| Second Year Engineering | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Third Semester | | | | | | | | | |
| | Theory | | | | | | Practical | | |
| **Code** | **Course Name** | | **Hours/ week L/T** | **Credit Theory** | **University Marks** | **Internal Evaluation** | **Hours/ Week L/T** | **Credit Practical** | **Marks** |
| PC | Analog Electronics Circuits | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Network Theory | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Signal & Systems | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Digital Electronics | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Semiconductor Devices | | 3-1 | 4 | 100 | 50 | | | |
| HS | Engineering Economics/ Organizational Behavior | | 2-1 | 3 | 100 | 50 | | | |
| Total | | | 19 | 19 | 600 | 300 | 8 | 4 | 200 |
| Total Marks: 1100 | | | | | | | | | |
| Total Credits: 23 | | | | | | | | | |
| Honours | | Probability and Random Processes | 4 | 4 | 100 | 50 | | | |
| Minor | | Analog Electronic Circuits | | | | | | | |

Semester : 3rd

| | | | | |
|---|---|---|---|---|
| 1. | PET3D001 Honours(CP) | Probability and Random Processes | 4-0-0 | 4 |
| 2. | PEK3E001 HS(O1) | Engineering Economics | 3-0-0 | 3 |
| 3. | POB3E002 HS(O1) | Organizational Behavior | 3-0-0 | 3 |
| 4. | PET3G001 Minor(CP) | Analog Electronic Circuits | 4-0-0 | 4 |
| 5. | PET3I001 PC(CP) | Semiconductor Devices | 4-0-0 | 4 |
| 6. | PET3I101 PC(CP) | Analog Electronic Circuits | 3-0-1 | 4 |
| 7. | PET3I102 PC(CP) | Network Theory | 3-0-1 | 4 |
| 8. | PET3I103 PC(CP) | Signal & Systems | 3-0-1 | 4 |
| 9. | PET3I104 PC(CP) | Digital Electronics | 3-0-1 | 4 |
| | | | | 27 |

*3rd Semester*

## PET3G001 ANALOG ELECTRONICS CIRCUIT (3-0-2)

**MODULE – I** **(12 Hours)**

**MOS Field-Effect Transistor:** Principle and Operation of FETs and MOSFETs; P-Channel and N-Channel MOSFET; Complimentary MOS; V-I Characteristics of E- MOSFET and D-MOSFET; MOSFET as an Amplifier and as a Switch. (4 Hours)

**Biasing of BJTs:** Load lines (AC and DC); Operating Points; Fixed Bias and Self Bias, DC Bias with Voltage Feedback; Bias Stabilization; Examples. (4 Hours)

**Biasing of FETs and MOSFETs:** Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

**MODULE – II** **(12 Hours)**

**Small Signal Analysis of BJTs:** Small-Signal Equivalent-Circuit Models; Small Signal Analysis of CE, CC, CB amplifiers. Effects of $R_S$ and $R_L$ on CE amplifier operation, Emitter Follower; Cascade amplifier, Darlington Connection and Current Mirror Circuits. (6 Hours)

**Small Signal Analysis of FETs:** Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifiers. Effects of $R_{SIG}$ and $R_L$ on CS Amplifier; Source Follower and Cascaded System. (6 Hours)

**MODULE – III** **(5 hours)**

**High Frequency Response of FETs and BJTs:** High Frequency equivalent models and frequency Response of BJTs and FETs; Frequency Response of CS Amplifier, Frequency Response of CE Amplifier. (5 Hours)

**MODULE – IV (9 hours)**

**Feedback amplifier and Oscillators:** Concepts of negative and positive feedback; Four Basic Feedback Topologies, Practical Feedback Circuits, Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits. (4 Hours)

**Operational Amplifier:** Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Non-inverting Configurations, Open-loop and Closed-loop Gains, Differentiator and Integrator, Instrumentation amplifier. (5Hours)

**Additional Module (Terminal Examination-Internal)** **(6 hours)**

Basic analysis of difference amplifier, Simulation of analog circuits i.e., different single and cascaded amplifier circuits, difference amplifier circuits and validating the theoretical parameters using PSpice and MULTISIM. Analysis op-amp IC circuits using LF411 and μA 741, Signal Generators using OPAMP: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation-introduction to analog simulation OPAMP as nonlinear element: comparator, Voltage controlled oscillator (VCO). Concept of Schmitt triggers circuit and sample/hold circuit using operational amplifier

**Text Books**

1. *Electronic Devices and Circuits theory, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi , 9th/10th Edition,2013. (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)*
2. *Milliman's Electronics Devices and Circuits, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd Edition,2008.*

**Reference Books**

1. *Microelectronics Circuits, Adel Sedra and Kenneth C Smith, Oxford University Press, New Delhi, 5th Edition, International Student Edition,2009. (Selected portion of Chapter 2,4, 5, 6, 8, 13, and 14)*
2. *Electronic Devices and Circuits, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, (For Problem Solving)*
3. *Electronics Circuits Analysis and Design, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition,2002.*
4. *Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi,2nd Edition.2004.*
5. *Microelectronic Circuits: Analysis and Design, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc. India Edition.*
6. *Electronic device and circuits, David A. Bell, Oxford University Press, 5thedition,2008.*
7. *Electronics devices and circuits, Anil.K.Maini, Wiley India Pvt.Ltd,2009*

## ANALOG ELECTRONICS CIRCUIT LAB

***List of Experiments***

**(At least 10 out of 12 experiments should be done)**

**1.** Design and simulate BJT bias circuit and compare the results.

***2.*** *Design and simulate JEET/MOSFET bias circuit and compare the results.*

***3.*** *Design and simulate BJT common-emitter circuit and compare D.C and A.C performance:*

***4.*** *Design and simulate JFET/MOSFET common-emitter circuit and compare D.C and A.C performance:*

***5.*** *Determining the frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response and compare with simulated results.*

***6.*** *Differential amplifiers circuits: D.C bias and A.C operation without and with current source.*

***7.*** *Study of Darlington connection and current mirror circuits.*

***8.*** *OP-Amp Frequency Response and Compensation.*

***9.*** *Application of Op-Amp as differentiator, integrator, square wave generator.*

***10.*** *Obtain the band width of FET/ BJT using Square wave testing of an amplifier.*

***11.*** *R.C phase shift oscillator/Wien-Bridge Oscillator using OP-Amp/Crystal Oscillator.*

***12.*** *Class A and Class B Power Amplifier.*

*3rd Semester*

## PET3I102 NETWORK THEORY

**Module- I** **[11 Hours]**

**University Portion (80%)**

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem.Coupled Circuits: Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling.

Resonance: Band Width and Q-factor for series and parallel resonant circuits.

**College/Institute Portion (20%):**

Electrical equivalent of magnetically Coupled Circuit, Tuned Couple Circuit: Single tuned and double tuned or related advanced topics as decided by the concerned faculty teaching the subject.

**Module- II** **[9 Hours]**

**University Portion (80%)**

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).

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 behavior from Pole-Zero plots.

**College/Institute Portion (20%):**

Necessary conditions for transfer function, natural response of a network, Routh Hurwitz criterion of stability of network function or related advanced topics as decided by the concerned faculty teaching the subject.

**Module- III** **[5 Hours]**

**University Portion (80%)**

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.

Passive Filter: Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response

**College/Institute Portion (20%):**

Active filter-Butterworth, Chebyshev filter or related advanced topics as decided by the concerned faculty teaching the subject.

**Module- IV** **[5 Hours]**

**University Portion (80%)**

Network Synthesis: Realizability concept, Hurwitz property, positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions in Foster and Cauer forms.

**College/Institute Portion (20%):**

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, Dual of a network or related advanced topics as decided by the concerned faculty teaching the subject.

**Text Book:**

1. *Fundamentals of Electric Circuits – Alexander & Sadiku – Tata McGraw Hil,5th Editionl.*
2. *Circuits & Networks: Analysis, Design and Synthesis- Sukhija & Nagsarkar- Oxford*

**Reference Book(s):**

1. *Network Analysis – M E Van Valkenburg – Pearson Education, 3rd Edition.*
2. *Network Synthesis – M E Van Valkenburg – Pearson Education.*
3. *Network Analysis and Synthesis – Franklin F. Kuo – Wiley Student Edition.*
4. *Linear Circuits Analysis and Synthesis – A Ramakalyan – Oxford University Press.*
5. *Problems & Solutions in Electric Circuit Analysis – Sivananda & Deepa – Jaico Book.*
6. *Theory and problem of electrical circuits, Schaum's Outline Series, TMH – Joseph A. Edminister, MahmoodMaqvi.*
7. *Electric Circuits – David A.Bell – Oxford, 7th Edition, 2015.*

## NETWORK THEORY LAB

**Select any 8 experiments from the list of 10 experiments**

1. *Verification of Network Theorems using AC circuits. (Superposition, Thevenin, Norton, Maximum Power Transfer).*
2. *Study of DC and AC Transients for R-L, R-C & R-L-C circuits using storage oscilloscope.*
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 using oscilloscope.*
9. *Study of resonance in R-L-C parallel circuit using oscilloscope.*
10. *Spectral analysis of a non-sinusoidal waveform.*

*3rd Semester*

# PET3I103 SIGNALS & SYSTEMS

**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: Cross correlation and Autocorrelation Sequences, Properties.

**MODULE – II (10 Hours)**

**The Continuous-Time Fourier Series:**
Basic Concepts and Development of the Fourier series; Calculation of the Fourier Series, Properties of the Fourier Series.

**The Continuous-Time Fourier Transform:**
Basic Concepts and Development of the Fourier Transform; Properties of the Continuous-Time Fourier Transform.

**MODULE- III (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; 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.

**MODULE- IV (6 Hours)**

**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.

**Additonal Module (Terminal Examination-Internal) (04 Hours)**

**Properties of Continuous-Time Systems:**
Block Diagram and System Terminology; System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality.

