai: "Data Structures & Algorithms; Concepts, Techniques & Algorithms "Tata McGraw Hill.

Reference Books:

1. "Fundamentals of data structure in C" Horowitz, Sahani & Freed, Computer Science Press.
2. "Fundamental of Data Structure" (Schaums Series) Tata-McGraw-Hill.

BE 7108 DATA STRUCTURE USING C LAB (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : - 0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Programming in C

Course Outcome: At the end of the course, the students will be able to :
CO1: Develop a program on matrix multiplication using C.
C02: Write the programming by using stacks, queues, linked lists, binary tree, and linked list.
CO3:Write program using recursive and non-recursive functions

Topics covered :

(Minimum 10 experiments to be done)

(To practice matrix multiplication using C. To write C programs to learn the use of stacks, queues, linked lists, binary tree, linked list.)

Experiment No.1
Write a C program to perform matrix multiplication using array.

Experiment No.2

(a) Write a C program to create a stack using an array and perform
(i) push operation (ii) pop operation

(b) Write a C program to create a queue and perform
i) Push ii) pop iii) Traversal

Experiment No. 3

Write a C program that uses Stack operations to perform the following:
i) Converting infix expression into postfix expression
ii) Evaluating the postfix expression

Experiment No. 4

Write a C program that uses functions to perform the following operations on Single linked list:
i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways

Experiment No. 5

Write a C program that uses functions to perform the following operations on Double linked list:
i) Creation ii) Insertion iii) Deletion

Experiment No. 6

Write a C program that uses functions to perform the following operations on Binary Tree:
i) Creation ii) Insertion iii) Deletion

Experiment No. 7

Write C programs that use both recursive and non recursive functions to perform the Linear search operation for a Key value in a given list of integers:
i) Linear search

Experiment No. 8

Write C program that use both recursive and non recursive functions to perform the Binary search operation for a Key value in a given list of integers:

Experiment No.9

Write a C program that implement Bubble Sort method to sort a given list of integers in descending order.

Experiment No.10

Write a C program that implement Quick Sort method to sort a given list of integers in ascending order:

Book:- “Data structure using C” by Sudipta Mukherjee, TMH Publication

COURSE SYLLABI OF
B.TECH ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E&TCE)
BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
Second Year

3rd Semester

THEORY

Code	*Subject*	*L-T-P*	*Credits*
BSCM1205	Mathematics – III	3-1-0	4
HSSM3204	Engineering Economics & Costing		
	Or	3-0-0	3
HSSM3205	Organizational Behavior		
BSMS1213	Material Science & Engineering	3-0-0	
	Or	3-0-0	3
BSCP 1207	Physics of Semiconductor Devices		
BEES2211	Network Theory	3-1-0	4
PCEE4204	Electrical & Electronics Measurement	3-0-0	3
PCEC4201	Analog Electronics Circuit	3-1-0	4
	Credits (Theory)	21	

PRACTICALS/SESSIONALS

BEES7211	Network & Devices Laboratory	0-0-3	2
PCEC7201	Analog Electronics Circuit Laboratory	0-0-3	2
PCEE7204	Electrical & Electronics Measurement laboratory	0-0-3	2
	Credits (Practicals/Sessionals)		6

4th Semester

THEORY

Code	*Subject*	*L-T-P*	*Cred*
PCEC4205	Electromagnetic Field & Waves	3-0-0	3
HSSM3205	Organizational Behavior		
	Or	3-0-0	3
HSSM3204	Engineering Economics & Costing		
BSCP1207	Physics of Semiconductor Devices		
	Or	3-0-0	3
BSMS1213	Material Science & Engineering		
BEEC2214	Energy Conversion Devices	3-1-0	4
BECS2212	C++ & Object Oriented Programming	3-0-0	3
PCEC4202	Digital Electronics Circuit	3-1-0	4
	Credits (Theory)	20	

PRACTICALS/SESSIONALS

BEEC7214	Energy Conversion Devices Laboratory	0-0-3	2
		0-0-3	2
PCEC7202	Digital Electronics Circuit Laboratory	0-0-3	2
BECS7212	C++ & Object Oriented Progamming Laboratory		
HSSM7203	Communication & Interpersonal Skills for Corporate Readiness Laboratory	0-0-3	2
	Credits (Practicals/Sessionals)		8

TOTAL SEMESTER CREDITS 27	TOTAL SEMESTER CREDITS 28
TOTAL CUMULATIVE CREDITS 83	TOTAL CUMULATIVE CREDITS 111

BSCM1205 **Mathematics – III**

Lecture :3
Tutorial : -1
Practical : -0

Internal Assessment:30
Final Examination: 70
Credits:4

Prerequisite: Mathematics II

Course Outcome : At the end of the course, the students will be able to :

CO1: Solve problems related to partial differential equations of first order, homogeneous and non-homogeneous partial differential equation and analyze signals in DSP & communication.

CO2: Analyze Complex analysis like Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping and Power Series, Taylor's series, Laurent's series to solve different equations related to digital signal processing and communication area.

(The students will be able to solve problems related to partial differential equations, Complex Analysis: Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping and Power Series, Taylor's series, Laurent's series and applications in engineering problems)

Topics Covered :

Module-I (18 hours)

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation

The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,

Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module –III (10 hours)

Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:

1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
   Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, " Higher Engineering Mathematics", McGraw Hill Education, 2008
   Reading chapter: 18

Reference books:

1. E.B. Saff, A.D.Snider, " Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
2. P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

HSSM3204 Engineering Economics & Costing

Lecture :3 **Internal Assessment:30**
Tutorial : 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic knowledge on Economics

Course Outcome: At the end of the course, the students will be able to :

CO1 : Apply the general concepts on micro and macro economics, Theory of demand, Demand function, Theory of production in market analysis in marketing job.

CO2: Implement the knowledge about the time value of money-Simple and Compound interest, cost benefit analysis in public projects to manage financial activity.

CO3: Apply the fundamental knowledge on cost concepts to prepare cost sheet and Break-even analysis

Topics Covered :

(The students will be able to know the general concepts on micro and macro economics, time value of money, evaluation of engineering projects, cost concepts, Break-even analysis-Linear approach ,meaning and functions of commercial banks)

Module-I: (12 hours)

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (Simple numerical problems to be solved). Theory of production, Law of variable proportion, Law of returns to scale.

Module-II: (12 hours)

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

Module-III: (12 hours)

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)

Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

1. Riggs, Bedworth and Randhwa, “Engineering Economics”, McGraw Hill Education India.
2. D.M. Mithani, Principles of Economics. Himalaya Publishing House

Reference Books :

1. Sasmita Mishra, “Engineering Economics & Costing “, PHI
2. Sullivan and Wicks, “ Engineering Economy”, Pearson
3. R.Paneer Seelvan, “ Engineering Economics”, PHI
4. Gupta, “ Managerial Economics”, TMH
5. Lal and Srivastav, “ Cost Accounting”, TMH

HSSM 3205 **Organizational Behaviour**

Lecture :3 **Internal Assessment:30**
Tutorial : -0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Engineering Economics, Communication Skill knowledge

Course Outcome : At the end of the course, the students will be able to :

CO1: Behave and manage properly in an organization by gaining the fundamental knowledge about behavior of people in an organization, such as personality, perception

CO2: Lead a team in a proper way in an organization to achieve the goal by applying the concept of learning. Organizational process such as communication, leadership, conflicts

CO3: Apply the concept of Organization culture such as human resource management which include selection, orientation, performance appraisal and training for the selection of right person in right post so that a company can grow in the right direction

(To study the behavior of people in an organization, such as personality, perception. Define learning. Organizational process such as communication, leadership, conflicts. Organization culture such as human resource management which include selection, orientation, performance appraisal, training etc.)

Topics Covered :

Module I :

The study of Organizational Behaviour : Definition and Meaning, Why Study OB

Learning – Nature of Learning, How Learning occurs, Learning and OB.

Foundations of Individual Behaviour : Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.

Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Herzberg’s Two Factor Theory, Maslow’s Need Hierarchy Theory, Alderfer’s ERG Theory, Evaluations.

Module II :

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness, Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-

making Managerial Implications, Effective Team Building. Leadership-Leadership & Management, Theories of Leadership-Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Follower ship, How to be an effective Leader, Conflict-Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA).

Module-III :
Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management-Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organisational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Text Books :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswathappa, Organisational Behaviour, Himalaya Publishing House.

Reference Books :

1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma" Organizational Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech
7. Kavita Singh, "Organizational Behaviour", Pearson

BSMS1213 Material Science and Engineering

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Chemistry I

Course Outcome : At the end of the course, the students will be able to :

CO1: Apply the fundamental knowledge about Engineering Materials, engineering properties of material for the selection of appropriate material in the field of engineering.

C02: Design different electrical and electronics circuits and devices by applying the fundamental properties of Electrical and Electronic materials such as electrical conductivity, thermal conductivity, energy bands, and concepts of conductor, semi-conductor and insulator.

CO3: Apply the fundamental knowledge on properties of Optical materials to design different fiber optics transmission channels with reduced loss.

CO4: Design different electronics devices by applying the fundamental knowledge on composite materials.

(The students get acquainted with various types of Engineering Materials, engineering properties of different materials and application of these materials in the field of engineering)

Topics covered :

MODULE-I (11 Hours)

Introduction, Classification of Engineering Materials, Engineering properties of materials, Selection of Materials

Mechanical Properties of Materials: Tensile strength, Stress–strain behaviour, Ductile and brittle material, Impact test, Toughness, Hardness test, Fatigue and fatigue test, Creep and Creep test, Fracture

MODULE-II (13 Hours)

Electrical and Electronic materials: Electrical conductivity, Thermal conductivity, Free electron theory, Energy band concept of conductor, insulator & semiconductor.

Superconductor materials: Principles of superconductivity, zero resistivity, Critical magnetic field and critical current density, Type I & II superconductors, Applications of superconductors

Dielectric Materials: Microscopic displacement of atoms and molecules in an external DC electric field, Polarization and dielectric constant, Dielectric susceptibility, polarization mechanisms, Temperature and frequency dependence of dielectric constant, Dielectric breakdown, Ferroelectric materials, Piezoelectrics, pyroelectrics and ferroelectrics, Dielectric materials as electrical insulators

Magnetic Materials: Concept of magnetism – Diamagnetic, Paramagnetic, Ferromagnetic materials, Hysteresis, Soft & hard magnetic materials, Ferrite

MODULE-III (11 Hours)

Optical materials: optical properties – scattering, refraction, reflection, transmission & absorption, Laser – principles and applications, Optical fibres – principles and applications

Polymeric materials: Types of polymers, Mechanism of polymerization, Mechanical behaviour of polymers, Fracture in polymers, Rubber types and applications, Thermosetting and thermoplastics, Conducting polymers

Composite Materials: Microcomposites & Macrocomposites, fibre reinforced composites, Continuous fibre composites, Short fibre composites, Polymer matrix composites, Metal-matrix composites, Ceramic-matrix composites, Carbon-carbon Composites, Hybrid composites.

Ceramics: Types, structure, properties and application of ceramic materials

Other materials: Brief description of other materials such as Corrosion resistant materials, Nano phase materials, Shape memory alloy, SMART materials

Text Books:

1. Material Science for Engineers, James F. Shackelford & Madanapalli K Muralidhara, Pearson Education
2. Materials Science and Engineering, W.D.Callister, Wiley and Sons Inc.

Reference Books

1. Materials Science by M.S. Vijaya , G.Rangarajan, Tata MacGraw Hill
2. Materials Science by V. Rajendra, A. Marikani, Tata MacGraw Hill
3. Materias Science for Electrical and Electronic Engineers, I.P.Jones, Oxford University Press

4. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
5. The Science and Engineering of Materials, Donald R. Askeland and Pradeep P Phule, Thomson Learning (India Edition)
6. Materials Science and Engineering, V.Raghavan, Prentice Hall of India Pvt.Ltd.
7. Materials Science and Engineering in SI units, W.F.Smith, J.Hashemi and R.Prakash, Tata MacGraw Hill
8. Engineering Materials, Properties and Selection, Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India
9. Material Science & Engineering, Vijaya M. S., Rangarajan G, Tata McGraw Hill.
10. Material Science & Enginnering, S.K.Tripathy, A.K.Padhy & A. Panda, Scitech publication.

BSCP 1207 Physics of Semiconductor Devices

Lecture :3 **Internal Assessment:30**
Tutorial : -0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Physics I , Material Science.

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the fundamental knowledge of quantum theory of solid, Electrons and holes in semiconductor, Motion and Recombination of Electrons and Holes to determine the characteristics and working principle of Diode, BJT and FET.

CO2: Design different complex circuits by utilizing the working principle of PN junction, Bipolar Transistor, MOS Capacitor and MOS Transistor.

(Students would be exposed to the quantum theory of solid, Motion and Recombination of Electrons and Holes ,PN junction, The Bipolar Transistor, MOS Capacitor , MOS Transistor)

Topics Covered :

Module-I (10 Hours)

1. **Introduction to the quantum theory of solids**: Formation of energy bands, The k-space diagram (two and three dimensional representation), conductors, semiconductors and insulators.

2. **Electrons and Holes in semiconductors:** Silicon crystal structure, Donors and acceptors in the band model, electron effective mass, Density of states, Thermal equilibrium, Fermi-Dirac distribution function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes: derivation of *n* and *p* from D(E) and f(E), Fermi level and carrier concentrations, The *np* product and the intrinsic carrier concentration. General theory of *n* and *p*, Carrier concentrations at extremely high and low temperatures: complete ionization, partial ionization and freeze-out. Energy-band diagram and Fermi-level, Variation of EF with doping concentration and temperature.

3. **Motion and Recombination of Electrons and Holes:** Carrier drift: Electron and hole mobilities, Mechanism of carrier scattering, Drift current and conductivity.

Module II (11 Hours)

4. **Motion and Recombination of Electrons and Holes (continued):** Carrier diffusion: diffusion current, Total current density, relation between the energy diagram and potential, electric field. Einstein relationship between diffusion coefficient and mobility. Electron-hole recombination, Thermal generation.

5. **PN Junction:** Building blocks of the pn junction theory: Energy band diagram and depletion layer of a pn junction, Built-in potential; Depletion layer model: Field and potential in the depletion layer, depletion-layer width; Reverse-biased PN junction; Capacitance-voltage characteristics; Junction breakdown: peak electric field. Tunneling breakdown and avalanche breakdown; Carrier injection under forward bias-Quasi-equilibrium boundary condition; current continuity equation; Excess carriers in forward-biased pn junction; PN diode I-V characteristic, Charge storage.

6. **The Bipolar Transistor:** Introduction, Modes of operation, Minority Carrier distribution, Collector current, Base current, current gain, Base width Modulation by collector current, Breakdown mechanism, Equivalent Circuit Models - Ebers -Moll Model.

Module III (12 Hours)

7. **Metal-Semiconductor Junction:** Schottky Diodes: Built-in potential, Energy-band diagram, I-V characteristics, Comparison of the Schottky barrier diode and the pn-junction diode. Ohmic contacts: tunneling barrier, specific contact resistance**.**

8. **MOS Capacitor:** The MOS structure, Energy band diagrams, Flat-band condition and flat-band voltage, Surface accumulation, surface depletion, Threshold condition and threshold voltage, MOS C-V characteristics, Qinv in MOSFET.

9. **MOS Transistor:** Introduction to the MOSFET, Complementary MOS (CMOS) technology, V-I Characteristics, Surface mobilities and high-mobility FETs, JFET, MOSFET Vt, Body effect and steep retrograde doping, pinch-off voltage,

Text Books:

1. Modern Semiconductor Devices for Integrated Circuits, Chenming Calvin Hu, Pearson Education/Prentice Hall, 2009.
2. Semiconductor Physics and Devices, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Limited, New Delhi.

Reference Books:

1. Fundamentals of Semiconductor Devices, M.K. Achuthan and K.N. Bhatt, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Solid State Electronics Devices, 6th Edition, Ben. G. Stretman and Sanjay Banarjee, Pearson Education, New Delhi.
3. Physics of Semiconductor Devices, 3rd Edition, S.M. Sze and Kwok K. Ng, Wiley India Pvt. Limited, New Delhi.
4. Physics of Semiconductor Devices, 2nd Edition, Dillip K. Roy, University Press (India) Pvt. Ltd., Hyderabad.
5. Solid State Electronics Devices, D.K. Bhattacharya and Rajnish Sharma, Oxford University Press, New Delhi.

BEES2211 **Network Theory**

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Basic Electrical Engineering and Mathematics-II

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of network topology, Network Theories and coupled circuits to Design different electrical circuits.

CO2: Apply the knowledge of Fourier series and Laplace Transform in analyzing the signal from time domain to frequency domain.

CO3: Implement the fundamentals of Network Synthesis to design and construct various electrical circuits.

(The students will be able to know about the network topology. Network Theories and coupled circuits. Two port network and its response. Laplace Transform and problems related to it. Fourier series & its application and able to synthesis an electrical network.)

Topics covered :

MODULE- I (14 Hrs)

1. NETWORK TOPOLOGY: Graph of a network, Concept of tree, Incidence matrix, Tie-set matrix, Cut-set matrix, Formulation and solution of network equilibrium equations on loop and node basis.
2. NETWORK THEOREMS & COUPLED CIRCUITS: Substitution theorem, Reciprocity theorem, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem, Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling, Band Width and Q-factor for series and parallel resonant circuits.

MODULE- II (13 Hrs)

3. LAPLACE TRANSFORM & ITS APPLICATION: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).
4. TWO PORT NETWORK FUNCTIONS & RESPONSES: z, y, ABCD and **h**-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks, Network Functions, Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

MODULE- III (13 Hrs)

5. FOURIER SERIES & ITS APPLICATION: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions, Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response.
6. NETWORK SYNTHESIS: Hurwitz polynomial, Properties of Hurwitz polynomial, Positive real functions and their properties, Concepts of network synthesis, Realization of simple R-L, R-C and L-C functions in Cauer-I, Cauer-II, Foster-I and Foster-II forms.

Text Book:

1. Network Theory – P K Satpathy, P Kabisatpathy, S P Ghosh and A K Chakraborty – Tata McGraw Hill, New Delhi.

Reference Book(s):

2. Network Analysis – M E Van Valkenburg – Pearson Education.
3. Network Synthesis – M E Van Valkenburg – Pearson Education.
4. Network Analysis and Synthesis – Franklin F. Kuo – Wiley Student Edition.
5. Fundamentals of Electric Circuits – Alexander & Sadiku – Tata McGraw Hill.
6. Linear Circuits Analysis and Synthesis – A Ramakalyan – Oxford University Press.
7. Problems & Solutions in Electric Circuit Analysis – Sivananda & Deepa – Jaico Book.
8. Network Theory, Smarajit Ghosh, PHI.

PCEE4204 **Electrical and Electronics Measurement**

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Electrical Engineering and Basic Electronics Engineering

Course Outcome : At the end of the course, the students will be able to :

CO1: Measure different electrical parameters easily by applying the Basic concepts of electronic measurements and error which include measurement of resistance, inductance and capacitance etc

CO2: Apply the Basic concepts on Galvanometer, Ammeter and Potentiometer in measurement of power, energy, frequency and power factor of electrical appliances for their smooth function in industry and power sector.

CO3: Operate of current transformer and potential transformer and its implementation in transmission and distribution.

CO4: Apply the knowledge of different types of oscilloscopes and analyzers to record the behavior of electrical machines at every instant for its efficient and stable operation in industries.

(The students will able to understand the working principle of different measuring instruments and could be able to design and operate different kind of industrial measuring instruments.)

Topics Covered :

MODULE- I (14 Hrs)

1. INTRODUCTION: (a) *Measurement and Error*: Definition, Accuracy and Precision, Significant Figures, Types of Errors. (b) *Standards of Measurement*: Classification of Standards, Electrical Standards, IEEE Standards.
2. MEASUREMENT OF RESISTANCE, INDUCTANCE and CAPACITANCE: (a) *Resistance*: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance, Measurement of High Resistance, Measurement of Resistance of Insulating Materials, Portable Resistance Testing set (Megohmmeter), Measurement of Insulation Resistance when Power is ON, Measurement of Resistance of Earth Connections. (b) *Inductance*: Measurement of Self Inductance by Ammeter and Voltmeter, and AC Bridges (Maxwell's, Hay's, & Anderson Bridge), Measurement of Mutual Inductance by Felici's Method, and as Self Inductance. (c) *Capacitance*: Measurement of

Capacitance by Ammeter and Voltmeter, and AC Bridges (Owen's, Schering & Wien's Bridge), Screening of Bridge Components and Wagnor Earthing Device.

MODULE- II (14 Hrs)

3. GALVANOMETER: Construction, Theory and Principle of operation of D'Arsonval, Vibration (Moving Magnet & Moving Coil types), and Ballistic Galvanometer, Influence of Resistance on Damping, Logarithmic decrement, Calibration of Galvanometers, Galvanometer Constants, Measurement of Flux and Magnetic Field by using Galvanometers.
4. AMMETER and VOLTMETER: Derivation for Deflecting Torque of; PMMC, MI (attraction and repulsion types), Electro Dynamometer and Induction type Ammeters and Voltmeters.
5. POTENTIOMETER: Construction, Theory and Principle of operation of DC Potentiometers (Crompton, Vernier, Constant Resistance, & Deflectional Potentiometer), and AC Potentiometers (Drysdale-Tinsley & Gall-Tinsley Potentiometer).
6. MEASUREMENT OF POWER, ENERGY, FREQUENCY and POWER FACTOR: Measurement of single phase and three phase power by wattmeter, Construction, Theory and Principle of operation of (a) Electro-Dynamometer and Induction type Wattmeters, (b) Single Phase and Polyphase Induction type Watt-hour meters, (c) Frequency Meters, and (d) Power Factor Meters.

MODULE- III (14 Hrs)

7. CURRENT TRANSFPRMER and POTENTIAL TRANSFOMER: Construction, Theory, Characteristics and Testing of CTs and PTs.
8. ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAAMETERS: Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters (Block Diagrams only), Q-meter.
9. OSCILLOSCOPE: Block Diagrams, Delay Line, Multiple Trace, Oscilloscope Probes, Oscilloscope Techniques, Introduction to Analog and Digital Storage Oscilloscopes, Measurement of Frequency, Phase Angle, and Time Delay using Oscilloscope.
10. COUNTERS and ANALYZERS: Introduction to Wave, Harmonic Distortion and Spectrum Analyzers, Frequency Counters, Computer Controlled Test Systems: Testing an Audio Amplifier.

Text Book(s) :

1. Electrical Measurements and Measuring Instruments – Golding & Widdis – 5th Edition, Reem Publication (For sections 2 to 6: Selected Portions from Ch.-VI, VII, IX, XIX, XX, XXI & XXII).
2. Modern Electronic Instrumentation and Measurement Techniques – Helfrick & Cooper – Pearson Education (For sections 1, 7 to 9: Selected Portions from Ch.-1, 3, 6, 7, 9, 10, and 13).

Reference Book(s):

3. A Course in Electrical and Electronic Measurements and Instrumentation – A K Sawhney – Dhanpat Rai & Co.
4. Elements of Electronic Instrumentation and Measurement – Joshep Carr – 3rd Edition, Pearson Education.
5. Electronic Instrumentation – H C Kalsi – 2nd Edition, Tata McGraw Hill.
6. Electronic Measurement and Instrumentation – Oliver & Cage – Tata McGraw Hill.

PCEC4201 **Analog Electronics Circuit**

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Basic Electronics and Basic electrical engineering

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the basics concept of MOS FET, Biasing of BJT and FET to analysis and design of basic transistor amplifier circuits, FET circuits.

CO2: Test and Analyze the behavior of BJT/FET in low and high frequency regions by performing frequency analysis of BJT and FET.

CO3: Apply the principle of Feedback Amplifiers and Oscillators and to design different oscillator and amplifier circuits of desired frequency and gain.

CO4: Implement the knowledge of op-amp and power amplifier in the area of signal processing, and communication.

(The students will be able to analyze and design of basic transistor amplifier circuits, FET circuits, Feedback circuits and power amplifier. Design of different circuits using Op-Amp.)

