BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

{*Instrumentation and Electronics Engineering (**I & EE**), Electronics and Instrumentation Engineering (**E&IE**), Instrumentation and Control Engineering (**I & CE**) and Applied Electronics and Instrumentation (**AE & IE**)*}

3rd Semester				**4th Semester**			
THEORY				***THEORY***			
Code	***Subject***	***L-T-P***	***Credits***	***Code***	***Subject***	***L-T-P***	***Credits***
BSCM1205	Mathematics – III	3-1-0	4	BEME2209	Fluid Mechanics and Machines	3-0-0	3
HSSM3204	Engineering Economics & Costing	3-0-0		HSSM3205	Organisational Behaviour	3-0-0	
	or		3		or		3
HSSM3205	Organisational Behaviour	3-0-0		HSSM3204	Engineering Economics & Costing	3-0-0	
BSMS1213	Material Science & Engineering	3-0-0		BSCP1207	Physics of Semiconductor Devices	3-0-0	
	or		3		or		3
BSCP1207	Physics of Semiconductor Devices	3-0-0		BSMS1213	Material Science & Engineering	3-0-0	
BEES2211	Network Theory	3-1-0	4	BEEC2214	Energy Conversion Devices	3-1-0	4
PCEE4204	Electrical & Electronic Measurement	3-0-0	3	BECS2212	C^{++} & Object Oriented Programming	3-0-0	3
PCEC4201	Analog Electronics Circuit	3-1-0	4	PCEC4202	Digital Electronics Circuit	3-1-0	4
	Credits (Theory)		**21**		**Credits (Theory)**		**20**
PRACTICALS/SESSIONALS				***PRACTICALS/SESSIONALS***			
BEES7211	Network & Devices Laboratory	0-0-3	2	BEEC7214	Energy Conversion Devices Laboratory	0-0-3	2
PCEC7201	Analog Electronics Circuit Laboratory	0-0-3	2	PCEC7202	Digital Electronics Circuit Laboratory	0-0-3	2
PCEE7204	Electrical & Electronic Measurement Laboratory	0-0-3	2	BECS7212	C^{++} & Object Oriented Programming Laboratory	0-0-3	2
				HSSM7203	Communication & Interpersonal skills for Corporate Readiness Laboratory	0-0-3	2
	Credits (Practicals/Sessionals)		**6**		**Credits (Practicals/Sessionals)**		**8**
	TOTAL SEMESTER CREDITS		**27**		**TOTAL SEMESTER CREDITS**		**28**
	TOTAL CUMULATIVE CREDITS		**83**		**TOTAL CUMULATIVE CREDITS**		**111**

BSCM1205 **Mathematics - III**

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**

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**

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**

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

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 E_F 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, Q_{inv} in MOSFET.
9. **MOS Transistor:** Introduction to the MOSFET, Complementary MOS (CMOS) technology, V-I Characteristics, Surface mobilities and high-mobility FETs, JFET, MOSFET V_t, 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**

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**

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

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 R_E. Effect of R_S and R_L 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 R_S. Effect of R_{SIG} and R_L 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 (f_t), 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**

Select any 8 experiments from the list of 10 experiments

1. Verification of Network Theorems (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients.
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
4. Determination of circuit parameters: Hybrid and Transmission parameters.
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**

List of Experiments

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

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

Select any 8 experiments from the list of 10 experiments

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

BEME2209 Fluid Mechanics & Machines

Module I **(12 Lectures)**

Introduction : Scope of fluid mechanics and its development as a science

Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid static Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.

Buoyancy and flotation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.

Fluid kinematics : Introduction, description of fluid flow, classification of fluid flow. Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity,

Module II **(10 Lectures)**

Fluid dynamics : Introduction, Euler's equation along a streamline, energy equation, Bernoulli's equation,

Hydraulic Measurements: Water level measurements, velocity measurements, discharge measurements, venturimeter, orifice meter, current meter, pitot tube, orifice, notch and weir.

Module III **(14 Lectures)**

Hydraulic turbines and pumps: Impulse and reaction turbines, construction and working principle of tangential, radial and axial type turbines. Power of turbines, efficiency of turbines. Construction and working principles of centrifugal type pumps. Power and efficiency of the pump. Positive displacement pump.

Hydraulic systems: hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic press, hydraulic torque converter.

Text Books

1. Fluid Mechanics and hydraulic machines, Modi & Seth
2. Hydraulics fluid machines and fluid machines by S. Ramamrutham

Reference Books:

1. Fluid Mechanics by A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics by Fox and McDonald, Willey Publications
3. Fluid Mechanics by Kundu, Elsevier
4. An Introduction to Fluid Dynamics by G.K.Batchelor, Cambridge University Press
5. Engineering Fluid Mechanics by Garde et. al., Scitech
6. Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education.

BEEC2214 **Energy Conversion Devices**

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):

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

BECS2212 C++ & Object Oriented Programming

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**

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 Modelling, 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**

Select any 8 experiments from the list of 10 experiments

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**

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.)

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**

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.

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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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

INSTRUMENTATION & ELECTRONICS ENGINEERING (I&EE), ELECTRONICS & INSTRUMENTATION ENGINEERING (E&IE), AND INSTRUMENTATION & CONTROL ENGINEERING (I&CE) etc.

