

# BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

{*Electronics and Communication Engineering (E&CE) and  
Electronics and Telecommunication Engineering (E&TCE)*}

<u>3<sup>rd</sup> Semester</u>				<u>4<sup>th</sup> Semester</u>			
<b>THEORY</b>				<b>THEORY</b>			
<b>Code</b>	<b>Subject</b>	<b>L-T-P</b>	<b>Credits</b>	<b>Code</b>	<b>Subject</b>	<b>L-T-P</b>	<b>Credits</b>
BSCM1205	Mathematics – III	3-1-0	4	PCEC4205	Electromagnetic Field & Waves	3-0-0	3
HSSM3204	Engineering Economics & Costing	3-0-0	3	HSSM3205	Organisational Behaviour	3-0-0	3
HSSM3205	Organisational Behaviour	3-0-0		HSSM3204	Engineering Economics & Costing	3-0-0	
BSMS1213	Material Science & Engineering	3-0-0	3	BSCP1207	Physics of Semiconductor Devices	3-0-0	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
			<b>Credits (Theory)</b>				<b>Credits (Theory)</b>
			<b>21</b>				<b>20</b>
<b>PRACTICALS/SESSIONALS</b>				<b>PRACTICALS/SESSIONALS</b>			
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
			<b>Credits (Practicals/Sessionals)</b>	HSSM7203	Communication & Interpersonal skills for Corporate Readiness Laboratory	0-0-3	2
				<b>6</b>			
			<b>6</b>				<b>8</b>
			<b>TOTAL SEMESTER CREDITS</b>				<b>TOTAL SEMESTER CREDITS</b>
			<b>27</b>				<b>28</b>
			<b>TOTAL CUMULATIVE CREDITS</b>				<b>TOTAL CUMULATIVE CREDITS</b>
			<b>83</b>				<b>111</b>

# 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, 3<sup>rd</sup> 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, 6<sup>th</sup> Edition, Ben. G. Stretman and Sanjay Banarjee, Pearson Education, New Delhi.
3. Physics of Semiconductor Devices, 3<sup>rd</sup> Edition, S.M. Sze and Kwok K. Ng, Wiley India Pvt. Limited, New Delhi.
4. Physics of Semiconductor Devices, 2<sup>nd</sup> 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 Wagner 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 TRANSFORMER and POTENTIAL TRANSFORMER:** Construction, Theory, Characteristics and Testing of CTs and PTs.
8. **ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS:** 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 – 5<sup>th</sup> 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 – Joseph Carr – 3<sup>rd</sup> Edition, Pearson Education.
5. Electronic Instrumentation – H C Kalsi – 2<sup>nd</sup> 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,  $\mu A$  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, 9<sup>th</sup>/10<sup>th</sup> 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, 5<sup>th</sup> 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, 3<sup>rd</sup> 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, 3<sup>rd</sup> Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Milliman's Electronics Devices and Circuits, 2<sup>nd</sup> 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.

# 4<sup>th</sup> Semester

## PCEC4205 **Electromagnetic Fields and Waves**

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

# BEEC2214 Energy Conversion Devices

## 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 McGraw Hill.
7. Electric Machinery And Transformers –Guru & Hizioglu –Oxford University Press.

## 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, 10<sup>th</sup> 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, 6<sup>th</sup> Edition, Donald P. Leach, Albert Paul Malvino and Goutam Saha, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Digital Fundamentals, 5<sup>th</sup> 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, 3<sup>rd</sup> 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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# 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 integrated steel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention – Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

## Text Book :

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

## Reference Books

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

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

## **Module I: Functions of Management**

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

## **Module II: Marketing Function of Management.**

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

## **Module III: Financial Function & HRM Functions.**

Financial Functions, Concept of Financial Management, Project Appraisal, Tools of Financial decisions making, Overview of Working Capital.

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

## **Reference Books:**

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

# PCEC4303 **CONTROL SYSTEM ENGINEERING** (3-0-0)

## **Module-I :**

**(12 Hours)**

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

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

## **Module-II :**

**(15 Hours)**

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

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

## **Module-III :**

**(13 Hours)**

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

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

Closed loop frequency response : Constant M-circles, Constant N-Circles, Nichol's chart.

Controllers : Concept of Proportional, Derivative and Integral Control actions, P, PD, PI, PID controllers. Zeigler-Nichols method of tuning PID controllers.