Topics Covered:

MODULE – I (12 Hours)

1. **MOS Field-Effect Transistor:** Principle and Physical Operation of FETs and MOSFETs. P-Channel and N-Channel MOSFET, Complimentary MOS, V-I Characteristics of E- MOSFETS and D-MOSFETS, MOSFETS as an Amplifier and a Switch (4 Hours)
2. **Biasing of BJTs:** Load lines (AC and DC), Operating Points, Fixed Bias and Self Bias, DC Bias with Voltage Feedback, Bias Stabilization, Design Operation. (4 Hours)
3. **Biasing of FETs and MOSFETs:** Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

MODULE – II (17 Hours)

4. **Small Signal Analysis of BJTs:** Small-Signal Equivalent-Circuit Model, Graphical Determination of h-parameters Small Signal Analysis of CE, CC, CB Amplifier with and without RE. Effect of RS and RL on CE Amplifier, Emitter Follower, Analysis of Cascade, Darlington Connection and Current Mirror Circuits using BJTs. (6 Hours)
5. **Small Signal Analysis of FETs:** Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifier with and without RS. Effect of RSIG and RL on CS Amplifier, Analysis of Source Follower and Cascaded System using FETs. (6 Hours)
6. **High Frequency Response of FETs and BJTs:** Low and High Frequency Response of BJTs and FETs, The Unit gain – frequency (ft), Frequency Response of CS Amplifier, Frequency Response of CE Amplifier, Multistage Frequency Effects, Miller Effect Capacitance, Square Wave Testing. (5 Hours)

MODULE – III (12 hours)

7. **Feedback and Oscillators:** Feedback Concepts, Four Basic Feedback Topologies, Practical Feedback Circuits, Feedback Amplifier Stability using Nyquist Plot, Basic Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits. (4 Hours)

8. **Operational Amplifier:** Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Slew rate, Non-inverting Configurations, Effect of Finite Open-loop and Closed-loop Gain, Differentiator and Integrator, Instrumentation amplifier, μA 741-Op-Amp . (5 Hours)
9. **Power Amplifier:** Classifications, Class-A and Class-B Amplifier Circuits, Transfer Characteristics, Power Dissipation and Conversion Efficiency of Power Amplifiers. (3 Hours)

Text Books:

1. Electronic Devices and Circuits theory, 9th/10th Edition, R.L. Boylestad and L.Nashelsky (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14), Pearson Education, New Delhi.
2. Microelectronics Circuits, 5th Edition, International Student Edition Sedra and Smith (Selected portion of Chapter 2,4, 5, 6, 8, 13, and 14), Oxford University Press, New Delhi.
3. Electronic Devices and Circuits, 3rd Edition, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi. (For Problem Solving)

Reference Books:

1. Electronics Circuits Analysis and Design, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Milliman's Electronics Devices and Circuits, 2nd Edition, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Microelectronic Circuits: Analysis and Design, India Edition, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc.

BEES7211 Network and Devices Lab

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Network Theory

Course Outcome : At the end of the course, the students will be able to :

CO1: Verify different circuit laws and theorems and apply this to solve complicated circuits.
CO2: Design electrical circuits by analyzing circuit parameters and circuit characteristics
CO3: Design various filter circuits in communication engineering by analyzing characteristics of Low pass, high pass, band pass and band elimination filters.
CO4: Apply the fundamental knowledge of resonance in RLC series and parallel circuits and spectral analyses of non-sinusoidal waves to design resonant circuit and analyze the signals in frequency domain.

Topics covered :

Select any 8 experiments from the list of 10 experiments

(Able to design and fault findings of any circuit. Would be able to evaluate various parameters of any hybrid and transmission line. Would be able to design low pass and high pass filters considering the

frequency response and designing of deferent RLC circuits. Could be able to analyze the non sinusoidal signals in frequency domain.)
(Verification of Network Theorems)

1. Verification of Network Theorems (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients.

(Able to design and fault findings of any circuit.)
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
(Able to evaluate various parameters of any hybrid and transmission line)

4. Determination of circuit parameters: Hybrid and Transmission parameters.
(Able to design low pass and high pass filters considering the frequency response and designing of deferent RLC circuits.)

5. Frequency response of Low pass and High Pass Filters.
6. Frequency response of Band pass and Band Elimination Filters.
7. Determination of self inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
8. Study of resonance in R-L-C series circuit.
9. Study of resonance in R-L-C parallel circuit.
10. Spectral analysis of a non-sinusoidal waveform.

PCEC7201 **Analog Electronics Circuit Lab**

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Analog Electronics Circuit

Course Outcome : At the end of the course, the students will be able to :

CO1: Design amplifier by analyzing the basic transistor amplifier circuits and Frequency response of a common-emitter amplifier: (low frequency, high frequency and mid frequency response).

CO2: Implement the op-amp as differentiator, integrator and square wave generator and analyze the frequency response of op-amp to design and develop electronics circuits and communication circuits.

CO3: Apply the Fundamental knowledge of oscillators & feedback amplifier to design waveform generators.

Topics covered :

List of Experiments

(At least 10 out of 13 experiments should be done)

(To familiarize the student with the analysis and design of basic transistor amplifiers and Oscillators.)

1. BJT bias circuit – Design, assemble and test.
2. JEET/MOSFET bias circuits – Design, assemble and test.
3. Design, assemble and test of BJT common-emitter circuit – D.C and A.C performance: Voltage gain, input impedance and output impedance with bypassed and un-bypassed emitter resistor.
4. Design, assemble and test of BJT emitter-follower – D.C and A.C performance: A.C. voltage gain, input impedance and output impedance.
5. Design, assemble and Test of JFET/MOSFET common-source and common-drain amplifiers – D.C and A.C performance: Voltage gain, input impedance and output impedance.
6. Frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response.
7. Differential amplifiers circuits: D.C bias and A.C operation without and with current source.
8. Study of Darlington connection and current mirror circuits.
9. OP-Amp Frequency Response and Compensation.
10. Application of Op-Amp as differentiator, integrator, square wave generator.
11. Square wave testing of an amplifier.
12. R.C phase shift oscillator/Wien-Bridge Oscillator using OP-Amp/Crystal Oscillator.
13. Class A and Class B Power Amplifier

PCEE7204 **Electrical and Electronics Measurement Lab**

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Electrical and Electronics Measurement

Course Outcome: At the end of the course, the students will be able to :
CO1: Apply the knowledge of operation of various types of measuring instrument And measurement of different unknown electrical parameters such as resistance, capacitance, inductance, voltage, current, impedance etc in designing and testing electrical circuits.
CO2: Operate the Spectrum analyzers, which will help them in analyzing the signals in frequency domain.

Topics covered :

Select any 8 experiments from the list of 10 experiments
(To know the operation of various types of measuring instrument and measurement of different unknown electrical parameters such as resistance, capacitance, inductance, voltage, current, impedance etc.)

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Self Inductance and Capacitance using Bridges.
3. Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.
4. Calibration of Voltmeters and Ammeters using Potentiometers.
5. Testing of Energy meters (Single phase type).
6. Measurement of Iron Loss from B-H Curve by using CRO.
7. Measurement of R, L, and C using Q-meter.
8. Measurement of Power in a single phase circuit by using CTs and PTs.

9. Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.
10. Study of Spectrum Analyzers.

4th Semester

PCEC4205 Electromagnetic Fields and Waves

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Physics I, Math III

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the concepts of calculations related to electric field, magnetic field, electromagnetic field; Maxwell's Equations to develop wave equation in general.

CO2: Design antennas and transmission line by applying the knowledge on wave propagation in free space and in material media

CO3: Design transmission mediums by analysis of transmission line and wave guide.

(Helps the students to understand the concepts related to electric field, magnetic field , electromagnetic field, Maxwell's Equations, Wave Equation in different medium. Designing concept and working principles of antennas, Transmission Line and waveguides.)

Topics Covered:

MODULE – I (11 Hours)

1. **Vectors and Fields:** Vector Algebra, Cartesian Coordinate System, Scalar and Vector Fields, Sinusoidally Time-Varying Fields, Electric Field, Magnetic Field.
2. **Maxwell's Equations in Integral Form:** Line Integral, Surface Integral, Faradays Law, Ampere's Circuital Law, Gauss's Law for Electric Field, Gauss's Law for Magnetic Field.
3. **Maxwell's Equations in Differential Form:** Faradays Law, Ampere's Circuital Law, Curl and Stoke's Theorem, Gauss's Law for Electric Field, Gauss's Law for Magnetic Field, Divergence and Divergence Theorem.

MODULE – II (11 Hours)

4. **Wave Propagation in Free Space:** Infinite Plane Current Sheet, Magnetic Field Adjacent to the Current Sheet, Successive Solution of Maxwells's Equations, Wave Equation and Solution, Uniform Plane Waves, Poynting Vector and Energy Storage.

5. **Wave Propagation in Material Media:** Conductors and Dielectrics, Magnetic Materials, Wave Equation and Solution, Uniform Plane Waves in Dielectrics and Conductors, Boundary Conditions, Reflection and Transmission of Uniform Plane Waves.

MODULE – III (10 Hours)

6. **Transmission Line Analysis:** Gradient and Electric Potential, Poisson's and Laplace's Equations, Low Frequency Behavior via Quasistatics, Short Circuited Line and Frequency Behavior.
7. **Wave Guide Principles:** Uniform Plane Wave Propagation in an Arbitrary Direction, Transverse Electric Waves in a Parallel-Plate Waveguide, Dispersion and Group Velocity, Rectangular Waveguide and Cavity Resonator, Reflection and Refraction of Plane Waves, Dielectric Slab Guide.

Text Book(s):

1. Fundamentals of Electromagnetics for Engineering, First Impression – 2009, N. N. Rao, Pearson Education, New Delhi.
2. Introduction to Electromagnetic Fields, 3rd Edition, Clayton R. Paul, Keith W. Whites and Syed A. Nasar, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Electromagnetics, 2nd Edition, Joseph A. Edminister, adapted by Vishnu Priye, Tata McGraw Hill Publishing Company Ltd., New Delhi. (For Problem Solving)

Reference Book(s):

1. Elements of Engineering Electromagnetics, 6th Edition, N. N. Rao, Pearson Education, New Delhi.
2. Electromagnetic Waves and Radiating Systems, 2nd Edition, E.C. Jordan and K.G. Balman, Pearson Education, New Delhi.
3. Engineering Electromagnetics, 7th Edition, William H. Hayt, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Electromagnetic Field Theory Fundamentals, B.S. Guru and H.R. Hiziroglu, PWS Publishing Company, a division of Thomson Learning Inc.
5. Elements of Electromagnetics, Mathew N.O. Sadiku, Oxford University Press, New Delhi.

BEEC2214 **Energy Conversion Devices**

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Network Theory, Electrical and Electronics Measurement.

Course Outcome: At the end of the course, the students will be able to :

CO1: Operate DC generator, DC motors and apply these learning for higher studies in this domain and their use in industry.

CO2: Apply knowledge of constructional features and operational features of transformers, three phase synchronous machines to determine losses, efficiency, electrical power, mechanical power etc. to enable them to work effectively in power sector.

CO3: Apply the knowledge of constructional and operational feature of three phase induction motor and commutator motors, their speed control and use in industry.

CO4: Apply knowledge of small and fractional horse power motors for their use, maintenance modification and design as applicable to domestic/household electrical appliances.

(Imparts knowledge on basic principles of operation and analysis of DC machines, DC generators, DC motors transformers, and induction motors.)

Topics Covered :

MODULE- I (14 Hrs)

1. GENERAL PRINCIPLES OF DC MACHINES: Constructional Features, Methods of Excitation, Expression for EMF Induced and Torque Developed in the Armature.
2. DC GENERATORS: No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.
3. DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, and (iv) DC Compound Motor, Speed control and Starting of DC shunt and DC series motors, Comparison Between Different types of DC Motors and their Application.

MODULE- II (13 Hrs)

4. TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Determination of Parameters From Tests (Open Circuit Test and Short Circuit Test), Equivalent Circuit, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.
5. THREE PHASE SYNCHRONOUS MACHINES: Constructional Features, Principle of operation as Alternator and Synchronous Motor, Synchronous Impedance, Voltage Regulation by Synchronous Impedance Method, Power-Angle curve, Synchronization of Alternators, Torque Expression and Phasor Diagram for Synchronous Motor, Electrical Power and Mechanical Power, Starting of Synchronous Motor.

MODULE- III (13 Hrs)

6. THREE PHASE INDUCTION MOTORS: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors
7. SINGLE PHASE INDUCTION MOTORS and COMMUTATOR MOTORS: Revolving Field Theory, Split Phase (capacitor start and run) and Shaded Pole Starting of Single Phase Induction Motors, Speed~Current, Torque~Current and Speed~Torque Characteristic for Single Phase AC Series Motor.

Text Book :

1. Electric Machines – D P Kothari & I J Nagrath – Tata McGraw Hill.

Reference Book(s):

1. The Performance and Design of DC Machines – A E Clayton
2. Theory and Performance of AC Machines – M G Say – CBS Publication.
3. Electrical Machinery – P S Bimbhra – Khanna Publishers.
4. Electrical Machines – P K Mukherjee and S Chakravorti – Dhanpat Rai Publications.
5. Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc Graw Hill.
6. Electric Machinery And Transformers –Guru & Hiziroglu –Oxford University Press.
7. Electric Machines – Charles Hubert – Pearson Education.

BECS2212 C++ & Object Oriented Programming

Lecture :3
Tutorial : - 0
Practical : -0

Internal Assessment:30
Final Examination: 70
Credits:3

Prerequisite: Data structure

Course Outcome: At the end of the course, the students will be able to :

CO1: Develop skills in object oriented programming such as structures, unions, variables, strings, functions, recursions, operators to get hold in programming.

CO2: Apply the knowledge of Abstraction mechanism such as classes, private, public, constructors, destructors, inheritance such as class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, execution of constructor and destructor to develop & execute high level programming.

CO3: Implement the process of Dynamic memory management, object copying, assignment operator, templates and namespaces to develop various programs.

(To develop the programming skills using object oriented programming, Abstraction mechanism and Dynamic memory management)

Topics Covered :

Module I (08 hrs)

Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

Module II (16 hrs)

Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.

Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.

Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.

Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.

Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

Module III (08 hrs)

Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.

Template: template classes, template functions.
Namespaces: user defined namespaces, namespaces provided by library.

Text Books:

1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

Reference Books:

1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3. C++ and Object Oriented Programming – Jana, PHI Learning.
4. Object Oriented Programming with C++ - Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

PCEC4202 **Digital Electronics Circuit**

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Analog Electronics Circuit

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the basic knowledge of Boolean algebra, basic gates, logic circuits, flip-flops, registers, arithmetic circuits, counters, interfacing with analog devices, and computer memory to design sequential and combinational circuit.

CO2: write programs using VHDL to simulate and test various digital circuits.

CO3: Apply the basic concept VLSI design, in designing of MOSFET, circuit layout, arrays and AOI gates, floor plans and interconnect writing.

(The students will understand the basic Gates. They would be able to design and analyze any kind of Digital electronic circuits using Gates.
They would be able to simulate hardware descriptive language like VHDL.
They would be able to design different types of FF and their applications in different digital electronic circuits. They would able to design RAM, ROM, and C-MOS memories.)

Topics Covered :

MODULE – I (11 Hours)

1. **Number System:** Introduction to Binary Numbers, Data Representation, Binary, Octal, Hexadecimal and Decimal Number System and their Conversion. (2 Hours)
2. **Boolean Algebra and Logic Gates:** Basic Logic Operation and Identities, Algebraic Laws, NOR and NAND Gates, Useful Boolean Identities, Algebraic Reduction, Complete Logic Sets, Arithmetic Operation using 1's and 2`s Compliments, Signed Binary and Floating Point Number Representation. (4 Hours)

3. Combinational Logic Design: Specifying the Problem, Canonical Logic Forms, Extracting Canonical Forms, EX-OR Equivalence Operations, Logic Array, K-Maps: Two, Three and Four variable K-maps, NAND and NOR Logic Implementations. (5 Hours)

MODULE – II (15 Hours)

4. Concepts in VHDL: Basic Concepts, Using a Hardware Description Language, Defining Module in VHDL, Structural and Combinational Modeling, Binary Words, Libraries, Learning VHDL. (4 Hours)

5. CMOS Logic Circuits: Voltages as Logic Variables, Logic Delay Times: Output Switching Times, Propagation Delay, Fan-In and Fan-out, Extension to other Logic Gate.

C-MOS Electronics, MOSFETS, The NOT Function in C-MOS: Complimentary Pairs and the C-MOS Invertors, Logic Formation Using MOSFETS: the NAND and NOR Gate, C-MOS Logic Connection, Complex Logic Gates in C-MOS: 3-input Logic Gates, A general 4-input Logic Gate, Logic Cascades. (6 Hours)

6. Introduction to VLSI: Introduction, Lithography and Patterning, MOSFET Design Rules, Basic Circuit Layout, MOSFET Arrays and AOI Gates, Cells, Libraries, and Hierarchical Design, Floor Plans and Interconnect Wiring. (5 Hours)

MODULE – III (16 hours)

7. **Logic Components:** Concept of Digital Components, An Equality Detector, Line Decoder, Multiplexers and De-multiplexers, Binary Adders, Subtraction and Multiplication. (5 Hours)

8. **Memory Elements and Arrays:** General Properties, Latches, Clock and Synchronization, Master-Slave and Edge-triggered Flip-flops, Registers, RAM and ROMs, C-MOS Memories. (6 Hours)

9. **Sequential Network:** Concepts of Sequential Networks, Analysis of Sequential Networks: Single State and Multivariable Networks, Sequential Network Design, Binary Counters, Importance of state machine. (5 Hours)

Text Books:

1. A First Course in Digital System Design: An Integrated Approach, India Edition, John P. Uyemura, PWS Publishing Company, a division of Thomson Learning Inc.
2. Digital Systems – Principles and Applications, 10th Edition, Ronald J. Tocci, Neal S. Widemer and Gregory L. Moss, Pearson Education.
3. Digital Design, Robert K. Dueck, CENGAGE Learning.

Reference Books:

1. Digital Principles and Applications, 6th Edition, Donald P. Leach, Albert Paul Malvino and Goutam Saha, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.
3. Digital Electronics, Principles and Integrated Circuit, Anil K. Jain, Wiley India Edition.
4. Digital Design, 3rd Edition, Moris M. Mano, Pearson Education.

BEEC7214 **Energy Conversion Devices Lab**

Lecture :0
Tutorial : -0
Practical : -3

Internal Assessment:100
Final Examination:
Credits:2

Prerequisite: Energy Conversion Devices

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of working principle of electrical machines (DC), 3/4 point starter, alternator, transformer, Induction motor (single and three phases) in designing electrical instruments and circuits.

CO2: Implement the knowledge in industrial application by analyzing the operation and characteristics of starter, DC shunt motor and generator and operation of starting of DC motors, speed controls of DC motor.

Topics covered :

Select any 8 experiments from the list of 10 experiments

(To develop the operational skill and fault diagnosis skills of students on deferent types of DC and AC machines)

1. Determination of critical resistance and critical speed from no load test of a DC shunt generator.
2. Plotting of external and internal characteristics of a DC shunt generator.
3. Starting of DC shunt motors by 3-point/ 4-point starter.
4. Speed control of DC shunt motor by armature control and flux control method.
5. Determination of Efficiency by Open Circuit and Short Circuit test on single phase transformer.
6. Polarity test and Parallel operation of two single phase transformers.
7. Open circuit and Short circuit test of an alternator.
8. Load test of three phase induction motors.
9. Calculation of slip and efficiency of three phase squirrel cage induction motor at full load.
10. Starting of single phase induction motors .

PCEC7202 **Digital Electronics Circuit Lab**

Lecture :0
Tutorial : -0
Practical : -3

Internal Assessment:100
Final Examination:
Credits:2

Prerequisite: Digital Electronics Circuit

Course Outcome: At the end of the course, the students will be able to :

CO1: Design and test sequential and combinational digital circuits, Digital Logic Gates, Gate-level minimization, Design, implement and test a given design example with NAND Gates, NOR Gates, minimum number of Gates

CO2: Design memory, multiplexing circuit in communication engineering by applying the knowledge of working principle of Multiplexer, Counter and shift register.

CO3: Test various digital circuits before hardware implementation by simulating various digital circuits using Verilog/VHDL program.

Topics covered :

List of Experiments:
(Atleast 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments atleast 3 experiments has to be implemented through both Verilog/VHDL and hardware implementation as per choice of the student totaling to 6 and the rest 2 can be either through Verilog/VHDL or hardware implementation.)

(Student will be able to implement simplified digital logic circuits using Gates and universal logic Gates. They would be able to design all kind of combinational and sequential Digital logic circuits. They would be able to design the above circuits using VHDL.)

1. Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates, use of Universal NAND Gate.
2. Gate-level minimization: Two level and multi level implementation of Boolean functions.
3. Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment display.
4. Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
5. Design with multiplexers and de-multiplexers.
6. Flip-Flop: assemble, test and investigate operation of SR, D & J-K flip-flops.
7. Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.
8. Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallel load.
9. Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memory expansion.
10. Clock-pulse generator: design, implement and test.
11. Parallel adder and accumulator: design, implement and test.
12. Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bit product.
13. Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12.

BECS7212 C++ & Object Oriented Programming Lab

Lecture :0
Tutorial : -0
Practical : -3

Internal Assessment:100
Final Examination:
Credits:2

Prerequisite: Data Structure

Course Outcome: At the end of the course, the students will be able to :

CO1: Develop a Program using classes and objects

CO2: Develop Programs using inheritance, static polymorphism and Programs on file handling, copy constructor, exception handling.

CO3: Apply template function and template class to write a program.

Topics covered :
(Improving the programming skill and concepts of classes and objects such as programs using inheritance, programs using static polymorphism and Programs on file handling)

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling.(1 class)

HSSM7203 Communication & Interpersonal skills for Corporate Readiness Lab.

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Business Communicative Laboratory

Course Outcome: At the end of the course, the students will be able to :
(To develop the presentation skill of the students and make them corporate ready so that they can achieve excellence)

CO1: Develop the communication skill in professional situation.
CO2: Prepare job application, CV, face an interview, participate in group discussion
CO3: Become a perfect team leader, manager or entrepreneur by developing in-house communication skill such as how to deal with the subordinate/junior, welcoming new entrants to the organization, introducing work place culture, motivating juniors, instructing /directing the subordinates, correcting or disciplining a subordinate, reporting problems or difficulties and offering suggestions .

Topics covered :
Lab 30 hours
This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.
Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
   i. Preparing job-applications and CVs
   ii. Facing an interview

iii. Participating in group discussion (as part of the recruitment process)

2 In-house communication

a. Superior/ Senior → Subordinate / junior (individual → individual / group)

i. Welcoming new entrants to the organization, introducing the workplace culture etc.
ii. Briefing subordinates / juniors : explaining duties and responsibilities etc.
ii. Motivating subordinates / juniors ('pep talk')
iii. Instructing/ directing subordinates/ juniors
iv. Expressing / recording appreciation, praising / rewarding a subordinate or junior
v Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking for an explanation etc.

b. Subordinate / Junior → Superior / Senior

i. Responding to the above
ii. Reporting problems / difficulties / deficiencies
iii. Offering suggestions

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COURSE SYLLABI OF
B.TECH ELECTRONICS AND TELECOMMUNICATION ENGINEERING
(E&TCE)
BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
Third Year

5th Semester

THEORY ***Contact Hour***

Code	*Subject*	*L-T-P*	*Credits*
HSSM3303	Environmental Engineering and Safety	3-0-0	3
	Or		
HSSM3301	Principle of Management	3-0-0	
HSSM3311	Control System Engineering	3-0-0	3
PCEC4303	Microprocessors	3-0-0	3
PCEC4301	Analog Communication Technique	3-1-0	4
PCEC4302			
	Professional Elective – I (Any one)		
	Fiber Optics & Optoelectronics Devices	3-0-0	3
	Advanced Electronics Circuits		
PEEC4302	Electronics Devices and Modeling		
PEEC4301	Signals and Systems		
PEEC4303			
PCBM4302	**Free Elective –I (Any one)**		
	Optimization Engineering	3-0-0	3
	Data Base Management Systems(DBMS)		
	Elements of Biomedical Instrumentation		
HSSM3302	Applied Physiology		
FEEC6301	Java Programming		
PCBM4301			
FEEC6302			
PCIT4303			
	Credits (Theory)		19

6th Semester

THEORY ***Contact Hour***

Code	*Subject*	*L-T-P*	*Credits*
HSSM3301	Principle of Management	3-0-0	
	Or		3
HSSM3303	Environmental Engineering and Safety	3-0-0	
PCEC4304	Digital Signal Processing	3-0-0	3
PCEC4305	Digital Communication Techniques	3-0-0	3
	Professional Elective –I I (Any one)		
PEEC5304	Antenna and Wave propagation	3-0-0	3
PEEC5303	Radar and TV Engineering		
	Professional Elective – III (Any one)		
PEEC5302	Mobile Communication	3-0-0	3
PEEC5301	Information Theory and Coding		
PEEC4304	Computer Networks & Data Communication		
	Free Elective –I I (Any one)		
PCCS4304	Operating System		
FESM6301	Numerical Methods	3-0-0	3
PEEI5302	Analog Signal Processing		
PCBM4304	Biomedical Signal Processing		
PEME5305	Robotics & Robot Applications		
	Credits (Theory)		18

PRACTICALS/SESSIONALS

PCEC7304	Digital Signal Processing Lab	0-0-3	2
PCEI7301	Communication System Engineering Lab	0-0-3	2
PCEC7305	Digital Communication Lab	0-0-3	2
	Credits (Practicals/Sessionals)		6

	PRACTICALS/SESSIONALS			
PCEC7303	Control & Instrumentation Lab	0-0-3	2	
PCEC7301	Microprocessor Lab	0-0-3	2	
PCEC7302	Analog Communication Lab	0-0-3	2	
	Credits (Practicals/Sessionals)		**6**	
25	**TOTAL SEMESTER CREDITS**			**24** **TOTAL SEMESTER CREDITS**
136	**TOTAL CUMULATIVE CREDITS**			**160** **TOTAL CUMULATIVE CREDITS**

HSSM3303 **ENVIRONMENTAL ENGINEERING & SAFETY (3-0-0)**

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Chemistry-I

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the concept of ecological concepts like biotic components, eco systems, food chain, environmental gradient, environmental law, atmospheric chemistry, noise pollution in industrial safety and application

CO2: Apply the knowledge of waste water treatment, air pollution, hazards waste management , waste minimization technique to minimize and manage the hazard wastes generated in the industry.