5th SEMESTER

	THEORY	*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*
HSSM3303	Environmental Engineering and Safety	3-0-0	
	or		3
HSSM3301	Principles of Management	3-0-0	
PCEC4301	Microprocessors	3-0-0	3
PCEI4301	Communication System Engineering	3-0-0	3
PCEI4302	Instrumentation Devices and Systems – I	3-1-0	4
	Professional Elective – I (*Any One*)	3-0-0	3
PCBM4302	Signals and Systems		
PEEI5303	Electromagnetic Waves and Fields		
PCEL4301	Power Electronics		
PEEC4301	Advance Electronic Circuits		
	Free Elective – I (*Any One*)	3-0-0	3
HSSM3302	Optimization in Engineering		
FEEC6301	Data Base Management Systems (DBMS)		
PCBM4301	Elements of Biomedical Instrumentation	3-0-0	3
FEEC6302	Applied Physiology		
PCIT4303	Java Programming		
	Credits (Theory)		19
	PRACTICALS/SESSIONALS		
PCEC7301	Microprocessor Lab.	0-0-3	2
PCEI7301	Communication System Engineering Lab.	0-0-3	2
PCEI7302	Instrumentation Devices and Systems Laboratory	0-0-3	2
	Credits (Practicals/Sessionals)		6
	TOTAL SEMESTER CREDITS		25
	TOTAL CUMULATIVE CREDITS		136

6th SEMESTER

	THEORY	*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*
HSSM3301	Principles of Management	3-0-0	
	or		3
HSSM3303	Environmental Engineering and Safety	3-0-0	
PCEI4303	Control Systems	3-0-0	3
PCEC4304	Digital Signal Processing	3-0-0	3
PCEI4305	Instrumentation Devices and Systems – II	3-0-0	3
	Professional Elective – II (*Any One*)	3-0-0	3
PEEI5302	Analog Signal Processing		
PEEI5301	Analytical Instrumentation		
PEEE5301	Optoelectronics Devices & Instrumentation		
PEEI5304	Intelligent & Virtual Instrumentation		
	Free Elective – II (*Any One*)	3-0-0	3
PCCS4304	Operating System		
FESM6301	Numerical Methods		
PEEC4304	Computer Network & Data Communication		
PCBM4304	Biomedical Signal Processing		
PEME5305	Robotics & Robot Applications		
	Credits (Theory)		18
	PRACTICALS/SESSIONALS		
PCEI7303	Control Systems Lab.	0-0-3	2
PCEC7304	Digital Signal Processing Lab.	0-0-3	2
PCEI7305	Instrumentation Systems Design Lab	0-0-3	2
	Credits (Practicals/Sessionals)		6
	TOTAL SEMESTER CREDITS		24
	TOTAL CUMULATIVE CREDITS		160

5th Semester

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

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 integratednsteel 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)

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.*

PCEC4301 **MICROPROCESSORS** (3-0-0)

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.

PCEI4301 COMMUNICATION SYSTEM ENGINEERING

(3-0-0)

MODUE-I

INTRODUCTION: Elements of an Electrical Communication System, Communication Channels and their Characteristics, Mathematical Models for Communication Channels

FREQUENCY DOMAIN ANALYSIS OF SIGNALS AND SYSTEMS: Fourier series, Fourier Transforms, Power and Energy, Sampling and Band limited signals, Band pass signals

MODULE-II

ANALOG SIGNAL TRANSMISSION AND RECEPTION: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting

MODULE-III

PULSE MODULATION SYSTEMS: Pulse amplitude modulation, Pulse Time Modulation

PULSE CODE MODULATION: PCM system, Intersymbol interference, Eye patterns, Equalization, Companding, Time Division Multiplexing of PCM signals, Line codes, Bandwidth of PCM system, Noise in PCM systems, Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Noise in Delta Modulation, Comparison between PCM and DM, Delta or Differential PCM (DPCM), S-Ary System

Text Book:

1. John G.Proakis,M. Salehi, *COMMUNICATION SYSTEMS ENGINEERING*, 2nd ed. New Delhi,India: PHI Learning Private Limited, 2009.; Selected portion from Chapter 1,2 and 3 for module MODULE-I and MODULE-II of the course.
2. R.P Singh and S.D Sapre, *COMMUNICATION SYSTEMS Analog & Digital*, 2nd ed. New Delhi, India: Tata McGraw Hill Education Private Limited, 2009; Selected portions from Chapter 7 and 8 of the book for MODULE-III.

Reference Book:

1. Taub, Schilling, Saha, Taub's Principles of Communication Systems, TMH.
2. Modern Digital and Analog Communication Systems, by B.P. Lathi, Oxford

PCEI4302**INSTRUMENTATION DEVICES & SYSTEMS–I**

(3-1-0)

Module –1 **10 lectures**

Elements of a general measurement system;
Static Characteristics: systematic characteristics, statistical characteristics, calibration;
Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, dynamic error in measurement systems.
(Bentley: Selected portions of Chapters 1 to 4)

Module-2 **14 lectures**

Sensing elements:
Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages.
Capacitive sensing elements: variable separation, area and dielectric;
Inductive sensing elements: variable reluctance and LVDT displacement sensors;
Electromagnetic sensing elements: velocity sensors,
Thermoelctric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.
IC temperature sensor
Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.
(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3 **16 lectures**

Signal Conditioning Elements:
Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity
Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.
(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2) .

Flow Measurement:
Basics of flow measurement; differential pressure flowmeters- Pitot tube, Orifice plate, Venturi tube; Rotameter, turbine type flowmeter, electromagnetic flowmeter. Doppler shift flowmeter.
(Bentley: Sections 12.1 to 12.3.2 and 12.5.1)

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.
3. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.

Reference Books:

1. Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.

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

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

PEEC4303 **ELECTROMAGNETIC WAVES AND FIELDS**(3-0-0)

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.

PCEL4301 **POWER ELECTRONICS** (3-0-0)

Module-1 12 Lecturers

1. Power semiconductor devices: Switching and V-I characteristic of devices Thyristor family: SCR, TRIAC,GTO,RCT,MCT, and Transistor Family: BJT, IGBT, and MOSFET Ch: (1.3, 1.4 , 4.2.2, 4.2.3, 4.3.2, 4.6, 4.10, 7.2, 7.4,7.5).
2. (a) Triggering Methods: SCR: UJT and R-C triggering scheme,Power Transistor: MOSFET Gate drive, BJT base drive, IGBT gate drive, Isolation of gate and base drive. Ch: (17.2, 17.3,17.4, 17.5).