### **Text Books :**

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

### **Reference Books :**

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

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

## **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 and 8088.

## **Module-III :** (13 Hours)

### **Instruction set and programming:**

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

### **I/O Interfacing :**

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

## **Text Books:**

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

## **Reference Book:**

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

# PCEC4302 ANALOG COMMUNICATION TECHNIQUES

(3-1-0)

## **Module-I :** (12 Hours)

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

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

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

## **Module-II :** (12 Hours)

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

### **PULSE MODULATION AND DIGITAL TRANSMISSION OF ANALOG SIGNAL:**

Analog to Digital( *Noisy Channel and Role of Repeater*), Pulse Amplitude Modulation and Concept of Time division multiplexing ,Pulse Width Modulation and Pulse Position Modulation, Digital Representation of Analog Signal.

## **Module-III :** (14 Hours)

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

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

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

## **Essential Reading:**

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

## **Supplementary Reading:**

1. Communication System Engineering,Second Edition by Masoud Salehi, John G. Proakis, ISBN: 0130950076 (paperback)
2. Analog Communication by Chandra Sekar, Oxford University Press.
3. Modern Digital and Analog Communication Systems, by B.P. Lathi, Oxford



# PEEC4302 **FIBER OPTICS AND OPTOELECTRONICS DEVICES**

(3-0-0)

## **Unit 1 (10 hours)**

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

## **Unit 2 (12 hours)**

Fiber fabrication, Double crucible method, Fiber optic cables, Connector and splice. Losses during coupling between source to fiber, fiber to fiber. Schemes for coupling improvement.

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

## **Unit 3 (13 hours)**

Optoelectronic Detector, PIN AND APD, Responsivity, Band width, Detector noise ,equivalent circuit and SNR calculation.

Optoelectronic Modulators, Basic principle, Electro optic and Acousto optic modulators, Optical Amplifier, Semiconductor optical Amplifier and Erbium Doped Fiber Amplifier, Solar cells, basic principle, heterojunction, cascaded solar cell, Schottky Barrier cells, WDM components-couplers, isolators ,circulators, filters. Optical switching-self electro optic effect Device, switching speed and energy

## **Text Books**

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

## **Reference Books**

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

# 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- $\pi$  , 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.

# PEEC4303 ELECTRONIC DEVICES AND MODELING

(3-0-0)

## MODULE – I

(13 hours)

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

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

## MODULE – II

(11 hours)

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

## MODULE – III

(11 hours)

**BJT Parameter Measurements:** Input and Model Parameters, Parameter Measurements

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

**Noise and Distortions:** Noise, Distortion.

### Textbooks:

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

### Reference Books:

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

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

## **Module – I**

(10 hours)

### Discrete-Time Signals and Systems:

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

Selected portions from Chapter 2 (2.1, 2.2, 2.3.1, 2.3.3, 2.3.4, 2.3.5, 2.3.6, 2.4, 2.5, 2.6.1, 2.6.2) of Textbook – I

### Properties of Continuous-Time Systems:

Block Diagram and System Terminology, System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality.

Selected portions from Chapter 4 (4.2, 4.4) of Textbook – II

## **Module – II**

(12 hours)

### The Continuous-Time Fourier Series:

Basic Concepts and Development of the Fourier Series, Calculation of the Fourier Series, Properties of the Fourier Series.

Selected portions from Chapter 8 (8.3, 8.4, 8.7) of Textbook – II

### The Continuous-Time Fourier Transform:

Basic Concepts and Development of the Fourier Transform, Properties of the Continuous-Time Fourier Transform.

Selected portions from Chapter 10 (10.3, 10.6) of Textbook – II

## **Module- III**

(13 hours)

### The Z-Transform and Its Application to the Analysis of LTI Systems:

The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Rational Z-Transforms: Poles and Zeros, Pole Location and Time-Domain Behavior for Causal Signals, The System Function of a Linear Time-Invariant System; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; The One-sided Z-Transform: Definition and Properties, Solution of Difference Equations.

Selected portions from Chapter 3 (3.1, 3.2, 3.3, 3.4.2, 3.4.3, 3.6.1, 3.6.2) of Textbook– I

### The Discrete Fourier Transform: Its Properties and Applications:

Frequency Domain Sampling: The Discrete Fourier Transform; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.

Selected portion from Chapter – 7 (7.1.2, 7.2.1, 7.2.2, 7.2.3) of Textbook – 1.