**Text Books**


1. *Digital Signal Processing – Principles, Algorithms and Applications, John. G. Proakis and Dimitris. G. Manolakis, 4th Edition, Pearson.*
2. *Fundamentals of Signals and Systems - M. J. Roberts, TMH*
3. *Signal & Systems by Tarun Kumar Rawat, Oxford University Press.*


**Reference Books**


1. *Signals and Systems - P. Ramakrishna. Rao, TMH.*
2. *Signals and Systems – A NagoorKani, TMH*
3. *Signals and Systems, Chi-Tsong Chen, Oxford*
4. *Principles of Signal Processing and Linear Systems, B.P. Lathi, Oxford.*
5. *Principles of Linear Systems and Signals, B.P Lathi, Oxford*

*3rd Semester*

## SIGNALS AND SYSTEMS LAB

**List of Experiments:**
**(At least 10 out of 15 experiments should be done)**

1. *Write a program to generate the discrete sequences (i) unit step (ii) unit impulse (iii) ramp (iv) periodic sinusoidal sequences. Plot all the sequences.*
2. *Find the Fourier transform of a square pulse .Plot its amplitude and phase spectrum.*
3. *Write a program to convolve two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.*
4. *Write a program to find the trigonometric Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.*
5. *Write a program to find the trigonometric and exponential Fourier series coefficients of a periodic rectangular signal. Plot the discrete spectrum of the signal.*
6. *Generate a discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.*
7. *The signal x (t) is defined as below. The signal is sampled at a sampling rate of 1000 samples per second. Find the power content and power spectral density for this signal.*

$$x(t) = \begin{cases} \cos(2\pi \times 47t) + \cos(2\pi \times 219t), & 0 \le t \le 10 \\ 0 & otherwise \end{cases}$$

8. *Write a program to find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.*
9. *Write a program to find the response of a low pass filter and high pass filter, when a speech signal is passed through these filters.*
10. *Write a program to find the autocorrelation and cross correlation of sequences.*
11. *Generate a uniformly distributed length 1000 random sequence in the range (0,1). Plot the histogram and the probability function for the sequence. Compute the mean and variance of the random signal.*
12. *Generate a Gaussian distributed length 1000 random sequence. Compute the mean and variance of the random signal by a suitable method.*
13. *Write a program to generate a random sinusoidal signal and plot four possible realizations of the random signal.*
14. *Generate a discrete time sequence of N=1000 i.i.d uniformly distributed random numbers in the interval (-0.5,-0.5) and compute the autocorrelation of the sequence.*
15. *Obtain and plot the power spectrum of the output process when a white random process is passed through a filter with specific impulse response*

*3rd Semester*

# PET3I104 DIGITAL ELECTRONICS

## *University Level:*

**MODULE – I (12 Hours)**

**Number System:** Introduction to various number systems and their Conversion. Arithmetic Operation using 1's and 2`s Compliments, Signed Binary and Floating Point Number Representation Introduction to Binary codes and their applications. (**5 Hours)**
**Boolean Algebra and Logic Gates**: Boolean algebra and identities, Complete Logic set, logic gates and truth tables. Universal logic gates, Algebraic Reductionand realization using logic gates **(3 Hours)**
**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. **(4 Hours)**

**MODULE – II** (14 Hours)

**Logic Components:** Concept of Digital Components, Binary Adders, Subtraction and Multiplication, An Equality Detector and comparator, Line Decoder, encoders, Multiplexers and De-multiplexers. **(5 Hours)**
**Synchronous Sequential logic Design:** sequential circuits, storage elements: Latches (SR, D), Storage elements: Flip-Flops inclusion of Master-Slave, characteristics equation and state diagram of each FFs and Conversion of Flip-Flops. Analysis of Clocked Sequential circuits and Mealy and Moore Models of Finite State Machines **(6 Hours)**
**Binary Counters :**Introduction, Principle and design of synchronous and asynchronous counters, Design of MOD-N counters, Ring counters. Decade counters, State Diagram of binary counters (4 hour)

**MODULE – III** (12 hours)

**Shift resistors**: Principle of 4-bit shift resistors. Shifting principle, Timing Diagram, SISO, SIPO ,PISO and PIPO resistors. (4 hour)
**Memory and Programmable Logic:** Types of Memories, Memory Decoding, error detection and correction), RAM and ROMs. Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices. **(5 Hours)**
**IC Logic Families:** Properties DTL, RTL, TTL, $I^2L$ and CMOS and its gate level implementation. A/D converters and D/A converters **(4 Hours)**
**College Level (20% )**
Basic hardware description language: Introduction to Verilog/VHDL programming language, Verilog/VHDL program of logic gates, adders, Substractors, Multiplexers, Comparators, Decoders flip-flops, counters, Shift resistors.
**Text book:**


1. *Digital Design, 3rd Edition, Moris M. Mano, Pearson Education.*
2. *Fundamentals of digital circuits, 8th edition, A. Anand Kumar, PHI*
3. *Digital Fundamentals, 5th Edition, T.L. Floyd and R.P. Jain, Pearson Education, New Delhi.*

**Reference Book:**

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

## DIGITAL ELECTRONICS LAB

**List of Experiments**:

(At least 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments at least 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 NANDGate.*
2. *Gate-level minimization: Two level and multi level implementation of Booleanfunctions.*
3. *Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segmentdisplay.*
4. *Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number ofGates.*
5. *Design with multiplexers andde-multiplexers.*
6. *Flip-Flop: assemble, test and investigate operation of SR, D & J-Kflip-flops.*
7. *Shift Registers: Design and investigate the operation of all types of shift registers with parallelload.*
8. *Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallelload.*
9. *Memory Unit: Investigate the behaviour of RAM unit and its storage capacity – 16 X 4 RAM: testing, simulating and memoryexpansion.*
10. *Clock-pulse generator: design, implement andtest.*
11. *Parallel adder and accumulator: design, implement andtest.*
12. *Binary Multiplier: design and implement a circuit that multiplies 4-bit unsigned numbers to produce a 8-bitproduct.*
13. *Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12*

*3rd Semester*

## PET3I001 SEMICONDUCTOR DEVICES(3-1-0)

**MODULE-I (10 Hours)**

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

**Electrons and Holes in semiconductors:** Silicon crystal structure; Donors and acceptors in the band model; electron effective mass; Density of states; Thermal equilibrium; and 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.

**MODULE-II (10 Hours)**

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

**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.

**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.

**MODULE-III (10 Hours)**

**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-IV (12 Hours)**

**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**.**

**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.

**Additonal Module (Terminal Examination-Internal) (06 Hours)**

**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. *Semiconductor Physics and Devices-Donald A. Neamen, Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition.*
2. *Solid State Electronics Devices-Ben. G. Streetman and Sanjay Banarjee, Pearson Education, New Delhi, 6th Edition.*

**Reference Books**

1. *Modern Semiconductor Devices for Integrated Circuits-Chenming Calvin Hu, Pearson Education/Prentice Hall, 2009.*
2. *Physics of Semiconductor Devices-S.M. Sze and Kwok K. Ng, Wiley India Pvt. Limited, New Delhi, 3rd Edition.*
3. *Physics of Semiconductor Devices-Dillip K. Roy, University Press (India) Pvt. Ltd., Hyderabad, 2nd Edition*
4. *Semiconductor Physics and Devices- Fowler, Oxford University Press.*
5. *Solid State Electronics Devices-D.K. Bhattacharya and Rajnish Sharma, Oxford University Press, New Delhi, 2nd Edition*
6. *Fundamentals of Semiconductor Devices-M.K. Achuthan and K.N. Bhatt, Tata McGraw Hill Publishing Company Limited, New Delhi.*

*3rd Semester*

## PEK3E001 ENGINEERING ECONOMICS

***Theory L/T (Hours per week):2/1, Credit: 3***

**Module I (12 hours)**

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved ), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale

**Module II (12 hours)**

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

**Module III (12 hours)**

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects .

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

**Text Books**


1. *Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India*
2. *Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.*
3. *Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson*
4. *R.Paneer Seelvan, " Engineering Economics", PHI*
5. *Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd*
6. *Jhingan,M.L., "Macro Economic Theory"*
7. *Macro Economics by S.P.Gupta, TMH*

*3rd Semester*

## POB3E002 ORGANIZATIONAL BEHAVIOUR

## Credit- 3 Class Hours - 40

**Objectives:**

1. To develop an understanding of the behavior of individuals and groups inside organizations
2. To enhance skills in understanding and appreciating individuals, interpersonal, and group process for increased effectiveness both within and outside of organizations.
3. To develop theoretical and practical insights and problem-solving capabilities for effectively managing the organizational processes.

| Unit | Contents | Class Hours |
|---|---|---|
| 01 | **Fundamentals of OB**: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB. | 6 |
| 02 | **Attitude:** Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes.<br>**Personality and values:** Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications.<br>**Perception:** Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).<br>**Motivation:** Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation. | 10 |

| | | |
|---|---|---|
| **03** | **Foundations of Group Behavior:** The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development.<br><br>**Managing Teams:** Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building.<br><br>**Leadership:** Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders. | **9** |
| **04** | **Organizational Culture** : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality. | **8** |
| **05** | **Organizational Change:** Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change.<br><br>Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change & Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization. | **7** |

**Reference Books**


1. *Understanding Organizational Behaviour, Parek, Oxford*
2. *Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.*
3. *Organizational Behaviour, K. Awathappa,HPH.*
4. *Organizational Behaviour, VSP Rao, Excel*
5. *Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.*
6. *Organizational Behaviour, Hitt, Miller, Colella, Wiley*

*3rd Semester*

## HONOURS SUBJECT
## PET3D001 PROBABILITY AND RANDOM PROCESSES(4-0-0)

**MODULE-I (06 Hours)**

**Probability:** Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events:

**MODULE-II (08 Hours)**

**The Random Variable :** Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties.

**MODULE-III (08 Hours)**

**Operation on one Random Variable:** Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable, Transformation of a Discrete-Random-Variable.

**MODULE-IV (10 Hours)**

**Multiple Random Variables:** Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal-Distributions.

**Additonal Module (Terminal Examination-Internal) (10 Hours)**

**Operations on Multiple Random Variables:** Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations-of-Gaussian-Random-Variables.

**Text Books**

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.

**Reference Books**

1. *Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.*
2. *Communication Systems Analog & Digital – R.P. Singh and S.D. Sapre, TMH, 1995.*
3. *Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.*
4. *Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem,Oxford,3rdEdition,1999.*
5. *Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.*
6. *Fundamentals of applied Probability and Random Processes-Oliver C. Ibe, Elsevier Academic press.*
7. *Probability& Random Processes for Electrical Engineering" by Alberto Leon-Garcia, Pearson education, 2nd editi*

*3rd Semester*

## PET3G001 ANALOG ELECTRONICS CIRCUIT Minor Subject)

**MODULE – I** **(12 Hours)**

**MOS Field-Effect Transistor:** Principle and Operation of FETs and MOSFETs; P-Channel and N-Channel MOSFET; Complimentary MOS; V-I Characteristics of E- MOSFET and D-MOSFET; MOSFET as an Amplifier and as a Switch. (4 Hours)

**Biasing of BJTs:** Load lines (AC and DC); Operating Points; Fixed Bias and Self Bias, DC Bias with Voltage Feedback; Bias Stabilization; Examples. (4 Hours)

**Biasing of FETs and MOSFETs:** Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design (4 Hours)

**MODULE – II** **(12 Hours)**

**Small Signal Analysis of BJTs:** Small-Signal Equivalent-Circuit Models; Small Signal Analysis of CE, CC, CB amplifiers. Effects of $R_S$ and $R_L$ on CE amplifier operation, Emitter Follower; Cascade amplifier, Darlington Connection and Current Mirror Circuits. (6 Hours)

**Small Signal Analysis of FETs:** Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifiers. Effects of $R_{SIG}$ and $R_L$ on CS Amplifier; Source Follower and Cascaded System. (6 Hours)

**MODULE – III** **(5 hours)**

**High Frequency Response of FETs and BJTs:** High Frequency equivalent models and frequency Response of BJTs and FETs; Frequency Response of CS Amplifier, Frequency Response of CE Amplifier. (5 Hours)