   (b) Protection of Devices: SCR: Over voltage, over current, dv/dt, di/dt, Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET, dv/dt & di/dt limitation. Ch: (18.4, 18.5, 18.6, 18.7, 18.8, 4.8, 7.9, 7.10)

Module-2 12 Lectures

3(a). AC to DC converter: Un controlled Diode rectifier : Single phase half wave and full wave rectifiers with R-L and R -L-E load ,3 phase bridge rectifier with R-L and R-L-E load Ch: (3.2, 3.3, 3.4, 3.5, 3.8)

Controlled rectifiers : Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load ,single phase semi converter with R-L and R-L-E load, 3 phase semi converter with R-L and R-L-E load.

Ch: (10.2, 10.3, 10.6, 10.9, 10.10)

Single phase PWM rectifier, Three phase PWM rectifier.

Ch: (10.8.3, 10. 8.4, 10.8.5)

3(b).AC –AC converter : AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters, ac-voltage controllers with PWM control. Ch: (11.4, 11.5, 11.9.1, 11.10)

Module 3 12 Lectures

3(c). DC to DC converter: Classification: First quadrant, second quardrant, first and second quardrant, third and fourth quardrant, fourth quardrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter.

Ch: (5.7,5.8.1,5.8.2,5.8.3,5.8.4)

3(d) DC to AC converter: Inverters: PWM inverters, Single phase Bridge Inverters, 3-Phase Inverters-180 deg. conduction, 120 deg. conduction. voltage control of 3-Phase Inverters: Sinusoidal PWM , space vector modulation, Current Source Inverter, Zero Current Switching resonant inverters, Zero Voltage Switching resonant inverter. Ch: (6.4, 6.5, 6.8.1, 6.8.4, 6.10, 8.8, 8.9)

4. Applications: UPS, SMPS, Battery Chargers, Electronic Ballast, Static VAR Compensator. Ch: (14.2.1, 14.2.2, 14.2.3, 14.2.4,14.2.6, 13.6.4)

Text Books:

1.Power Electronics: Circuits,Devices and Applications by M H Rashid, 3rd Edition, Pearson

Reference Books:

1. Power Electronics: Principles and Applications by J. Vithayathil, TMH Edition
2. Power Converter Circuits by W Shepherd and L Zhang, CRC, Taylor and Francis, Special Indian Edition
3. Power Electronics: Converters , Applications, and Design by Mohan, Undeland and Robbins, Wiley Student Edition.

PEEC4301 **ADVANCED ELECTRONIC CIRCUITS**

(3-0-0)

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 F. Driscoll (Pearson Education Publication).
2. Pulse and Digital Circuits by A. Anand Kumar, PHI.

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

Module-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

Module-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.

Module-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.

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)

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 Education)
(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 Edition, 2005, Elsevier India Publications, New Delhi

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

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)

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)

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.

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

Equipment necessary:8086 training kit with minimum two line and 10 characters per line LCD display On-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.
4. Searching the existence of a certain data in a given data set.
5. Gray – to – Binary and Binary – to – Gray conversion and BCD – to –Binary and Binary – to – BCD Conversion
6. Design a Up/down Counter.
7. Multiply two 8 Bit numbers using Successive addition and shifting method.
8. Add a series of unsigned 8- Bit data. Extend the experiment to add signed number and multi byte numbers.
9. Generate a Square wave and rectangular wave of given frequency at the output pin of 8255 chip.
10. Finding out 10‘s complement of a 4- digit BCD number.
11. Add a series of Decimal numbers.
12. Division of 8 Bit unsigned numbers by two. Division of a unsigned numbers by two.
13. Disassembling of the given 2 digit decimal number into two nibbles.
14. Generation of different types of analog signal using DAC.
15. Sampling of analog signal using ADC.
16. A small project work for construction of a display system/ real time digital clock.

PCEI7301 **Communication System Engineering Lab**

(0 0 2)

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

1. 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

2. 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.

3. 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.

4. 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

5. 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

6. 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

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 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.

PCEI7302 **Instrumentation Devices and Systems Lab**

(Total 10 experiments to be performed)

1. Characteristics of RTD and Thermistor
2. Temperature sensing using semiconductor type temperature sensor
3. Load cell using strain gage
4. LVDT and its signal conditioning
5. Pressure measurement using Bourdon tube and diaphragm type sensor
6. Temperature measurement using thermocouple
7. Flow measuring transducers
8. Capacitive and Inductive type transducers
9. Speed measurement using optical and variable reluctance type transducers
10. Active 2^{nd} order low pass filter
11. Instrumentation amplifier
12. Phase sensitive detector

6th Semester

PCEI 4303 CONTROL SYSTEMS (3-0-0)

Module-I: (12 Hours)

Introduction: definition, automatic control, open loop, close loop, modern control, properties of transfer function, linear approximation of physical systems;

Mathematical Modeling: translational, rotational systems and their electrical analogy, mechanical coupling, liquid level systems, servo motors, sensors, magnetic amplifiers, stepper motor, synchors, block diagram, signal flow graph, gain formula.

Characteristic of Feedback Control: sensitivity of control system, parameter variation and disturbance of signal.

Module-II: (12 Hours)

Time Domain Analysis: typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error confidents, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stability criteria.

Root Locus Technique: Basic conditions for root loci, rules for construction, stability and conditional stability on root locus.

Module-III: (12 Hours)

Frequency Response Analysis: Bodes plot, frequency domain behaviour of control, gain margin and phase margin, Wp and Mp for second order system, stability criteria.

Nyquist Criteria: Stability criteria, conformal mapping, Cauchy's theorem, Nyquist stability criteria, conditionally stable system.

State variable Technique: state variable for continuous system, transfer function to state variable, state variable to transfer function, state transition matrix, time domain solution of single input single output system.

Text Book:

1. D Roy Choudhury, Modern Control Engineering, PHI, 2008. (Selected portions from Chapter 1, 2, 3, 4, 5, 6, 8, 9 and 11)

Reference Books:

1. K Ogata, Modern Control Engineering, PHI, 5th edition
2. I J Nagrath and M Gopal, Control system engineering; New Age International Publisher 2010.
3. R C Dorf and R H Bishop, Modern Control Systems; Pearson Education; 2009
4. R T Stefani, B Shahiana, C J Savant and G H Hostetter, Design of Feedback control System, Oxform University Press
5. B C Kuo, Automatic Control System; PHI; 7th Edition.