### **Text Books:**

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

### **Reference Book:**

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

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

### **Unit-I (10 Hours)**

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

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

### **Unit-II (10 Hours)**

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

**Assignment problems:** Hungarian method for solution of Assignment problems

**Integer Programming:** Branch and Bound algorithm for solution of integer Programming Problems

**Queuing models:** General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

### **Unit-III (10 Hours)**

**Non-linear programming:** Introduction to non-linear programming.

**Unconstrained optimization:** Fibonacci and Golden Section Search method.

**Constrained optimization with equality constraint:** Lagrange multiplier, Projected gradient method

**Constrained optimization with inequality constraint:** Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

### **Recommended text books**

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

### **Recommended Reference books:**

1. Stephen 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.

# FEEEC6301 **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 Ed)
- (3) Database management system by leon &leon (Vikas publishing House).
- (4) Fundamentals of Database Management System – Gillenson, Wiley India
- (5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, 4<sup>th</sup> Ed., 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-2<sup>nd</sup> 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<sup>++</sup>.

## **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), Electrooculogram (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 Existing 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 Handling: 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, 7<sup>th</sup> Edition.
2. Java The complete reference: Herbert Schildt, TMH, 5<sup>th</sup> Edition.

### **Reference Books:**

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

# PCEC7303 **CONTROL AND INSTRUMENTATION**

## **LABORATORY (0-0-3)**

### **List of Experiment :**

#### **Control:**

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

#### **Instrumentation:**

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

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

**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 chip Timer Buffered standard port Interrupt controller IBM 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 simulator Stepper motor control card with stepper motors. List of Experiments to be conducted. Part A Study of 8086 kit and all the peripheral pin numbers Detail 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 like Programs related to data transfer group Related to different addressing modes. Flag manipulation. Simple programs related to Arithmetic, logical, and shift operation. Loop and Branch Instructions String operations. Stack manipulation and subroutine program. (5 Periods)

#### **At least seven of the following list of experiments.**

1. Arranging a set of data 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.

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

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

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

**Equipment Required:**

  - Signal/ function generator- frequency range upto 1MHz, signal types: square, triangle, sinusoidal, saw-tooth, DC offset signal.
  - Spectrum analyzer Upto 100MHz atleast.
2. Analyze the process of frequency division multiplexing and frequency division de-multiplexing.
 

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

**Equipment Required:**

  - Frequency division multiplexing/ de-multiplexing experiment board.
  - CRO
3. Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SSBSC)
 

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

**Equipment Required:**

  - AM modulator/ demodulator experimental board.
  - Function generator (sine, square, modulating signal), 1MHz maximum frequency
  - CRO - 20MHz, dual trace
  - Spectrum analyzer.
4. Study of FM modulation and Demodulation Techniques.
 

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

**Equipment Required:**

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

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

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

**Equipment Required:**

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

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

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

**Equipment Required:**

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

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

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

- For experiment 7/8 MATLAB of current version/ scilab is required.
- Computer of good configuration

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

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

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

11. Design a receiver to demodulate and receive the signal from an 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

## 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, TMH
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.
3. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, TMH.
4. Digital Signal Processing: A Modern Introduction – Ashok Ambardar, Cengage Learning.
5. Modern Digital Signal Processing – Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications – Li Tan, Academic Press, Elsevier.
7. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
8. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

PCEC4305 **DIGITAL COMMUNICATION TECHNIQUES**  
(3-0-0)

**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", 5<sup>th</sup> Edition 2008, McGraw Hill, 2008.(Selected portion form Chapter 3,4, 6, 9 and 12.)

**Reference Book:**

1. B. Sklar and P K Ray; Digital Communications – Fundamentals and Applications; Pearson Education; 2009

# PEEC5304 **ANTENNAS & WAVE PROPAGATION** (3-0-0)

## **Module – I**

**(10 hours)**

Introduction, Wave equation in terms of potential functions; Vector potential A for an electric current source J & Vector potential F for a magnetic current source M

Fundamental parameters of Antenna:

Principle of Radiation, Radiation Pattern – Isotropic, Directional and omni directional patterns; Principle Patterns and Secondary lobes: Field regions: radiation field and Steradian.

Radiation Power Density; Radiation Intensity, Directivity, Gain, Antenna Efficiency, HPBW, Beam efficiency, Bandwidth, Polarization – Linear, Circular and Elliptical Polarization. Noise Figure and Noise Temperature. Effects of antenna height and effect of ground on performance of antenna. Antenna effective length.

## **Module –II**

**(12 hours)**

Short Dipole and half wavelength Dipole – Current distribution, Radiated Fields, Power density and Radiation resistance; radiating near field (Fresnel) and reactive near field region, intermediate field and far field (Fraunhofer) region, Ground effects – vertical and horizontal electric dipole, earth curvature.

Loop Antenna and Horn Antenna (basics). Frequency independent Antennas: Log periodic Dipole antenna and helical antenna (basics).

Antenna Arrays: Uniform linear arrays of isotropic elements, array factor and directivity. Broadside & Endfire array, principle of pattern multiplication. Binomial array.