**MODULE – IV (9 hours)**

**Feedback amplifier and Oscillators:** Concepts of negative and positive feedback; Four Basic Feedback Topologies, Practical Feedback Circuits, Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits. (4 Hours)

**Operational Amplifier:** Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Non-inverting Configurations, Open-loop and Closed-loop Gains, Differentiator and Integrator, Instrumentation amplifier. (5Hours)

**Additional Module (Terminal Examination-Internal)** **(6 hours)**

Basic analysis of difference amplifier, Simulation of analog circuits i.e., different single and cascaded amplifier circuits, difference amplifier circuits and validating the theoretical parameters using PSpice and MULTISIM. Analysis op-amp IC circuits using LF411 and μA 741, Signal Generators using OPAMP: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation-introduction to analog simulation OPAMP as nonlinear element: comparator, Voltage controlled oscillator (VCO). Concept of Schmitt triggers circuit and sample/hold circuit using operational amplifier

**Text Books**

1. *Electronic Devices and Circuits theory, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi , 9th/10th Edition,2013. (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)*
2. *Milliman's Electronics Devices and Circuits, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd Edition,2008.*

**Reference Books**

1. *Microelectronics Circuits, Adel Sedra and Kenneth C Smith, Oxford University Press, New Delhi, 5th Edition, International Student Edition,2009. (Selected portion of Chapter 2,4, 5, 6, 8, 13, and 14)*
2. *Electronic Devices and Circuits, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, (For Problem Solving)*
3. *Electronics Circuits Analysis and Design, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition,2002.*
4. *Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi,2nd Edition.2004.*
5. *Microelectronic Circuits: Analysis and Design, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc. India Edition.*
6. *Electronic device and circuits, David A. Bell, Oxford University Press, 5thedition,2008.*
7. *Electronics devices and circuits, Anil.K.Maini, Wiley India Pvt.Ltd,2009*

| Fourth Semester | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Theory | | | | | | Practical | | |
| **Code** | **Course Name** | | **Hours/ week L/T** | **Credit Theory** | **University Marks** | **Internal Evaluation** | **Hours/ Week L/T** | **Credit Practical** | **Marks** |
| HS | Purely Applied Mathematics for Specific Branch of Engineering | | 3-0 | 3 | 100 | 50 | | | |
| PC | Electromagnetics Engg. | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Electrical Machines & Power Devices | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Electrical & Electronics Measurements | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Microprocessors & Microcontrollers | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| HS | Engineering Economics/ Organizational Behavior | | 2-1 | 3 | 100 | 50 | | | |
| | *Skill Project and Hands on | | | | | | 6 | 3 | 100 |
| Total | | | 18 | 18 | 600 | 300 | 14 | 7 | 300 |
| Total Marks: 1200 | | | | | | | | | |
| Total Credits: 25 | | | | | | | | | |
| Honours | | Audio and Video Engineering | 4 | 4 | 100 | 50 | | | |
| Minor | | Digital Electronic Circuits | | | | | | | |

Semester : 4th

| | | | | | |
|---|---|---|---|---|---|
| 1. | PET4D001 | Honours(CP) | Audio and Video Engineering | 4-0-0 | 4 |
| 2. | PET4E001 | HS(CP) | Purely Applied Mathematics for Specific Branch of Engineering | 3-0-0 | 3 |
| 3. | PEK4E002 | HS(O1) | Engineering Economics | 3-0-0 | 3 |
| 4. | POB4E003 | HS(O1) | Organizational Behavior | 3-0-0 | 3 |
| 5. | PET4G001 | Minor(CP) | Digital Electronic Circuits | 4-0-0 | 4 |
| 6. | PET4I101 | PC(CP) | Electromagnetics Engineering | 3-0-1 | 4 |
| 7. | PET4I102 | PC(CP) | Electrical Machines & Power Devices | 3-0-1 | 4 |
| 8. | PET4I103 | PC(CP) | Electrical & Electronics Measurement | 3-0-1 | 4 |
| 9. | PET4I104 | PC(CP) | Microprocessor & Microcontroller | 3-0-1 | 4 |
| 10. | PET4I201 | PC(CP) | Skill Project and Hands on | 0-0-3 | 3 |
| | | | | | 29 |

*4th semester*

## PET4I101 ELECTROMAGNETICS ENGINEERING

**Module-I (10 Hours)**

1. Cartesian, Cylindrical and Spherical Coordinate Systems; Scalar and Vector Fields; Line, Surface and Volume Integrals.
2. Coulomb's Law; The Electric Field Intensity; Electric Flux Density and Electric Flux; Gauss's Law; Divergence of Electric Flux Density: Point Form of Gauss's Law; The Divergence Theorem; The Potential Gradient; Energy Density; Poisson's and Laplace's Equations.
3. Ampere's Magnetic Circuital Law and its Applications; Curl of H; Stokes' Theorem; Divergence of B; Energy Stored in the Magnetic Field.

**Module-II (8 Hours)**

1. The Continuity Equation; Faraday's Law of Electromagnetic Induction; Conduction Current: Point Form of Ohm's Law, Convection Current; The Displacement Current;
2. Maxwell's Equations in Differential Form; Maxwell's Equations in Integral Form; Maxwell's Equations for Sinusoidal Variation of Fields with Time; Boundary Conditions; The Retarded Potential; The Poynting Vector; Poynting Vector for Fields Varying Sinusoid ally with Time

**Module-III (8 Hours)**

1. Solution of the One-Dimensional Wave Equation; Solution of Wave Equation for Sinusoid ally Time-Varying Fields; Polarization of Uniform Plane Waves; Fields on the Surface of a Perfect Conductor; Reflection of a Uniform Plane Wave Incident Normally on a Perfect Conductor and at the Interface of Two Dielectric Regions; The Standing Wave Ratio; Oblique Incidence of a Plane Wave at the Boundary between Two Regions; Oblique Incidence of a Plane Wave on a Flat Perfect Conductor and at the Boundary between Two Perfect Dielectric Regions;

**Module-IV (8 Hours)**

1. Types of Two-Conductor Transmission Lines; Circuit Model of a Uniform Two-Conductor Transmission Line; The Uniform Ideal Transmission Line; Wave Reflection at a Discontinuity in an Ideal Transmission Line; Matching of Transmission Lines with Load.

**Additional Module (Terminal Examination-Internal) (8 Hours)**

1. Formulation of Field Equations; Wave Types; the Parallel-Plate Waveguide; the Rectangular Waveguide.
2. Radiation Properties of a Current Element; Radiation Properties of a Half-Wave Dipole; Yagi–Uda Antenna; the Parabolic Reflector Antenna.
3. The Vector Magnetic Potential; Energy stored in a capacitor, Graphical field mapping; Continuity of Current in a Capacitor; Critical Angle of Incidence and Total Reflection; Brewster Angle.

**Text Books**

1. *Principles of Electromagnetic, S.C. Mahapatra, S. Mahapatra, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015.*
2. *Principles of Electromagnetics, Mathew N.O. Sadiku & S.V. Kulkarni., Oxford University Press, 6th edition,2009.*
3. *Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, Pearson Education, New Delhi, 2nd Edition,2009.*
4. *Engineering Electromagnetic Essentials, B. N. Basu, University Press.*

## Reference Books

1. *Engineering Electromagnetic, William H. Hayt & J. Buck, Tata McGraw Hill Publishing Company Ltd., New Delhi, 7th Edition,2006*
2. *Electromagnetic, Joseph A. Edminister, adapted by Vishnu Priye, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition.*
3. *Fundamentals of Electromagnetic for Engineering, First Impression, N. N. Rao, Pearson Education, New Delhi, 2009.*
4. *Fields and Waves in Communication Electronics, Simon Ramo, Wiley Publication, 3ed, 2007.*
5. *Electromagnetic Field Theory, Bhag Singh Guru, Cambridge Publication,3rd Edition, 2011.*

*4th semester*

## PET4I102 ELECTRICAL MACHINES AND POWER DEVICES

**Module- I(10 Hours)**

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.

**Module-II(8 Hours)**

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, Brushless motors; Motor drive circuits.

**Module-III (10 Hours)**

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-IV (10 Hours)**

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.

**Additional Module (Terminal Examination-Internal) (6 Hours)**

8. **POWER SEMICONDUCTOR DEVICES:** Switching and V-I characteristic of devices Thyristor family: SCR, DIAC, TRIAC, GTO; Different Triggering Methods of SCR.

**Text Book**

1. *Electric Machines, D P Kothari & I J Nagrath, Tata McGraw Hill, 4th edition,7 July 2010.*
2. *Electrical Machine, J.B.Gupta, S K Kataria and Sons publications, Reprint 2012 edition, 2012.*
3. *Electrical Machinery, P S Bimbhra, Khanna Publishers, 7th edition, 2009.*
4. *Power Electronics: Circuits, Devices and Applications, M H Rashid, Pearson Education, 4th edition.*

**Reference Books**

1. *Electrical Machine, Ashfaq Husain, Dhanpat Rai and Co. Publisher, 2nd edition, 2014.*
2. *Electrical Machines, Smarajit Ghosh, Pearson Education, 2nd edition. 2012*
3. *A Textbook of Electrical Technology: volume2 AC and DC machines, B.L. Theraja and A.K. Theraja, S. Chand publications, 1st June 2006.*
4. *Electrical Machines, Krishna Reddy, Scitech Publication.*
5. *Electric Machines and Drives, Ned Mohan, Wiley Publication,2013.*

## PET4I103 ELECTRICAL AND ELECTRONICS MEASUREMENTS

**Module-I (6 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.

**Module-II (8 Hrs)**

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 (Mega ohm meter), 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, and Anderson Bridges), Measurement of Mutual Inductance by Felici's Method. (c) Capacitance: Measurement of Capacitance by Ammeter and Voltmeter, and AC Bridges (Owen's, Schering & Wien's Bridge), Screening of Bridge Components and Wagnor Earthing Device.

**Module- III (10 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.
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:** Principle of operation of DC Potentiometers (Crompton, Vernier, Constant Resistance and Deflectional Potentiometer); AC Potentiometers (Drysdale-Tinsley and Gall-Tinsley Potentiometer).

**Module- IV (12 Hrs)**

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 Watt meters, (b) Single Phase and Poly Phase Induction Type Watt-hour meters, (c) Frequency Meters, and (d) Power Factor Meters.
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.