CO3: Create a healthy and safety environment inside the industry by applying the knowledge of different types of occupational safety and health acts, safety management which will help them to

(To understand the ecological concepts. Accruing the knowledge of waste water treatment, the deferent modes of air pollutions. Understanding the occupational safety and health acts to prevent different hazards and accidents.)

Topics Covered :

Module – I

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Noise pollution- Noise standards, measurement and control. Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Module – II

(a)Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

(b) Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

(c) Solid waste, Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing,

Module – III

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error and Hazard Analysis. Hazard Control Measures in integrated steel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention – Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

Text Book :

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill Publication.

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

HSSM3301 **PRINCIPLES OF MANAGEMENT** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Organizational Behavior.

Course Outcome: At the end of the course, the students will be able to :

CO1: Become a good manager and a team player by applying the management concepts like concept of management, process of management, managerial skills and evaluation of management thought

CO2: Adopt marketing policy by applying the modern concept of marketing, fundamental need of customer, the roll of distribution channel in market.

CO3: Apply the knowledge of financial function and HRM function to manage the financial strategy and to handle the employees in an organized manner.

(To know about Management Principles, different functions of management such as marketing, financial and HRM and after all to make the students ready to act as a good manager)

Topics Covered :

Module I: Functions of Management

Concept of Management, Management as an Art or Science, The Process of Management, Managerial Skills, Good Managers are Born, not Made, Management is concerned with Ideas, Things and People, How a Manager Induces Workers to Put in Their Best, Levels and Types of Management, **Evolution of Management Thought**: Managerial Environment, The process of Management-Planning, Organizing, Directing, Staffing, Controlling.

Module II: Marketing Function of Management.
Modern Concept of Marketing, The Functional Classification of Marketing, Functions of a Marketing Management, Marketing Mix, Fundamental Needs of Customers, The Role of Distribution channels in Marketing, Advertising, Marketing, Consumerism and Environmentalism.

Module III: Financial Function & HRM Functions.
Financial Functions, Concept of Financial Management, Project Appraisal, Tools of Financial decisions making, Overview of Working Capital.

HRM Function of Management: Human Resource Management, Human Resource Development, Importance of HRM, Overview of Job Analysis, Job Description, Job Specification, Labour Turnover. Manpower Planning, Recruitment, Selection, Induction, Training and Development, Placement, Wage and Salary Administration, Performance Appraisal, Grievance Handling, Welfare Aspects.

Reference Books:

1. Business Organization & Management, CR Basu, TMH
2. Business Organization & Management, Tulsia, Pandey, Pearson
3. Marketing Management, Kotler, Keller, Koshi, Jha, Pearson
4. Financial Management, I.M. Pandey, Vikas
5. Human Resource Management, Aswasthapa, TMH.
6. Modern Business Organisation & Management by Sherlekar, Himalaya Publishing House.

PCEC4303 CONTROL SYSTEM ENGINEERING (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Network Theory and Mathematics II

Course Outcome: At the end of the course, the students will be able to :
(To familiarize the students with concept related to the operation analysis and stabilization of control systems using time response analysis and frequency response analysis of a system)
The students will be able to

CO1 : Apply the basic concepts of control system, mathematical model of physical systems and different types of control components to design different types of control components for reliable application in industry.

CO2: Apply the time response analysis like time response of first order and second order system, stability conditions, routh stability criteria, root locus method to design a stable system which will run effectively in industrial application.

CO3: utilize the frequency response analysis like stability in frequency domain, closed loop frequency response which will help them to determine and calculate gain margin and phase margin.

CO4: Implement the controllers like P, PD, PI, PID controllers effectively in control mechanism like flow, pressure, level control in industry.

Topics Covered :

Module-I : (12 Hours)

Introduction to Control Systems : Basic Concepts of Control Systems, Open loop and closed loop systems, Servo Mechanism/Tracking System, Regulators, Mathematical Models of Physical Systems: Differential Equations of Physical Systems: Mechanical Translational Systems, Mechanical Acceloroments, Retational systems, Gear Trains, Electrical Systems, Analogy between Mechanical and electrical quanties, Thermal systems, fluid systems, Derivation of Transfer functions, Block Diagram Algebra, Signal flow Graphs, Mason's Gain Formula. Feedback characteristics of Control Systems: Effect of negative feedback on sensitivity, bandwidth, Disturbance, linearizing effect of feedback, Regenerative feedback.

Control Components : D.C. Servomotors, A.C. Servomotors, A.C. Tachometer, Synchros, Stepper Motors.

Module-II : (15 Hours)

Time response Analysis : Standard Test Signals : Time response of first order systems to unit step and unit ramp inputs. Time Response of Second order systems to unit step input, Time Response specifications, Steady State Errors and Static Error Constants of different types of systems. Generalised error series and Gensalised error coefficients, Stability and Algebraic Criteria, concept of stability, Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, Application of the Routh stability criterion to linear feedback system, Releative stability by shifting the origin in s-plane.

Root locus Technique: Root locus concepts, Rules of Construction of Root locus, Determination of Roots from Root locus for a specified open loop gain, Root contours, Systems with transportation lag. Effect of adding open loop poles and zeros on Root locus.

Module-III : (13 Hours)

Frequency Response Analysis : Frequency domain specifications, correlation between Time and Frequency Response with respect to second order system, Polar plots, Bode plot. Determination of Gain Margin and Phase Margin from Bode plot.

Stability in frequency domain : Principle of argument, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system.

Closed loop frequency response : Constant Mcircles, Constant N-Circles, Nichol's chart.
Controllers : Concept of Proportional, Derivative and Integral Control actions, P, PD, PI, PID controllers. Zeigler-Nichols method of tuning PID controllers.

Text Books :

1. Modern Control Engineering by K. Ogata, 5th edition PHI.
2. Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010).
3. Modern Control Systems by Richard C.Dorf and Robert H. Bishop, 11th Ed (2009), Pearson

Reference Books :

1. Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press.
2. Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.
3. Analysis of Linear Control Systems by R.L. Narasimham, I.K. International Publications
4. Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu, 1st Edition (2004), S. Chand Co. Ltd.
5. Problems and solutions in Control System Engineering by S.N. Sivanandam and S.N. Deepa, Jaico Publishing House.

PCEC4301 MICROPROCESSORS (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Digital Electronics Circuit

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge on organization of microprocessor to write instruction and execute it for complex application.

CO2: Apply the concept of the hardware architecture like pin description, register organization, memory addressing, , read /write operation, bidirectional bus transreceiver, bus controller which will help them in memory interfacing and interrupting so that the processing can be done in a faster and intelligent way.

CO3: Design embedded systems for real time application by applying the programming skill on instruction set and programming language, I/O interfacing of microcontroller

(To familiarize the students with Organization of Microprocessor,8086 microprocessors, Programming concepts of microprocessors, I/O interfacing (8255, 8279, 8251)

Topics Covered :

Module-I : (10 Hours)

Organization of Microprocessor

Introduction to the general concept of microprocessor organization, I/O sub-systems, programming the system, ALU, instruction execution, instruction word format, addressing modes, address/data/control bus, tristate bus, interfacing I/O devices, data transfer schemes, architectural advancements of microprocessor, evolution of microprocessors.

Module-II : (12 Hours)

Intel 8086- Hardware Architecture:

Introduction, Bus interface unit(BIU), Execution unit(EU), pin description, register organization, instruction pointer, data register, pointer and index registers, status register, stack, external memory addressing, bus cycle (minimum mode):memory or I/O read/write for minimum mode, clock generator

Intel- 8284A, bidirectional bus trans-receiver 8286/8287, bus controller 8288, bus cycle memory read/write for minimum mode, 8086 system configuration (minimum mode as well as maximum mode), memory interfacing, interrupt processing; software interrupts, single step interrupt, non-maskable interrupt, maskable interrupt, interrupt priority, DMA, Halt State, Wait for Test state, comparison between 8086 an 8088.

Module-III : (13 Hours)

Instruction set and programming:

Programmer's model of Intel 8086, operand type, addressing modes 8086 assembler directives, instruction set, programming examples on data transfer group, arithmetic-logical groups, control transfer groups (loop and loop handling instruction), conditional and unconditional group, procedures and stack operations, string instructions., branch program structure like IF-THEN-ELSE REPEAT-UNTIL and WHILE-DO,

I/O Interfacing ;

8-bit input- output port 8255 PPI, memory mapped i/o ports,8254 programmable Interval Timer, 8273 Programmable Direct Memory Access Controller, 8251 USART, 8279 Programmable Keyboard/Display Controller.

Text Books:

1.The 8088 and 8086 Microprocessors Programming, Interfacing, Softw, Hardware and Application; by Walter A. Triebel & Avtar Singh ; Pearson India.
2. Microprocessors and Interfacing; by Douglas V Hall ; McGraw Hill.

Reference Book:

1. Microprocessors and Micro controllers Architecture, programming and system Design 8085, 8086, 8051, 8096: by Krishna Kant; PHI.
2. The 8086 Microprocessor: Programming & Interfacing the PC- Kenneth J. Ayala, Delmar Cengage Learning, Indian Ed.

PCEC4302 ANALOG COMMUNICATION TECHNIQUES

(3-1-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Math III, Electromagnetic Field and Waves

Course Outcome: At the end of the course, the students will be able to :

(To familiarize the students about fundamentals of communication, Random variables and processes, Different types of analog modulation and demodulation techniques, Handling Noise in communication and understanding characteristics of different types of channels etc.)

CO1: Apply the knowledge about signal analysis in time and frequency domain, random variable and processes to determine the properties of different signals.

CO2: Apply the knowledge of different modulation techniques like amplitude and angle modulation, pulse time modulation in communication mechanism like frequency translation, transmission & reception of signals effectively.

CO3: Design the mathematical modeling of noise, effect of noise on modulated signals, types of noise in AM and FM signals and also can determine the signal to noise ratio and how to optimize the noise

Topics Covered :

Module-I : (12 Hours)

SIGNALS AND SPECTRA: An Overview of Electronic Communication Systems, Signal and its Properties, Fourier Series Expansion and its Use, The Fourier Transform, Orthogonal Representation of Signal.

RANDOM VARIABLES AND PROCESSES: Probability, Random variables, Useful Probability Density functions, Useful Properties and Certain Application Issues.

AMPLITUDE MODULATION SYSTEMS: Need for Frequency translation, Amplitude Modulation(*Double Side Band with Carrier DSB-C*),Single Sideband Modulation(SSB) Other AM Techniques and Frequency Division Multiplexing ,Radio Transmitter and Receiver.

Module-II : (12 Hours)

ANGLE MODULATION: Angle Modulation, Tone Modulated FM Signal, Arbitrary Modulated FM signal, FM Modulators and Demodulators, Approximately Compatible SSB Systems.

PULSE MODULATION AND DIGITAL TRANSMISSION OF ANALOG SIGNAL:
Analog to Digital*(Noisy Channel and Role of Repeater*), Pulse Amplitude Modulation and Concept of Time division multiplexing ,Pulse Width Modulation and Pulse Position Modulation, Digital Representation of Analog Signal.

Module-III : (14 Hours)

MATHEMATICAL REPRESENTATION OF NOISE: Some Sources of Noise, Frequency-domain Representation of Noise ,Superposition of Noises, Linear Filtering of Noise.

NOISE IN AMPLITUDE MODULATION SYSTEM : Framework for Amplitude Demodulation, Single Sideband Suppressed Carrier(SSB-SC), Double Sideband Suppressed Carrier(DSB-SC), Double Sideband With Carrier(DSB-C).

NOISE IN FREQUENCY MODULATION SYSTEM : An FM Receiving System, Calculation of Signal to Noise Ratio, Comparison of FM and AM, Preemphasis and Deemphasis and SNR Improvement, Noise in Phase Modulation and Multiplexing Issues, Threshold in Frequency Modulation, Calculation of Threshold in an FM Discriminator, The FM Demodulator using Feedback(FMFB).

Essential Reading:

1. H. Taub, D. L Schilling, G. Saha; *Principles of Communication System, 3rd Edition; 2008, Tata McGraw Hill, India;* ISBN**:** 0070648115. (**Selected portions from chapters**: Chapter-1,Chapter-2, Chapter-3, Chapter-4, Chapter-5, Chapter-7, Chapter-8, Chapter-9)

Supplementary Reading:

1. Communication System Engineering,Second Edition by Masoud Salehi, John G. Proakis, ISBN: 0130950076 (paperback)

2. Analog Communication by Chandra Sekar, Oxford University Press.
3. Modern Digital and Analog Communication Systems, by B.P. Lathi, Oxford

PEEC4302 FIBER OPTICS AND OPTOELECTRONICS DEVICES (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Physics of Semiconductor Devices, Analog Communication Technique

Course Outcome: At the end of the course, the students will be able to :
The student will be able to
CO1: Apply the fundamental of fiber optics communication systems, their physical construction and operation to design fiber optics transmission link.
CO2: Apply the knowledge of fabrication techniques of fiber such as double crucible method, coupling schemes of fibers to modify the property of fiber that improves the gain during the transmission.
CO3: Design optoelectronics devices like optoelectronics modulator, demodulator, amplifier, switch etc by analyzing the properties optoelectronics devices, optoelectronics modulators and optical amplifiers.
(Fundamental of fiber optics Fiber fabrication , Basic concept of optical source, optical medium , optoelectronics devices and optical detector, principle of data communication in optical Fiber.)

Topics Covered :
Unit 1 (10 hours)
Fundamental of fiber optics, Different generations of optical fiber communication systems. Optical fiber structure, Fiber types, step index fiber and graded index fiber, ray propagation, total internal reflection, Numerical Aperature, acceptance angle. Wave propagation in a cylindrical wave guides, modal concept, V-number, power flow in step index fiber and graded index fiber, attenuation (absorbtion, scattering and bending) and dispersion (inter and intramodal, chromatic, wave guide and polarization) in fiber, dispersion shifted and dispersion flattened fiber

Unit 2 (12 hours)
Fiber fabrication, Double crucible method, Fiber optic cables, Connector and splice. Losses during coupling between source to fiber, fiber to fiber. Schemes for coupling improvement.

Optoelectronic Sources, LED, ILD,light source materials, Radiation Pattern modulation capability.

Unit 3 (13 hours)
Optoelectronic Detector, PIN AND APD, Responsivity,Band width, Detector noise ,equivalent circuit and SNR calculation.

Optoelectronic Modulators, Basic principle, Electro optic and Acousto optic modulators, Optical Amplifier, Semiconductor optical Amplifier and Erbium Doped Fiber Amplifier, Solar cells, basic

principle,heterojunction,cascadedsolar cell,Schottky Barrier cells,WDM components-couplers, isolators ,circulators, filters. Optical switching-self electro optic effect Device, switching speed and energy

Text Books

1. Fiber optics and Optoelectronics, R.P.Khare, Oxford University Press(selected sections from chapters 1,2,3,4,5,6,7,8,9and10)
2. Semiconductor Optoelectronic Devices, Pallab Bhatttacharya, second edition, Pearson Education (selected sections from chapters 10 and 11)

Reference Books

1. Fiber optic communications, Joseph C Palais, fourth edition, Pearson Education.
2. Optical Fiber Communications, Keiser G, 4th Edition Tata McGraw Hill Education Private Limited.
3. Optical Fiber Communication Principles and practice,Senior J,Prentice Hall of India.

PEEC4301 **ADVANCED ELECTRONICS CIRCUITS (3-0-0)**

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Electronics Circuit

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of active filters, oscillators and comparators in designing frequency selective network and signal generator in telecommunication engineering sectors.

CO2: Apply the knowledge of different multivibrator like astable, monostable and bistable multivibrator and wide band amplifiers to design memory circuit and other digital circuits.

CO3: Apply the characteristics of the negative resistance switching devices like tunnel diode to design different multivibrator and microwave oscillators.

CO4: Implement different voltage and current time base generators and specialize IC applications to design multivibrator, Phase locked loop, phase detector, Instrumentation amplifier that can be used in electronics circuits, communication circuits etc.

(To Study about different advanced circuits such as design of filters, amplifiers, power amplifiers, oscillators, multivibrator, switching devices, voltage and current time base generator, application of different special ICs. etc.)

Topics Covered :

MODULE-I (10 Hours**)**

1: Active Filters :Active Filters, Frequency response of Major Active filters, First order low-pass Butterworth filter: Filter Design, Frequency Scaling, Second-order low-pass Butterworth filter: First-order high-pass Butterworth filter, Second-order high-pass Butterworth filter, Band-pass filters: Wide band-pass Filter, Narrow Band-Pass Filter, Band-reject filters: Wide Band-Reject Filter, Narrow Band-Reject Filter, All-Pass filter.

2: Oscillators: Oscillators: Oscillator Principles, Oscillator Types, Quadrature Oscillator, Sawtooth wave generator, Voltage-controlled oscillator.

3: Comparators: Comparators: basic comparator, zero-crossing detector, Schmitt trigger, comparator characteristics, limitations of Op-Amp as comparators, voltage limiters.

MODULE-II (14 Hours**)**

4: Bistable Multivibrator: Bistable Multivibrator, fixed-bias bistable multivibrator, Loading, self-biased transistor binary, commutating capacitors, Triggering the binary, Unsymmetrical Triggering of the bistable multivibrator, Triggering Unsymmetrically through a Unilateral Device, Symmetrical Triggering, Triggering of a Bistable Multi Symmetrically without the Use of Auxiliary Diodes, Schmitt Trigger Circuit (Emitter-coupled Bistable Multivibrator).

5: Monostable and Astable Multivibrator: Monostable Multivibrator, Gate Width of a Collector-Coupled Monostable Multivibrator, Waveforms of the Collector-Coupled Monostable Multivibrator, Emitter-Coupled Monostable Multivibrator, Triggering of the Monostable Multivibrator. Astable Collector-Coupled Multivibrator, Emitter-coupled Astable multivibrator.

6: Wideband amplifiers: Wideband amplifiers: The Hybrid-π , High-frequency, Small-signal, Common-emitter Model, RC-Coupled Amplifier, Frequency Response of a Transistor Stage-The Short-Circuit Current Gain, Current Gain with Resistive Load, Transistor Amplifier Response taking Source Impedance into Account, Transient Response of a Transistor Stage, Cascaded CE Transistor Stages, Rise-time Response of Cascaded Stages, Shunt Compensation of a Transistor Stage in a Cascade, Rise Time of Cascaded Compensated Stages, Low frequency Compensation.

MODULE-III (12 Hours**)**

7: Negative Resistance Switching Devices: Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, Monostable Astable, Bistable circuits using tunnel diode, Voltage controlled Negative Resistance Switching Circuits.

8: Voltage and Current Time Base Generators: Time-Base Generators, General features of a Time-base signal, Methods of generating a voltage time-base waveform, Exponential sweep circuit, Miller and bootstrap time base generators-Basic principles, Transistor miller time base generator, Transistor bootstrap time base generator, Current Time-Base Generators, A Simple Current sweep, Linearity Correction through adjustment of driving waveform, Transistor current time base generator.

9: Specialized IC Applications: IC 555 Timer: IC 555 Timer as a Monostable Multivibrator and its applications, IC 555 Timer as Astable Multivibrator and its applications. Phase Locked Loop: Operating principle of PLL, Phase detectors, Exclusive-OR phase detector, Monolithic phase detector, Instrumentation Amplifier and its applications.

Text Books:

1. Pulse, Digital and switching Waveforms, Second Edition - Jacob Millman, Herbert Taub and Mothiki S Prakash Rao (TMH Publication). (Selected portion from Chapter 3, 8, 9, 10, 11, 12 and 13)
2. OP-Amps and Linear Integrated Circuits- Ramakant A. Gayakwad (PHI Publication). (Selected portion from Chapter 7, 8 and 9)
3. Pulse & Digital Circuits by K.Venkata Rao, K Rama Sudha & G Manmadha Rao, Pearson Education, 2010. (Selected portions)

Reference Books:

1. OP-Amps and Linear Integrated Circuits - Robert F. Coughlin, Frederick 1. Driscoll (Pearson Education Publication).
2. Pulse and Digital Circuits by A. Anand Kumar, PHI.

PEEC4303 **ELECTRONIC DEVICES AND MODELING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Electronics Circuit, Electrical and Electronics Measurement

Course Outcome: At the end of the course, the students will be able to :

CO1: Design complicated analog circuits by analyzing the properties of PN junction, Schottky diode, BJT and their modeling

CO2: Apply the knowledge of metal oxide semiconductor transistors , its structure and operating regions, small signal models, effect of temperature on MOSFET to design amplifiers and oscillator using MOSFET.

CO3: Measure the different parameters of BJT and MOST and design the electronics circuits with required output.

CO4: Measure the noise and distortion due to noise in signal so that they can modify the circuit parameters.

(Modeling of Electronics components, BJT, structure and the operating region of the MOST, BJT parameter measurement, and MOST parameter measurement and Noise and Distortions.)

Topics Covered :

MODULE – I (13 hours)

PN–Junction Diode and Schottky Diode: DC Current-Voltage Characteristics, Static Model, Large-Signal Model, Small-Signal Model, Schottky Diode and its Implementation in SPICE2, Temperature and Area Effects on the Diode Model Parameters, SPICE3, HSPICE and PSPICE Models

Bipolar Junction Transistor (BJT): Transistor Conversions and Symbols, Ebers-Moll Static Model, Ebers-Moll Large-Signal Model, Ebers-Moll Small-Signal Model, Gummel-Poon Static Model, Gummel-Poon Large-Signal Model, Gummel-Poon Small-Signal Model, Temperature and Area Effects on the BJT Model Parameters, Power BJT Model, SPICE3, HSPICE and PSPICE Models

MODULE – II (11 hours)

Metal-Oxide-Semiconductor Transistor (MOST): Structure and Operating Regions of the MOST, LEVEL1 Static Model, LEVEL2 Static Model, LEVEL1 and LEVEL2 Large-Signal Model, LEVEL3 Static Model, LEVEL3 Large-Signal Model, The Effect of Series Resistances, Small-Signal Models, The Effect of Temperature, BSIM1, BSIM2, SPICE3, HSPICE and PSPICE Models

MODULE – III (11 hours)

BJT Parameter Measurements: Input and Model Parameters, Parameter Measurements

MOST Parameter Measurements: LEVEL1 Model Parameters, LEVEL2 Model (Long-Channel) Parameters, LEVEL2 Model (Short-Channel) Parameters, LEVEL3 Model Parameters, Measurements of Capacitance, BSIM Model Parameter Extraction.

Noise and Distortions: Noise, Distortion.

Textbooks:

1. ***Semiconductor Device Modeling with SPICE,*** Giuseppe Massobrio and Paolo Antognetti,Tata McGraw-Hill Education.

Reference Books:

1. ***Device Electronics for Integrated Circuits***, 3rd edn., Richard S. Muller, Theodore I. Kamins, and Mansun Chan, John Wiley and Sons, New York, 2003. ISBN: 0-471-59398-2. Listed as D
2. ***Devices for Integrated Circuits: Silicon and III-V Compound Semiconductors***, H. Craig Casey, John Wiley, New York, 1999. Listed as DI
3. ***Semiconductor Material and Device Characterization***, Dieter K. Schroder, John Wiley and Sons, New York, 1990. Listed as S.