Microstrip Antenna – Basic Characteristics, Rectangular Patch, Circular Patch, Quality factor bandwidth and efficiency, Feed to microstrip antenna: probe feed, microstrip line feed, aperture feed (basic ideas).

## **Module –III**

**(12 hours)**

Ground Wave, Sky Wave, Space Wave & Scatter Propagation with general application: Propagation with general applications: Propagation Equations in Ground Waves: Attenuation Factor, Transmission Coverage, Receiving Antenna for ground wave. Sky Wave Propagation: Attenuation, Refractive Index, Conductivity and Permittivity, Electron Collision Frequency, D, E & F Layers, Critical Frequency & MUF, skip distance, Curved Ionosphere, Propagation Equation, Antennas for Sky Wave reception. Space Wave Propagation in the Troposphere: LOS Range, Flat Earth Reflection with variable wavelengths and heights, Inverse Distance Equation, Point of reflection on curved Earth, Curvature of space Waves in the Troposphere, Diffraction of space waves, Duct Propagation, Fading of Space Waves. Antennas for Space wave Propagations.

### **Text Books:**

1. Antenna Theory – Analysis and Design By C Balanis, 2<sup>nd</sup> Edition, John Willey & Sons.
2. Antenna by J.D. Kraus, 2<sup>nd</sup> Edition, TATA McGraw Hill.
3. Radio Wave Propagation and Antennas, An Introduction –John Griffiths, PHI International

### **Reference Books:**

1. Electromagnetic Wave and Radiating Systems by E.C. Jordan and K.G. Balmain, 2<sup>nd</sup> Ed. PHI
2. Antenna Engineering by W. L. Weeks
3. Antennas and Wave Propagation by G.S.N. Raju, Person Education.
4. Antenna & Wave Propagation by R. E. Collins



# PEEC5303 **RADAR AND TV ENGINEERING** (3-0-0)

## **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, 2<sup>nd</sup> edition, Tata McGraw Hill.
2. Introduction to RADAR systems by Merrill I. Skolnik, 3<sup>rd</sup> 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, 6<sup>th</sup> edition, McGRAW HILL.
3. RADAR Principles, Technology, Application by Byron Edde, 1<sup>st</sup> edition, Pearson, 2004.
4. Understanding RADAR system by Simon Kingsley, Shaun Quegan, Standard publication.
5. Principles of RADAR by J. C. Toomay, PHI, 2<sup>nd</sup> edition, 2004.

## PEEC5302 **MOBILE COMMUNICATION** (3-0-0)

### **MODULE-I**

An Overview of Wireless Systems: Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G Systems, Future Wireless Networks

Radio Propagation and Propagation Path-Loss Models: Introduction, Free-space Attenuation, Attenuation over Reflecting Surfaces, Radio wave Propagation, Characteristics of Wireless Channel, Signal Fading Statistics, Propagation Path-loss Models, Cost 231 Model

### **MODULE-II**

Fundamentals of Cellular Communications: Introduction, Cellular Systems, Hexagonal Cell Geometry, Co-channel Interference Ratio, Cellular System Design in Worst-Case Scenario with an Omni directional Antenna, Co-channel Interference Reduction, Directional Antennas in Seven-Cell Reuse Pattern, Cell Splitting, Adjacent Channel Interference (ACI), Segmentation,

Multiple Access Techniques: Introduction, Narrowband Channelized Systems, Comparisons of FDMA, TDMA and DS-CDMA, Comparison of DS-CDMA vs. TDMA System Capacity, Multicarrier DS-CDMA (MC-DS-CDMA)

### **MODULE-III**

Modulation schemes: Introduction, Introduction to modulation, Phase Shift Keying, Quadrature Amplitude Modulation, M-ary Frequency Shift Keying, Synchronization, Equalization

Spread Spectrum(SS) and CDMA Systems: Introduction, Concept of Spread Spectrum, System Processing Gain, Requirements of Direct-Sequence Spread Spectrum, Frequency-Hopping Spread Spectrum Systems

### **Text Books:**

1. Essential Reading: Selected portions from V K Garg, Wireless Communication and Networking; Morgan Kaufman Publishers India; 2008

### **Reference Book:**

1. T S Rappaport, Wireless Communications, Pearson Education, India
2. W C Y Lee, Mobile Communication Engineering – Theory and Applications; TMH
3. T L Singhal, Wireless Communications, Tata McGraw Hill 2010

# PEEC5301 **INFORMATION THEORY AND CODING** (3-0-0)

## **Module-1**

**(8 Hours)**

### **Information Theory**

Introduction to information theory, uncertainty and information, average mutual information and entropy, cross entropy, information measures for continuous random variables, source coding theorem, Channel models, channel capacity, information capacity theorem, the Shannon limit.