**Additional Module (Terminal Examination- Internal) (8 Hrs.)**

9. **Oscilloscope**: 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, E.W Golding & F.C Widdis, Reem Publication, 5th Edition, (For sections 2 to 6: Selected Portions from Ch.-VI, VII, IX, XIX, XX, XXI & XXII).*
2. *Modern Electronic Instrumentation and Measurement Techniques, Albert D Helfrick & W. D Cooper, 2nd Edition Phi Learning (For sections 1, 7 to 9: Selected Portions from Ch.-1, 3, 6, 7, 9, 10, and 13).*
3. *Electronic Instrumentation and Measurements, David A. Bell, Oxford university press,3rd edition.*

**Reference Book(s)**

1. *A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Puneet Swhney, Dhanpat Rai & Co, 2013*
2. *Electronic Instrumentation, H C Kalsi, Tata McGraw Hill, 2nd Edition*
3. *Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, Pearson Education. 3rd Edition,*
4. *Electronic Measurement and Instrumentation, B. M. Oliver & J. M. Cage, Tata McGraw Hill.*
5. *Electrical Measurements, Krishna Reddy, Scitech Publication.*

*4th semester*

## PET4I104 MICROPROCESSORS AND MICROCONTROLLERS

**Module-I (10 Hours)**

1. **Introduction to 8 bit and 16 bit Microprocessors-H/W architecture**
   Introduction to microprocessor, computer and its organization, Programming system; Address bus, data bus and control bus, Tristate bus; clock generation; Connecting Microprocessor to I/O devices; Data transfer schemes; Architectural advancements of microprocessors. Introductory System design using microprocessors; 8086 – Hardware Architecture; External memory addressing; Bus cycles; some important Companion Chips; Maximum mode bus cycle; 8086 system configuration; Memory Interfacing; Minimum mode system configuration, Interrupt processing.

**Module -II (11 Hours)**

1. **16-bit microprocessor instruction set and assembly language programming:**
   Programmer's model of 8086; operand types, operand addressing; assembler directives, instruction Set-Data transfer group, Arithmetic group, Logical group.

**Module-III(12 Hours)**

2. **Microprocessor peripheral interfacing:**
   Introduction; Generation of I/O ports; Programmable Peripheral Interface (PPI)-Intel 8255; Sample-and-Hold Circuit and Multiplexer; Keyboard and Display Interface; Keyboard and Display Controller (8279).

**Module-IV (11 Hours)**

3. **8-bit microcontroller- H/W architecture instruction set and programming:**
   Introduction to 8051 Micro-Controllers, Architecture; Memory Organization; Special Function register; Port Operation; Memory Interfacing, I/O Interfacing; Programming 8051 resources, interrupts; Programmer's model of 8051; Operand types, Operand addressing; Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions; Programming.

**Additional Module (Terminal Examination-Internal) (6 Hours)**

**5.** 8086: Maximum mode system configuration, Direct memory access, Interfacing of D-to-A converter, A-to-D converter, CRT Terminal Interface, Printer Interface, Programming of 8051 timers, 8051 serial interface.

**Text Book(s)**


1. *Microprocessor Architecture, Programming and application with 8085, R.S. Gaonkar, PRI Penram International publishing PVT. Ltd., 5th Edition*
2. *Microprocessors and Interfacing, Programming and Hardware, Douglas V Hall, TMH Publication, 2006.*
3. *Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, S. Jeevananthan and S.K. Shah, Oxford University Press.*
4. *The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.M C Kinlay, Pearson Education, Second Edition, 2008.*

**Reference Book(s)**

1. *Microcontrollers: Principles and Application, Ajit Pal, PHI Publication*
2. *Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096, Krishna Kant, PHI Publication, 2007.*
3. *Advanced Microprocessors and Peripherals, A.K. Ray, K M Bhurchandi, TMH Publication, 2007.*
4. *Textbook of Microprocessor and Microcontroller, Thyagarajan, Scitech Publication.*

## HONOURS SPECIALIZATION:

## PET4D001 AUDIO & VIDEO ENGINEERING

**Module I (10 Hours)**

1. **Fundamentals of Colour Television**
   Color TV systems, fundamentals; mixing of colours; colour perception; chromaticity diagram; NTSC, PAL, SECAM systems; colour TV transmitter; (high level, low level); colour TV receivers; remote control; Fault finding and servicing equipments like Wobbuloscope; TV Pattern Generator and Field Strength meter.

**Module II (10 Hours)**

1. **Digital TV and Display Devices**
   Introduction to Digital TV; Digital TV signals and parameters; Digital TV Transmitters, MAC signals, advanced MAC signal transmission; Digital TV receivers; Basic principles of Digital Video compression techniques, MPEG Standards; Digital TV recording techniques; Display devices: LED, LCD, TFT, Plasma.

**Module III (10 Hours)**

2. **HDTV**
   HDTV standards and systems, HDTV transmitter and receiver/encoder; Digital TV satellite Systems; video on demand; CCTV, CATV, direct to home TV, set top box with recording facility, conditional access system (CAS), 3D TV systems; Digital broadcasting; case study (Cricket match, Marathon, Football match).

**Module IV (10 Hours)**

3. **Fundamentals of Audio-Video Recording**
   Methods of sound recording & reproduction, optical recording, CD recording; audio standards, Digital Sound Recording; CD/ DVD player, MP3 player, Blue Ray DVD Players, MPEG, MP3Player.
4. **Fundamentals of Acoustics**
   Studio acoustics and reverberation; P.A. system for auditorium; acoustic chambers; Cordless microphone system; special types of speakers & microphones; Digital Radio Receiver Satellite radio reception.

**Additional Module (Terminal Examination-Internal) (10 Hours)**

**5. Advanced TV Systems**

IP Audio and Video, IPTV systems, Mobile TV; Video transmission in 3G mobile System; IPod (MPEG4 Video player); Digital Video Recorders, Personal Video Recorders; Wi-Fi Audio /Video Transmitter and Receivers; Video Projectors, HD Video projectors; Video Intercom systems/ Video door phones.

**Text Books**

**1.** Television and Video Engineering, A. M Dhake, Tata McGraw Hill, 2nd edition, 2003.
**2.** Video Demystified, Keith jack, Penram International Publication.
**3.** Audio Video Systems, R.G. Gupta, TMH Publication, 2nd edition, 2010.

**Reference Books**

**1.** Color Television Theory and Practice, S. P. Bali, Tata McGraw Hill, 1st edition, 1994.
**2.** Basic TV and Video Systems, Bernard Grob, Charles E Herndon, TMH, 6th edition, 1998.
**3.** Modern Television Practice-Principles, Technology and Servicing, R R Gulati, New Age International Publisher, 2nd edition, 2004.
**4.** Television Engineering: Audio and Video Systems, D.S. Bormane, Wiley Publication,2015.
**5.** Speech and Audio Processing, Shaila D. Apte, Wiley Publication,2012.
**6.** Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Ben Gold, Wiley Publication,2006.

## ELECTROMAGNETICS ENGINEERING LAB

## (08 Experiments from the following list)

1. *Wave-propagation in conductors and dielectrics using HFSS/CST/MATLAB.*
2. *Current and charge flow of electromagnetic wave in a rectangular waveguide using HFSS/CST/MATLAB.*
3. *Uniform Plane Wave Propagation in an Arbitrary Direction*
4. *Transverse Electric Waves in a Parallel-Plate Waveguide*
5. *To calculate Dispersion and Group Velocity*
6. *To design Rectangular Waveguide*
7. *To design cavity Resonator*
8. *To show the modes of a rectangular waveguide using HFSS.*
9. *To show azimuth and elevation patterns*
10. *To show the input and output impedence*
11. *SWR measurements of rectangular waveguide*
12. *Reflection of plane waves*

*HFSS – High Frequency Structure Simulator
*CST- Computer Simulation Tool

*4th semester*

## ELECTRICAL MACHINES AND POWER DEVICES LAB

**(08 Experiments from the following list)**

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*
11. *Study of the V-I characteristics of SCR, TRIAC and DIAC*

## ELECTRICAL AND ELECTRONICS MEASUREMENTS LAB

**(08 Experiments from the following list)**

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. *Design a digital voltmeter using signal processing circuit, ADC and display*
11. *Study of Spectrum Analyzers*

*4th semester*

## MICROPROCESSORS AND MICROCONTROLLERS LAB

## (08 Experiments from the following list)

1. *Programs for 16 bit arithmetic operations using 8086.*
2. *Programs for Sorting and Searching (Using 8086).*
3. *Programs for String manipulation operations (Using 8086).*
4. *Programs for Digital clock and Stop watch (Using 8086).*
5. *Interfacing ADC and DAC.*
6. *Parallel Communication between two MP Kits using Mode 1 and Mode 2 of 8255.*
7. *Interfacing and Programming 8279, 8259, and 8253.*
8. *Serial Communication between two MP Kits using 8251.*
9. *Interfacing and Programming of Stepper Motor and DC Motor Speed control.*
10. *Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051microcontroller.*
11. *Programming and verifying Timer, Interrupts and UART operations in 8051*
12. *Communication between 8051 Microcontroller kit and PC.*
13. *A design problem using 8051 (A problem like multi-parameter data acquisition system, voltmeter, power meter, frequency counter, traffic simulation, digital clock, etc)*

| Fifth Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Theory | | | | | Practical | | |
| **Code** | **Course Name** | **Hours/ week L/T** | **Credit Theory** | **University Marks** | **Internal Evaluation** | **Hours/ week L/T** | **Credit Practical** | **Marks** |
| PC | Control Systems | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Digital signal Processing | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | Analog Communication | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PE | Fiber Optics & Optoelectronics Devices/Computer Architecture & Organization /Power Electronics/Electromagnetic Interference & Compatibility /Sensors & Transducers/Object Oriented Programming/Advanced Analog Electronic Circuits | 3-1 | 4 | 100 | 50 | | | |
| OE | JAVA Programming/Digital VLSI Design/Digital System design/Brain Computer Interfacing/ Optimization in Engineering | 3-1 | 4 | 100 | 50 | | | |
| PC | Advance Lab-I(VLSI & Embedded System Lab) | | | | | 8 | 4 | 200 |
| Total | | 17 | 17 | 500 | 250 | 14 | 7 | 350 |
| Total Marks: 1100 | | | | | | | | |
| Total Credits: 24 | | | | | | | | |
| Honours | Electronic Devises & Modeling | 4 | 4 | 100 | 50 | | | |
| Minor | Analog and Digital Communication | | | | | | | |

Semester : 5th

| | | | | | |
|---|---|---|---|---|---|
| 1. | PET5D001 | Honours(CP) | Electronic Devises & Modeling | 4-0-0 | 4 |
| 2. | PET5G001 | Minor(CP) | Analog and Digital Communication | 4-0-0 | 4 |
| 3. | PET5H001 | OE(O2) | JAVA Programming | 4-0-0 | 4 |
| 4. | PET5H002 | OE(O2) | Digital VLSI Design | 4-0-0 | 4 |
| 5. | PET5H003 | OE(O2) | Digital System design | 4-0-0 | 4 |
| 6. | PET5H004 | OE(O2) | Brain Computer Interfacing | 4-0-0 | 4 |
| 7. | PET5H005 | OE(O2) | Optimization in Engineering | 4-0-0 | 4 |
| 8. | PET5I101 | PC(CP) | Control Systems | 3-0-1 | 4 |
| 9. | PET5I102 | PC(CP) | Digital signal Processing | 3-0-1 | 4 |
| 10. | PET5I103 | PC(CP) | Analog Communication | 3-0-1 | 4 |
| 11. | PET5I201 | PC(CP) | Advance Lab - I (VLSI & Embedded System Lab) | 0-0-4 | 4 |
| 12. | PET5J001 | PE(O3) | Fiber Optics & Optoelectronics Devices | 4-0-0 | 4 |
| 13. | PET5J002 | PE(O3) | Computer Architecture & Organization | 4-0-0 | 4 |
| 14. | PET5J003 | PE(O3) | Power Electronics | 4-0-0 | 4 |
| 15. | PET5J004 | PE(O3) | Electromagnetic Interference & Compatibility | 4-0-0 | 4 |
| 16. | PET5J006 | PE(O3) | Sensor & Transducers | 4-0-0 | 4 |
| 17. | PET5J007 | PE(O3) | Object Oriented Programming | 4-0-0 | 4 |
| 18. | PET5J008 | PE(O3) | Advanced Analog Electronic Circuit | 4-0-0 | 4 |
| | | | | | 28 |

## PET5I101 PROFESSIONAL COURSE (PC)
## CONTROL SYSTEMS

### Module-I

1. **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 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.
2. **Feedback characteristics of Control Systems:** Effect of negative feedback on sensitivity, bandwidth, Disturbance, linearizing effect of feedback, Control Components: D.C. Servomotors.