PCEC4304 **DIGITAL SIGNAL PROCESSING** (3-0-0)

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

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

Adaptive Filters:

Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.

Selected portions from chapter 13 (13.1.1, 13.1.2, 13.1.5, 13.1.6, 13.2.1, 13.2.2) of Text book –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, Tata McGraw Hill.
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, Tata McGraw Hill.
3. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, Tata McGraw Hill.
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.

PCEI4305 INSTRUMENTATION DEVICES AND SYSTEMS–II (3-0-0)

Module –1 (7 Hrs)

Acceleration Measurement:

Piezoelectric transducers: basic principle, equivalent circuit, frequency response, charge amplifier; acceleration measurement: basic principle and frequency response; piezoelectric accelerometer. (Bentley: Section 8.7, Ghosh: Section 9.1)

Miscellaneous Measurements: (6 Hrs)

Level measurements using floats, hydrostatic pressure gage and capacitive type; principles of ultrasonic and gamma ray type level indicators. Humidity sensor: capacitive type. pH and liquid conductivity measurements: basic principles.

(Ghosh: Sections 12.1, 12.3.3, 12.4, 13.3 and 13.5; Bentley: Section 8.9)

Module-2:

Optical sensing: (7 Hrs)

LED and photoresistors and photodiodes; Radiation pyrometer: Planck's law, Stefan Boltzmann's law, broad band and narrow band pyrometer; optical fiber and fiber optic sensing.

(Johnson: Chapter 6, Bentley: Sections 15.2, 15.3.2, 15.5, 15.6)

Module-3:

Final Control Elements: (8 Hrs)

Pneumatic systems: Flapper nozzle amplifier and its characteristics, pneumatic actuators; elements of power electronic devices; Electrical actuators: solenoids, d.c and a.c. servomotors, principle of stepper motors, hydraulic actuators; Control valve characteristics.

(Johnson: chapter 7)

Programmable Logic Controllers: (8 Hrs)

Discrete state process control and its characteristics; input and output devices; Event sequence description with examples; Relay ladder logic and its construction; Programmable Logic Controllers (PLCs): functional description, PLC software functions; programming examples.

(Johnson: Chapter 8)

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, N Delhi,
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning.
3. Process Control Instrumentation Technology- C.D. Johnson (8/e), PHI Learning,

Reference Books:

1. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.
2. Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.
3. Modern Control Technology Components and Systems- C.T. Kilian (3/e), Clengage Learning, New Delhi, 2006.

PEEI5302 **ANALOG SIGNAL PROCESSING** (3-0-0)

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

PEEI5301 **ANALYTICAL INSTRUMENTATION** (3-0-0)

Module I: 12 Hours

Fundamentals of Analytical Instruments: Elements of an Analytical Instrument, Intelligent Analytical Instrumentation Systems, PC-based Analytical Instruments.

Spectrophotometers: Ultraviolet and Visible Absorption Spectroscopy, Calorimeters, Photometers, Different types of Spectrophotometers, Sources of Errors and Calibration, Infrared Spectrophotometers – Basic Components and Types, Sample Handling Techniques, Flame Photometers – Principle, Constructional Details, Types and accessories, Atomic Absorption Spectrophotometers and their instrumentation.

(1.1, 1.5, 1.6, 2.4, 2.5, 2.6, 2.7, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 4.3, 4.5, 5.1 and 5.2)

Module II: 14 hours

Chromatography: Gas Chromatograph – Basic Parts of a Gas Chromatograph, Methods of Measurement of Peak Areas, Liquid Chromatograph – Types, High Pressure Liquid Chromatograph.

pH meters and Ion Analyzers: Principle of pH Measurement, Electrodes for pH Measurement, pH Meters, Ion Analyzers, Blood pH Measurement.

Gas Analyzers: Measurement of Blood pCO_2 and pO_2, Industrial Gas Analyzers – Types, Paramagnetic Gas Analyzer, Infrared Gas Analyzers, Industrial gas Analyzers Based on Other Methods.

(16.1, 16.3, 16.4, 16.5, 17.1, 17.2, 17.3, 21.2, 21.3, 21.4, 21.6, 22.2, 22.3, 22.4, 23.1, 23.2, 23.3, 23.5)

Module III: 12 Hours

Principles of Nuclear Magnetic Resonance: Nuclear Magnetic Resonance (NMR) Spectroscopy – Principle, Types and Construction details of NMR Spectrometers.

Radiochemical Instruments: Fundamentals of Radiochemical Methods, Radiation Detectors, Liquid Scintillation Counters, Gamma Spectroscopy.

X-Ray Spectrometers: Instrumentation for X-Ray Spectrometry, X-Ray Diffractometers, X-Ray Absorption Meters, Electron Probe Microanalyzer.

(10.1, 10.2, 10.3, 10.4, 13.1, 13.2, 13.3, 13.5, 14.2, 14.3, 14.4, 14.6)

TEXT BOOK:

1. Handbook of Analytical Instruments – by R.S. Khandpur, TMH Education Pvt. Ltd.

REFERENCE BOOKS:

1. Instrumental Methods of Analysis – by Willard H.H., Merrit L.L., Dean J.A.. and Seattle F.L., CBS Publishing and Distributors, 6/e, 1995.
2. Instrument Technology – by Jones B.E., Butterworth Scientific Publ., London, 1987.
3. Mechanical and Industrial Measurements by Jain R.K., Khanna Publishing,N Delhi, 2/e, 1992.
4. Principles of Instrumental Analysis – by Skoog D.A. and West D.M., Holt Sounder Publication, Philadelphia, 1985.
5. Instrumental Analysis – by Mann C.K., Vickerks T.J. & Gullick W.H., Harper and Row Publishers, New York, 1974.
6. Jone's instrument Technology (vol. 2 and 3) - B.E. Noltingk, Butterworth-Heinmann, N Delhi.
7. Instrumental Methods of Chemical Analysis - E.W. Ewing, McGraw-Hill.
8. Instrumentation, Measurement and Analysis - B.C. Nakra and K.K. Chowdhurry, TMH.
9. Measurement and Instrumentation: Trends and Applications - M.K. Ghosh, S.Sen and S. Mukhopadhyay (ed.), Ane Books, New Delhi, 2008.