PCBM4302 **SIGNALS & SYSTEMS** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Math III and Basic Electronics

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of fundamentals of discrete/continuous time signals and systems , classification of signals and systems, stability of systems and their properties such as homogeneity, time invariance, additivity, linearity and superposition, stability, causality to analyze and design different systems

CO2: Apply the knowledge of different transformation techniques like Z-transform and Discrete Fourier Transform to analyze the signal in different domain easily

(To familiarize the student about the Types of signals and its properties, derive the Mathematical model of signals, discrete time signals and systems, Basic Concepts and Development of the Fourier Series, Fourier transform, The Z-Transform and Its application to the analysis of LTI Systems)

Topics Covered :

Module – I (10 hours)

Discrete-Time Signals and Systems:

Discrete-Time Signals: Some Elementary Discrete-Time signals, Classification of Discrete-Time Signals, Simple Manipulation; Discrete-Time Systems : Input-Output Description, Block Diagram Representation, Classification, Interconnection; Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Properties of Convolution, Causal LTI Systems, Stability of LTI Systems; Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems; Correlation of Discrete-Time Signals: Crosscorrelation and Autocorrelation Sequences, Properties.

Selected portions from Chapter 2 (2.1, 2.2, 2.3.1, 2.3.3, 2.3.4, 2.3.5, 2.3.6, 2.4, 2.5, 2.6.1,

2.6.2) of Textbook – I

Properties of Continuous-Time Systems:
Block Diagram and System Terminology, System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality. Selected portions from Chapter 4 (4.2, 4.4) of Textbook – II

Module – II (12 hours)
The Continuous-Time Fourier Series:
Basic Concepts and Development of the Fourier Series, Calculation of the Fourier Series, Properties of the Fourier Series.
Selected portions from Chapter 8 (8.3, 8.4, 8.7) of Textbook – II

The Continuous-Time Fourier Transform:
Basic Concepts and Development of the Fourier Transform, Properties of the Continuous-Time Fourier Transform.
Selected portions from Chapter 10 (10.3, 10.6) of Textbook – II

Module- III (13 hours)
The Z-Transform and Its Application to the Analysis of LTI Systems:
The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Rational Z-Transforms: Poles and Zeros, Pole Location and Time-Domain Behavior for Causal Signals, The System Function of a Linear Time-Invariant System; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; The One-sided Z-Transform: Definition and Properties, Solution of Difference Equations.
Selected portions from Chapter 3 (3.1, 3.2, 3.3, 3.4.2, 3.4.3, 3.6.1, 3.6.2) of Textbook– I

The Discrete Fourier Transform: Its Properties and Applications:
Frequency Domain Sampling: The Discrete Fourier Transform; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.
Selected portion from Chapter – 7 (7.1.2, 7.2.1, 7.2.2, 7.2.3) of Textbook – 1.

Text Books:
1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. Fundamentals of Signals and Systems - M. J. Roberts, TMH

Reference Book:
1. Signals and Systems - P. R. Rao, TMH.
2. Signals and Systems – A Nagoor Kani, TMH
3. Signals and Systems by Chi-Tsong Chen, Oxford
4. Principles of Signal Processing and Linear Systems, by B.P. Lathi, Oxford.
5. Principles of Linear Systems and Signals, by B.p. Lathi, Oxford

HSSM3302 **OPTIMIZATION IN ENGINEERING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Mathematics- III and Analysis of Algorithms

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of Engineering optimization problems, classification of optimization algorithms and linear programming to analyze the sensitivity of linear programming.

CO2: Apply the knowledge of Transportation problems, Assignment Problems and queuing models to find an initial basic feasible solution of a model.

CO3: Design and develop different types of algorithms such as genetic algorithm and non linear algorithm by using Non-linear programming, Unconstrained optimization and constrained optimization.

(Idea of Engineering Optimization problem, Liner programming , assignment problem, Transportation problem, queuing models and non-linear programming. Constrained optimization and unconstrained optimization problems.)

Topics Covered :

Unit-I (10 Hours)

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

Unit-II (10 Hours)

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

Assignment problems: Hungarian method for solution of Assignment problems
Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems
Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Unit-III (10 Hours)

Non-linear programming: Introduction to non-linear programming.
Unconstraint optimization: Fibonacci and Golden Section Search method.
Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method
Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming
Introduction to Genetic Algorithm.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, *" Operations Research- Principle and Practice"*, Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " *Optimization for Engineering Design*", PHI Learning Pvt Ltd

Recommended Reference books:

1. **S**tephen G. Nash, A. Sofer, *" Linear and Non-linear Programming"*, McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "*Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, *" Operations Research"*, Eighth Edition, Tata McDraw Hill
5. P.K.Gupta, D.S.Hira, "*Operations Research*", S.Chand and Company Ltd.

FEEC6301 **DATABASE MANAGEMENT SYSTEM** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: C++ and Object Oriented Programming

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of Database System Architecture like Data Abstraction, Data Definitions and Data Manipulation Languages to design object oriented data models.

CO2:They will apply the knowledge in Relational Query Languages and Relational Database Design.

CO3: Apply the knowledge of Transaction processing and Database Recovery System to recover the missing data during system failure.

(Data base system architecture, Data definitions and data manipulation languages, object oriented data models, relational database design, Types of data base failure and data base recover.)

Topics Covered :

Module I : (10 hours)

Database System Architecture - Data Abstraction, Data Independence, Data Definitions and
Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II : (12 hours)

Relation Query Languages, Relational Algebra and Relational Calculus, SQL.
Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.
Query Processing Strategy.

Module III: (10 hours)

Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers. Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:

1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education)
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:

1. An introduction to Database System – Bipin Desai, Galgotia Publications
2. Database System: concept, Design & Application by S.K.Singh (Pearson Ed)
3. Database management system by leon &leon (Vikas publishing House).
4. Fundamentals of Database Management System – Gillenson, Wiley India
5. Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, 4th Ed., 2005, Elsevier India Publications, New Delhi

PCBM4301 ELEMENTS OF BIOMEDICAL INSTRUMENTATION (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Electrical and Electronics Measurement.

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of bioengineering, medical instrumentation and bioelectrical signals and Electrodes to operate different types of instruments.

CO2: Apply the knowledge of electrodes for ECG and physiological Transducers to design various transducers for medical application.

CO3: Implement different physiological transducers and recording systems to design different sensor, preamplifier, isolation amplifier and differential amplifier.

(To familiarize the students about various biomedical signals and instruments. Working principles of different transducers and recording systems.)

Topics Covered :

Module I (13 Hours)

(i) What is bioengineering: Engineering versus Science, Bioengineering, Biochemical Engineering, Biomedical Engineering, and Career Opportunities.

(ii) Medical Instrumentation: Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices.

(iii) Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

(Text Book-I-Chapter-0 , Text Book-II —Chapter-1, Text book-II- Chapter-2)

Module -II (14 Hours)

(iv) Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

(v) **Physiological Transducers:** Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and Motion Transducers.

(Text book-II- Chapter-2 , Text Book-II, Chapter- 3)

Module –III (13 Hours)

(vi) **Physiological Transducers:** Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, Thermister, Photovoltaic transducers, Photo emissive Cells & Biosensors or Biochemical sensor

(vii) Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)
(Text Book-II, Chapter- 3, Text Book-II-Chapter-4)

Text Books:-

1. Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc,-2004
2. II-Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill, 2003.

Reference Books:

1. Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN M.BROWN (Pearson education publication)
2. Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications
3. Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI
4. Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers.

FEEC6302 **APPLIED PHYSIOLOGY (3-0-0)**

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Basic Knowledge of +2 Zoology

Course Outcome: At the end of the course, the students will be able to :

(Basic functional concept of a body such as Respiratory pathways and hormones, blood as Newtonian fluid. Concept of ECG. Overall concept of human body and its caring.)

CO1: Apply the knowledge about Basic functional concept of the body, electrical properties of the neurons and ionic currents so that they can implement it to design different biomedical instruments.

CO2: Apply the knowledge of Respiratory pathways, Nephron structure and functions, body temperature regulation & feedback control of BP to regularize the respiration rate and body temperature.

CO3: Apply the knowledge of Hormones, Receptors, Pitch, Optics of the eye & EEG to design biomedical instruments

Topics covered :

Module-1 : (12 HOURS*)*

Introductory Lecture :-(1 HOUR)

1. Basic functional concept of the body as whole & contribution of individual systems & their inter-dependence for achieving the goal.
2. Electrical properties of the Neurons. Electrical potentials, their nature, origin and propagation of AP and Non- propagatory potentials (Generator Potential, Receptor Potential).
3. Ionic currents, conductance and capacitance properties of excitable membranes. Basic idea on cable properties and core conductor theory. Velocity of conduction of Action Potential and factors influencing it. Compound Action Potentials. Equivalent electrical circuit diagram for neural membranes.
4. Muscle physiology in general. Functional difference between smooth, cardiac and skeletal muscle types. Muscles as energy transducer. Force-velocity and Load-Tension relationships. EPPs and EPSP, IPSP and MEPPs. Excitation, contraction coupling mechanism, Role of $Ca^{++.}$

Module – 2: (12 Hours)

1. Respiratory pathways (upper and lower). Mechanism of respiration, feedback control mechanism of respiration.
2. Nephron structure and functions, counter current exchange mechanism. Voiding of urine, Reflex Control, Bladder Plasticity and Urine Volume relationship.
3. Body Temperature Regulation and role of Hypothalamic Thermostat. Responses to cold and warm environment. Thermo neutral range & Lethal Temperature concepts.
4. Blood as Newtonian fluid –Its physical properties. Haemodynamics, Blood pressure and its measuring techniques.
5. Feedback control of BP. Role of heart as pump. Regulation of cardiac pump – Extrinsic, Intrinsic factors, Auto regulation. Starling's Law. Pacemaker potentials. ECG – Its gross normal features. Means of recording.

Module -3: (12 Hours)

1. Hormones: classification, second messenger hypothesis, sources, half life, effective concentration, feed back control, & molecular mechanism of peptide & steroids hormones.
2. Receptors. The role of transducers. General and specific functional characteristics of Receptors Classification, Receptor Potential, Amplification and Propagation to CNS. Sound as stimulus. Quality of Sound.
3. Pitch, Loudness, SPL, Auditory receptor, genesis of potential change in the Internal ear. Mechanism of Hearing.
4. Optics of the EYE. Camera principles applied to the eye. Accommodation, Purkinje Shift, Electroretinogram (ERG), Electroocculogram (EOG).
5. Electroencephalography (EEG) – its basic principles. Electro-corticogram (ECOG). Neuro- physiological and Bioelectrical basis of Learning and Memory.

Reference Books:

1) Concise Medical Physiology By Chauduri

2) Anatomy and Physiology – Ross & Wilson, Churchill Livigstone publications.
3) Principles of Anatomy & Physiology – Tortora & Grabowski – Harper Collins College Publisher – latest edition.
4) J Gibson, Modern Physiology & Anatomy for Nurses; Black-well Scientific Publishers, 1981

PCIT4303 **JAVA PROGRAMMING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite : C++ and object oriented programming

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the fundamental knowledge of the Java and Java programming Environment. Fundamental programming structure , Package to design and develop a program.

CO2: Apply the knowledge of Multi Threading and JDBC in developing a program.

CO3: Implement the concept of Applets, Basic Architecture, AWT and Swing to develop a java program

(Introduction to Java, concept of objects and class, inheritance, threading, applets, AWT, Swing (Japlet), Icons and labels. Programming skills in Java.)

Topics covered :

Module – I 12 Hrs

Introduction to Java and Java programming Environment. Object Oriented Programming.
Fundamental Programming Structure: Data Types, variable, Typecasting Arrays, Operators and their precedence.

Control Flow: Java's Selection statements (if, switch, iteration, statement, while, do-while, for, Nested loop).
Concept of Objects and Classes, Using Exiting Classes building your own classes, constructor overloading, static , final, this keyword .

Inheritance: Using Super to Call Super class constructor, Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance. The Object Class.

Packages & Interfaces : Packages, Access Protection, Importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.

Exception Handling: Fundamentals, Types Checked , Unchecked exceptions, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module - II 12 Hrs

Multi Threading: Java Thread Model, Thread Priorities, Synchronization, Creating a thread, Creating Multiple threads, Using isAlive ( ) and join ( ), wait () & notify ( ).

String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.

Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.

JDBC: Fundamentals, Type I, Type II, Type III, Type IV drivers.

Networking: Basics, Socket overview, Networking classes, & interfaces, TCP/IP client sockets, whois, URL format, URL connection, TCP/IP Server Sockets.

Module - III 12 Hrs
Applets: Basics, Architecture, Skeleton, The HTML APPLET Tag, Passing Parameters to Applets, Applet context and show documents ().

Event Handing: Delegation Event model, Event Classes, Event Listener Interfaces, Adapter classes.

AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame , Canvas, Creating a frame window in an Applet , working with Graphics , Control Fundamentals , Layout managers, Handling Events by Extending AWT components.
Core java API package, reflection, Remote method Invocation (RMI)

Swing: J applet, Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables. Exploring Java-lang: Simple type wrappers, Runtime memory management, object (using clone () and the cloneable Interface), Thread, Thread Group, Runnable.

Text Books:
1. Introduction to Java Programming: Liang, Pearson Education, 7th Edition.
2. Java The complete reference: Herbert Schildt, TMH, 5th Edition.

Reference Books:
1. Balguruswamy, Programming with JAVA, TMH.
2. Programming with Java*:* Bhave &. Patekar, Pearson Education.
3. Big Java: Horstman, Willey India, 2nd Edition.
4. Java Programming Advanced Topics: Wigglesworth, Cengage Learning.
5. Java How to Program: H.M. Deitel & Paul J. Deitel, PHI, 8th Edition.

PCEC7303 **CONTROL AND INSTRUMENTATION LABORATORY** (0-0-3)

Lecture : 0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Control System Engineering

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of DC motor, AC servo motor to determine its transfer function using control mechanism

CO2: Apply the knowledge of the frequency response and time response of 2nd order process to design a controller and Implement the PID controller to the servo motor.

CO3: Measure the resistance, inductance and capacitance using bridges and will be able to analyze displacement-voltage characteristics and resistance-voltage characteristics of devices like LVDT and thermister and implement these components in different control circuits in industrial applications.

(To familiarize the students with concept related to the operation analysis and stabilization of control systems.)

List of Experiment :

Control:

1. Study of a dc motor driven position control system
2. Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function
3. Obtain the frequency response of a lag and lead compensator
4. To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor
5. To study the characteristics of a relay and analyse the relay control system (Phase Plane)
6. To study and validate the controllers for a temperature control system
7. To study the position control system using Synchros

Instrumentation:

1. Measurement of unknown resistance, inductance and capacitance using bridges
2. To plot the displacement-voltage characteristics of the given LVDT
3. Measurement of temperature-voltage characteristics of J-type thermocouple
4. Use a strain gauge to plot the curve between strain applied to a beam and the output voltage
5. Study of resistance-voltage characteristics of Thermistors
6. To study on the interface of PLC with PC for data acquisition applications.

PCEC7301 **MICRO PROCESSOR LAB** (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Microprocessors

Course Outcome: At the end of the course, the students will be able to :

The students will be able to

CO1: Apply the knowledge of different microprocessors like 8086 trainer kit, LCD display, ADC and DAC, I/O interfacing to assemble microprocessor and microcontroller.

CO2: Write programs on arranging data in ascending and descending order, transfer of data from one to other memory location, different data conversion techniques, up down counter.

CO3: Generate square and rectangular wave of a given frequency using 8255 chip, find out different types of complements, generation of different types of analog signals, sampling of

analog signals using DAC and ADC and apply these knowledge to design and develop embedded system.

(Programming concepts of microprocessors, microcontrollers and interfacing techniques)

Equipment necessary:

8086 training kit withWith minimum two line and 10 characters per line LCD displayOn-board single line/two pass assembler with all standard directives.ADC and DAC card.I/O port chipTimer Buffered standard portInterrupt controllerIBM PC Keyboard and Interface.Rs 232C Serial Interface.Standard MONITOR Program.PC based cross- assembler, editor, linker, binary code converter with up-load and down load facilities.50 MHZ DSO for measurement of timing diagram.Some interface cards like Stair case simulatorStepper motor control card with stepper motors.List of Experiments to be conducted.Part AStudy of 8086 kit and all the peripheral pin numbersDetail study of use of MONITOR program. Learn how to edit the program, assemble it and run it in all the different modes (GO, step and Break-point mode. (2 Periods)Simple Programs to understand operation of different set of instructions likePrograms related to data transfer groupRelated to different addressing modes.Flag manipulation.Simple programs related to Arithmetic, logical, and shift operation.Loop and Branch InstructionsString operations.Stack manipulation and subroutine program. (5 Periods)

At least seven of the following list of experiments.

1. Arranging a set of date in ascending and descending order.
2. Finding out the number of positive, negative and zeros from a data set. 3. transfer of data from one memory location to another memory location.
3. Searching the existence of a certain data in a given data set.
4. Gray – to – Binary and Binary – to – Gray conversion and BCD – to –Binary and Binary – to – BCD Conversion
5. Design a Up/down Counter.
6. Multiply two 8 Bit numbers using Successive addition and shifting method.
7. Add a series of unsigned 8- Bit data. Extend the experiment to add signed number and multi byte numbers.
8. Generate a Square wave and rectangular wave of given frequency at the output pin of 8255 chip.
9. Finding out 10‘s complement of a 4- digit BCD number.
10. Add a series of Decimal numbers.
11. Division of 8 Bit unsigned numbers by two. Division of a unsigned numbers by two.
12. Disassembling of the given 2 digit decimal number into two nibbles.
13. Generation of different types of analog signal using DAC.
14. Sampling of analog signal using ADC.
15. A small project work for construction of a display system/ real time digital clock.

PCEC7302**ANALOG COMMUNICATION TECHNIQUES LAB** (0-0-3)

Lecture :0
Tutorial : -0
Practical : -3

Internal Assessment:100
Final Examination:
Credits:2

Prerequisite: Analog Communication Technique

Course Outcome: At the end of the course, the students will be able to :

CO1: Determine different properties of signals by analyzing the signals in frequency domain

CO2: Apply the principle of different analog modulation and demodulation techniques like Amplitude modulation and angle modulation to design AM and FM receiver and transmitter.

CO3: Utilize different multiplexing techniques to reduce the bandwidth of channels, PTM techniques like PWM and PPM to convert an analog signal to digital form.

CO4: Write programming and simulation languages like MATLAB and LABVIEW simulate and test different modulation circuit outputs.

(To familiarize the students about various modulation techniques, multiplexing, spectral analysis of signals.)

1. Analyze and plot the spectrum of following signals with aid of spectrum analyzer: Sine wave, square wave, triangle wave, saw-tooth wave of frequencies 1KHz, 10Khz, 50Khz, 100KKz and 1 MHz.

Experiment objective: Analysis of spectrum of different signals. Measurement of power associated with different harmonics in signals.

Equipment Required:

- Signal/ function generator- frequency range upto 1MHz, signal types: square, triangle, sinusoidal, saw-tooth, DC offset signal.
- Spectrum analyzer Upto 100MHz atleast.

2. Analyze the process of frequency division multiplexing and frequency division de multiplexing.

Experiment objective: Demonstrate the process of multiplexing of signals in time and frequency domain.

Equipment Required:

- Frequency division multiplexing/ de-multiplexing experiment board.
- CRO

3. Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SSBSC)

Experiment objective: Demonstrate the process of modulation and demodulation using AM.
Measure different parameters associated with modulated signals. Analyze the spectrum of modulated signals.

Equipment Required:

- AM modulator/ demodulator experimental board.
- Function generator (sine, square, modulating signal), 1MHz maximum frequency
- CRO - 20MHz, dual trace
- Spectrum analyzer.

4. Study of FM modulation and Demodulation Techniques.

Experiment objective: Demonstrate the process of modulation and demodulation using FM.
Measure different parameters associated with modulated signals. Analyze the spectrum of FM modulated signals and compare with theoretical bandwidth.

Equipment Required:

- FM modulator/ demodulator experimental board.
- Function generator (sine, square, modulating signal), 1MHz maximum frequency
- CRO - 20MHz, dual trace
- Spectrum analyzer.

5. Observer the process of PAM, quantization and determination of quantization noise.

Experiment objective: Demonstrate the process of PAM, PWM and PPM. Measure the spectrum of the PAM, PPM and PWM signals.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board
- CRO

6. Multiplex 2-4 PAM/ PPM and PWM signals.

Experiment objective: Demonstrate the process of multiplexing in time domain.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board
- CRO

7. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using AM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.

8. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using FM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.
   - For experiment 7/8 MATLAB of current version/ scilab is required.
   - Computer of good configuration

9. Using Lab-View software simulate AM modulation and demodulation system.

10. Using Lab-View software simulate FM modulation and demodulation system.

- For experiment 9/10 Lab-View of current version is required.
- Computer of good configuration

11. Design a receiver to demodulate and receive the signal from AM radio station.
12. Design a receiver to demodulate and receive the signal from the local FM radio station.
    - For experiment 11/12 following equipment is required
    - CRO
    - Components of assorted values.
    - AM and FM receiver ICs.

Experiment objective (for simulation exercises): Verify the process of modulation and demodulation in simulation environment. Analyze frequency spectrum of the signal after modulation and demodulation. Observe the modulated and demodulated signals for different forms of modulation signal

6th Semester

PCEC4304 DIGITAL SIGNAL PROCESSING (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Microprocessor, Signals & Systems

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the knowledge of different transformation techniques like Z-transform and Discrete Fourier Transform to analyze the signal in different domain easily.

CO2: Implement different discrete time system to design different digital filters.

CO3: Compute the DFT using FFT technique, efficiently

CO4: apply the adaptive filtering technique in adaptive channel equalization, adaptive line enhancer, adaptive noise cancelation and system identification

(Processing methods on signals different transformation techniques to the analysis of LTI system, discrete Fourier transform and its implementation, Design of Digital Filters.)

Topics covered :

Module – I (10 hours)

The Z-Transform and Its Application to the Analysis of LTI Systems:

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations.

Selected portions from Chapter 3 (3.1.1, 3.1.2, 3.2, 3.4.2, 3.4.3, 3.5.1, 3.5.2, 3.5.3, 3.5.4) of Textbook – I

The Discrete Fourier Transform: Its Properties and Applications

Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

Chapter – 7 of Textbook – 1.

Module – II (10 hours)

Implementation of Discrete-Time Systems:

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.
Selected portions from Chapter 9 (9.1, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 9.3.2, 9.3.3, 9.3.4) of Textbook – I

Design of Digital Filters:
General Considerations: Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.
Selected portions from Chapter 10 (10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.3.2, 10.3.3) of Textbook – I

Module III (15 Hours)
Efficient Computation of the DFT: Fast Fourier Transform Algorithms Adaptive Filters
Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.
Selected portions from Chapter 8 (8.1.1, 8.1.3, 8.2.1, 8.2.2, 8.2.3) of Textbook – I

Text Books

1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.

Reference Book :

1. Digital Signal Processing: a Computer-Based Approach – Sanjit K. Mitra, TMH
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.
3. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, TMH.
4. Digital Signal Processing: A Modern Introduction – Ashok Ambardar, Cengage Learning.
5. Modern Digital Signal Processing – Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications – Li Tan, Academic Press, Elsevier.
7. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
8. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

PCEC4305 DIGITAL COMMUNICATION TECHNIQUES (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Communication Technique

Course Outcome: At the end of the course, the students will be able to

CO1: Apply different digital modulation techniques like ASK, FSK, PSK,MSK , different optimum receivers for AWGN channel to transmit the signals, to find the error probability and error detection in a channel.

CO2: Compress the data using different coding and compression techniques and send it using the modulation techniques.

CO3: Design optimum receiver and equalizer with less ISI and AWGN effect by analyzing the characteristics of band limited channels

CO4: Apply the knowledge of different models of spread spectrum communication, different spread spectrum signals like direct sequence, frequency hopping spread spectrum to synchronize the spread spectrum system to reduce the bandwidth of transmission channel.

(To familiarize the student about different A/D conversion techniques. Basic concepts of digital modulation, different types of digital modulation schemes and demodulation techniques, concept of optimum filter for minimum error in detection, different coding techniques and Spread Spectrum Signal for Digital Communication.)