## **Module-2**

**(12 Hours)**

### **Channel Coding**

Waveform Coding and Structured Sequences, Types of Error Control, Structured Sequences, Linear Block Codes, Error Detecting and Correcting Capability, Usefulness of the Standard Array, Cyclic Code, Well Known Block Codes.

Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes, Other Convolutional Decoding Algorithms

Reed Solomon Codes, Interleaving and Concatenated Codes, Coding and Interleaving Applied to the Compact Disc, Digital Audio Systems, Turbo Codes.

## **Module-3**

**(12Hours)**

### **Modulation and Coding Trade offs:**

Goals of the Communications System Designer, Error Probability Plane, Nyquist Minimum Bandwidth, Shannon-Heartley Capacity Theorem, Bandwidth Efficiency Plane, Modulation and Coding Trade-offs, Defining, Designing, and Evaluating Digital Communication Systems, Bandwidth Efficient modulation, Modulation and Coding for Bandlimited Channels, Trellis-Coded Modulation.

**Source Coding:** Sources, Amplitude Quantizing, Differential Pulse-Code Modulation, Adaptive- Prediction, Transform Coding, Source Coding for Digital Data, Examples of Source Coding.

### **Text Books:**

- (1) Information Theory, Coding and Cryptography, by Ranjan Bose, 2<sup>nd</sup> Edition, TMH Publication, 2<sup>nd</sup> reprint, 2008.
- (2) Digital Communications – Fundamentals and applications, by Bernard sklar, 2<sup>nd</sup> Edition, Pearson education Publication, 2009.

### **References:**

- (3) Digital Communications, J. G. Proakis, 3<sup>rd</sup> edition, Mc Graw Hill Publication.
- (4) Information Theory and coding, by Norman Abramson, Mc Graw Hill Publication.

PEEC4304 **COMPUTER NETWORK & DATA  
COMMUNICATION** (3-0-0)

**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, 4<sup>th</sup> Ed
3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5<sup>th</sup> Ed

**Reference Book :**

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4<sup>th</sup> Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9<sup>th</sup> Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

# PCCS4304 **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, 8<sup>th</sup> edition, Wiley-India, 2009.
2. **Modern Operating Systems** – Andrew S. Tanenbaum, 3<sup>rd</sup> 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, 3<sup>rd</sup> 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 method, 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, " *Numerical methods*", Thomson/ Cengage India
2. K.E. Atkinson," *Numerical analysis*," Second edition, John Wiley & Sons.

# 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**

Linear 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***, 3<sup>rd</sup> 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***, 2<sup>nd</sup> Edn., Michigan Technological University Published by Nelson Engineering, 1999.
4. A.S. Sedra and K.C. Smith, ***Microelectronic Circuits***, Oxford University Press, New Delhi
5. J.N. Jacob, ***Application & Design with Analog Integrated Circuits***, PHI Pub, New Delhi.
6. D. Patranabis, ***Electronic Instrumentation***, PHI Pub, New Delhi

# PCBM4304 **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, McGraw Hill
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W.Spong and M. Vidyasagar , Wiley India.
5. Industrial Robotics Technology, programming and application, M.P.Groover, McGraw Hill
6. Introduction to Robotics: Analysis, Systems, Applications, S.B.Niku, PHI
7. Robotics: Fundamental Concepts and Analysis, A. Ghosal, Oxford University Press
8. Fundamentals of Robotics: Analysis and Control, R. J. Schilling, PHI
9. Robotic Engineering: An Integrated Approach, R.D. KLAFTER, T. A. Chmielewski, and M. Negin, PHI
10. Robot Technology: Fundamentals: J. G. Keramas, Cengage Learning

## PCEC7304 **Digital Signal Processing Lab**

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.

# PCEC 7306 COMMUNICATION ENGINEERING LAB

L. T. P.: 0-0-3

## List of Experiment

Any 10 experiment have to perform in the lab of around 40 hours.