PEEE5301 **OPTOELECTRONICS DEVICES & INSTRUMENTATION** (3-0-0)

Module –1

Wave Optics: 12 Hrs

Wave properties of light: Propagation, polarization, interference, diffraction, transmission of light through slab and cylindrical waveguides.

Optical Fiber:

Construction of step and graded index fibers, single mode and multimode fibers, loss and dispersion characteristics;

Module –2 12 Hrs

Fiber optic components: couplers, splicer, polarizer.

Sources and Detectors :

Sources: LED, Lasers-fundamentals, conditions for oscillations, construction and principle of operation of gas and semiconductor, pulsed and continuous type lasers;

Detectors: photodiodes- PN, PIN and APD.

Module –3

Optoelectronic Instrumentation 12 lectures

Modulation techniques: intensity, polarization, interference, electro-optic, electromagnetic; Sensing techniques for displacement, pressure, acceleration, flow, current and voltage measurement, Fiber optic gyroscope, Distributed fiber optic sensors- OTDR and OFDR principles.

Text Books:

1. A. Ghatak and K. Tyagrajan: Introduction to Fiber Optics: Cambridge University Press, New Delhi, 2004. (Chapter 2, Sections 7.2-7.3, Chapter 3, Sections 4.3,8.2, 17.2, 17.8, Section 11.3, 11.6, Chapter 12, Chapter 18)
2. J. Wilson and J.F.B. Hawkes: Optoelectronics: An Introduction (2/e), PHI, New Delhi, 2001. (Chapter 1, Sections 3.1-3.2; 8.1-8.2, Sections 8.3-8.4, 8.5, Sections 4.6, 5.1-5.6, 5.10.2, 7.2, Sections 3.4, 3.7, 3.8, Chapter 10)

Reference Books:

1. J.P. Bentley- Principles of Measurement Systems (3/e), Pearson Education, New Delhi, 2007.
2. N. Bala Saraswathi and I. Ravi Kumar- Principles of Optical Communications and Optoelectronics (2/e), Laxmi Publications, New Delhi, 2007.
3. M.K. Ghosh, S.Sen and S. Mukhopadhyay (ed.)- Measurement and Instrumentation: Trends and Applications, Ane Books, New Delhi, 2008.
4. R.P.Khare: Fibre Optics & Optoelectronics, Oxford University Press, New Delhi, 2010.

PEEI5304 INTELLIGENT & VIRTUAL INSTRUMENTATION

(3-0-0)

MODULE: I (Basic Concepts for Intelligent Instrumentation) 12 hours

Fuzzy Systems and Neural Networks:

Motivation and Basic Definitions, Fuzzy Arithmetic and Fuzzy Relations, Standard Additive Model, Fuzzy Logic Control. (selected portions from Chapter 8 of Text Book 1)

Neural networks:

Threshold Logic Unit, Identification using Adaptive Linear Element, Backpropagation, Neural Fuzzy Identifier, Radial-Basis Function (RBF) Networks, Hopfield Neural Network. (selected portions from Chapter 9 of Text Book 1)

MODULE: II (Virtual Instrumentation) 12 hours

Introduction to Virtual Instrumentation: Computers in instrumentation, What is Virtual instrumentation (VI), History of VI, LabVIEW and VI, Conventional and graphical programming, Distributed systems.

Basics of LabVIEW: Components of LabVIEW, Owned and free labels, Tools and other palettes, Arranging objects, pop-up menu, Colour coding, Code debugging, Context sensitive help, Creating sub-Vis.

FOR and WHILE Loops: The FOR loop, The WHILE loop, Additional loop problem, Loop behaviour and interloop communication, Local variables, Global variables, Shift registers, Feedback, Autoindexing, Loop timong, Timed loop.

Other Structures: Sequence structures, Case structures, Formula node, Event structure.

Arrays and Clusters: Arrays, Clusters, inter-conversion of arrays and clusters.

Graphs and Charts: Waveform chart, Resetting plots, Waveform graph, Use of cursors, X-Y graph.

State Machines: What is a state machine? A simple state machine, Event structures, The full state machine, Notes and comments.

File Input/Output: File formats, File I/O functions, Path functions, Sample VIs to demonstrate file WRITE and READ, Generatinf file names automatically.

String Handling: String functions, LabVIEW string formats, Examples, Some more functions, Parsing of strings.

MODULE: III (Data Acquisition and Interfacing in Virtual Instrumentation) 12 hours

Basics of Data Acquisition: Classification of signals, Read-world signals, Analog interfacing, Connecting the signal to the board, Guidelines, Practical versus ideal interfacing, Bridge signal sources.

Data Acquisition with LabVIEW DAQmx and DAQ Vis: Measurement and automation explorer, The waveform data type, Working in DAQmx, Working in NI-DAQ (Legacy DAQ), Use of simple VIs, Intermediate VIs.

Interfacing with Assistants: DAQ assistant, Analysis assistant, Instrument assistant.

Interfacing Instruments: GPIB and RS232: RS232C versus GPIB, Handshaking, GPIB interfacing, RS232C/RS485 interfacing, Standard commands for programmable instruments, VISA, Instrument interfacing and LabVIEW.

Textbooks:

1. Stanislaw H. Zak, ***Systems and Control***, Oxford University Press 2003, **ISBN-10:** 0195685709, **ISBN-13:** 9780195685701.
2. Sanjay Gupta and Joseph John, ***Virtual Instrumentation Using LabVIEW***, 2nd Edn., Tata McGraw-Hill, 2010, **ISBN-10:** 0-07-070028**-1**, **ISBN-13:** 978-0-07-070028-4.