Topics covered :

MODULE-I. 12 Hrs

Digital Modulation Schemes: Representation of Digitally Modulated Signals, Memory less Modulation Methods, Signaling Schemes with Memory, Power Spectrum of Digitally Modulated Signals

Optimum Receivers for AWGN Channels: Waveform and Vector Channel Models, Waveform and Vector AWGN Channels, Optimal Detection and Error Probability for Band-Limited Signaling, Optimal Detection and Error Probability for Power-Limited Signaling, A Comparison of Digital Signaling Methods, Detection of Signaling Schemes with Memory, Optimum receiver for CPM Signals

MODULE-II 12 Hrs

Introduction to Information Theory: Mathematical model for information sources, Logarithmic measure of information, lossless coding for information sources, channel model and channel capacity, Channel reliability function, channel cutoff rate.

Digital Communication through Band-Limited Channels: Characterization of Band-Limited Channels, Signal design for Band-Limited Channels, Optimum Receiver for Channels with ISI and AWGN, Linear Equalization, Decision-feedback Equalization.

MODULE-III 12 Hrs

Spread Spectrum Signal for Digital Communication: Models of spread spectrum communication, Direct sequence spread spectrum signals, frequency hopping spread spectrum signals, other types of spread spectrum signals, synchronization of spread spectrum system.

Text Book:

1. John G.Proakis, M. Salehi, "Digital Communications",5th Edition 2008, McGraw Hill, 2008.(Selected portion form Chapter 3,4, 6, 9 and 12.)

Reference Book:

1. B. Sklar and P K Ray; Digital Communications – Fundamentals and Applications; Pearson Education; 2009

PEEC5304 **ANTENNAS & WAVE PROPAGATION** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Electromagnetic Field and Waves

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of wave equation, magnetic current source, fundamental parameters of antenna such as principle of radiation and radiation pattern , radiation intensity, directivity, gain, antenna efficiency, beam efficiency, bandwidth, polarization, effect o height and effect of ground on performance of antenna to design and place an antenna in appropriate position for maximum transmission and reception of signals.

CO2: Apply the knowledge about the antenna elements such as dipole, current distribution, power density, and radiation resistance to investigate the cause of poor reception of signals.

CO3: Implement the antenna in a convincing way by analyzing the characteristic of loop antenna, horn antenna, micro strip antenna such as quality factor bandwidth and efficiency.

CO4: Utilize the knowledge of different propagation techniques such as ground wave, sky wave, space wave to design the proper antenna and appropriate transmission medium for various signals.

(Basic concept of antenna, concept of EM Waves , Types of antenna and their properties with radiation patterns, types of waves , Transmission and Reception of EM Waves through antenna)

Topics covered :

Module – I (10 hours)

Introduction, Wave equation in terms of potential functions; Vector potential A for an electric current source J & Vector potential F for a magnetic current source M

Fundamental parameters of Antenna:

Principle of Radiation, Radiation Pattern – Isotropic, Directional and omni directional patterns; Principle Patterns and Secondary lobes: Field regions: radiation field and Steradian.

Radiation Power Density; Radiation Intensity, Directivity, Gain, Antenna Efficiency, HPBW, Beam efficiency, Bandwidth, Polarization – Linear, Circular and Elliptical Polarization. Noise Figure and Noise Temperature. Effects of antenna height and effect of ground on performance of antenna. Antenna effective length.

Module –II (12 hours)

Short Dipole and half wavelength Dipole – Current distribution, Radiated Fields, Power density and Radiation resistance; radiating near field (Fresenel) and reactive near field region, intermediate field and far field (Fraunhofer) region, Ground effects – vertical and horizontal electric dipole, earth curvature.

Loop Antenna and Horn Antenna (basics). Frequency independent Antennas: Log periodic Dipole antenna and helical antenna (basics).

Antenna Arrays: Uniform linear arrays of isotropic elements, array factor and directivity. Broadside & Endfire array, principle of pattern multiplication. Binomial array.
Microstrip Antenna – Basic Characteristics, Rectangular Patch, Circular Patch, Quality factor bandwidth and efficiency, Feed to microstrip antenna: probe feed, microstrip line feed, aperture feed (basic ideas).

Module –III (12 hours)
Ground Wave, Sky Wave, Space Wave & Scatter Propagation with general application: Propagation with general applications: Propagation Equations in Ground Waves: Attenuation Factor, Transmission Coverage, Receiving Antenna for ground wave. Sky Wave Propagation: Attenuation, Refractive Index, Conductivity and Permittivity, Electron Collision Frequency, D, E & F Layers, Critical Frequency & MUF, skip distance, Curved Ionosphere, Propagation Equation, Antennas for Sky Wave reception. Space Wave Propagation in the Troposphere: LOS Range, Flat Earth Reflection with variable wavelengths and heights, Inverse Distance Equation, Point of reflection on curved Earth, Curvature of space Waves in the Troposphere, Diffraction of space waves, Duct Propagation, Fading of Space Waves. Antennas for Space wave Propagations.

Text Books:

1. Antenna Theory – Analysis and Design By C Balanis, 2nd Edition, John Willey & Sons.
2. Antenna by J.D. Kraus, 2nd Edition, TATA McGraw Hill.
3. Radio Wave Propagation and Antennas,An Introduction –John Griffiths, PHI International

Reference Books:

1. Electromagnetic Wave and Radiating Systems by E.C. Jordan and K.G. Balmain,2nd Ed. PHI
2. Antenna Engineering by W. L. Weeks
3. Antennas and Wave Propagation by G.S.N. Raju, Person Education.
4. Antenna & Wave Propagation by R. E. Collins

PEEC5303 **RADAR AND TV ENGINEERING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Communication Techniques, Advanced Electronics Circuit

Course Outcome: At the end of the course, the students will be able to

CO1: Design various transmission techniques and find out the faults in Television system by applying the knowledge about basic television system and scanning principle, sound and picture transmission, aspect ratio, persistence of vision and flicker, interlaced scanning .

CO2: Modify and design advanced visual techniques by using the color and digital TV technology and some advance visual techniques such as plasma displays, liquid crystal display and large screen display .

CO3: Design different types of RADAR and utilize the technique in real time application such as obstacle detection, range measurement by applying the knowledge of basic radar , different radars such as MTI, CW and FMCW.

(To introduce the concept of RADAR operation, various types of RADAR in use. & Understanding the principle of operation of Basic Television System And Scanning Principles, Color and Digital TV Technology.)

Topics covered :

MODULE – I (12 hours)

Basic Television System And Scanning Principles: Block diagram of TV transmitter & receiver, Sound and picture transmission, scanning process, transmission & reception of video signal, brightness perception & photometric quantities, aspect ratio & rectangular scanning, persistence of vision & flicker, Kell factor, vertical and horizontal resolution, interlaced scanning, Composite Video Signal, Horizontal and Vertical Synchronous and Blanking Standard Signal, TV pick up tubes, Vidicon, CCD.

Module – II (12 hours)

Color and Digital TV Technology: mixing of colors and colors perception, chromaticity diagram, color TV signals & transmission, NTSC & PAL system, color TV receiver & specification, Fully digital TV system, Digital TV signal & transmission, digitized video parameters, digital TV receiver, fundamentals of Flat panel displays, Plasma displays, Liquid crystal displays, and Large screen displays.

Module – III (14 hours)

Introduction to Radar: Basic radar, radar block diagram, radar frequencies & applications, Radar Indicators.

RADAR Equation: Detection of signal in noise, receiver noise and SNR, probability of detection and false alarm, integration of radar pulses, radar cross section of targets, PRF, system losses.

MTI, CW, FMCW RADAR: Introduction, delay line cancellers, Doppler filter banks, limitation of MTI, Staggered PRF, Pulse Doppler radar, Tacking by RADAR, mono pulse, sequential lobing, & conical scan of targets.

Text Books:

1. Television and video Engineering by A. M Dhake, 2nd edition, Tata McGraw Hill.
2. Introduction to RADAR systems by Merrill I. Skolnik, 3rd edition, Tata McGraw Hill.

Reference Books:

1. Modern Television Practice-Principles, Technology and Servicing, by R R Gulati.
2. Basic Television & Video systems, Bernard Grob, Charles E Hernfon, 6th edition, McGRAW HILL.
3. RADAR Principles, Technology, Application by Byron Edde, 1st edition, Pearson, 2004.
4. Understanding RADAR system by Simon Kingsley, Shaun Quegan, Standard publication.
5. Principles of RADAR by J. C. Toomay, PHI, 2nd edition, 2004.

PEEC5302 **MOBILE COMMUNICATION** (3-0-0)

Lecture :3
Tutorial : - 0
Practical : -0

Internal Assessment:30
Final Examination: 70
Credits:3

Prerequisite: Analog Communication Techniques, Digital Communication Techniques, Antenna and Wave Propagation

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of wireless communication system, 1st & 2nd generation of cellular system, cellular communication from 1 G to 3G & 4G, radio wave propagation, characteristics of wireless channels to design advanced mobile communication.

CO2: Apply the fundamental knowledge of cellular communication, cell geometry, cell reuse, cell splitting, adjacent channel interference, segmentation , TDMA, FDMA and CDMA techniques to design different transmission and reception techniques in cellular systems

CO3: Implement the various modulation schemes such as Phase shift keying, QAM, M-ary FSK, spread spectrum and CDMA system to design different modulators as per the requirement.

(An Overview of Wireless Systems , Cellular Systems, Large scale propagation model and small scale propagation model, Fundamentals of Cellular Communications, Multiple Access Techniques and Modulation schemes)

Topics covered :-

MODULE-I

An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G Systems, Future Wireless Networks

Radio Propagation and Propagation Path-Loss Models: Introduction, Free-space Attenuation, Attenuation over Reflecting Surfaces, Radio wave Propagation, Characteristics of Wireless Channel, Signal Fading Statistics, Propagation Path-loss Models, Cost 231 Model

MODULE-II

Fundamentals of Cellular Communications: Introduction, Cellular Systems, Hexagonal Cell Geometry, Co-channel Interference Ratio, Cellular System Design in Worst-Case Scenario with an Omni directional Antenna, Co-channel Interference Reduction, Directional Antennas in Seven-Cell Reuse Pattern, Cell Splitting, Adjacent Channel Interference (ACI), Segmentation,

Multiple Access Techniques: Introduction, Narrowband Channelized Systems,Comparisons of FDMA,TDMA and DS-CDMA, Comparison of DS-CDMA vs. TDMA System Capacity, Multicarrier DS-CDMA (MC-DS-CDMA)

MODULE-III

Modulation schemes: Introduction, Introduction to modulation, Phase Shift Keying, Quadrature Amplitude Modulation, M-ary Frequency Shift Keying, Synchronization, Equalization

Spread Spectrum(SS) and CDMA Systems: Introduction, Concept of Spread Spectrum, System Processing Gain, Requirements of Direct-Sequence Spread Spectrum, Frequency-Hopping Spread Spectrum Systems

Text Books:

1. Essential Reading: Selected portions from V K Garg, Wireless Communication and Netwrking; Morgan Kaufman Publishers India; 2008

Reference Book:

1. T S Rappaport, Wireless Communications, Pearson Education, India
2. W C Y Lee, Mobile Communation Engineering – Theory and Applications; TMH
3. T L Singhal, Wireless Communicaions, Tata McGraw Hill 2010

PEEC5301 **INFORMATION THEORY AND CODING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Communication Techniques, Mobile Communication

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of information theory, channel models, channel capacity etc to design channels and estimate the bandwidth of channel.

CO2: Apply the knowledge of Waveform Coding and Structured Sequences, Types of Error Control, , Linear Block Codes, Cyclic Code, Convolution code, Reed Solomon Codes, Interleaving and Concatenated Codes Usefulness of the Standard Array, , Well Known Block Codes error for correction and detection of errors and implement this to the Compact Disc, Digital Audio Systems.

CO3: Design, and evaluate Digital Communication Systems and Bandwidth Efficient modulation,

(Concept of Information, Types of source coding and channel coding, concept of Entropy, Modulation and Coding Tradeoffs)

Topics covered :-

Module-1 (8 Hours)

Information Theory

Introduction to information theory, uncertainty and information, average mutual information and entropy, cross entropy, information measures for continuous random variables, source coding theorem, Channel models, channel capacity, information capacity theorem, the Shannon limit.

Module-2 (12 Hours)

Channel Coding

Waveform Coding and Structured Sequences, Types of Error Control, Structured Sequences, Linear Block Codes, Error Detecting and Correcting Capability, Usefulness of the Standard Array, Cyclic Code, Well Known Block Codes.

Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes, Other Convolutional Decoding Algorithms

Reed Solomon Codes, Interleaving and Concatenated Codes, Coding and Interleaving Applied to the Compact Disc, Digital Audio Systems, Turbo Codes.

Module-3 (12Hours)

Modulation and Coding Trade offs:

Goals of the Communications System Designer, Error Probability Plane, Nyquist Minimum Bandwidth, Shannon-Heartley Capacity Theorem, Bandwidth Efficiency Plane, Modulation and Coding Trade-offs, Defining, Designing, and Evaluating Digital Communication Systems, Bandwidth Efficient modulation, Modulation and Coding for Bandlimited Channels, Trellis-Coded Modulation.

Source Coding: Sources, Amplitude Quantizing, Differential Pulse-Code Modulation, Adaptive-Prediction, Transform Coding, Source Coding for Digital Data, Examples of Source Coding.

Text Books:

(1) Information Theory, Coding and Cryptography, by Ranjan Bose, 2nd Edition , TMH Publication, 2nd reprint, 2008.
(2) Digital Communications – Fundamentals and applications, by Bernard sklar, 2nd Edition, Pearson education Publication, 2009.

References:

(3) Digital Communications, J. G. Proakis, 3rd edition, Mc Graw Hill Publication.
(4) Information Theory and coding, by Norman Abramson, Mc Graw Hill Publication.

PEEC4304 **COMPUTER NETWORK & DATA COMMUNICATION** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Communication Technique

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the basic knowledge of physical layer, data transmission and transmission media to transmit the data using different techniques.

CO2: Apply the knowledge of Data Link Layer in error detection and correction, point-to-point access and local area networks.

CO3: Apply the knowledge about network and application layer to design and develop different networking techniques such as host to host delivery, routing and addressing technique.

(To introduce the concepts and technologies used in data communication and computer networking. Understanding the protocols. Concepts and designing principles of Data Link layer, Network layer and Application layer in data communication.)

Topics covered :

Module – I 12 Hrs

Overview of Data Communications and Networking.
Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.

Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.
Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals.

Multiplexing : FDM , WDM , TDM ,
Transmission Media: Guided Media, Unguided media (wireless)
Circuit switching and Telephone Network: Circuit switching, Telephone network.

Module –II 12 Hrs

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction
Data Link Control and Protocols:
Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC.

Point-to –Point Access: PPP
Point –to- Point Protocol, PPP Stack,
Multiple Access
Random Access, Controlled Access, Channelization.
Local area Network: Ethernet.
Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring
Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Module – III 12 Hrs
Network Layer:
Host to Host Delivery: Internetworking, addressing and Routing
Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6
Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.

Application Layer :
Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed
3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning PCCS4304

PCCS 4304 OPERATING SYSTEM (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Data Base Management System

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the fundamentals of operating system & Process Management like Multithreading Models and scheduling algorithm to work with OS.

CO2: Implement the process coordination and memory management mechanism to design page replacement algorithm, allocating frame, trashing and segmentation.

CO3: Utilize the storage management to manage disk scheduling, disk management, swap-space management, different transformation techniques etc

(To familiarize the students about the basics of any operating systems and the structure of operating system consisting of process management, process coordination and process management.)

Topics covered :

MODULE-I 12 Hours

INTRODUCTION TO OPERATING SYSTEM:

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls

PROCESS MANAGEMENT:

Process Concept, Process Scheduling, Operation on Processes, Interprocess communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

MODULE-II 12 Hours

PROCESS COORDINATION: Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

MEMORY MANAGEMENT: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

MODULE-III 11 Hours

STORAGE MANAGEMENT:

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

CASE STUDIES: The LINUX System, Windows XP, Windows Vista

TEXT BOOK:

1. **Operating System Concepts –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. **Mordern Operating Systems –** Andrew S. Tanenbaum, 3rd Edition, PHI
3. **Operating Systems:** A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition

REFERENCE BOOK:

1. **Operating Systems –** Flynn, McHoes, Cengage Learning
2. **Operating Systems –** Pabitra Pal Choudhury, PHI
3. **Operating Systems –** William Stallings, Prentice Hall
4. **Operating Systems –** H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson

FESM6301 **NUMERICAL METHODS** (3-0-0)

Lecture : 3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Math III , Optimization Engineering

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of Approximation of numbers, significant figures, accuracy and precision and about error definitions to calculate the error and accuracy percentage.

CO2: Implement the knowledge of Interpolation and numerical integration to develop Newton-cotes algorithm.

CO3: Apply ordinary differential equation to design the algorithm and to determine the error.

(Approximation of numbers, Error definition, Linear algebraic equation, interpolation, numerical integration and ordinary differential equation)

Unit –I (10 hors)

Approximation of numbers, Significant figures, Accuracy and precision, Error definition, Round off errors, Error propagation, Total numerical error

Roots of equation: Bisection ethos, False-position method, Fixed point iteration, Newton-Raphson method, Secant method, Convergence and error analysis, System of non-linear equations

Linear algebraic equation: LU decomposition, The matrix inversion, Error analysis and system conditions, Gauss-Siedel method

Unit-II (10 hours)

Interpolation: Newton's divided difference interpolating polynomial, Lagrange interpolating polynomial, Spline interpolation.

Numerical integration: The Trapezoidal rule, Simpson's rule, Newton-Cotes algorithm for equations, Romberg integration, Gauss quadrature

Unit-III (10 Hours)

Ordinary differential equation: Euler method, Improvement of Euler's method, Runge-Kutta methods, System of equations, Multi step methods,
General methods for boundary value problems, Eigen value problems
(Algorithm and error analysis of all methods are included)

Text Book:

1. S.C. Chapra, R.P. Canale," *Numerical methods for Engineers*", Fifth edition, THM Publication.

Reference Books

1. S. Kalavathy, " *Numerica methods*", Thomson/ Cengage India
2. K.E. Atkinson," *Numerical analysis,*" Second edition, John Wiley & Sons.

PEEI5302 **ANALOG SIGNAL PROCESSING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Signals and Systems

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the fundamentals of operational amplifier, different converter circuits, Instrumentation amplifier to design transducer bridge amplifier.

CO2: Design logarithm amplifier, analog multiplier and analog divider by applying linear analog functions like addition, subtraction, differentiation, integration and conversion

CO3: Implement the concept of different filter design techniques, Interference and noise to design a standard filter with less noise.

(Review of OPAMP, Linear and non Linear analog function, Analog filter design.)

Topics covered :

Module – I 10 lectures

Introduction: Review of Operational Amplifier Fundamentals, Current-to-Voltage Converters, Voltage-to-Current Converter, Current Amplifiers, Difference Amplifiers, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge Amplifiers. (Selected Portions of Chapters 1 and 2 of Textbook 1).

Module – II 12 lectures

Liner Analog Functions: Addition, Subtraction, Differentiation, Integration, Impedance Transformation and Conversion (Selected Portions of Chapter 4 of Text book 2)

AC/DC Signal Conversion: Signal Rectification, Peak and Valley Detection, rms to dc Conversion, Amplitude Demodulation (Selected Portions of Chapter 5 of Text book 2)

Other Nonlinear Analog Functions: Voltage Comparison, Voltage Limiting (Clipping), Logarithmic Amplifiers, Analog Multipliers, Analog Dividers (Selected Portions of Chapter 6 of Text book 2)

Module- III 13 lectures

Analog Filters: Introduction to filtering and filter design, components for filter implementation, active low-pass, high-pass, band-pass, band-reject and all-pass filters – design and realization, Switch capacitance filter. (Selected Portions of Chapter 3 and 4 of Text book 1 and Chapter 7 of Text book 2)

Interference and Noise: Sources of signal coupling, Grounding and shielding techniques, Isolation amplifiers, Noise fundamentals, Noise modelling for electronic components and circuits.. (Selected Portions of Chapter 10 and 11 of Text book 2)

Text Books:

1. Sergio Franco, *Design with Operational Amplifiers and Analog Integrated Circuits*, 3rd Edn., Tata McGraw Hill Education Pvt. LTd., New Delhi, 2002, ISBN: 0-07-232084-2.
2. Ramon Pallas-Areny, John G. Webster, *Analog Signal Processing*, John Wiley& Sons, 1999, ISBN: 9814-12-696-9.

Reference Books:

1. R. Schaumann and M. E. Valkenberg, *Design of Analog Filters*, Oxford University Press, 2001, ISBN: 0-19-568087-1.
2. Don Meador, *Analog Signal Processing With Laplace Transform and Active Filter Design*, Thomson Learning.
3. Ashok Ambardar, *Analog and Digital Signal Processing*, 2nd Edn., Michigan Technological University Published by Nelson Engineering, 1999.
4. A.S. Sedra and K.C. Smith, *Microelectronic Circuits*, Oxford University Press, New Delhi
5. J.N. Jacob, *Application & Design with Analog Integrated Circuits*, PHI Pub, New Delhi.
6. D. Patranabis, *Electronic Instrumentation*, PHI Pub, New Delhi PCBM4304

PCBM 4304 BIOMEDICAL SIGNAL PROCESSING (3-0-0)

Lecture : 3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Signal Processing, Elements of Biomedical Instrumentation

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the basic knowledge of Bio-Medical signals like ECG, EEG, EMG, ERPs, EGG, biomedical signal analysis, Difficulties in biomedical signal analysis, computer-aided Diagnosis to design and modify the biomedical instruments to overcome the difficulties related to biomedical signals

CO2: Implement the knowledge of concurrent couples and correlated Processes and removal of Artifacts, operation of Adaptive noise canceller for reducing interference in ECG signal and canceling of maternal ECG in fetal ECG and cancelation of high frequency noise in electro surgery.

CO3: Apply the knowledge PQRS & T waves in ECG, EEG rhythms, derivative method for QRS detection, detection of P wave for ECG rhythm analysis, identification of heart sound.

(Objective of biomedical signal analysis, difficulties in biomedical signal analysis, computer aided diagnosis)

Topics covered :

Module I (15 Hours)

Bio-Medical signals: The nature of bio-medical signals, Examples of biomedical signals: Action potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Event related potentials (ERPs), Electrogastrogram (EGG), Phonocardiogram (PCG), Carotid pulse (CP), Vibromyogram (VMG), Vibroarthrogram (VAG), Speech signals,

Objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, Computer –aided Diagnosis.

Sources of Artifacts: Physiological Interference, Stationary Verses Non-Stationary Processes, High Frequency Noise in ECG, Motion Artifacts in ECG, Power Line Interference in ECG, Maternal Interference in fetal ECG, Muscle Contraction Interference in VAG Signals.

(Text Book – I – Chapter 1& 3)

Module II (12 Hours)
Concurrent Couples & Correlated Processes:
Problem Statement, Illustration of the problem with case studies: The ECG & PCG, The PCG & Carotid Pulse, The ECG & Atrial Electrogram, Cardio-Respiratory Interaction, The EMG & Vibromayogram, The Knee Joint and muscle vibration signals, Applications: Segmentation of the PCG.

Removal of Artifacts: Adaptive Noise Canceller, Cancellation of 60 Hz (power line) interference in ECG, Canceling Donor-Heart Interference in Heart Transplant ECG, Cancellation of ECG signal from the electrical activity of chest muscle.
(Text Book – I – Chapter 2 & Text Book – II – Chapter 6)

Module III (13 Hours)
Removal of Artifacts: Canceling of Maternal ECG in fetal ECG, Cancellation of High Frequency noise in Electro-surgery.

Event Detection:
Problem Statement, The PQRS & T waves in ECG, First & Second Heart Sounds, EEG Rhythms, waves and transients. Derivative Methods for QRS Detection, The Pan-Tompkins Algorithm for QRS detection, Detection of the Dicortic Notch, Detection of P wave. Applications: ECG rhythm Analysis, Identification of heart sounds, Detection of Aortic components of second heart sounds
(Text Book – II – Chapter 6 & Text Book – I : Chapter 4)

Text Books:

1) Biomedical Signal Analysis – A case Study Approach- Rangaraj M. Rangayyan – John Willey & Sons Inc-2002.
2) Biomedical Signal processing – Principles & Techniques – D.C Reddy – Tata McGraw Hill Companies – 2005

PEME5305 **Robotics & Robot Applications** (3-0-0)

Lecture: 3
Tutorial: - 0
Practical: -0

Internal Assessment: 30
Final Examination: 70
Credits: 3

Prerequisite: knowledge of Electrical Engineering and Basic electronics

Course Outcome: At the end of the course, the students will be able to
CO1: Apply the fundamental of robotics and mathematical modeling of a robot to design a robot.
CO2: Implement the knowledge of inverse kinematics, dynamic modeling and robot sensor to design and develop automatic robot
CO3: Apply the mechanism of robot actuators and trajectory planning to assemble the mechanical machinery of a robot such as capabilities of robots, material handling, machine loading and unloading, welding, obstacle avoidance etc.
(Fundamental of robotics, Mathematical modeling of robot, dynamic modeling, robot sensors, application of robotics.)