### Module-II

3. **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.
4. **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.

### Module-III

5. **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.
6. **Stability in frequency domain:** Principle of argument, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system.

### Module – IV

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

## Additional Module (Terminal Examination-Internal)

9. **Control Components**: A.C. Servomotors, A.C. Tachometer, Synchros, Stepper Motors.
10. **Feedback characteristics of Control Systems:** Regenerative feedback.
11. **Root locus Technique:** Systems with transportation lag. Effect of adding open loop poles and zeros on Root locus.

## Text Books

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

## Reference Books

1. Design of Feedback Control Systems, R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Oxford University Press, Fourth Edition (2009).
2. Control Systems (Principles and Design),M. Gopal, TMH,3rd edition (2008).
3. Analysis of Linear Control Systems, R.L. Narasimham, I.K. International Publications,2008
4. Principles of Control Systems, S.P. Eugene Xavier and J. Josheph Cyril Babu, S. Chand Co. Ltd, 2006.
5. Control Systems, A Nagoorkani, RBA Publication.
6. Control Systems, N.C. JAGAN, BSP BOOKS PVT LTD,3rd edition.

## CONTROL AND INSTRUMENTATION LAB

## (At least 10 experiments should be done)

### List of Experiments:

**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 analyze 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.

## PET5I102 DIGITAL SIGNAL PROCESSING

**MODULE – I**

1. **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.

2. **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, The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

**MODULE – II**

3. **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.

4. **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.

**MODULE- III**

5. **Efficient Computation of the DFT: Fast Fourier Transform Algorithm**
   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.

**MODULE – IV**

6. **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.

## Additional Module (Terminal Examination-Internal)

1. **The Z-Transform and Its Application to the Analysis of LTI Systems:**Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations.
2. **The Discrete Fourier Transform: Its Properties and Applications:**Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT.
3. **Efficient Computation of the DFT:** Use of the FFT Algorithm in Linear Filtering and Correlation.

## Text Books

1. Digital Signal Processing Principles, Algorithms and Applications, J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press.

## Reference Books

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, TMH.
4. Digital Signal Processing: A Modern Introduction, Ashok K Ambardar, Cengage Learning.
5. Modern Digital Signal Processing, Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications, Li Tan, Jean Jiang, 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.

## DIGITAL SIGNAL PROCESSING LAB

## (At least 10 experiments should be done)

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 save using MATLAB.

    (ii) Implementation of noise cancellation using adaptive filters on a DSP kit.

# PET5I103 ANALOG COMMUNICATION (3-0-2)

**MODULE-I**

1. **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.
2. **RANDOM VARIABLES AND PROCESSES:** Probability, Random variables, Useful Probability Density functions, Useful Properties and Certain Application Issues.
3. **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.

**MODULE-II**

4. **ANGLE MODULATION:** Angle Modulation, Tone Modulated FM Signal, Arbitrary Modulated FM signal, FM Modulators and Demodulators, Approximately Compatible SSB Systems.
5. **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, Digital Representation of Analog Signal

**MODULE-III**

6. **MATHEMATICAL REPRESENTATION OF NOISE:** Some Sources of Noise, Frequency-domain Representation of Noise, Superposition of Noises, Linear Filtering of Noise.
7. **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).

**MODULE-IV**

8. **NOISE IN FREQUENCY MODULATION SYSTEM:** An FM Receiving System, Calculation of Signal to Noise Ratio, Comparison of FM and AM, Pre emphasis and De-emphasis and SNR Improvement, Noise in Phase Modulation and Multiplexing Issues, The FM Demodulator using Feedback (FMFB).

**Additional Module (Terminal Examination-Internal)**

1. AMPLITUDE MODULATION SYSTEMS:Radio Transmitter and Receiver.
2. PULSE MODULATION: Pulse Width Modulation and Pulse Position Modulation.
3. SYSTEM NOISE IN FREQUENCY MODULATION:Threshold in Frequency Modulation, Calculation of Threshold in an FM Discriminator.

**Text Books**

**1.** Principles of Communication System, H. Taub, D. L Schilling, G. Saha, Tata McGraw Hill, 3rd Edition, 2008.

**2.** Modern Digital and Analog Communication Systems, B.P. Lathi,Zhi Ding, Oxford University Press, 4th edition 2010.

**Reference Books**


1. Communication System Engineering, MasoudSalehi, John G. Proakis, PHI, Pearson Education, Second Edition 2002.
2. Analog Communication, V. Chandra Sekar, Oxford University Press 2010.
3. Communication Systems S.Haykin, john Wiley& sons 4th edition 2001.
4. Communication Systems, B. P.Lathi, BS Publications, 2001.


## ANALOG COMMUNICATION LAB

## (At least 10 experiments should be done)

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 1 KHz, 10 KHz, 50 KHz, 100KKz and 1 MHz.
2. Analyze the process of frequency division multiplexing and frequency division de-multiplexing.
3. Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SSBSC)
4. Study of FM modulation and Demodulation Techniques.
4. Observer the process of PAM, quantization and determination of quantization noise.
5. Multiplex 2-4 PAM/ PPM and PWM signals.

6. Using MATLAB/ LABVIEW 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.
7. Using MATLAB/ LABVIEW 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.
8. Using Lab-View software simulates AM modulation and demodulation system.
9. Using Lab-View software simulate FM modulation and demodulation system.
10. Design a receiver to demodulate and receive the signal from AM radio station.
11. Design a receiver to demodulate and receive the signal from the local FM radio station.

**(**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)

***PROFESSIONAL ELECTIVES (PE):***

## PET5J001 FIBER OPTICS AND OPTOELECTRONIC DEVICES

MODULE- I

1. 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

MODULE-II

2. 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.

MODULE- III

3. Optoelectronic Detector, PIN AND APD, Responsivity, Band width, Detector noise equivalent circuit and SNR calculation.
4. Optoelectronic Modulators, Basic principle, Electro optic and Acoustoptic modulators.

MODULE – IV

5. Optical Amplifier, Semiconductor optical Amplifier and Erbium Doped Fiber Amplifier.

Additional Module (Terminal Examination-Internal)

1. WDM components-couplers, isolators, circulators, filters. Optical switching-self electro optic effect Device, switching speed and energy

Text Books

1. Optical Fiber Communications, Keiser G, Tata McGraw Hill Education Private Limited, 4th Edition.
2. Optical Fiber Communication Principles and practice, Senior J, Prentice Hall of India.
3. Fiber optics and Optoelectronics, R.P.Khare, Oxford University Press.
4. Fiber-Optic Communication Systems, G P Agarwal,4th edition, John wiley& sons publication, 2011.

Reference Books

1. Fiber optic communications, Joseph C Palais, fourth edition, Pearson Education.
2. Semiconductor Optoelectronic Devices, PallabBhatttacharya, second edition, Pearson Education.

## PET5J002 COMPUTER ARCHITECTURE AND ORGANISATION

**MODULE-I**

1. **Introduction**

   Computing and Computers, Evolution of Computers, VLSI, System Design- Register Level, Processor Level, CPU Organization, Data Representation, Fixed – Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types. Addressing modes.

2. Fixed Point Arithmetic, Addition, Subtraction, Multiplication and division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth's algorithm, non-restoring division algorithm, Floating Point Arithmetic, Coprocessor, Pipeline Processing, Pipeline Design, Modified booth's Algorithm.

**MODULE-II**

3. **Control Design**

   Hardwired Control, Micro programmed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, Superscalar Processing, Nano Programming

**MODULE–III**

4. **System Organization**

   Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, operation systems, multiprocessors, fault tolerance.

**MODULE –IV**

5. **Memory Organization**

   Random access memories, serial-access memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory

**Additional Module (Terminal Examination-Internal)**

1. **System Organization:** RISC and CISC processors, Superscalar and vector processor.

**Textbooks**


1. Computer System Architecture,M Morris, R Mano, Prentice-Hall of India, 2000
2. Computer architecture and Organisation,John P. Hayes, Tata McGraw-Hill, Third edition, 1998.
3. Computer Organisation, V.CarlHamacher, Zvonko G. Varanesic and Safwat G. Zaky, Fifth edition, McGraw-Hill Inc, 1996.
4. Computer architecture and Organisation, S.R Sarangi,Tata McGraw-Hill, First edition, 2015.
5. Computer Organisation and Design, David A Patterson and John L Hennessy, 4th edition.


**References Books**


1. Computer Architecture,BParhami, Oxford University Press, BEH 2002.
2. Computer Organization and Design, P.PalChaudhuri, 2nd edition,PHI,2007

# PET5J003 POWER ELECTRONICS

**MODULE-I**

1. **Power electronics devices:**
   Characteristics of power devices – characteristics of SCR, diac, triac, SCS, GTO, PUJT, power transistors – power FETs – LASCR – two transistor model of SCR – Protection of thyristors against over voltage – over current, dv/dt and di/dt.
2. **Triggering techniques:**
   Turn on circuits for SCR – triggering with single pulse and train of pulses synchronizing with supply – triggering with microprocessor – forced commutation – different techniques – series and parallel operations of SCRs.

**MODULE-II**

3. **Controlled rectifiers:**
   Converters – single phase – three phase – half controlled and fully controlled rectifiers – Waveforms of load voltage and line current under constant load current – effect of transformer leakage inductance – dual converter

**MODULOE-III**

4. **Inverters:**
   Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC choppers – DC to DC converters – Buck, boost and buck – boost.

**MDULOE-IV**

5. **Industrial applications**
   DC motor drives – Induction and synchronous motor drives – switched reluctance and brushless motor drives.

**<u>Additional Module</u> (Terminal Examination-Internal)**

6. Battery charger – SMPS – UPS – induction and dielectric heating.

**Text Books**


1. Power Electronics Circuits, Devices and Applications, M Rashid, PHI, 3rd Edition. 2004.
2. Power Electronics, M.D. Singh and K.B. Khanchandani, TMH,2nd Edition, 2007.