Recommended Reading:

1. J.S.R. Jang, C.T. Sun, E. Mizutani, ***Neuro Fuzzy and Soft Computing***, PHI.
2. Ham & I. Kostanic, ***Principles of Neuro Computing for Science & Engineering***, TMH.
3. V.keeman, ***Learning and Soft Computing***, Pearson Education, New Delhi.
4. Jerome Jovitha, ***Virtual Instrumentation Using Labview***, PHI Learning,, 2010, **ISBN-10:** 8120340302, **ISBN-13:** 9788120340305, 978-8120340305.
5. Gary W. Johnson & Richard Jeninngs, ***LabVIEW Graphical Programming***, 4th Edn., TMH.
6. J. Travis and J. Kring, ***LabVIEW for Everyone***, 3rd Edn., Prentice Hall, 2006.
7. Peter A. Blume, ***The LabVIEW Style Book***, Prentice Hall, 2007.

PCCS4304 **OPERATING SYSTEM** (3-0-0)

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)

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.

PEEC4304 Computer Network & Data Communication

(3-0-0)

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

PCBM4304 **BIOMEDICAL SIGNAL PROCESSING** (3-0-0)

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)

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, TMH
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 & M. Negin, PHI
10. Robot Technology: Fundamentals: J. G. Keramas, Cengage Learning

PCEI7303 **CONTROL SYSTEMS LAB** (3-0-0)

1. Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications
2. (a) To design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.

   (b) To determine experimentally the transfer function of the lead compensating network.
3. (a) To design RC lag compensating network for the given specifications., viz., the maximum phase lag and the frequency at which it occurs, and to obtain its frequency response.

   (b) To determine experimentally the transfer function of the lag compensating network.
4. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
5. To study the effect of P, PI, PD and PID controller on the step response of a feedback control system (using control engineering trainer/process control simulator). Verify the same by simulation.
6. (a) Experiment to draw the speed – torque characteristic of a two - phase A.C. servomotor.

   (b) Experiment to draw speed torque characteristic of a D.C. servomotor.
7. To determine the frequency response of a second -order system and evaluation of frequency domain specifications.
8. Simulate a D. C. position control system using MATLAB/SCILAB and obtain its step response.
9. Obtain the phase margin and gain margin for a given transfer function by drawing bode plots. Verify the same using (i) MATLAB/SCILAB and (ii) The rltool command of MATLAB or equivalent in SCILAB.
10. (a) To draw the root loci for a given transfer function and verification of breakaway point and imaginary axis crossover point using (i) MATLAB/SCILAB (ii) The rltool command of MATLAB or equivalent in SCILAB (b) To draw the Nyquist plot for a given transfer function using MATLAB/SCILAB.
11. To draw and study syncro pair characteristics.

PCEC7304 Digital Signal Processing Lab

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.

PCEI7305 **INSTRUMENTATION SYSTEMS DESIGN LAB** (0-0-3)

1.Design of a temperature measurement system with thermocouple providing cold junction compensation.

2.Design of a microcontroller based storage & display device.

3.Design of LVDT and its signal conditioning circuit.

4. Design of an orifice type flowmeter, with diaphragm type differential pressure tranducer with capacitive sensing scheme.

5.Design of a piezoelectric accelerometer with charge amplifier configuration.

6. Design of active low pass, high pass & band pass filters.

7. Design of RLL for a PLC based sequential control scheme.

8. Design of PID controller.

9.Design of a stepper motor drive.

10. Design of Regulated power supply unit (including heat sick design

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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

{*Instrumentation and Electronics Engineering (**I & EE**), Electronics and Instrumentation Engineering (**E&IE**), Instrumentation and Control Engineering (**I & CE**) and Applied Electronics and Instrumentation (**AE & IE**)*}

7th SEMESTER

	THEORY	*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*
HSSM3401	Entrepreneurship Development	3-0-0	3
	Professional Elective – III (*Any One*)	3-0-0	3
PEEC5414	Advanced Control Systems		
PEEI5401	Microcontroller & Applications		
PEEC5416	Biomedical Instrumentation		
PEEL5401	Adaptive Signal Processing		
PCEC4401	VLSI Design	3-1-0	4
	Free Elective – III (*Any One*)	3-0-0	3
FEEI6401	TV & Radar Engineering		
FEEI6402	Digital Communication		
FECE6401	Computer System Architecture		
PECS5403	Real Time Systems		
PCCS4401	Computer Graphics		
	Free Elective – IV (*Any One*)	3-0-0	3
FECE6402	Principles of Mobile Computing		
PEEC5415	Advanced Communication Systems		
PEEE5407	Industrial Automation & Control		
FECE6403	Mathematics for Communication Engineers		
PECS5401	Artificial Intelligence		
	Credits (Theory)		16
	PRACTICALS/SESSIONALS		
PCEC7401	VLSI Design Laboratory	0-0-3	2
PCEI7402	Project	0-0-6	3
PCEI7403	Seminar	0-0-3	2
	Credits (Practicals/Sessionals)		7
	TOTAL SEMESTER CREDITS		23
	TOTAL CUMULATIVE CREDITS		183

8th SEMESTER

	THEORY	*Contact Hours*	
Code	*Subject*	*L-T-P*	*Credits*
	Professional Elective – IV (Any One)	3-0-0	3
PEEI5404	Analog VLSI Design		
PECS5406	Digital Image Processing		
PEEI5405	Micro-Electro-Mechanical Systems (MEMS)		
PEEI5406	Adaptive Control		
	Professional Elective – V (Any One)	3-0-0	3
PEEC5405	Embedded Systems		
PEEI5402	Optimal Control		
PEEI5403	Industrial Instrumentation		
	Free Elective – V (*Any One*)	3-0-0	3
PCEC4402	Microwave Engineering		
PEEC5418	Satellite Communication Systems		
FECE6404	Network Security and Cryptography		
FECE6405	Internet Technology and Applications		
PECS5407	Wireless Sensor Networks		
	Credits (Theory)		09
	PRACTICALS/SESSIONALS		
PCEI7401	Instrumentation Systems Simulation Lab	0-0-3	2
PCEI7404	Project (50% External Evaluation)	0-0-9	7
PCEI7405	Comprehensive Viva-Voce (External Evaluation)	0-0-0	3
	Credits (Practicals/Sessionals)		12
	TOTAL SEMESTER CREDITS		21
	TOTAL CUMULATIVE CREDITS		204

ENTREPRENEURSHIP DEVELOPMENT (3-0-0)

Module I: Understanding Entrepreneurship

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.