Topics covered :

Module – I

1. Fundamentals of Robotics: Evolution of robots and robotics, Definition of industrial robot, Laws of Robotics, Classification, Robot Anatomy, Work volume and work envelope, Human arm characteristics, Design and control issues, Manipulation and control, Resolution; accuracy and repeatability, Robot configuration, Economic and social issues, Present and future application.
2. Mathematical modeling of a robot: Mapping between frames, Description of objects in space, Transformation of vectors.
   Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship between adjacent links, Manipulator Transformation matrix.

Module – II

3. Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Jacobian singularity, Static analysis.
4. Dynamic modeling: Lagrangian mechanics, 2D- Dynamic model, Lagrange-Euler formulation, Newton-Euler formulation.
5. Robot Sensors: Internal and external sensors, force sensors, Thermocouples, Performance characteristic of a robot.

Module – III

6. Robot Actuators: Hydraulic and pneumatic actuators, Electrical actuators, Brushless permanent magnet DC motor, Servomotor, Stepper motor, Micro actuator, Micro gripper, Micro motor, Drive selection.
7. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian space planning.
8. Applications of Robotics: Capabilities of robots, Material handling, Machine loading and unloading, Robot assembly, Inspection, Welding, Obstacle avoidance.

Text Books:

1. Robotics and Control**,** R.K. Mittal and I.J. Nagrath, Tata McGraw Hill
2. Introduction to Robotics: Mechanics and control, John J Craig, PHI
3. Robotics Technology and Flexible Automation, S.R.Deb and S. Deb, Tata McGraw Hill

Reference Books:

1. Introduction to Robotics, S. K. Saha, Tata McGraw Hill
2. Robotics: Control, Sensing, Vision and Intelligence, K.S.Fu, R.C.Gonzalez and C.S.G.Lee, McGraw Hill
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W.Spong and M. Vidyasagar , Wiley India.
5. Industrial Robotics Technology, programming and application, M.P.Groover, McGraw Hill
6. Introduction to Robotics: Analysis, Systems, Applications, S.B.Niku, PHI
7. Robotics: Fundamental Concepts and Analysis, A. Ghosal, Oxford University Press
8. Fundamentals of Robotics: Analysis and Control, R. J. Schilling, PHI
9. Robotic Engineering: An Integrated Approach, R.D. KLAFTER, T. A. Chmielewski, and M. Negin, PHI
10. Robot Technology: Fundamentals: J. G. Keramas, Cengage Learning .

PCEC7304 **Digital Signal Processing Lab** (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Digital Signal Processing

Course Outcome: At the end of the course, the students will be able to

CO1: Implement the use of standard DSP kit, generation of various types of waveforms, convolution, correlation, and autocorrelation of sequences, computation of PSD, application of DFT and IDFT in finding convolution.

CO2 : Implement FFT by decimation in time as well as in frequency domain.

CO3: Design and develop different FIR and IIR filters by using MATLAB and DSP Kit TMS 320C6 series.

(Designing of different filters, Implementation of these filters using MatLab, Knowledge about the TI and different DSP processors. Implementing different DSp algorithms in real-time using these Processors.)

1. Familiarization with the architecture of a standard DSP kit (Preferably TMS 320C6XXX DSP kit of Texas Instruments)
2. Generation of various types of waveforms (sine, cosine, square, triangular etc.) using MATLAB and DSP kit.
3. Linear convolution of sequences (without using the inbuilt conv. function in MATLAB) and verification of linear convolution using DSP kit.
4. Circular convolution of two sequences and comparison of the result with the result obtained from linear convolution using MATLAB and DSP kit.
5. (i)Computation of autocorrelation of a sequence, cross correlation of two sequences using MATLAB.
   (ii) Computation of the power spectral density of a sequence using MATLAB also implementing the same in a DSP kit.
6. Finding the convolution of a periodic sequence using DFT and IDFT in MATLAB.
7. (i) Implementation of FFT algorithm by decimation in time and decimation in frequency using MATLAB.
   (ii) Finding the FFT of a given 1-D signal using DSP kit and plotting the same.
8. Design and implementation of FIR (lowpass and highpass) Filters using windowing techniques (rectangular window, triangular window and Kaiser window) in MATLAB and DSP kit.
9. Design and implementation of IIR (lowpass and highpass) Filters (Butterworth and Chebyshev) in MATLAB and DSP kit.
10. (i) Convolution of long duration sequences using overlap add, overlap XXXXX using MATLAB.
    (ii) Implementation of noise cancellation using adaptive filters on a DSP kit.

Reference Books:

1. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

PCEI 7301 COMMUNICATION SYSTEM ENGINEERING LAB (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Antenna and Wave Propagation, Digital Communication Techniques Laboratory

Course Outcome: At the end of the course, the students will be able to :

CO1: Design different antenna by analyzing the radiation pattern, polarization and detection of dipole and yagi antenna

CO2: Design different types of RADARS and measure range as well as velocity using Doppler effect.

CO3: Design monochrome and color TV receiver using RF amplifier, IF amplifier, sync separator, vertical oscillator, Color picture tube etc.

CO4: Design optical fiber communication link and measure different losses in fiber optics and measurement of different parameters like numerical aperture, refractive index etc by analyzing the characteristics of different types of optical sources.

(To familiarize the students about the operation of RADAR, Fiber optics communication and Satellite Communications)

List of Experiment

Any 10 experiment have to perform in the lab of around 40 hours.

1. Radiation pattern of Dipole, Yagi, Helical and Slot Antenna (3 hours)
2. Velocity Measurement using Doppler RADAR. (3 hours)
3. Study of different blocks of colour TV receiver such as RF amplifier, IF amplifier, sync separator, vertical oscillator, colour picture tube etc and measurement of various voltage signal waveform. (6 hours)
4. Polarization Detection of Dipole, Yagi, Helical and Slot Antenna (3 hours)
5. Measurement of Rafractive Index profile, Numerical Aperture, attenuation and bending loss/dispersion in a multimode optical fiber. (6 hours)
6. Study the laser diode and determination of its characteristics (3 hours)
7. Measurement of Gain of a fiber communication link using (a) optical fiber, (b) free space (3 hours)
8. Establishing and testing an optical Fiber Communication Link (6 hours)
9. Simulation of a pn sequence generator using MATLAB. (3 hours)
10. Simulation of direct sequence spread spectrum technique using MATLAB. (3 hours)
11. Simulation of TDM and WDM using MATLAB (3 hours)

PCEC7305 **Digital Communication Techniques Lab** (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Digital Communication Technique, Analog Communication Techniques Laboratory

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the principle of PCM and Delta modulation and to convert Analog signal to digital form

CO2: Apply the Multiplexing technique like TDM and FDM to reduce bandwidth of channel.

CO3: Implement different coding and decoding techniques in compressing the data.

CO4: Apply the principles of different digital modulation techniques like ASK, FSK, PSK and to transmit the digital signals with appropriate bandwidth and S/N ratio.

CO5:Utilize the satellite communication techniques using uplink and downlink path and data communication using LAN technology like star, bus, ring topology to transmit and receive audio, video and tone simultaneously.

(Design and analysis of different modulation and demodulation techniques, various network topologies and coding techniques)

1. Study the functioning of PCM and Delta modulator

Experiment objective: Demonstrate the process of PCM modulation and Delta modulation.

Equipment Required:

- Experiment board for PCM/ Delta Modulation/ Adaptive Delta Modulation generation and detection
- Signal generator
- CRO

2. To study Time division multiplexing.
3. To study PCM.
4. To study the different channel coding and decoding technique.
5. Generation and reception of different types of signals like ASK, PSK, FSK.
6. To transmit and receive three separate signal audio, video, tone simultaneously through satellite link.
7. To transmit PC data through satellite link using a satellite communication demonstration unit.
8. Experimentally compare different forms of BPSK, QPSK, OQPSK and analyze their spectrum with spectrum analyzer.
9. Spreading and dispreading using additive white Gaussian noise generation/ Gold code and other forms of spreading techniques.
10. Transmit different types of signals suing a ISDN system.
11. Analyze the process of data communication in LAN using LAN trainer and compare the performance different media access techniques.

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COURSE SYLLABI OF
B.TECH ELECTRONICS AND TELECOMMUNICATION ENGINEERING (E&TCE)
BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
Fourth Year

7th Semester

THEORY ***Contact Hour***

Code	*Subject*	*L-T-P*	*Credits*
HSSM3401	Entrepreneurship Development	3-0-0	3
PCEC4401	VLSI Design	3-1-0	4
	Professional Elective – I V(Any one)	3-0-0	3
	Biomedical Instrumentation		
PEEC5403	Digital Switching & Telecom Networks		
PEEC5404	Advance Control System		
PEEC5401	Adaptive Signal Processing		
PEEL5401			
	Free Elective –III(Any one)	3-0-0	3
	Computer System Architecture		
FECE6401	Real time Systems		
PECS5403	Microcontroller & Applications		
PEEI5401	Computer Graphics		
PCCS4401			
	Free Elective – IV (Any one)	3-0-0	3
	Principle of Mobile Computing		
FECE6402	Industrial Automation & Control		
PEEE5402	Mathematics for Communication		
FECE6403	Engineers		
	Artificial Intelligence		
PECS5401			
	Credits (Theory)	**16**	

PRACTICALS/SESSIONALS

8th Semester

THEORY ***Contact Hour***

Code	*Subject*	*L-T-P*	*Cred*
PCEC4402	Microwave Engineering	3-0-0	3
	Professional Elective –V (Any one)	3-0-0	3
PEEI5404	Analog VLSI Design		
PEEC5405	Embedded Systems		
PECS5406	Digital Image Processing		
PEEC5406	Satellite Communication System		
	Free Elective –V (Any one)		
FECE6404	Network Security and Cryptography	3-0-0	3
FECE6405	Internet Technology and Application		
PEEI5405	MEMS		
PEEI5403	Industrial Instrumentation		
PECS5407	Wireless Sensor Networks		
	Credits (Theory)	**09**	

PRACTICALS/SESSIONALS

PCEC7401	VLSI Design Laboratory	0-0-3	2	PCCS7402	Microwave Engineering Laboratory	0-0-3	2
PCEC7402	Project	0-0-6	3	PCEC7404	Project (50% External Evaluation)	0-0-3	7
PCEC7403	Seminar	0-0-3	2	PCEC7405	Comprehensive Viva-Voce (External Evaluation)	0-0-0	3
	Credits (Practicals/Sessionals)		**7**		**Credits (Practicals/Sessionals)**		**1**
	TOTAL SEMESTER CREDITS		**23**		**TOTAL SEMESTER CREDITS**		**21**
	TOTAL CUMULATIVE CREDITS		**183**		**TOTAL CUMULATIVE CREDITS**		**204**

HSSM3401 **ENTREPRENEURSHIP DEVELOPMENT** (3-0-0)

Lecture :3
Tutorial : - 0
Practical : -0

Internal Assessment:30
Final Examination: 70
Credits:3

Prerequisite: Principle of Management

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the concept of entrepreneurship, motivation for economic development and entrepreneurial achievement to start a enterprise.

CO2: Identify business opportunity in various sectors, environmental pollution and allied regulatory and non-regulatory clearance for new promotion in SME sector, writing business plan, determination of bankability of the project to set up small enterprise in manufacturing and services.

CO3: Utilize the different institutional support SME to solve the different problem arising in an SME.

(It helps the students understanding the concept of entrepreneurship, setting up a small business enterprise, Institutional support for small industries)

Topics covered :-

Module I: Understanding Entrepreneurship 10Hrs

Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society

Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change.

Entrepreneurial Process

Step by step approach to entrepreneurial start up

Decision for Entrepreneurial start up.

Module II: Setting up of a small Business Enterprise. 10Hrs

Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector.

Writing a Business plan, components of a B-Plan, determining Bankability of the project.

Module III: Institutional Support for SME. 10Hrs
Central / State level Institution promoting SME.
Financial Management in small business.
Marketing Management, problems & strategies
Problems of HRM – Relevant Labour – laws.

Sickness in Small Enterprises.
Causes and symptoms of sickness – cures of sickness.
Govt. policies on revival of sickness and remedial measures.

Reference Books:

1. Entrepreneurship Development, Small Business Enterprises, Chavantimath, Pearson.
2. Entrepreneurial Development, S.S. Khanka, S Chand
3. Entrepreneurship, Barringer BR, Ireland R.D., Pearson
4. Entrepreneurship, David H Holt, PHI
5. Entrepreneurship, Kurilko, D.F. and Attodgets RM, Cengage
6. The Dynamics of Entrepreneurial Development & Management, Vasant Desai, HPH.
7. Entrepreneurship, Roy, Oxford
8. Entrepreneurship, Hisrich, Peters, Shepherd, TMH

PCEC4401 **VLSI DESIGN** (3-1-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 1 **Final Examination: 70**
Practical : -0 **Credits:4**

Prerequisite: Digital Electronics Circuit

Course Outcome: At the end of the course, the students will be able to

CO1: Implement the knowledge of different VLSI Design methodologies, fabrication of MOSFET and MOS transistor to design different semiconductor components.

CO2: Implement the static and switching characteristics of MOSFET and Transistors to design MOS inverters and combinational MOS logic circuits like CMOS transmission gates.

CO3: Apply the sequential MOS logic circuits and dynamic logic circuits, semiconductor memories so that they can design and test faults types and models.

(Basic concepts of VLSI Design methodology, Flow, Hierarchy, Regularity, Modularity and locality. Design and implementation of MOS inverter, logic circuits and memories.)

Topics covered :-

Module – I 08 Hours

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.

Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs Mask Layout Design.

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.
(Chapter 1 to 3 of Text Book 1 and for Stick Diagram Text Book 2)

Module – II 14 Hours

MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.

MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).
(Chapter 5 to 7 of Text Book 1)

Module – III 18 Hours

Sequential MOS Logic Circuits: Introduction, Behavior of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, Flash Memory.

Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring I_{DDQ} Test.

Text Books:

1. Sung-Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 3rd Edn., Tata McGraw-Hill Publishing Company Limited, 2003.
2. K. Eshraghian and N.H.E. Weste, *Principles of CMOS VLSI Design – a Systems Perspective*, 2nd Edn., Addison Wesley, 1993.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits – A Design Perspective***,** 2nd Edn., PHI.
2. Wayne Wolf, *Modern VLSI Design System – on – Chip Design*, 3rd Edn., PHI
3. Debaprasad Das, *VLSI Design*, Oxford University Press, New Delhi, 2010.
4. John P. Uyemura, *CMOS Logic Circuit Design*, Springer (Kluwer Academic Publishers), 2001.
5. Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2000.

PEEC5403 **BIOMEDICAL INSTRUMENTATION** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Biomedical Signal Processing

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the fundamental s of biomedical instrumentation, biomedical signals and electrodes to analyze different constraints and design electrodes for ECG, EEG, EMG and motion artifacts.

CO2: Implement the physiological transducers and biomedical recording systems to design and test biomedical instruments like electrocardiograph (ECG), Phonocardiograph, Electroencephalograph (EEG), Electromyography (EMG).

CO3: Measure heart rate, blood pressure, respiration rate by applying the knowledge of operating principle of patient monitoring system and blood flow meters.

(Fundamental of biomedical instrumentation, Biomedical signals, physiological transducers, biomedical recording and monitoring system and patient safety)

Topics covered :

Module – I (10 Hours)

Fundamentals of Biomedical Instrumentation: Sources of Biomedical Signals, Basic Medical Instrumentation System, Intelligent Medical Instrumentation Systems, PC Based Medical Instrumentation Systems, General Constraints & Regulations of Medical Devices

Biomedical Signals & Electrodes: Origin of Bioelectric Signals-Repolarization, Depolarization, Resting Potential Recording Electrodes – Ag-AgCl Electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes, Skin Contact Impedance, Motion Artifacts

Module – II (13 Hours)

Physiological Transducers: Introduction to Physiological Transducers, Classification of Transducers, Pressure Transducers, Transducers for Body Temperature Measurement, Biosensors, Smart Sensors

Biomedical Recording Systems: Basic Recording Systems, General Considerations for Signal Conditioners, Biomedical Signal Analysis Techniques, Signal Processing Techniques, Writing Systems: Direct Writing Recorders, Inkjet Recorder, Potentiometric Recorders, Digital Recorders

Biomedical Recorders: Electrocardiograph (ECG), Phonocardiograph, Electroencephalograph (EEG), Electromayograph (EMG)

Module – III (14 Hours)

Patient Monitoring Systems: System Concepts, Measurement of Heart Rate, Blood Pressure Measurement, Measurement of Respiration Rate

Blood Flow meters: Electromagnetic Blood Flow meter, Ultrasonic Blood Flow meter, NMR Blood Flow meter, Laser-Doppler Blood Flow meter

Patient Safety: Electric Shock Hazards, Leakage Currents, Safety Codes for Biomedical Equipment

Text Books:

1. Hand Book of Biomedical Instrumentation-2nd Edition by R.S.Khandpur, Tata McGraw Hill 2003 (Chapters 1-6,11,18)
2. Biomedical Instrumentation and Measurements-2nd Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI learning Pvt Ltd 2nd Edition

Reference Books:

1. Introduction to Biomedical Equipment Technology-4th Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007

PEEC5404 DIGITAL SWITCHING AND TELECOM NETWORKS (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Digital Electronics Circuit, Analog Communication Technique, Digital Communication Techniques, Mobile Communication

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the fundamentals of switching system, store program control, two stage and three stage network, space division switching, time division switching, combination switching to design a switching system.

CO2: Implement the knowledge of traffic load and parameters, GOS and blocking probability, types of blocking models, delay systems to calculate traffic intensity in a telephone switching network.

CO3: Apply the process of subscriber loop system, switching hierarchy, routing, transmission plan and system, signaling techniques to transmit a data from calling subscriber to call subscriber efficiently and effectively.

CO4: Implement different types of data network like PSTN by using, circuit switching and packet switching, ISO-OSI reference model, satellite based data networks to design ISDN .

(It helps the students to know the concept of switching in telecom network, Network traffic, data transmission techniques, ISDN for voice and data integrated transmission.)

Topics covered :-

MODULE – I (16 hours)

Introduction: Fundamentals of switching system, telecommunication networks.

Electronic space division switching: Stored program control, centralized and distributed SPC, application software architecture, enhanced services, two and three stage & n stage networks. Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space and time switching, combination switching, three-stage & n stge combination switching. (Chapter 1, 4 and 6)

MODULE – II (12 hours)

Traffic Engineering: Network traffic load and parameters, Grade of services & blocking probability, modeling of switching systems, incoming traffic & service time characterization, blocking models and loss estimates, Delay systems (Chapter 8)

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, Signaling techniques : in channel & common channel signaling (Chapter 9)

MODULE – III (12 hours)
Data Networks: Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, an overview of data network standards. (Chapter 10)
Integrated Service Digital Network: Motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration (Chapter 11)

Text Books :

1. Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks by, PHI Learning Pvt. Ltd., New Delhi.

References:

1. Communication Networks, A Leon-Garcia and Indra Widiaja, TMH, New Delhi
2. Data and Computer Communications by W Stallings, Pearson Education

PEEC5401 ADVANCED CONTROL SYSTEMS (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Control System Engineering

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the principles of digital control system, z-transform, z-plane analysis of discrete time control system, mapping between the s-plane and z-plane, stability analysis of closed loop systems in the z-plane to design a stable system.

CO2: Utilize the concept of state, state variable and state model , diagonalization, solution of state equation, concepts of controllability and observability, linear discrete time system to design state model for linear continuous and discrete system.

CO3: Implement the concepts of non-linear system, common physical non linearities like saturation, friction, relay and the basic concept of phase plane method to develop non linear systems.

CO4: Apply the principle of construction of phase trajectories, describing function method in stability analysis by describing function method and constructing of liapunov functions for non linear system.

(It gives idea about digital control system, state variable analysis and design, nonlinear systems and stability analysis of a system.)

Topics covered :

Module-I : (15 Hours)

Discrete - Time Control Systems :

Introduction: Discrete Time Control Systems and Continuous Time Control Systems, Sampling Process.
Digital Control Systems: Sample and Hold, Analog to digital conversion, Digital to analog conversion.

The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important properties and Theorms of the Z-transform. The inverse Z-transform, Z-Transform method for solving Difference Equations.

Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorm, folding, aliasing. **Pulse Transfer function:** Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loop systems. **Mapping between the s-plane and the z-plane, Stability analysis of closed loop systems in the z-plane:** Stability analysis by use of the Bilinear Transformation and Routh stability critgion, Jury stability Test.**Book No. 1:** 1.1; 1.2; 1.4; 2.1; 2.2; 2.3; 2.4; 2.5; 2.6; 3.2; 3.4; 3.5; 4.2; 4.3.

Module -II : (15 Hours)

State Variable Analysis & Design:
Introduction: **Concepts of State, State Variables and State Model (of continuous time systems)**: State Model of Linear Systems, State Model for Single-Input-Single-Output Linear Systems, Linearization of the State Equation. **State Models for Linear Continuous – Time Systems**: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State – space Representation using Canonical Variables, Derivation of Transfer Function for State Model. **Diagonalization**: Eigenvalues and Eigenvectors, Generalized Eigenvectors. **Solution of State Equations**: Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley-Hamilton Theorem, Sylvester's Expansion theorm.

Concepts of Controllability and Observability: Controllability, Observability, Effect of Pole-zero Cancellation in Transfer Function. **Pole Placement by State Feedback**, **Observer Systems**. **State Variables and Linear Discrete – Time Systems:** State Models from Linear Difference Equations/z-transfer Functions, Solution of State Equations (Discrete Case), An Efficient Method of Discretization and Solution, Linear Transformation of State Vector (Discrete-Time Case), Derivation of z-Transfer Function from Discrete-Time State Model. **Book No. 2:** 12.1 to 12.9.

Module -III : (12 Hours)

Nonlinear Systems :
Introduction : Behaviour of Non linear Systems, Investigation of nonlinear systems.
Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, Multivariable Nonlinearity.
The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus Point, Centre or Vortex Point, **Stability of Non Linear Systems:** Limit Cycles, **Construction of Phase Trajectories:** Construction by Analytical Method, Construction by Graphical Methods. **The Describing Function Method: Basic Concepts: Derivation of Describing Functions:** Dead-zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash. **Stability Analysis by Describing Function Method:** Relay with Dead Zone, Relay with Hysteresis, Stability Analysis by Gain-phase Plots. **Jump Resonance. Liapunov's Stability Analysis: Introduction, Liapunov's Stability Critrion:** Basic Stability Theores, Liapunov Functions, Instability. **Direct Method of Liapunov & the Linear System:** Methods of constructing Liapunov functions for Non linear Systems.
Book No. 2: 13.1 to 13.4; 15.1 to 15.10.

Text Books:

1. Discrete-Time Control System, by K.Ogata, 2nd edition (2009), PHI.
2. Control Systems Engineering, by I.J. Nagrath and M.Gopal., 5th Edition (2007 / 2009), New Age International (P) Ltd. Publishers.

Reference Books:

1. Design of Feedback Control Systems by Stefani, Shahian, Savant, Hostetter, Fourth Edition (2009), Oxford University Press.
2. Modern Control Systems by K.Ogata, 5th Edition (2010), PHI.
3. Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11th Edition (2008), Pearson Education Inc. Publication.
4. Control Systems (Principles & Design) by M.Gopal, 3rd Edition (2008), Tata Mc.Graw Hill Publishing Company Ltd.
5. Control Systems Engineering by Norman S.Nise, 4th Edition (2008), Wiley India (P) Ltd.

PEEL5401 **ADAPTIVE SIGNAL PROCESSING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Signal Processing, Digital Signal Processing

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the concept of definition and characteristics, general properties of adaptive system to design close and open adoptive systems.

CO2: Apply the theory of adaption with stationary signals, searching the performance surface for gradient estimation like performance penality, variance of the gradient estimate and misadjustment.