**Reference Books**


1. Power Electronics, P C Sen, TMH, 1987.
2. Thyristorised Power Controllers, G K Dubey, Wiley Eastern 1986.
3. Power Electronics – Principles and Applications, JVithayathil, McGraw-Hill, 1995.
4. Power Electronics,V.R. Moorthy, Oxford University Press, 2005

## PET5J004 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

**MODULE-I**

1. **Overview of EMI/EMC:**
   Electromagnetic environment, History, Concepts and definitions, Overview of EMI/EMC, Natural and Nuclear sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters.

2. **EMI Coupling Principles:**
   Electromagnetic emissions, noise from relays and switches, Nonlinearities in circuits, passive inter-modulation, cross talk in transmission lines, transients in power supply lines, Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling,

**MODULE-II**

3. **Radiated and Conducted Interference Measurements:**
   EMI Test Instruments/ Systems, Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents/voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI, detectors and measurements, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/ Injectors/ Couplers, Test beds for ESD and EFT.

**MODULE-III**

4. **EMI Control Techniques:**
   Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design shielding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting, PCB Traces Cross Talk.

**MODULE-IV**

5. Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

**<u>Additional Module</u> (Terminal Examination-Internal)**

6. Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Cable to Cable Coupling, Power Mains and Power Supply coupling.

**Reference Books**

1. Engineering EMC Principles, Measurements and Technologies,V.P.Kodali, IEEE Press, 1996.
2. Noise Reduction Techniques in Electronic Systems, Henry W. Ott, John Wiley and Sons, New York, 1988.
3. Introduction to Electromagnetic Compatibility ,C.R.Paul, John Wiley and Sons, 1992
4. Principles of Electromagnetic Compatibility, Bernhard Keiser, Artech house, 3rdEd,1986

# PET5J006 SENSORS AND TRANSDUCERS

**MODULE–I**

Elements of a general measurement system; Static Characteristics: systematic characteristics, statistical characteristics, calibration; Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems.

**MODULE–II**

Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages. Capacitive sensing elements: variable separation, area and dielectric; Inductive sensing elements: variable reluctance and LVDT displacement sensors.

**MODULE–III**

Signal Conditioning Elements: Deflection bridges: design of resistive and reactivebridges, push-pull configuration for improvement of linearity and sensitivity Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.

**MODULE–IV**

Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation. IC temperature sensor Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.

**<u>Additional Module</u> (Terminal Examination-Internal)**

**Electromagnetic sensing elements: velocity sensors**

**Text Books:**

1. Principles of Measurement Systems, J.P. Bentley, Pearson Education, New Delhi, 3rd Edition 2007.

2. Introduction to Measurement and Instrumentation, A.K. Ghosh , PHI Learning, 3rd Edition,2009.

3. Transducers and Instrumentation, D.V.S. Murthy, PHI Learning, New Delhi, 2009.

**Reference Books:**

1. Measurement Systems Application and Design, E.O. Doeblin, McGraw-Hill, 4th Edition.

2. Instrumentation for Engineering Measurements, J.W. Dally, W.F. Riley and K.G. McConnel , John Wiley, NY,2nd edition 2003.

3. Industrial Instrumentation, T.R. Padmanabhan, Springer, London, 2000.

## PET5J007 OBJECT ORIENTED PROGRAMMING (3-1-0)

**MODULE- I**

1. **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**

2. **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.

3. **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.

**Module-III**

4. **Dynamic memory:** Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.
5. **Template**: template classes, template functions.

**Module-IV**

6. **Operator overloading:** This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.
7. **Exception handling:** Try, throw, and catch, exceptions and derived classes, function exception declaration.

**Additional Module (Terminal Examination-Internal)**

1. **Namespaces:** user defined namespaces, namespaces provided by library.

**Text Books:**

1. Object Oriented Programming with C++, E. Balagurusamy, McGraw-Hill Education.
2. ANSI and Turbo C++,Ashoke N. Kamthane, Pearson Education.
3. Object Oriented Programming with C++,ReemaThareja, Oxford University Press.

## Reference Books:

1. C++ the Complete Reference**,** HSchildt, McGraw-Hill Education.
2. C++ and Object Oriented Programming,DJana, PHI Learning.
3. Mastering C++, K RVenugopal, McGraw-Hill Education.
4. Object Oriented Programming with C++,Rajiv Sahay, Oxford.

## PET5J008 ADVANCED ANALOG ELECTRONIC CIRCUITS(3-1-0)

**MODULE-I**

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, Saw tooth 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**

4. **BistableMultivibrator:** BistableMultivibrator, fixed-bias bistable multi vibrator, Loading, self-biased transistor binary, commutating capacitors, Triggering the binary, Unsymmetrical Triggering of the bistablemultivibrator, Triggering Un symmetrically through a Unilateral Device, Triggering, Triggering of a Bistable Multi Symmetrically without the Use of Auxiliary Symmetrical Diodes, Schmitt Trigger Circuit (Emitter-coupled BistableMultivibrator
5. **Monostable and AstableMultivibrator:** MonostableMultivibrator, Gate Width of a Collector-Coupled MonostableMultivibrator, Waveforms of the Collector-Coupled MonostableMultivibrator, Emitter-Coupled MonostableMultivibrator, Triggering of the MonostableMultivibrator. Astable Collector-Coupled Multivibrator, Emitter-coupled Astablemultivibrator.
6. **Wideband amplifiers**: Wideband amplifiers: The Hybrid-π, High-frequency, Small-signal, Common-emitter Model, RC-Coupled Amplifier, Frequency Response of a Transistor Stage-The Short-Circuit Current Gain, Current Gain with Resistive Load, Transistor Amplifier Response taking Source Impedance into Account, Transient Response of a Transistor Stage.

**MODULE-III**

7. **Negative Resistance Switching Devices:** Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, MonostableAstable, 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.

**MODULE-IV**

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

**Additional Module (Terminal Examination-Internal)**

10. Cascaded CE Transistor Stages, Rise-time Response of Cascaded Stages, Shunt Compensation of a TransistorStage in a Cascade, Rise Time of Cascaded Compensated Stages, Low frequency Compensation.

**Text Books**

1. Pulse, Digital and switching Waveforms, Jacob Millman, Herbert Taub and MS PrakashRao, TMH Publication, Second Edition.
2. Pulse, Switching and Digital Circuits,David A. Bell, Oxford University Press, Fifth Edition.
3. OP-Amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI Publication.
4. Pulse & Digital Circuits, K.VenkataRao, K Rama Sudha& G ManmadhaRao, Pearson Education, 2010.

## Reference Books

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

**OPEN ELECTIVES (OE):**

## PET5H001 JAVA PROGRAMMING (3-1-0)

**MODULE – I**

1. Introduction to Java and Java programming Environment. Object Oriented Programming. Fundamental Programming Structure: Data Types, variable, Typecasting Arrays, Operators and their precedence. Control Flow: Java's Selection statements (if, switch, iteration, statement, while, do-while, for, Nested loop).Concept of Objects and Classes, Using Exiting Classes building your own classes, constructor overloading, static, final, this keyword .
2. Inheritance: Using Super to Call Super class constructor, Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance, The Object Class.
3. Packages & Interfaces: Packages, Access Protection, Importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.
4. 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**

5. Multi Threading: Java Thread Model, Thread Priorities, Synchronization, Creating a thread, Creating Multiple threads, Using is Alive ( ) and join ( ), wait () & notify ( ).
6. String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string
7. Java I/O: Classes& Interfaces, Stream classes, Byte streams, Character streams, Serialization. JDBC: Fundamentals, Type I, Type II, Type III, Type IV drivers.

**Module - III**

8. Applets: Basics, Architecture, Skeleton, The HTML APPLET Tag, Passing Parameters to Applets, Applet context and show documents ().
9. Event Handing: Delegation Event model, Event Classes, Event Listener Interfaces, Adapter classes.
10. 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)

**Module – IV**

11. 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.

**Additional Module (Terminal Examination-Internal)**

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

**Text Books**

**1.** Introduction to Java Programming, Y Daniel Liang, Pearson Education, 7th Edition.
**2.** Java The complete reference, Herbert Schildt, TMH, 5th Edition.

**Reference Books**

**1.** Programming with JAVA,E Balagurusamy,TMH, 4th edition.
**2.** Programming with Java, Jaya MaheshBhave& SunilPatekar, Pearson Education.
**3.** Big Java, Cay S Horstman, Willey India, 2nd Edition.
**4.** Java Programming Advanced Topics, Joe Wigglesworth, Cengage Learning.
**5.** Java How to Program, H.M. Deitel& Paul J. Deitel, PHI, 8th Edition
**6.** Theory and Problems of Programming with JAVA, John Hubbard, TMH.
**7.** Programming in java, Sachin Malhotra &SauravChoudhary, Oxford University Press, 2nd Edition 2004.

## PET5H002 DIGITAL VLSI DESIGN (3-1-0)

**Module-I**

1. **Introduction:** Historical Perspective, VLSI Design Methodologies, VLSI Design Flow,Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.
2. **Fabrication of MOSFETs:** Introduction, Fabrication Processes Flow – Basic Concepts The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs Mask Layout Design.
3. **MOS Transistor:** The Metal Oxide Semiconductor (MOS) Structure, The MOS Systemunder External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

**Module – II**

4. **MOS Inverters – Static Characteristics:** Introduction, Resistive-Load Inverters, Inverterswith n-Type MOSFET Load, CMOS Inverter.
5. **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.
6. **Combinational MOS Logic Circuits:** Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).

**Module – III**

7. **Sequential MOS Logic Circuits:** Introduction, Behaviour of Bistable Elements, SR LatchCircuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-
   Flop.
8. **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.

**Module – IV**

9. **Design for Testability:** Introduction, Fault Types and Models, Ad Hoc Testable DesignTechniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring $I_{DDQ}$ Test.

**Additional Module (Terminal Examination-Internal)**

10. **Semiconductor Memories:** Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, Flash Memory.

**Text Books**


1. *CMOS Digital Integrated Circuits: Analysis andDesign*, Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, 3rdEdn, 2003.
2. Principles of CMOS VLSI Design – a SystemsPerspective, K. Eshraghian and N.H.E. Weste, Addison Wesley,2nd Edition, 1993.


**Reference Books**


1. Digital Integrated Circuits– *A Design Perspective*, Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, PHI, 2nd Edn.
2. Modern VLSI Design System – *on – Chip Design*, Wayne Wolf, PHI, 3rd Edn.
3. VLSI Design, Debaprasad Das, Oxford University Press, New Delhi, 2010.
4. CMOS Logic Circuit Design, John P. Uyemura, Springer, 2001.
5. Digital Integrated Circuit Design, Ken Martin, Oxford University Press, 2000.
6. VLSI Design Technique forAnalog and Digital Circuits, R LGEIGER, TMH.
7. Algorithms for VLSI Physical Design Automation, Naveed SHERWANI, BSP BOOKS PVT Ltd., 3rd Edition.
8. Introduction to VLSI Systems a logic, Circuits and System, Ming BOLin, BSP BOOKS PVT LTD.