1. Radiation pattern of Dipole, Yagi, Helical and Slot Antenna (3 hours)
2. Velocity Measurement using Doppler RADAR. (3 hours)
3. Study of different blocks of colour TV receiver such as RF amplifier, IF amplifier, sync separator, vertical oscillator, colour picture tube etc and measurement of various voltage signal waveform. (6 hours)
4. Polarization Detection of Dipole, Yagi, Helical and Slot Antenna (3 hours)
5. Measurement of Refractive Index profile, Numerical Aperture, attenuation and bending loss/dispersion in a multimode optical fiber. (6 hours)
6. Study the laser diode and determination of its characteristics (3 hours)
7. Measurement of Gain of a fiber communication link using (a) optical fiber, (b) free space (3 hours)
8. Establishing and testing an optical Fiber Communication Link (6 hours)
9. Simulation of a pn sequence generator using MATLAB. (3 hours)
10. Simulation of direct sequence spread spectrum technique using MATLAB. (3 hours)
11. Simulation of TDM and WDM using MATLAB (3 hours)

## PCEC7305 **Digital Communication Techniques Lab**

1. Study the functioning of PCM and Delta modulator  
**Experiment objective:** Demonstrate the process of PCM modulation and Delta modulation.  
**Equipment Required:**  
Experiment board for PCM/ Delta Modulation/ Adaptive Delta Modulation generation and detection  
Signal generator  
CRO
2. To study Time division multiplexing.
3. To study PCM.
4. To study the different channel coding and decoding technique.
5. Generation and reception of different types of signals like ASK, PSK, FSK.
6. To transmit and receive three separate signal audio, video, tone simultaneously through satellite link.
7. To transmit PC data through satellite link using a satellite communication demonstration unit.
8. Experimentally compare different forms of BPSK, QPSK, OQPSK and analyze their spectrum with spectrum analyzer.
9. Spreading and dispreading using additive white Gaussian noise generation/ Gold code and other forms of spreading techniques.
10. Transmit different types of signals suing a ISDN system.
11. Analyze the process of data communication in LAN using LAN trainer and compare the performance different media access techniques.

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# BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

{*Electronics and Communication Engineering (E&CE) and  
Electronics and Telecommunication Engineering (E&TCE)*}

<u>7<sup>th</sup> SEMESTER</u>				<u>8<sup>th</sup> SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
HSSM3401	Entrepreneurship Development	3-0-0	3	PCEC4402	Microwave Engineering	3-0-0	3
PCEC4401	VLSI Design	3-1-0	4				
	<b>Professional Elective – IV (Any One)</b>	3-0-0	3		<b>Professional Elective – V (Any One)</b>	3-0-0	3
PEEC5403	Biomedical Instrumentation			PEEI5404	Analog VLSI Design		
PEEC5404	Digital Switching & Telecom Networks			PEEC5405	Embedded Systems		
PEEC5401	Advance Control Systems			PECS5406	Digital Image Processing		
PEEL5401	Adaptive Signal Processing			PEEC5406	Satellite Communication Systems		
	<b>Free Elective – III (Any One)</b>	3-0-0	3				
FECE6401	Computer System Architecture						
PECS5403	Real Time Systems						
PEEI5401	Microcontroller & Applications						
PCCS4401	Computer Graphics						
	<b>Free Elective – IV (Any One)</b>	3-0-0	3		<b>Free Elective – V (Any One)</b>	3-0-0	3
FECE6402	Principles of Mobile Computing			FECE6404	Network Security and Cryptography		
PEEE5402	Industrial Automation & Control			FECE6405	Internet Technology and Applications		
FECE6403	Mathematics for Communication Engineers			PEEI5405	MEMS		
PECS5401	Artificial Intelligence			PEEI5403	Industrial Instrumentation		
				PECS5407	Wireless Sensor Networks		
			<b>Credits (Theory) 16</b>				<b>Credits (Theory) 09</b>
	<b>PRACTICALS/SESSIONALS</b>				<b>PRACTICALS/SESSIONALS</b>		
	<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>		
PCEC7401	VLSI Design Laboratory	0-0-3	2	PCCS7402	Microwave Engineering Laboratory	0-0-3	2
PCEC7402	Project	0-0-6	3	PCEC7404	Project (50% External Evaluation)	0-0-9	7
PCEC7403	Seminar	0-0-3	2	PCEC7405	Comprehensive Viva-Voce (External Evaluation)	0-0-0	3
			<b>Credits (Practicals/Sessionals) 7</b>				<b>Credits (Practicals/Sessionals) 12</b>
			<b>TOTAL SEMESTER CREDITS 23</b>				<b>TOTAL SEMESTER CREDITS 21</b>
			<b>TOTAL CUMULATIVE CREDITS 183</b>				<b>TOTAL CUMULATIVE CREDITS 204</b>

# ENTREPRENEURSHIP DEVELOPMENT

- Module I: Understanding Entrepreneurship 10Hrs**  
Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society  
Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change.  
**Entrepreneurial Process**  
Step by step approach to entrepreneurial start up  
Decision for Entrepreneurial start up.
- Module II: Setting up of a small Business Enterprise. 10Hrs**  
Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector.  
Writing a Business plan, components of a B-Plan, determining Bankability of the project.
- Module III: Institutional Support for SME. 10Hrs**  
Central / State level Institution promoting SME.  
Financial Management in small business.  
Marketing Management, problems & strategies  
Problems of HRM – Relevant Labour – laws.  
**Sickness in Small Enterprises.**  
Causes and symptoms of sickness – cures of sickness.  
Govt. policies on revival of sickness and remedial measures.