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.

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

VLSI DESIGN

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, Behaviour 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.

ADVANCED CONTROL SYSTEMS

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), TMH Publishing Company Ltd.
5. Control Systems Engineering by Norman S.Nise, 4th Edition (2008), Wiley India (P) Ltd.

MICROCONTROLLERS AND APPLICATIONS

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*]**, TMH, 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 New Delhi, 2004.
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***, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
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.

BIOMEDICAL INSTRUMENTATION

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

ADAPTIVE SIGNAL PROCESSING

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.

TV AND RADAR ENGINEERING

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.

DIGITAL COMMUNICATION

MODULE-I **(12 Hrs)**

Digital Modulation Schemes: Representation of Digitally Modulated Signals, Memoryless 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

COMPUTER SYSTEM ARCHITECTURE

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

REAL-TIME SYSTEMS

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.

COMPUTER GRAPHICS

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)

PRINCIPLES OF MOBILE COMPUTING

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.

ADVANCED COMMUNICATION SYSTEMS

MODULE – I: **(10 hrs)**

Data-Link Protocol and Data Communications Networks: Data-link Protocol Function, Character and bit Oriented Data Link Protocols. Asynchronous Data Link Protocols, Synchronous Data-Link Protocols, Synchronous Data –Link Control, High-Level Data Link Control, Public Switched Data Networks, CCITTX. 25, User-to-Network Interface Protocol. Integrated Services Digital Network (ISDN) (Chapter 23)

MODULE – II: **(15 hrs)**

Digital T-Carriers and Multiplexing :Time-Division Multiplexing (TDM); T1 Digital Carrier. North American Digital Hierarchy. Digital Carrier Line Encoding. T Carrier Systems, Digital Carrier Frame Synchronization. Bit Vrs Word Interleaving. Statistical TDM. Codecs and Combo Chips. FDM. AT & T's FDM Hierarchy. Composite Base band Signal . Formation of Master group. Wavelength Division Multiplexing (WDM) (Chapter 11)

Cellular Telephone Concepts: Mobile telephone service, Cellular Telephone, Frequency Reuse, Interefernce, Cell Splitting, Sectoring, Segmentation, and dualization, Cellular System Topology, Roaming and Hand ofs, Cellular Telephone Network Components, Cellular Telephone call Processing (Chapter 19)

Data Communication and Networking: Data Communication Network Architecture, Protocols, and standards, Layered Network Architecture, Introduction to GSM, GPRS, CDMA (Chapter 20)

MODULE – III: **(15 hrs)**

Satellite Communication: Introduction, Keepler's Law, Satellite Orbir\ts, geosynchronous satellites, Antenna Look Angles, Satellite Classifications, spacing and frequency allocation, Satellite Antenna Radiation patterns, Satellite System Link Models, Satellite System Parameters, Satellite System Link Equations, Link Budget (Chapter 25)

Satellite Multiple Accessing Arrangements: Introduction, FDM/FM Satellite Systems, Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Channel Capacity, Satellite Radio NavigationEstimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT (Chapter 26)

Text Book:

1. Electronic Communications Systems Fundamentals through Advanced by Wayne Tomasi; Pearson.

References:

1. Satellite Communication - by Timothy Pratt; Addison Wesley.

INDUSTRIAL AUTOMATION AND CONTROL

(**Prerequisite: Control System Engineering – I**)

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.

MATHEMATICS FOR COMMUNICATION ENGINEERS

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]

Eigenvalues 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.

ARTIFICIAL INTELLIGENCE

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

VLSI DESIGN LABORATORY

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.

8th Semester

ANALOG VLSI DESIGN

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:

1. P. Gray, P. Hurst, S. Lewis, and R. Meyer, *Analysis and Design of Analog Integrated Circuits*, 4th Edition, John Wiley, 2001.
2. Behzad Razavi, *Fundamentals of Microelectronics*, 1st Edition, John Wiley, 2008.
3. D. Holberg and P. Allen, *CMOS Analog Circuit Design*, Oxford University Press, 2002.
4. D. Johns and K. Martin, *Analog Integrated Circuit Design*, John Wiley, 1997.
5. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, McGraw-Hill, Inc., 1994.
6. A. Sedra and K.C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press, 2004.

DIGITAL IMAGE PROCESSING

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

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)

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.

ADAPTIVE CONTROL

Module-I : ***(10 Hours)***

Concept of adaptive control: **Adaptive Schemes:** Gain Scheduling, Model Reference Adaptive Systems (MRAS), Self tuning Regulators (STR), Dual Control. **Real time Parameter Estimation: Least squares and Regression Models**, Geometric Interpretation, Statistical Interpretation, **Estimating Parameters in Dynamical Systems**, Finite-Impulse Response (FIR) Models, Transfer Function Models, Closed loop Estimation.

Book-1: 1.1, 1.4, 2.1, 2.2, 2.3, 2.4, 2.5.

Module-II : ***(15 Hours)***

Deterministic Self Tuning Regulators (STR): Pole Placement: Process Model, Model-following, **Indirect Self-Tuning Regulators**, **Direct Self Tuning Regulators**. **Stochastic and Predictive Self-Tuning Regulators: Minimum-Variance and Moving-Average Controllers**, Linear Quadratic Gaussian Control (LQG). **Stochastic Self-tuning Regulators:** Direct Minimum-Variance and Moving-Average STR. **Adaptive Predictive Control, Model-Reference Adaptive Systems: The MIT Rule**, **Determination of the Adaptation Gain**, Kalman-Yaluebovich Lemma and its proof. **Feedback linearization of Nonlinear systems**, Adaptive feedback linearization.