## PET5H003 DIGITAL SYSTEM DESIGN

**MODULE-I**

1. **Combinational Logic:** Review of adders, Subtractor, Multipliers, Multiplexers, ROM, PLA, PAL and PLD.
2. **Synchronous Sequential Logic:** Flip-flops, Triggering of flip-flops, Analysis of clocked sequential circuits, State reduction and assignment, Flip-flop excitation tables, Design procedure, Design of counters,

**MODULE-II**

3. **Finite State Machines:** Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modeling and Simulation of Moore and Mealy machines.

**MODULE-III**

4. **Asynchronous Sequential Logic:** Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, Race-free state assignment, Hazards, Design examples.

**Module – IV**

5. **Designing with Programmable Logic Devices and Programmable Gate Arrays:** Read only memories, Programmable logic arrays, Programmable array logic, Designing with FPGAs, Xilinx series FPGA

**Additional Module (Terminal Examination-Internal)**

6. **Algorithmic State Machines**: ASM chart, Timing considerations, Control implementation, Control Design with multiplexers, PLAs, etc.

**Text Books**

1. VHDL: Programming by Example, Douglas L Perry, TMH, 3rd Edition, 2008.
2. Fundamentals of Digital Logic with VHDL design, Stephen Brown, ZvonkoVranesic, TMH, 3rd Edition, 2008.
3. Digital Design Principles, William I Fletcher, Prentice Hall of India, 3rd edition-1980.
4. Reference Books
5. Digital System Design Using VHDL, Chales H. Roth, Cengage Learning India, 2nd Edition,2012.
6. Digital System Design, John Wakerley, Pearson Education, 4th Edition,2008.
7. VHDL, ZainalabedinNavabbi, McGraw Hill Publication, 6th Edition, 2007.

## PET5H004 BRAIN COMPUTER INTERFACING

**MODULE-I**

1. Anatomy and physiology of the human brain, Brain signal processing: Laplacian Filtering, Nearest Neighbour Filtering, Time-domain features including Hzorth parameters, Frequency domain features including power spectral density.

**MODULE-II**

2. **Feature Selection:** Principal Component Analysis, Independent Component Analysis, Common spatial patterns. EEG Classification: Linear Discriminant Analysis, Quadratic Discriminant analysis.

**MODULE-III**

3. Applications in rehabilitative robotics, olfactory perceptual-ability detection, cognitive failure detection in driving and detection of true emotion or deception using Brain-Computer Interfacing.

**MODULE-IV**

4. Neural Classifier using Gradient Descent Learning and Back-propagation algorithm, Linear and Kernelized Support Vector Machines

**Additional Module (Terminal Examination-Internal)**

5. Time-frequency correlated features including wavelets

**Reference Books**

1. BRAIN-COMPUTER INTERFACING: AN INTRODUCTION, RAJESH P.N. RAO, CAMBRIDGE UNIVERSITY PRESS, 1ST EDITION.
2. Brain-Computer Interfaces: Principles and Practice, Jonathan Wolpaw and Elizabeth Winter Wolpaw, Oxford University Press.

## PET5H005 OPTIMIZATION IN ENGINEERING

**MODULE-I**

1. Idea of Engineering optimization problems, Classification of optimization algorithms, modeling of problems and principle of modeling.
2. **Linear programming:** Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

**MODULE-II**

3. **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
4. **Assignment problems:** Hungarian method for solution of Assignment problemsInteger Programming:Branch and Bound algorithm for solution of integer Programming Problems

**MODULE-III**

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

**MODULE-IV**

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

**Additional Module (Terminal Examination-Internal)**

9. Introduction to Genetic Algorithm.

**Text Books**

1. Operations Research- Principle and Practice, A. Ravindran, D. T. Philips, J. Solberg, Second edition, Wiley India Pvt Ltd.
2. Operation Research, Prabhakar Pai ,Oxford University Press
3. Optimization for Engineering Design, Kalyanmoy Deb, PHI Learning Pvt Ltd.
4. OperationsResearch, H.A.Taha, A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, Pearson Education, Eighth Edition.
5. Engineering Optimization, S S Rao, New Age International(P) Ltd, 2003.

**Reference Books**

1. Linear and Non-linear Optimization, **S**tephen G. Nash, A. Sofer, McGraw Hill,2nd Edition.
2. Engineering Optimization, A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Wiley India Pvt. Ltd, Second edition.
3. Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition, 2005.
4. Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.

***ADVANCE LAB:***

## VLSI AND EMBEDDED SYSTEMS LAB

## (All the experiments should be done)

**VLSI Experiment List:**

1. Design of schematic and simple layout for CMOS Inverter & perform parasitic extraction and simulation.
2. Design of schematic and simple layout for CMOS NAND gate & perform parasitic extraction and simulation.
3. Design of schematic and simple layout for CMOS NOR gate & perform parasitic extraction and simulation.
4. Plotting of VTC curve of CMOS inverter using p-SPICE.
5. Modelling and transient analysis of 2-inputs NAND & NOR gates using p-SPICE.
6. Design & implementation of 16-bit Arithmetic & Logic unit using VHDL.

**Embedded Systems Experiment list:**

1. Study of ARM7 & ARM9 Bit Processor Architecture and Pin Diagram.
2. Study of Interrupt structure in ARM Processors.
3. Write ARM Processor program to Flash LED.
4. Interfacing of an LCD Display.
5. Write a program to interface an ADC.
6. Write a program to control a Stepper Motor.
7. Write a program to control the speed of DC motor.
8. Interface relays and write a program to control them.
9. Interface ZIGBEE with ARM to control more external devices.
10. Interfacing RFID module with ARM Microcontroller.

## HONOUR SUBJECT

## PET5D001 ELECTRONICS DEVICES AND MODELING

**MODULE – I**

1. **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

**MODULE– II**

2. **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.

**MODULE–III**

3. **BJT Parameter Measurements:** Input and Model Parameters, Parameter Measurements**,**
4. **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.

**MODULE–IV**

5. **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.

**Additional Module (Terminal Examination-Internal)**

6. BSIM1, BSIM2, SPICE3, HSPICE and PSPICE Models

**Textbooks**

1. Semiconductor Device Modeling with SPICE,Giuseppe Massobrio and Paolo Antognetti, Tata McGraw-Hill Education, 2nd edition, 2010.

**Reference Books**

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

## MINOR SUBJECT

## PET5G001 ANALOG AND DIGITAL COMMUNICATION

**OBJECTIVES:**

The student should be made to:

- Understand analog and digital communication techniques
- Learn data and pulse communication techniques.
- Be familiarized with source and Error control coding.
- Gain knowledge on multi-user radio communication.

**UNIT I ANALOG COMMUNICATION**

Noise: Source of Noise - External Noise - Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

**UNIT II DIGITAL COMMUNICATION**

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) – Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

**UNIT III DATA AND PULSE COMMUNICATION**

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM)

**UNIT IV SOURCE AND ERROR CONTROL CODING**

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

**UNIT V MULTI-USER RADIO COMMUNICATION**

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Hand off - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

**OUTCOMES:**

At the end of the course, the student should be able to:

- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.
- Utilize multi-user radio communication.

**TEXT BOOK:**

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2009.

**REFERENCES:**

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004 35
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007
3. H.Taub, D L Schilling and G Saha,”Principles of Communication”, 3 rd Edition, Pearson Education, 2007.
4. B.P.Lathi, “Modern Analog and Digital Communication Systems”, 3 rd Edition, Oxford University Press, 2007.
5. Blake, “Electronic Communication Systems”, Thomson Delmar Publications, 2002.
6. Martin S.Roden, “Analog and Digital Communication System”, 3 rd Edition, Prentice Hall of India, 2002.
7. B.Sklar, “Digital Communication Fundamentals and Applications” 2 nd Edition Pearson Education 2007.

| Sixth Semester | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Theory | | | | | | Practical | | |
| **Code** | **Course Name** | | **Hours/ Week L/T** | **Credit Theory** | **University Marks** | **Internal Evaluation** | **Hours/ Week L/T** | **Credit Practical** | **Marks** |
| PC | Digital Communication | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PC | High Frequency Engineering | | 3-0 | 3 | 100 | 50 | 2 | 1 | 50 |
| PE | Information Theory & Coding/Computer Network & Data Communication/Mobile Communication/Biomedical Electronics/Industrial Electronics/Robotics & computer Vision/Pattern Analysis & Machine Intelligence/Analog VLSI Design | | 3-1 | 4 | 100 | 50 | | | |
| PE | Cryptography & Network Security/Advance Digital Signal Processing/Operation System/Antennas & Wave Propagation/Speech Propagation/Telecommunication System Modelling & Simulation | | 3-1 | 4 | 100 | 50 | | | |
| MC & GS | Environmental Science & Engineering | | 3-0 | 3 | 100 | 50 | | | |
| OE | Industrial Lecture # | | | | | | 3 | 1 | 50 |
| HS | Business Communication & Skill for Interview # # | | 2-0 | 1 | | 50 | 4 | 2 | 100 |
| MC | Yoga | | | | | | 2 | 1 | 50 |
| Total | | | 19 | 18 | 500 | 300 | 13 | 6 | 300 |
| Total Marks: 1100 | | | | | | | | | |
| Total Credits: 24 | | | | | | | | | |
| Honours | | Software Define Radio Architecture System and Function | 4 | 4 | 100 | 50 | | | |
| Minor | | Signal & Systems | | | | | | | |

SEMESTER : 6TH

| SL. NO. | SUBJECT CODE | CATEGORY | SUBJECT NAME | L-T-P | CREDIT |
|---|---|---|---|---|---|
| 1. | PET6D001 | HONOURS(CP) | SOFTWARE DEFINE RADIO ARCHITECTURE SYSTEM AND FUNCTION | 4-0-0 | 4 |
| 2. | PET6E101 | HS(CP) | BUSINESS COMMUNICATION & SKILL FOR INTERVIEW | 1-0-2 | 3 |
| 3. | PET6G001 | MINOR(CP) | SIGNAL & SYSTEMS | 4-0-0 | 4 |
| 4. | PET6H301 | OE(CP) | INDUSTRIAL LECTURE # | 0-0-1 | 1 |
| 5. | PET6I101 | PC(CP) | DIGITAL COMMUNICATION | 3-0-1 | 4 |
| 6. | PET6I102 | PC(CP) | HIGH FREQUENCY ENGINEERING | 3-0-1 | 4 |
| 7. | PET6J001 | PE(O1) | INFORMATION THEORY & CODING | 4-0-0 | 4 |
| 8. | PET6J002 | PE(O1) | COMPUTER NETWORK AND DATA COMMUNICATION | 4-0-0 | 4 |
| 9. | PET6J003 | PE(O1) | MOBILE COMMUNICATION | 4-0-0 | 4 |
| 10. | PET6J004 | PE(O1) | BIOMEDICAL ELECTRONICS | 4-0-0 | 4 |
| 11. | PET6J005 | PE(O1) | INDUSTRIAL ELECTRONICS | 4-0-0 | 4 |
| 12. | PET6J006 | PE(O1) | ROBOTICS & COMPUTER VISION | 4-0-0 | 4 |
| 13. | PET6J007 | PE(O1) | PATTERN ANALYSIS & MACHINE INTELLIGENCE | 4-0-0 | 4 |
| 14. | PET6J008 | PE(O1) | ANALOG VLSI DESIGN | 4-0-0 | 4 |
| 15. | PET6J009 | PE(O2) | CRYPTOGRAPHY & NETWORK SECURITY | 4-0-0 | 4 |
| 16. | PET6J010 | PE(O2) | ADVANCE DIGITAL SIGNAL PROCESSING | 4-0-0 | 4 |
| 17. | PET6J011 | PE(O2) | OPERATION SYSTEM | 4-0-0 | 4 |
| 18. | PET6J012 | PE(O2) | ANTENNAS AND WAVE PROPAGATION | 4-0-0 | 4 |
| 19. | PET6J013 | PE(O2) | SPEECH PROPAGATION | 4-0-0 | 4 |
| 20. | PET6J014 | PE(O2) | TELECOMMUNICATION SYSTEM MODELLING & SIMULATION | 4-0-0 | 4 |
| | | | | | 28 |

# PET6I101 DIGITAL COMMUNICATION

## MODULE – I (19 HOURS)

Sampling Theorem, Some applications of sampling theorem.