CO3: Implement the adaptive algorithm and structures like LMS algorithm, convergence, learning curve, performance analysis and filtered XLMS algorithm and apply the knowledge to adaptive modeling and system identification using adaptive filter, inverse adaptive modeling,deconvolution and equalization

(Design of adaptive filter, theory of adaptation with stationary signals, gradient estimation and its effect on adoption, The LMS algorithm and its applications)

Topics covered :

Module – I (10 Hours)

Introduction: Adaptive Systems – Definition and characteristics, General properties, Open and Closed Loop Adaptations, Applications

The Adaptive Linear Combiner: Performance function, Gradient and Mean Square Error, Examples.

Module – II (14 Hours)

Theory of Adaptation with Stationary Signals: Properties of the Quadratic Performance Surface, Significance of eigen values, eigen vectors, coorelation matrix.

Searching the Proformance Surface: A simple gradient search algorithm, Stability and Rate of convergence, the learning curve

Gradient Estimation and its effects on Adoption: The performance penalty, Variance of the gradient estimate, Misadjustment.

Module – III (16 Hours)
Adaptive Algorithms and Structures: The LMS Algorithm, Convergence, learning Curve, Performanece analysis, Filtered X LMS algorithm,

Applications: Adaptive Modeling and System Identification using adaptive filter, Inverse Adaptive Modeling, Deconvolution, and equalization using adaptive filter, Adaptive Control Systems using Filtered X LMS Algorithm, Adaptive Noise Cancellation using Adaptive filter

Text Books :

1. Bernard Widrow and Samuel D. Stearns, *Adaptive Signal Processing*, Pearson Education, 2nd impression 2009.

Reference Book:

1. Simon Haykin, *Adaptive Filter Theory*, 4th Edn., Pearson Education.

FECE6401**COMPUTER SYSTEM ARCHITECTURE** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Analog Communication Techniques, Operating System, Digital Signal Processing.

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the basic structures of computers, machine instruction and programs such as memory location and addressing, memory operations, instructions and instruction sequencing, addressing modes, assembly language, basic input/output operations, and subroutine to design the memory structure of a computer.

CO2: Apply the principle of arithmetic operation of computer such as addition and subtraction of signed numbers, design of fast adder, multiplication of positive numbers, fast multiplication, integer division, floating point numbers to execute a complex programs.

CO3: Apply the basic processing units to design and develop the execution of instruction, bus organization, hardware control, RISC /CISC architecture.

CO4: Implement the basic concept of memory systems such as cache memory , memory mapping policy, cache updating schemes, virtual memory, paging and page replacement policies, memory management, secondary storage to enhance the speed of operation of processor as well as the storage capacity of computer.

(The students get acquainted with basic structure of a computer such as machine instructions and programs, arithmetic unit, basic processing unit and memory units.)

Topics covered :
Module –I 12 Hrs

Basic Structures of Computers: Functional units, operational concepts, Bus structures, Software, Performance, Computer Architecture vs Computer Organization.
Machine Instruction and Programs: Memory location and addresses, Big-endian and Little-endian representation. Memory Operations, Instructions and instruction Sequencing, Addressing modes, Assembly Language, Basic Input/output operations, subroutine, additional Instructions.

Module – II 12 Hrs

Arithmetic: Addition and subtraction of signed Numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed-operand multiplication , Fast multiplication, Integer Division, Floating- point Numbers, (IEEE754 s…) and operations.

Module – III 12 Hrs

Basic Processing units: Fundamental concepts, execution of complete Instructions, Multi bus organization, Hardwired control, Micro programmed control, RISC vs CISC architecture.
Memory System: Basic Concepts, cache Memory, Cache memory mapping policies, Cache updating schemes, performance consideration, Virtual memories, Paging and Page replacement policies, Memory Management requirement, secondary storage.

***Text Books*:**

1. Computer Organization and Design Hardware/ Software Interface: David A. Patterson, John L. Hennessy, Elsevier, 4th Edition.
2. Computer Organization:Carl Hamacher, Zvonkovranesic, Safwat Zaky,Mc Graw Hill,5th Ed.

Reference Book:

1. Computer Architecture and Organization: William Stallings, Pearson Education.
2. Computer Architecture and Organizations, Design principles and Application: B. Govinda Rajalu, Tata McGraw-Hill Publishing company Ltd.
3. Computer Architecture: Parhami, Oxford University Press
4. Computer system Architecture: Morris M. Mano PHI NewDelhi.
5. Computer Architecture and Organization: John P. Hayes Mc Graw Hill introduction.
6. Structured Computer Organization: A.S. Tanenbum, PHI
7. Computer Architecture And Organization: An Integrated Approach, Murdocca, Heuring Willey India, 1st Edition

PECS5403**REAL-TIME SYSTEMS** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Computer System Architecture.

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the basic model of real time system, characteristics of real time system, type of real time tasks, timing constraints, real time task scheduling, clock-driven scheduling, hybrid schedulers, event driven scheduling, and rate monotonic algorithm for model timing constraints, and RMA in practical situations.

CO2: Apply the concept of resource sharing, priority inversion, priority inheritance protocol, highest locker protocol, priority ceiling protocol (PCP) in designing a protocol for a real time task.

CO3: Apply the knowledge on commercial real time operating system, UNIX, WINDOWS, POSIX-RT and real time data bases , real time communication to work with various operating systems and the real time communication in LAN and packet switched networks.

(Introduction to real time and its application, real time task scheduling and commercial real time operating system)

Topics covered :

MODULE-1 10Hrs

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteistics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints

Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

MODULE-2 10Hrs

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies.

Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

MODULE-3 10Hrs

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system,POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.

Text Book:

1. Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.

References:

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH.

PEEI5401 MICROCONTROLLERS AND APPLICATIONS (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Microprocessors.

Course Outcome: At the end of the course, the students will be able to

CO1: Implement the knowledge of microcontrollers and microcontroller devices such as 8051 microcontroller, addressing modes and instruction sets, assembly language programming tools, interrupts, timer/counter to write program for various real time tasks as well as to develop microcontroller based embedded system.

CO2: Implement the Atmel microcontroller, PIC microcontroller, and introduction to PIC PIC 16F8XX flash microcontroller to design square wave, rectangular and pulse wave generation circuit, PWM modulator, staircase ramp generator, sine wave generator, frequency counter, A/D converter, Oscillators etc.

CO3: Apply their skill to interface and industrial application of microcontroller and relays and latch connection, keyboard interfacing, 7-segment displays, LCD interfacing, ADC and DAC interfacing (using 89C51 MC), and measurement, automation and control application in industry

(Introduction to microcontroller, like 8051, Design with Atmel MC System. PIC Microcontroller, Industrial application of microcontroller. Advance programming and math calculations)

Topics covered :
MODULE: I (12 hours)

1. **Introduction to Microcontrollers:** Introduction, Microcontrollers and Microprocessors, History of Microcontrollers and Microprocessors, Embedded versus External Memory Devices, 8-bit and 16-bit Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Commercial Microcontroller Devices.
2. **8051 Microcontrollers – Pin Description, Connections, I/O Ports and Memory Organization:** Introduction, MCS-51 Architecture, Registers in MCS-51, 8051 Pin Description, 8051 Connections, 8051 Parallel I/O Ports, Memory Organization.
3. **MCS-51 Addressing Modes and Instructions:** 8051 Addressing Modes, MCS-51 Instruction Set, 8051 Instructions and Simple Programs, Using Stack Pointer.
4. **8051 Assembly Language Programming Tools:** 8051 Assembly Language Programming, Development Systems and Tools, Software Simulators of 8051.
5. **MCS-51 Interrupts, Timer/Counters and Serial Communication:** Interrupts, Interrupts in MCS-51, Timers and Counters, Serial Communication.

MODULE: II (12 hours)

1. **Design with Atmel Microcontrollers:** Atmel Microcontrollers (89CXX and 89C20XX), Architectural Overview of Atmel 89C51 and Atmel 89C2051, Pin Description of 89C51 and 89C2051, Using Flash Memory Devices Atmel 89CXX and 89C20XX, Power Saving Options.
2. **Applications of MCS-51 and Atmel 89C51 and 89C2051 Microcontrollers:** Applications of MCS-51 and Atmel 89C51 and 89C2051 microcontrollers, Square Wave Generation, Rectangular Waves, Pulse Generation, Pulse Width Modulation (PWM), Staircase Ramp Generation, Sine Wave Generation, Pulse Width Measurement, Frequency Counter.
3. **Introduction to PIC Microcontrollers:** PIC Microcontrollers – Overview and Features, PIC 16C6X/7X, FSR (File Selection Register) [Indirect Data Memory Address Pointer], PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC).
4. **Introduction to PIC PIC 16F8XX Flash Microcontrollers:** Introduction, Pin Diagram of 16F8XX, STATUS Register, OPTION_REG Register, Power Control Register (PCON), PIC 16F8XX Program Memory, PIC 16F8XX Data Memory, DATA EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O Ports, Timers.

MODULE: III (12 hours)

1. **Interfacing and Microcontroller Applications:** Introduction, Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections, Keyboard Interfacing, Interfacing 7-Segment Displays, LCD Interfacing, ADC and DAC Interfacing with 89C51 Microcontrollers.
2. **Industrial Applications of Microcontrollers:** Introduction, Measurement Applications, Automation and Control Applications.
3. **Advanced Programming and Math Calculations:** Introduction, Fixed-Point Numbers, Addition of two 16-bit Numbers, Unsigned 32-bit Addition, Subtraction of Two 16-bit Numbers, Conversion of 8-bit Signed Number into a 16-bit Signed Number, 16-bit Signed Addition, Binary to BCD Conversion, Square Root Calculations, Integration, Differentiation, Floating-Point Arithmetic.

Text Books:

1. Ajay V. Deshmukh, ***Microcontrollers* [*Theory and Applications*]**, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.

Reference Books:

1. M.A. Mazidi, J. G. Mazidi and R.D. McKinlay, ***The 8051 Microcontroller and Embedded Systems using Assembly and C***, 2nd Edition, Pearson Education, 2008.
2. Myke Predko, ***Programming and Customizing the 8051 Microcontroller***, TMH
3. Subrata Ghoshal, ***8051 Microcontroller Internals, Instructions, Programming and Interfacing***, Pearson Education, 2010.
4. Kenneth J. Ayala, ***The 8051 Microcontroller – Architecture, Programming and Applications***, 2nd Edition, Thomson Delmar Learning, 2004.
5. David Calcutt, Fred Cowan, Hassan Parchizadeh, ***8051 Microcontrollers – An Application based Introduction***, Elsevier Publications.
6. Myke Predko, ***Programming and Customizing the PIC Microcontroller***, TMH
7. John B. Peatman, ***Design with PIC Microcontrollers***, Pearson Education, 2005.
8. Han Way Huang, ***PIC Microcontroller***, Cengage Learning.

9. Martin Bates, ***PIC Microcontrollers***, 2nd Edition, Elsevier Publications.

PCCS4401 **COMPUTER GRAPHICS**(3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Operating System

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the concept of graphics system, output primitives such as video display unit, raster-scan, line drawing algorithms, basic transformation, matrix representation, and composite transformation to transform between two separate coordinate system.

CO2: Apply the process of line clipping, aliasing and anti aliasing, two dimensional object representation, fractal geometry, three dimensional geometric, projections to analyze the object in different domain and to design different transformation models.

CO3: Apply the knowledge on surface detection method, illumination models, surface rendering methods, computer animation and virtual reality to develop scan line algorithm, design various illumination models, controlling animation etc

(Overview of Graphics system. Drawing algorithms, computer animations, fractal calculation and fractal dimension)

Topics covered :

Module – I (10 hours)

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.

Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.

Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

Module –II (12 hours)

Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).

Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character.

Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.

Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.

Fractal Geometry: Fractal Classification and Fractal Dimension.

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.

Projections: Parallel Projection and Perspective Projection.

Module –III (8 hours)

Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm.
Illumination Models: Basic Models, Displaying Light Intensities.
Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.
Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.
Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices.

Textbook

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, Wiley-Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Reference Books

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley
2. Procedural Elements of Computer Graphics- David Rogers (TMH)
3. Computer Graphics: Algorithms and Implementations – D.P Mukherjee & Debasish Jana (PHI)
4. Introduction to Computer Graphics & Multimedia – Anirban Mukhopadhyay & Arup Chattopadhyay (Vikas)

FECE6402**PRINCIPLES OF MOBILE COMPUTING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Mobile Communication

Course Outcome: At the end of the course, the students will be able to

CO1: Implement PCS and its architecture, network signaling, GSM and its architecture, GPRS and its architecture, WLANs to design various communication system architecture

CO2: Apply the concept of WAP such as WAP gateway and protocols, WML, WLL and its architecture, 3G mobile service WCDMA and CDMA technique to minimize the channel bandwidth as well as to reduce the noise and in 4G mobile service.

CO3: Apply the skill of global mobile satellite systems and the case studies of IRIDIUM, ICO and GLOBAL STAR, wireless enterprise network such as blue tooth technology, blue tooth protocol in sending data though wireless technology and also to design modified wireless communication architecture.

(The students are familiarized with personal communication services and its architecture. GPRS and its application, Wireless application services, 3G mobile services and global mobile satellite system)

Topics covered :
Module – I: (10 Hrs)

Introduction to Personal Communications Services (PCS): PCS Architecture, mobility management, Networks signaling, Global System for Mobile Communication (GSM) System overview : GSM Architecture, Mobility management, Network signaling.
General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.

Module – II: (14 Hrs)

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML), Wireless Local Loop (WLL) : Introduction to WLL Architecture, wireless Local Loop Technologies.
Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000

Module – III: (12 Hrs)

Global Mobile Satellite Systems ; case studies of the IRIDIUM, ICO and GLOBALSTAR systems. Wireless Enterprise Networks : Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.
Server-side programming in Java, Pervasive web application architecture, Device independent example application.

Text Books:

1. Mobile Communication: J. Schiller, Pearson Education
2. Mobile Computing: P.K. Patra, S.K. Dash, Scitech Publications.
3. Mobile Computing: Talukder, TMH, 2nd Edition.

Reference Books:

1. Pervasive Computing: Burkhardt, Pearson Education.
2. Principles of Mobile Computing: Hansmann, Merk, Springer, 2nd Edition.
3. Wireless Communication & Networking: Garg, Elsevier
4. Third Generation Mobile Telecommunication Systems: P. Stavronlakis, Springer.
5. The Wireless Application Protocol: Sandeep Singhal, Pearson Education.

PEEE5402**INDUSTRIAL AUTOMATION AND CONTROL** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Advanced Control System

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the fundamental of process control and PID controller tuning, Digital PID controller to flow control, pressure control and level control mechanism in industries.

CO2: Implement the special control process such as cascade control, feed forward control, ratio control, selective control, adaptive control and actuators such as pneumatic actuator, hydraulic actuator, electric actuator, motor actuator and control valve in industrial control units

CO3: Utilize the Industrial automation, PLC, distributed control and real time programming to design PLC architecture of required output.

(Process control, Different controller tuning, special control structures. And industrial automation (PLC) and real time programming.)

Topics covered :
Module I: (12 Hours)

Process Control: Introduction: Process Definition, Feedback Control, PID Control, Multivariable Control. (Chapter 1 of Text Book 1)
PID Controller Tuning: Introduction, Zeigler-Nichols Tuning Method (Based on Ultimate Gain and Period, and Process Reaction Curve), Digital PID Controllers. (Chapter 13 of Text Book 2)

Module II: (15 Hours)

Special Control Structures: Cascade Control, Feedfroward Control, Feedfroward-Feedback Control Configuration, Ratio Control, Selective Control, Adaptive Control, Adaptive Control Configuration. (Chapter 10 and 11 of Text book 3)
Actuators: Introduction, Pneumatic Actuation, Hydraulic Actuation, Electric Actuation, Motor Actuators and Control Valves. (Chapter 8 of Text Book 1)

Module III: (10 Hours)

Industrial Automation: Programmable Logic Controllers: Introduction, Principles of operation, Architecture, Programming (Programming Languages, Ladder Diagram, Boolean Mnemonics) (Chapter 5 of Text Book 1)
Distributed Control: Distributed vs. Centralized, Advantages, Functional Requirements, System Architecture, Distributed Control Systems (DCS), Communication options in DCS. (Chapter 6 of Text Book 1)

Real-time Programming: Multi-tasking, Task Management, Inter-task Communication, Real-time Operating System. (Chapter 9 of Text Book 1)

Text Books:

1. Krishna Kant, "Computer-Based Industrial Control", PHI, 2009.
2. M. Gopal, "Digital Control and State Variable Methods" Tata McGraw Hill, 2003.
3. Surekha Bhanot, Process Control: Principles and Applications, Oxford university Press, 2010

Reference Books:

1. Smith Carlos and Corripio, "Principles and Practice of Automatic Process Control", John Wiley & Sons, 2006.
2. Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall, 2003.
3. C. Johnson, "Process Control Instrumentation Technology", PHI, New Delhi
4. D.R. Coughnowr, "Process System analysis and Control", McGraw Hill.

FECE6403 MATHEMATICS FOR COMMUNICATION ENGINEERS

(3-0-0)

Lecture :3
Tutorial : - 0
Practical : -0

Internal Assessment:30
Final Examination: 70
Credits:3

Prerequisite: Math III

Course Outcome: At the end of the course, the students will be able to

- **CO1**: Apply the mathematical models for linear systems and signals, Gaussian random variable, random process, markov models, vector space and linear algebra to represent the signal in terms of orthogonal and orthonormal function, find the constolation diagram of modulated signals.
- **CO2:** Implement representation and approximation in vector spaces, matrix factorization, eigen values and vectors, and singular value decomposition to calculate the minimum min square error estimation and filtering.
- **CO3**: Apply Knowledge for detection and estimation theory like hypothesis testing and maximum-like hood principle to design optimum receiver in communication system.

(Mathematical models, vector space and linear algebra, representation and approximation in vector spaces, the singular value decomposition, detection theory and estimation theory)

Topics covered :

MODULE – I (10 hours)

Introduction and Foundations: Mathematical Models, Models for Linear Systems and Signals, Adaptive Filtering, Gaussian Random Variables and Random Processes, Markov and Hidden Markov Models [Moon: 1.3 to 1.7]

Vector Spaces and Linear Algebra: Metric Spaces, Vector Spaces, Norms and Normed Vector Spaces, Inner Products and Inner Product Spaces, Induced Norms, The Cauchy-Schwarz Inequality, Orthogonal Subspaces, Projections and Orthogonal Projections, Projection Theorem Orthogonalization of Vectors. [Moon: 2.1 to 2.6, 2.10, 2.13, 2.14, and 2.15]

MODULE – II (13 hours)

Representation and Approximation in Vector Spaces: The Approximation Problem in Hilbert Space, The Orthogonality Principle, Matrix Representation of Least-Squares Problems, Linear Regression, Least-Squares Filtering, Minimum Mean-Square Estimation, Minimum Mean-Squared Error (MMSE) Filtering, Comparison of Least Squares and Minimum Mean Squares. [Moon: 3.1, 3.2, 3.4, 3.8 to 3.12]

Some Important Matrix Factorization: The LU Factorization, The Cholesky Factorization, Unitary Matrices and the QR Factorization. [Moon: 5.1 to 5.3]

Eigen values and Eigenvectors: Eigen Values and Linear Systems, Linear Dependence of Eigenvectors, Diagonalization of a Matrix. [Moon: 6.1 to 6.3]

The Singular Value Decomposition: Theory of the SVD, Matrix Structure from the SVD, Pseudo-inverses and the SVD, Rank-Reducing Approximations: Effective Rank, System Identification Using the SVD. [Moon: 7.1 to 7.3 and 7.5]

MODULE – III (13 hours)

Introduction to Detection and Estimation, and Mathematical Notation: Detection and Estimation Theory, Some Notational Conventions, Conditional Expectation, Sufficient Statistics, Exponential Families. [Moon: 10.1 to 10.3, 10.5, and 10.6]

Detection Theory: Introduction to Hypothesis Testing, Neyman-Pearson Theory, Neyman Pearson testing with Composite Binary Hypotheses, Bayes Decession Theory, Some M-ary Problems, Maximum–Likelihood Detection. [Moon: 11.1 to 11.6]
Estimation Theory: The Maximum-Likelihood Principle, ML Esimates and Sufficiency, Applications of ML Estimation, Bayes Estimation Theory, Bayes risk [Moon: 12.1 to 12.6]

Textbook:

1. Todd K.Moon and Wynn C. Stirling, ***Mathematical Methods and Algorithms for Signal Processing***, Pearson Education.

Reference Books:

1. ***Probability and Random Processes with Application to Signal Processing***, Pearson Education.

PECS5401 **ARTIFICIAL INTELLIGENCE** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Optimization Engineering, Operating System.

Course Outcome: At the end of the course, the students will be able to

CO1: Apply AI technique, knowledge representation, uses of predicate logic, uses of rules, symbolic reasoning under uncertainty to define the problem, representation and mapping, representing simple facts in logic, procedurial VS declarative knowledge

CO2: Apply the knowledge of game playing, planning, understanding and natural language processing in syntactic processing, semantic analysis, pragmatic processing and spell checking.

CO3: Implement the fundamentals of expert systems to represent and use the domain knowledge, expert system Shells, explanation and knowledge acquisition.

(Introduction to Artificial intelligence techniques, Game playing, processing and learning,)

Topics covered :
Module 1 12Hrs

What is Artificial Intelligence? AI Technique, Level of the Model,Problem Spaces, and Search: Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs.Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis,**Knowledge Representation:** Representations and Mappings, Approaches to Knowledge Representation, **Using Predicate Logic**: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction.**Using Rules**: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.**Symbolic Reasoning Under Uncertainty**: Introduction to Nonmonotonic Reasoning, Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Depth-first Search, Breadth-first Search.**Weak and Strong Slot-and-Filler Structures**: Semantic Nets, Frames, Conceptual DependencyScripts, CYC.

Module 2 10Hrs

Game Playing: The Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening. **Planning**: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical PlanningOther Planning Techniques. **Understanding**: What is Understanding, What Makes Understanding Hard?, Understanding as Constraint Satisfaction. **Natural Language Processing**: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

Module 3 8Hrs

Learning: Rote Learning, Learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. **Expert Systems**: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Text Book:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009

References:

1) Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
2) S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

PCEC7401 **VLSI DESIGN LABORATORY** (0-0-3)

Lecture :0 **Internal Assessment:100**
Tutorial : - 0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: VLSI Design

Course Outcome: At the end of the course, the students will be able to
CO1: Design Combinational logic circuits and sequential logic circuits,, test bench creation, functional verification, and sequential execution.
CO2: Apply the concept of FPGA, floor plan, critical path to design and synthesis different types of GATES.
CO3: Design the schematic and simple layout for CMOS inverter, CMOS NAND Gate, CMOS NOR Gate and ALU.

(To impart design concepts , technology and FPGA implementation of all levels)

1. Design Entry and simulation of combinational logic circuits (8 bit adders, 4 bit multipliers, address decoders, multiplexers), Test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted.
2. Design Entry and simulation of sequential logic circuits (counters, PRBS generators, accumulators). Test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted.
3. Synthesis, P&R and Post P&R simulation for all the blocks/codes developed in Expt. No. 1 and No. 2 given above. Concepts of FPGA floor plan, critical path, design gate count, I/O configuration and pin assignment to be taught in this experiment.

4. Generation of configuration/fuse files for all the blocks/codes developed as part of Expt.1. and Expt. 2. FPGA devices must be configured and hardware tested for the blocks/codes developed as part of Expt. 1. and Expt. 2. The correctness of the inputs and outputs for each of the blocks must be demonstrated at least on oscilloscopes (logic analyzer preferred).
5. Design a schematic and simple layout for CMOS Inverter, parasitic extraction and simulation.
6. Design a schematic and simple layout for CMOS NAND gate, parasitic extraction and simulation.
7. Design a schematic and simple layout for CMOS NOR gate, parasitic extraction and simulation.
8. Design an ALU or a 4-bit Microprocessor with limited instructions.

PCEC7402 **Project**

Lecture :0 **Internal Assessment:100**
Tutorial : -0 **Final Examination:**
Practical : -6 **Credits:3**

Prerequisite: Basic Electronics, Analog and Digital Communication, Antenna and Wave Propagation, VLSI

Course Outcome: At the end of the course, the students will be able to
CO1: Design & development of various electronic instruments and control systems.
CO2: Handle the project management and finance which will help them to become a good manager in future.
CO3: Motivated for newer areas of in-depth study research and life long learning.

PCEC7403 **Seminar**

Lecture :0 **Internal Assessment:100**
Tutorial : - 0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Current Trends in Communication Engineering, Communication and Interpersonal Skill.

Course Outcome: At the end of the course, the students will be able to
CO1: Ability and interest among the students toward the advanced technologies and globalization will be developed.
CO2: Enhance their communication and representation skills towards becoming a good team leader and manager
CO3: Appreciate importance of lifelong learning, make them corporate ready to fit with the global job scenario.