Book-1: 3.2, 3.3, 3.5, 4.2, 4.3, 4.6, 5.2, 5.3, 5.6 (P-223), 5.10.

Module-III : ***(15 Hours)***

Properties of Adaptive Systems: Non linear dynamics, Analysis of a simple Discrete-Time system. **Adaptation of a feedforward Gain**. **Analysis of indirect descrete-time self tuners**, Identification in closed loop. **Averaging:** The averaged equations, **Application of averaging Techniques**, Analysis of a simple MRAS, **Averaging in stochastic Systems**, **Robust Adaptive Controllers**. **Stochastic Adaptive Control: The stochastic Adaptive Problem:** The Model, the criterion, Admissible control strategies, **Dual Control. Roubust and Self-Oscillating systems: Robust High-Gain Feedback Control**, Comparison between Robust and Adaptive Control, **Self-Oscillating Adaptive Systems**. **Introduction to Variable structure systems**.

Book-1: 6.1, 6.2, 6.3, 6.4 (P-288), 6.6, 6.7, 6.8, 6.9, 7.1, 7.3, 7.4, 10.1, 10.2, 10.3, 10.4.

Text Book:

1. Karl J.Astrom, Bjorn Wittenmark, *Adaptive Control*, 2nd Edition, Pearson Education, 2006.

Reference :

1. Jean-Jacques Slotine, *Applied Non linear Control*, Prentice Hall Publicatios (1991).
2. M. Srivastava, M.C. Srivastava and S. Bhatnagar, *Control Systems*, Tata Mc.Graw-Hill Publishing Co.(P) Ltd., 2009.

EMBEDDED SYSTEMS

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*, Tata McGraw Hill Education 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,

OPTIMAL CONTROL

Module-I : ***(15 Hours)***

Performance Indices: Selection of Performance Index, **Calculus of variations:** Variation and its properties, Euler-Lagrange Equation.

Linear Quadratic Regulator: Formulation of Algebraic Riccati Equation (ARE), Solving the ARE using the Eigenvector Method, Optimal systems with prescribed poles, Linear Quadratic Regulator for Discrete Systems on an infinite Time Interval.

Book-1: 5.1, 5.2, 5.2.1, 5.2.2, 5.3, 5.3.1, 5.3.2, 5.3.3, 5.3.5.

Module -II : ***(10 Hours)***

Dynamic Programming: Discrete Time Systems, Discrete Linear Quadratic Regulator Problem, Continous Minimum Time Regulator Problem, The Hamilton Jacobi Belman Equation.

Pontryagin's Minimum Principle: Optimal control with constraints on inputs.

Book-1: 5.4, 5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.5, 5.5.1.

Module - III : ***(15 Hours)***

Optimal Observers-the Kalmanfilter: The linear Quadratic Gaussian (LQG) problem, **Loop Transfer Recovery (LTR). H_∞ Control:** H_∞ Control Solution, **Sub-optimal linear regulators:** Continuous Time Systems, Discrete Time Systems, **Introduction to Stochastic Optimal Linear Estimation and Control**.

Book-2: 10.3, 10.4, 10.6, 10.7, 10.7.1, 10.7.2, 10.7.3.

Book-3: 11.7, 12.1, 12.2.

***Text Books*:**

1. Systems and Control by Stanislaw h.Zak, Oxford University Press, Publication (2003).
2. Design of Feedback Control Systems by Raymond T. Stefani, B.Shahian, Clement J.Savant, Jr. Gene H. Hostetter, 4^{th} edition (2002), Oxford University Press Publication.
3. Modern Control System Theory by M.Gopal, Second edition (2000), New Age International (P) Ltd. Publishers.

Reference Books:

1. Linear Optimal Control by Jeffrey B.Burl, Prentice Hall Publication (1999).
2. Control Theory (Multivariable and Non linear Methods) by Torkel Glad and Lennart Ljung, Taylor & Francis Publications (2009).
3. Control Systems Theory (with Engineering Application) by Sergey, Edward Lysters (2006).

INDUSTRIAL INSTRUMENTATION

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

MICROWAVE ENGINEERING

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

SATELLITE COMMUNICATION SYSTEMS

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

NETWORK SECURITY AND CRYPTOGRAPHY

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

INTERNET TECHNOLOGY AND APPLICATIONS

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

WIRELESS SENSOR NETWORKS

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.

INSTRUMENTATION SYSTEMS SIMULATION LABORATORY

(Six of the following experiments are to be performed taking *ATLEAST* three from each Group)

Group A:

1. Understanding the behavior of first order and 2nd order process using some level control system kit and finding out the process parameters like the Time constant Process gain etc
2. Implementation of a PID Controller using labview/Matlab Simulink and check its operation by taking various plant model (First order stable , first order stable +delay , 2nd order etc) and with a given set point .
3. Implementation of Various Controller Structures like Feed-forward , Cascade , ratio , Internal model structures for Various first order and 2nd order plant model using Simulink or labview
4. Implementation of Ladder logic programming for controlling various sequential process using a PLC simulator .
5. Implementation of Controller Tuning methods for various plant models either in Simulink or Labview.

REFERENCE:

1. Experiment manuals and MATLAB/LabView Reference Books.

Group B:

1. Design, Simulation and Implementation of an Instrumentation Amplifier.
2. Design, Simulation and Implementation of a State-Variable and Biquad Filter.
3. Design, Simulation and Implementation of a Frequency Synthesizer using a Phase Locked Loop (PLL).
4. Design and Implementation of Resistive Bridge Linearization using any of the available techniques.
5. Design and Implementation of a DAC-Based A-D converter.

REFERENCE:

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.

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