## Reference Books:

1. Entrepreneurship Development, Small Business Enterprises, Chavantimath, Pearson.
2. Entrepreneurial Development, S.S. Khanka, S Chand
3. Entrepreneurship, Barringer BR, Ireland R.D., Pearson
4. Entrepreneurship, David H Holt, PHI
5. Entrepreneurship, Kurilko, D.F. and Attodgets RM, Cengage
6. The Dynamics of Entrepreneurial Development & Management, Vasant Desai, HPH.
7. Entrepreneurship, Roy, Oxford
8. Entrepreneurship, Hisrich, Peters, Shepherd, TMH

# 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*, 3<sup>rd</sup> 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.

# 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), Electromyograph (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-2<sup>nd</sup> Edition by R.S.Khandpur, Tata McGraw Hill 2003 (Chapters 1-6,11,18)
2. Biomedical Instrumentation and Measurements-2<sup>nd</sup> Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI learning Pvt Ltd 2<sup>nd</sup> Edition

### Reference Books:

1. Introduction to Biomedical Equipment Technology-4<sup>th</sup> Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007



# DIGITAL SWITCHING AND TELECOM NETWORKS

## MODULE – I (16 hours)

**Introduction:** Fundamentals of switching system, telecommunication networks.

**Electronic space division switching:** Stored program control, centralized and distributed SPC, application software architecture, enhanced services, two and three stage & n stage networks.

Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space and time switching, combination switching, three-stage & n stage combination switching. (Chapter 1, 4 and 6)

## MODULE – II (12 hours)

**Traffic Engineering:** Network traffic load and parameters, Grade of services & blocking probability, modeling of switching systems, incoming traffic & service time characterization, blocking models and loss estimates, Delay systems (Chapter 8)

**Telephone Networks:** Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, Signaling techniques : in channel & common channel signaling (Chapter 9)

## MODULE – III (12 hours)

**Data Networks:** Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, an overview of data network standards. (Chapter 10)

**Integrated Service Digital Network:** Motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration (Chapter 11)

### Text Books :

1. Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks by, PHI Learning Pvt. Ltd., New Delhi.

### References:

1. Communication Networks, A Leon-Garcia and Indra Widiaja, TMH, New Delhi
2. Data and Computer Communications by W Stallings, Pearson Education

# 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 Theorems 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 theorem, 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 criterion, 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)

## 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 theorem. **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)

## 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 Criterion:** Basic Stability Theorems, 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, 5<sup>th</sup> Edition (2010), PHI.
3. Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11<sup>th</sup> Edition (2008), Pearson Education Inc. Publication.
4. Control Systems (Principles & Design) by M.Gopal, 3<sup>rd</sup> Edition (2008), Tata Mc.Graw Hill Publishing Company Ltd.
5. Control Systems Engineering by Norman S.Nise, 4<sup>th</sup> Edition (2008), Wiley India (P) Ltd.

## **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, correlation matrix.

**Searching the Performance Surface:** A simple gradient search algorithm, Stability and Rate of convergence, the learning curve

**Gradient Estimation and its effects on Adaptation:** The performance penalty, Variance of the gradient estimate, Misadjustment.

### **Module – III**

**(16 Hours)**

**Adaptive Algorithms and Structures:** The LMS Algorithm, Convergence, learning Curve, Performance 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.

# 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, Characteristics 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.

# 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]*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.

### Reference Books:

1. M.A. Mazidi, J. G. Mazidi and R.D. McKinlay, *The 8051 Microcontroller and Embedded Systems using Assembly and C*, 2<sup>nd</sup> Edition, Pearson Education, 2008.
2. Myke Predko, *Programming and Customizing the 8051 Microcontroller*, TMH
3. Subrata Ghoshal, *8051 Microcontroller Internals, Instructions, Programming and Interfacing*, Pearson Education, 2010.
4. Kenneth J. Ayala, *The 8051 Microcontroller – Architecture, Programming and Applications*, 2<sup>nd</sup> Edition, Thomson Delmar Learning, 2004.
5. David Calcutt, Fred Cowan, Hassan Parchizadeh, *8051 Microcontrollers – An Application based Introduction*, Elsevier Publications.
6. Myke Predko, *Programming and Customizing the PIC Microcontroller*, TMH
7. John B. Peatman, *Design with PIC Microcontrollers*, Pearson Education, 2005.
8. Han Way Huang, *PIC Microcontroller*, Cengage Learning.
9. Martin Bates, *PIC Microcontrollers*, 2<sup>nd</sup> Edition, Elsevier Publications.