8th Semester

PCEC4402 **MICROWAVE ENGINEERING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Electromagnetic Field and Waves

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of transmission lines and its circuit model, rectangular and cylindrical waveguide to design transmission line of less loss.

CO2: Implement the fundamentals of power dividers and its properties, T-Junction power divider, Wilkinson power divider, directional coupler, variable attenuator, isolator, cavities resonator, resonance frequency, microwave filters , filter transformations and implementation to design wave guide of required parameter and microwave filter.

CO3: Utilize the concept of microwave sources such as reflex klystron, Magnetron, Microwave transistor, Gun diode and their construction and principle of operation, microwave radiation hazards, hazard limits, radiation protections to design microwave oscillators and to protect themselves from EM radiation from microwave source and also from transmission medium.

(To understand the concept of transmission line and its parameters. Requirement of wave guide and types of wave guides, power dividers and Couplers. Deferent types of Microwave filters, sources. Understanding the hazards in microwave radiations.)

Topics covered :

Module – I (12 hours)

Transmission lines: The Lumped -Element Circuit model for a Transmission line. Wave propagation. Field Analysis of two wire & Co-ax Transmission Lines. Terminated transmission line. Reflection coefficient, Scattering matrix, Signal flow graph. Transmission line problems Single Stub and Double Stub matching using Smith Chart.

Rectangular and Cylindrical waveguide: Design & analysis to support various modes. Field solution for TE and TM modes, Field patterns of power flow through waveguide. Attenuation due to conductor and dielectric losses

Module – II (10 hours)

Power Dividers and Couplers: Basic Properties, T -Junction Power Divider, Wilkinson Power divider, Waveguide Directional Couplers, Fixed and Precision Variable Attenuator, Ferrite Isolator. Rectangular Cavities Resonator, Resonant frequencies and of Cavity Supporting dominant mode only, Dielectric resonator. Strip line and micro strip.

Microwave Filters: Periodic structures, design by image parameter method and insertion loss method , Filter transformations, Filter implementations, Coupled line filters.

Module – III (12 hours)

Reflex Klystron: Velocity Modulation. Electronic Admittance. Output Power and Frequency Multicavity Magnetron: Principle of Operation, Rotating Field. II-Mode of Operation, Frequency of Oscillation. The Ordinary type (O- Type) TWT - Principle of Operation as an amplifier.

Microwave Transistor: modes of operation, transconductance, max operating frequency and microwave applications, Gunn Oscillator Principle and performance Simple Analysis Electron – field interaction.
Microwave radiation hazards: Hazards of EM radiation, Radiation hazard limits, radiation protection

Text Books:

1. Microwave Engineering by D. M. Pozor, 2nd Edition, John Willy & Sons.
2. Microwave Device and Circuit, 3rd Edition, Sammuel Y, Liao, Perason

Reference Books:

1. Principles of Microwave Engineering, Reich, Oudong and Others.
2. Elements of Engineering Electromagnetics, 6th Edition, N. N. Rao, Pearson Education,
3. Electromagnetic Waves and Radiating Systems, 2nd Edition, E.C. Jordan and K.G.Balman, Pearson Education, New Delhi.
4. Engineering Electromagnetics, 7th Edition, William H. Hayt, Tata McGraw Hill Publishing Company Ltd., New Delhi

PEEI5404 **ANALOG VLSI DESIGN** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: VLSI Design

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the concept of single-stage amplifiers like common source stage , common source stage with resistive load, CS stage with diode connected load, source follower, common gate stage and differential amplifier to design amplifiers

CO2: Apply the mechanism of passive and active current mirror, band gap reference and operation amplifier to design biasing circuits, amplifiers and filter and to determine various performance parameters.

CO3: Apply the frequency response analysis of different type of amplifiers, different feed back circuits to design different types of oscillator, signal generator, amplifier and filters.

(Design of Single stage and differential amplifier, current mirror circuits, OPAMP, Oscillator, feedback circuits, and frequency response of filters)

Topics covered :-
Module – I 10 Hours

Introduction to Analog Design: General Concepts, Levels of Abstraction, Robust Analog Design
Single-Stage Amplifiers: Basic Concepts, Common-Source Stage, Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode.
Differential Amplifiers: Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell.
(Chapters 1, 3 and 4 of Text Book)

Module – II 12 Hours

Passive and Active Current Mirrors: Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties.
Bandgap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, Bandgap Reference.
Operational Amplifiers: General Considerations, Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection.
(Chapters 5, 11 and 9 of Text Book)

Module – III 14 Hours

Frequency Response of Amplifiers: General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair.
Feedback: General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise.
Oscillators: General Considerations, Ring Oscillators, LC Oscillators, Crossed-Coupled Oscillator, Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs.
(Chapters 6, 8 and 14 of Text Book)

Text Books:

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata McGraw-Hill Publishing Company Limited, 2002.

Reference Books:

2. P. Gray, P. Hurst, S. Lewis, and R. Meyer, *Analysis and Design of Analog Integrated Circuits*, 4th Edition, John Wiley, 2001.
3. Behzad Razavi, *Fundamentals of Microelectronics*, 1st Edition, John Wiley, 2008.
4. D. Holberg and P. Allen, *CMOS Analog Circuit Design*, Oxford University Press, 2002.
5. D. Johns and K. Martin, *Analog Integrated Circuit Design*, John Wiley, 1997.
6. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, McGraw-Hill, Inc., 1994.
7. A. Sedra and K.C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press, 2004.

PEEC5405**EMBEDDED SYSTEMS** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**

Practical : -0 **Credits:3**

Prerequisite: VLSI Design, Analog VLSI Design, Microcontroller and Application

Course Outcome: At the end of the course, the students will be able to :
CO1: Understand the application and charcterstics of embedded systems, overview of HW units, Systems on a chip(SoC), sensors, Actuators, Firmware, application in real environment like washing machine and knowledge about modeling languages as UML.
CO2: Gain knowledge on analog and digital electronics components, EDA tools, Embedded C and task scheduling for real time operating systems. Some example of commercial RTOS.
CO3: Develop the skills in analysis, approach, optimization, and implementation of embedded systems; embedded C programming, testing of embedded systems.
CO4: Design and Develop Embedded Systems (IDE), Integration and Testing of Embedded Hardware and Firmware, Product Enclosure Design & Development Embedded Product Development Life Cycle (EDLC) and Trends in the Industry.

(Introduction to embedded system, hardware software code sign and program modeling, **Real** Time Operating System (RTOS) based Embedded System Design, Integration and Testing of Embedded Hardware and Firmware, Embedded Product Development Life Cycle (EDLC)

Topics covered :
MODULE – I 10 Hours

Embedded System: Understanding the Basic Concepts:
Introduction to Embedded System: Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, 'Smart' running shoes from Adidas – The Innovative bonding of Life Style with Embedded Technology.

The Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components.

Characteristics and Quality Attributes of Embedded System: Characteristics of Embedded System, Quality Attributes of Embedded System.

Embedded Systems – Application and Domain Specific: Washing Machine – Application Specific Embedded System, Automotive – Domain Specific Example for Embedded System.

Hardware Software Co-Design and Program Modeling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.

MODULE – II 12 Hours

Design and Development of Embedded Product:
Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI and Integrated Circuit Design, Electronic Design Automation (EDA) Tools.

Embedded Firmware Design and Development: Embedded firmware Design Approaches, Embedded firmware Development Languages, Programming in Embedded 'C'.

Real Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronisation, Device Drivers, How to choose an RTOS.

MODULE – III 14 Hours

Design and Development of Embedded Systems:
An Introduction to Embedded System Design with VxWorks and MicroC/OS-II (μCOS-II) RTOS: VxWorks, MicroC/OS-II (μCOS-II).

Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware & Firmware, Board Power up.

The Embedded System Development Environment: Integrated Development Environment (IDE), Types of files generated on cross-compilation, Disassembler/Decompiler, Simulators, Emulators & Debugging, Target Hardware Debugging, Boundary Scan.

Product Enclosure Design & Development: Product Enclosure Design Tools, Product Enclosure Development Techniques.

Embedded Product Development Life Cycle (EDLC): Definition and Objectives of EDLC, Different Phases of EDLC, EDLC Approaches (Modeling the EDLC).

Trends in the Embedded Industry: Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends, Open standards, Frameworks and Alliances, Bottlenecks.

Text Book:

1. Shibu K.V., *Introduction to Embedded Systems*, TMH Private Limited, New Delhi, 2009.

Reference Book:

1. Peter Marwedel, *Embedded System Design*, Springer, 2006 http://ls12-www.cs.uni-dortmund.de/~marwedel/kluwer-es-book/
2. Wayne Wolf, *Computers as Components*, Morgan Kaufmann, 2001 http://www.ee.princeton.edu/~wolf/embedded-book
3. G. De Micheli, Rolf Ernst and Wayne Wolf, eds, Readings in Hardware/Software Co-Design, Morgan Kaufmann, Systems-on-Silicon Series Embedded
4. Frank Vahid and Tony D. Givargis, System Design: A Unified Hardware/Software Introduction, Addison Wesley, 2002.
5. Michael Barr, Programming Embedded Systems in C and C++, O'Reilly, 1999.
6. David E. Simon, An Embedded Software Primer, Addison Wesley, 1999.
7. Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2000.
8. K. Short, *Embedded Microprocessor System Design*, Prentice Hall, 1998.
9. C. Baron, J. Geffroy and G. Motet, *Embedded System Applications*, Kluwer, 1997.

10. Raj Kamal, *Embedded Systems – Architecture, Programming and Design*, Tata McGraw Hill Publishing Company Limited, New Delhi,

PECS5406 **DIGITAL IMAGE PROCESSING** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Digital Signal Processing

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the digital image fundamentals like image sampling and quantization, relationship between pixels, histogram processing to design spatial filters for smoothing and sharpening of filters.

CO2: Apply the principle of filtering in the frequency domain for image restoration and reconstruction in presence of noise.

CO3: Implement the process of color image processing, wavelets and multi-resolution processing, image compression and morphological image processing to design color models, to reduce the size of an image and modification of the image by erosion and dilation.

(Introduction to Digital image, Image restoration and reconstruction in frequency and spatial domain, Color space and processing, Wavelets and multi-resolution processing, Image compression and morphological image processing)

Topics covered :
Module: 1 (12 hours)

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening (Chapt: 2 & 3 of Text book 1)

Module: 2 (12 hours)

Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening (Chapt: 4 of Text book 1)
Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function (Chapt: 5 of Text Book 1)

Module: 3 (12 hours)

Color Image Processing: color models, Color transformation (Chapt: 6 of Text book 1)
Wavelets and Multi-resolution Processing: multiresolution expansions, wavelet transforms in one and two dimension (Chapt: 7 of Text book 1)

Image Compression: Fundamentals, Some basic compression methods (Chapt: 8 of Text book 1)
Morphological Image Processing: Erosion and Dilation, opening and closing (Chapt: 9 of Text book 1)

Text Books:

1. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education
2. R C Gonzalez, Woods and Eddins, *Digital Image Processing using Matlab*, 2nd Edition, Tata McGraw Hill

Reference Books:

1. S.Sridhar, *Digital Image Processing*, Oxford University Press, 2011

PEEC5406 **SATELLITE COMMUNICATION SYSTEMS** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Digital Communication Techniques, Computer Network and Data Communication, RADAR and TV Engineering.

Course Outcome: At the end of the course, the students will be able to

CO1: Implement the state of satellite communication like orbital mechanics and parameters, look angle determination, attitude and orbit control system, transponders to design uplink and downlink satellite link.

CO2: Apply the principle of analog telephone and television transmission technique, multiple accesses like FDMA, TDMA and CDMA for network distribution and direct broadcasting TV.

CO3: Implement the Satellite propagation, satellite antenna, earth station technology to design small earth station antenna.

(Introduction to satellite communication, Satellite link design, (UP line and Down link) analog telephone and TV transmission, satellite antennas,)

Topics covered :

Module – I (12 Hours)

Introduction to state of satellite communication: Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system(AOCS), TT&C , Description of spacecraft System – Transponders,
Equipment reliability and space qualification.
Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Module – II (10 Hours)

Analog telephone and television transmission: Energy dispersal, digital transmission
Multiple Access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. Estimating Channel requirements, SPADE, Random access
Application of Satellite communication: Network distribution and direct broad casting TV, fundamentals of mobile communication satellite

Module – III (12 Hours)

Propagation on satellite: Earth paths and influence on link design: Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects
Satellite Antennas: Types of antenna and relationships , Basic Antennas Theory – linear, rectangular & circular aperture. Gain, pointing loss,
Earth station Technology: Earth station design, Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,
Design of small earth station antennas: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station

Text Books:

1. Satellite Communication by T. Pratt, C. Bostian. 2nd Edition, John Wiley Co.

Reference Books:

1. Digital Communication with Satellite and Fiber Optic Application, Harlod Kolimbins, PHI
2. Satellite Communication by Robert M. Gagliardi, CBS Publishers

FECE6404 **NETWORK SECURITY AND CRYPTOGRAPHY** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Computer Networks and Data Communication

Course Outcome: At the end of the course, the students will be able to
CO1: Apply the concept of information security, mathematical background which will help them to generate random number and prime numbers
CO2: Implement the knowledge on traditional encryption methods, symmetric Ciphers, asymmetric Ciphers, message integrity, authentication to different types of algorithm MAC algorithm, Hash Algorithm, digital signature, entity authentication and key management.
CO3: Implement the knowledge of network and system security at the application layer to e-mail security, PGP and S/MIME, security at the transport layer, secure sock et layer, and security at the network layer, malicious software, malicious programs, viruses, worms, malware, firewall etc.
(Introduction to information security, mathematical background, traditional encryption methods, network and system security)

Topics Covered :
Module 1 10Hrs

Introduction to Information Security: Security Goals, Attacks, Security Services and Mechanisms, **Mathematical Background**: Integer and Modular Arithmetic, Matrices, Linear Congruence. Groups, Rings, and Fields, GF(p), Euclidean and Extended Euclidean Algorithms, Polynomial Arithmetic, GF(2n). Random Number Generation, Prime Numbers, Fermat's and Euler's Theorems, Primality Testing Methods, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Discrete Logarithms.

Module 2 10Hrs

Traditional Encryption Methods: Symmetric Cipher Model, Substitution Ciphers, Transposition Ciphers, Block and Stream Ciphers, Rotor Cipher, Steganography. **Symmetric Key Ciphers**: Data Encryption Standard, Advanced Encryption Standard. **Asymmetric Key Ciphers**: RSA Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem.**Message Integrity, Authentication**: Message Integrity, Random Oracle Model, Message Authentication, MAC Algorithms. Cryptographic Hash Functions: MD Hash Family, Whirlpool, Secure Hash Algorithm. Digital Signature and Authentication: Digital Signature Schemes, Variations and Applications, Entity Authentication.Key Management: Diffie-Hellman Key Exchange.

Module 3 10Hrs

Network and System Security:Security at the Application Layer: e-mail security, PGP and S/MIME. Security at the Transport Layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS). Security at the Network Layer: IP Security. **System Security**: Malicious Software, Malicious Programs, Viruses, Worms, Malware, Intrusion Detection System, Firewalls.

Text Books:

1. B. A. Forouzan & D Mukhopadhyay ,Cryptography and Network Security., McGraw Hill, 2nd ed.2010

References:

1. B. Menezes ,Network Security and Cryptography., Cengage Learning, 1st ed.2010
2. Stallings ,Cryptography and Network Security., PHI, 4th ed.2010

FECE6405 **INTERNET TECHNOLOGY AND APPLICATION** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Computer Graphics, Network Security and Cryptography

Course Outcome: At the end of the course, the students will be able to :

CO1: Apply the concept of www and the internet, web server, web browsers, protocols, and HTML using images to design a web site.

CO2: Apply the fundamentals of java script programming, statements, and operators, pop up boxes, try---catch statement, throw statements, date object, array object to design and develop a program script.

CO3: Implement the concept of CGI/PERL, Java Applet to test and debug a java program (The internet and WWW, HTML programming, Java script, Java applet and other designing tools)

Topics covered :

Module – I (12 Hour)

The Internet and WWW
Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites
HTML
Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Module – II (12 Hour)

JAVA Script
Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Javascript: Date object, array object, Boolean object, math object
CSS
External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag
DOM
HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

Module – III (12 Hour)

CGI/PERL
Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl
Java Applet
Introduction to Java, Writing Java Applets, Life cycle of applet

Textbooks
1. Web Warrior Guide to Web Design Technologies, Don Gosselin, Joel Sklar & others, Cengage Learning

Reference Books
1. Web Programming: Building Internet Applications, Chris Bates, Wiley Dreamtech
2. Programming the World Wide Web, Robert W Sebesta, Pearson
3. Web Technologies, Uttam K Roy, Oxford
4. Web Technology: A developer perspective, Gopalan & Akilandeswari, PHI

PEEI5405 **MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: VLSI Design, Industrial Automation and Control

Course Outcome: At the end of the course, the students will be able to
CO1: Manufacture different micromachining materials by implementing MEMS and Microsystems, micromachining techniques.

CO2: Apply the knowledge of micro system modeling such as mechanics of deformable bodies, estimation of stiffness and damping for different microstructures to design the model of electromechanical systems.

CO3: Implement the Mechanical sensors and actuators, piezeresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, piezoelectric actuators, optical MEMS such as Micro-lens, Micro-mirror, optical switch, Radio frequency MEMS such as inductor, varactor, filter, resonators to design smart embedded systems using the MEMS products

(Overview of MEMS and Microsystems, MS modeling and design, MEMS application and radio frequency MEMS)

Topics covered :-

Module-I 14 Lectures

Overview of MEMS and Microsystems. (Chapter 1 of Text Book 1)

Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II 10 lectures

Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III 15 Lectures

MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators. (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)

Optical: Micro-lens, Micro-mirror, Optical switch (Section 7.5 to 7.7 of Text Book 2)

Radio frequency MEMS: Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)

Microfluidics: Capillary action, Micropumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

Text Books:

1. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.
2. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.

Reference Book:

1. T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

PEEI5403 **INDUSTRIAL INSTRUMENTATION** (3-0-0)

Lecture :3 **Internal Assessment:30**

Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Advanced Control System, Microcontroller, Industrial Automation and Control

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the process and concept of calibration, errors, error analysis, to different analytical instruments such as Gas analyzer, liquid analyzer, x-ray methods, chromatography

CO2: Apply the telemetry technology such as frequency telemetry, multiplexing, modulation, modulation of digital data, transmission channel, Wireless I/O to transmit data as well as to design and operate transmitters and receiver, design transmission channel of reduced bandwidth using multiplexing techniques.

CO3: Implement the concept of power plant instruments, to handle a power plant, to maintain different parameters such as temperature, flow, level, vibration and expansion as well as to analyze flue gas

CO4: Implement safety mechanism of power plant

(Introduction to industrial instrumentation , Instruments for analysis, Telemetry, power plant instrumentation , hazard and safety)

Topics Covered :

Module 1 18 Hours

Introduction: Functional Units, Classification, Performance characteristics, Dynamic Calibration, Errors: An Overview, Statistical Error Analysis, Reliability and Related Topics (Chapter 1 of Text book)
Instruments for Analysis: Introduction, Gas Analysers, Liquid Analysers, X-ray Methods, Chromatography (Chapter 8 of Text Book)

Module II: 10 Hours

Telemetry: Introduction, Pneumatic Means, Electrical Means, Frequency Telemetring, Multiplexing, Modulation, Modulation of Digital Data, Transmission Channels, Briefing of a Telemetry System in Operation, Wireless I/O (Chapter 10 of Text Book)

Module III: 10 Hours

Power Plant Instruments: Introduction, The Power Plant Scheme, Pressure, Temperature, Flow and Level, Vibration and Expansion, Analysis, Flue Gas Analysis (Chapter 12 of Text Book)
Hazard and Safety: Initial consideration, Enclosures, Intrinsic Safety, Prevention of Ignition, Methods of Production, Analysis Evaluation and Construction (Chapter 13 of Text Book)

Text Book:

1. Principles of Industrial Instrumentation, Third Edition, D Patranabis, Tata McGraw Hill Education Private Limited, New Delhi

Reference Books:

1. Process/Industrial Instruments and Controls Handbook, Gregory K. Mc Millian Editor-in-Chief, Douglas M. Considine Late Editor-in-Chief

PECS5407 **WIRELESS SENSOR NETWORK** (3-0-0)

Lecture :3 **Internal Assessment:30**
Tutorial : - 0 **Final Examination: 70**
Practical : -0 **Credits:3**

Prerequisite: Computer Network and Data Communication

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the sensor network concept and network deployment such as network topology, connectivity, mobile deployment to design a sensor network

CO2: Apply the process of localization and tracking, synchronization to formulate problems and tracking of multiple objects.

CO3: Apply the knowledge of wireless communications, medium-access and sleep scheduling, routing technologies, sensor network databases, in data-centric storage and retrieval, data-centric routing, data gathering and querying and security such as privacy issues and attacks.

(Sensor network concept, network deployment, Localization and tracking, state space decomposition, Routing, querying and security)

Topics Covered :

Unit I 8Hrs

Sensor Network Concept: Introduction, Networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.

Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

Unit II 8Hrs

Localization and Tracking: Issues and approaches, Problem formulations: Sensing model, collaborative localization. Coarse-grained and Fine-grained node localization. Tracking multiple objects: State space decomposition.

Synchronization: Issues and Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

Unit III 14Hrs

Wireless Communications: Link quality, shadowing and fading effects

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.

Routing: Metric-based approaches, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing.

Sensor network Databases: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, the database perspective on sensor networks.

Security: Privacy issues, Attacks and countermeasures.

Text Books:

1. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

References Books:

1. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Springer.
3. Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, Taieb Znati , Wiley Inter Science.

PCCS7402 **MICROWAVE ENGINEERING LABORATORY** (0-0-3)

Lecture :0 **Internal Assessment: 100**
Tutorial : -0 **Final Examination:**
Practical : -3 **Credits:2**

Prerequisite: Microwave Engineering

Course Outcome: At the end of the course, the students will be able to

CO1: Apply the knowledge of transmission line and its circuit model, rectangular and cylindrical waveguide to design transmission line of less loss

CO2: Implement fundamentals of power dividers and its properties-junction power divider Wilkinson power divider, directional coupler, variable attenuator, isolator, cavities resonator, resonance frequency, microwave filters, filter transformation and implementation to design waveguide of required parameter and microwave filter

CO3: Utilize the concept of microwave sources such as reflex klystron,magnetron,microwave transistor, gun diode and their construction and their principle of operation, microwave radiation hazards, hazard limit, radiation protection to design microwave oscillator and to [protect themselves from EM radiation from microwave sources and also from transmission medium

(To impart knowledge on performance analysis of Microwave sources and devices)

(Any Ten of the following experiments are to be performed with X-band/S-band/ Ku- band Microwave components)

1. Reflex Klystron Characteristics
2. Gun Diode Characteristics
3. Directional Coupler Characteristics
4. Measurement of Voltage Standing Wave Ratio.
5. Radiation Pattern Measurement of a Horn Antenna
6. Impedance, Wavelength and Frequency Measurement.
7. Determination of Polarization of Horn antenna.
8. Measurement of Scattering Parameters.

9. Coupling Measurement of H-plane, E-Plane and Magic Tee junctions.
10. Measurement of Dielectric Constant.
11. Measurement of Phase shift.
12. Scattering parameters of Circulator /Isolators.

PCEC7404 **Project (50% External Evaluation)**

Lecture: 0 **Internal Assessment: 50**
Tutorial: -0 **Final Examination: 50**
Practical: -9 **Credits:7**

Prerequisite: Basic Electronics, Analog and Digital Communication, Antenna and Wave Propagation, VLSI

Course Outcome: At the end of the course, the students will be able to

CO1: define the problem statement, investigate the complex problem and will utilize the modern tools to solve the problems.

CO3: work in a group which will develop team spirit and leadership quality among the students.

CO3: Design & develop various electronic instruments and control systems.

CO4: Handle projects involving both technological aspects and finance that will help them to become a good manager in future.

CO5: Motivated for newer areas of in-depth study and research and life long learning.

PCEC7405 **Comprehensive Viva-Voce (External Evaluation)**

Lecture :0 **Internal Assessment:00**
Tutorial : -0 **Final Examination: 100**
Practical : 0 **Credits:3**

Prerequisite: Knowledge on all Engineering subjects taught

Course Outcome: At the end of the course, the students will be able to

CO1: Appreciate importance of fundamental knowledge and its application.

CO2: Communicate with larger audience on core tech.

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