# 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 802.11 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, 2<sup>nd</sup> Edition.

### **Reference Books:**

1. Pervasive Computing: Burkhardt, Pearson Education.
2. Principles of Mobile Computing: Hansmann, Merk, Springer, 2<sup>nd</sup> 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.



# 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, Feedforward Control, Feedforward-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. Coughnour, "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 Decision Theory, Some Many Problems, Maximum-Likelihood Detection. [Moon: 11.1 to 11.6]

**Estimation Theory:** The Maximum-Likelihood Principle, ML Estimates 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 Dependency Scripts, 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 Planning Other 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.

**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

# 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.

# 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 ( $\mu$ COS-II) RTOS:** VxWorks, MicroC/OS-II ( $\mu$ COS-II).

**Integration and Testing of Embedded Hardware and Firmware:** Integration of Hardware & Firmware, Board Power up.

**The Embedded System Development Environment:** Integrated Development Environment (IDE), Types of files generated on cross-compilation, Disassembler/Decompiler, Simulators, Emulators & Debugging, Target Hardware Debugging, Boundary Scan.

**Product Enclosure Design & Development:** Product Enclosure Design Tools, Product Enclosure Development Techniques.

**Embedded Product Development Life Cycle (EDLC):** Definition and Objectives of EDLC, Different Phases of EDLC, EDLC Approaches (Modeling the EDLC).

**Trends in the Embedded Industry:** Processor Trends in Embedded System, Embedded OS Trends, Development Language Trends, Open standards, Frameworks and Alliances, Bottlenecks.

### **Text Book:**

1. Shibu K.V., *Introduction to Embedded Systems*, TMH Private Limited, New Delhi, 2009.

### **Reference Book:**

1. Peter Marwedel, *Embedded System Design*, Springer, 2006 <http://ls12-www.cs.uni-dortmund.de/~marwedel/kluwer-es-book/>
2. Wayne Wolf, *Computers as Components*, Morgan Kaufmann, 2001 <http://www.ee.princeton.edu/~wolf/embedded-book>
3. G. De Micheli, Rolf Ernst and Wayne Wolf, eds, *Readings in Hardware/Software Co-Design*, Morgan Kaufmann, Systems-on-Silicon Series Embedded
4. Frank Vahid and Tony D. Givargis, *System Design: A Unified Hardware/Software Introduction*, Addison Wesley, 2002.
5. Michael Barr, *Programming Embedded Systems in C and C++*, O'Reilly, 1999.
6. David E. Simon, *An Embedded Software Primer*, Addison Wesley, 1999.
7. Jack Ganssle, *The Art of Designing Embedded Systems*, Newnes, 2000.
8. K. Short, *Embedded Microprocessor System Design*, Prentice Hall, 1998.
9. C. Baron, J. Geffroy and G. Motet, *Embedded System Applications*, Kluwer, 1997.
10. Raj Kamal, *Embedded Systems – Architecture, Programming and Design*, Tata McGraw Hill Publishing Company Limited, New Delhi,

# 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



# SATELLITE COMMUNICATION SYSTEMS

## Module – I

(12 Hours)

**Introduction to state of satellite communication:** Orbital mechanics and parameters, look angle determination, Launches and Launch 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,  $GF(2^n)$ . 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

# 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. Ananthuresh, 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.

# 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 Telemetry, 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

# WIRELESS SENSOR NETWORK

## 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 Krishmachari, 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.

# **MICROWAVE ENGINEERING LABORATORY**

**(Any Ten of the following experiments are to be performed with X-band/S-band/ Ku-band Microwave components.)**

1. Reflex Klystron Characteristics
2. Gun Diode Characteristics
3. Directional Coupler Characteristics
4. Measurement of Voltage Standing Wave Ratio.
5. Radiation Pattern Measurement of a Horn Antenna
6. Impedance, Wavelength and Frequency Measurement.
7. Determination of Polarization of Horn antenna.
8. Measurement of Scattering Parameters.
9. Coupling Measurement of H-plane, E-Plane and Magic Tee junctions.
10. Measurement of Dielectric Constant.
11. Measurement of Phase shift.
12. Scattering parameters of Circulator /Isolators.

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