**Digital Representation of Analog Signal** - Quantization of Signals, Quantization error, PCM, Electrical representation of binary digits, PCM System, Companding (4); Line coding, scrambling, T1 Digital System, Multiplexing T1 lines – The T2, T3 and T4 lines (3); Differential PCM- Linear predicted design, Delta Modulation, and Adaptive Delta Modulation.

**Noise in PCM and DM** - Calculation of Quantization Noise, Output Signal Power, Thermal Noise, Output SNR in PCM, Quantization noise in Delta Modulation, output signal power, output SNR, Comparison with PCM and DM.

## MODULE – II (7 HOURS)

**Digital Modulation Technique**- Generation, Transmission, Reception; Spectrum and Geometrical Representation in the Signal Space of BPSK, DPSK, QPSK, QASK, M-ary PSK, BFSK, M-ary FSK, and Minimum Shifting Keying (MSK).

## MODULE – III (8 HOURS)

**Principle of Digital Data Transmission**- Digital Communication Systems – Source, Line coder, Multiplexer, Regenerative repeater; Line Coding- PSD of various line codes, polar signalling, constructing a DC Null in PSD by pulse shaping, On Off signalling, Bipolar signalling; Pulse shaping – ISI and effect, Nyquist first criterion for zero ISI; Scrambling, Digital receiver and regenerative repeaters; Equalizers, Timing extraction, Detection error, Eye Diagram.

## MODULE-IV (4 HOURS)

**Data Transmission-** A base band signal Receiver, Peak signal to RMS noise output voltage ratio, probability of error, optimum threshold, optimum receiver for both base band and pass band: calculation of optimum filter transfer function, optimum filter realization using Matched filter, Probability error of the matched filter, optimum filter realization using correlator.

## ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)

1. **Multiple Access Techniques**- FDMA, TDMA, CDMA, OFDM, MIMO

## TEXT BOOKS

1. Modern Digital and Analog Communication Systems, B.P. Lathi, Z Ding and Hari Mohan Gupta , Oxford University Press, New Delhi.2017.
2. Principles of Communication Systems, H Taub, D L Schilling and G Saha, TMH Education Pvt Ltd, 4th Edition 2013.
3. An Introduction to Analog and Digital communications, Simon Haykin, Wiley Publication, 2nd edition, 2007

## REFERENCE BOOKS

1. Digital and Analog Communication System, Leon W. Couch-II, Prentice Hall of India, Pearson Education, 6th Edition 2001.
2. Digital and Analog Communication System, K. Sam Shanmugam, Wiley India Pvt. Ltd 2006.
3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2nd Edition, 2009.
4. R N Mutagi, Digital Communication- Theory, Techniques and Applications, Oxford University Press

## DIGITAL COMMUNICATION TECHNIQUES LAB

### (At least 10 experiments should be done)

### List of Experiments:

1. Study the functioning of PCM and Delta modulator; Demonstrate the process of PCM modulation and Delta modulation.
2. Modulation generation and detection Signal generator CRO
3. To study Time division multiplexing.
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, and 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 using ISDN system.
11. Analyze the process of data communication in LAN using LAN trainer and compare the performance different media access techniques.

# PET6I102 HIGH FREQUENCY ENGINEERING (3-0-2)

## MODULE-I (10 HOURS)

**Microwave Tubes-** Limitations of conventional tubes, construction, operation; Properties of Klystron Amplifier, reflex Klystron, Magnetron, Travelling Wave Tube (TWT); Backward Wave Oscillator (BWO); Crossed field amplifiers.

## MODULE-II (10 HOURS)

**Microwave Solid State Devices-** Limitation of conventional solid state devices at Microwaves; Transistors (Bipolar, FET); Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode); Avalanche transit time effect (IMPATT, TRAPATT, SBD); Microwave Amplification by Stimulated Emission of Radiation (MASER).

## MODULE-III (10 HOURS)

**Microwave Components-** Analysis of Microwave components using s-parameters, Junctions (E, H, Hybrid), Directional coupler; Bends and Corners; Microwave posts, S.S. tuners, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator); Cavity resonator.

## MODULE-IV (12 HOURS)

**Introduction to Radar Systems-** Basic Principle-Block diagram and operation of Radar; Radar range Equation; Pulse Repetition Frequency (PRF) and Range Ambiguities.
**Doppler Radars-** Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI) radar, Delay line cancellers, Blind speeds and staggered PRFs.
**Scanning and Tracking Techniques-** Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding); Angle tracking systems (Lobe switching, conical scan, mono pulse),

## ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)

**Microwave Measurements-** Power measurements using calorimeters and bolometer; Measurement of Standing Wave Ratio (SWR), Frequency and wavelength; Microwave bridges; Matched termination.
Applications of Radar; Range tracking systems, Doppler (velocity) tracking systems.

## TEXT BOOKS

1. Microwave Engineering, David M. Pozer, Fourth Edition, Wiley Publications, 2011
2. Microwave Engineering, Sushrut Das, Oxford University Press, 2014.
3. Introduction to radar systems, Merill I. Skolink, McGraw Hill Publications, Second Edition, 2001
4. Microwave and Radar Engineering, G. S. Rao, Pearson India Publisher, 2014

## REFERENCE BOOKS

1. Microwave devices and Circuits, Samuel Liao, Pearson Education Publisher, Third Edition,1990
2. Foundation of Microwave Engg, R.E. Collin, Second Edition,Wiley Publications, 2007
3. Microwave devices and Radar Engg, M. Kulkarni; Umesh Publications, Fifth Edition,1998
4. Microwave Engineering, Subol Kar, University Press.

# HIGH FREQUENCY ENGINEERING LAB

## (At least 10 experiments should be done)

**LIST OF EXPERIMENTS:**

1. Study of microwave components and instruments.
2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.
3. Measurement of klystron characteristics.
4. Measurement of VSWR and standing wave ratio.
5. Measurement of Dielectric constants.
6. Measurement of Directivity and coupling coefficient of a directional coupler.
7. Measurement of Q of a cavity.
8. Calibration of the attenuation constant of an attenuator.
9. Determination of the radiation characteristics and gain of an antenna.
10. Determination of the phase-shift of a phase shifter.
11. Determination of the standing wave pattern on a transmission line and finding the length and position of the short circuited stub.

**PROFESSIONAL ELECTIVES (PE-I)**

# PET6J001 INFORMATION THEORY & CODING

**MODULE-I**

**Basic Concepts of Information Theory-** The concept of Amount of Information, Average Information, Entropy, Information rate, Mutual information; Shannon's Theorem, Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth – S/N Trade-off; Introduction to Channel Capacity & Coding; Channel Models, Channel Capacity Theorem, Shannon Limit.

**MODULE-II**

**Introduction to Error Control Coding- Linear Block Codes-** Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code.

**Cyclic Codes-** Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes.

**BCH Codes-** Description of codes; Decoding of BCH codes; Implementation of error connection.

**MODULE-III**

**Convolution Codes-** Encoding of convolution codes; structural properties of Convolution codes; Distance Properties of convolution codes.

**Automatic Repeat Request Strategies-** Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

**MODULE-IV**

**Discrete Messages and information content-** The Concept of amount of Information, Average Information, Entropy; Information rate, Source coding to increase average information per bit; Shanon-Fano coding; Huffman source coding algorithm, Lempel Ziv source coding algorithm.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

Shanon's Theorem- Channel Capacity, Capacity of Gaussian channel, Bandwidth – S/N Trade off; Use of Orthogonal Signals to attain Shannon's limit; Matched Filter Reception, calculation of error probability, Efficiency of orthogonal Signal transmission.

**TEXT BOOKS**

1. Information Theory, Coding and Cryptography, Ranjan Bose, TMH Publication
2. Introduction to Error Control Codes, S Gravano, Oxford University Press
3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2nd Edition, 2009.

**REFERENCE BOOKS**

1. Information Coding Techniques, R. Avudaiammal, Tat McGraw-Hill Education Pvt. Ltd., 2nd Edition New Delhi
2. Information Theory, F.M Reza: McGraw Hill
3. Error Control Coding, Shu Lin& J Costeib:, PHI

# PET6J002 COMPUTER NETWORK AND DATA COMMUNICATION

**Module – I (12 Hrs)**

Overview of Data Communication Networks, Protocols and standards, OSI Reference model, TCP/IP Protocol.

Physical Layer: Analog Signals, Digital Signals, Data Rate Limits, Transmission Impairment, Data rate limit, Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion, Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion, Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing (TDM), Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable) and unguided media (wireless), Switching: Circuit Switched Network, Datagram Network, Virtual-Circuit Network , Telephone Network, Dial-up Modems and Digital Subscriber Lines.

**Module – II (10 Hrs)**

Error Detection and correction: Types of Errors, Error Detection mechanism (Linear codes, CRC, Checksum), Error Correction mechanism: Hamming Encoding.

Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC and Point-to-Point Protocol

Multiple Access: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Polling, Reservation, Token Passing), Channelization (FDMA, TDMA, CDMA).

Wired LANs (Ethernet): Traditional Ethernet, Fast Ethernet, Gigabit Ethernet.

**Module – III (10 Hrs)**

Wireless LANs: IEEE 802.11 and Bluetooth.

Connecting Devices: Passive Hub, Repeater, Active Hub, Bridge, Two layers Switch, Router, Three layers Switch, Gateway.

Virtual Circuit Networks: Frame Relay, Architecture & layers, ATM: Design goals, Architecture & layers.

Network Layer: IPV4 addresses, IPV6 addresses, Internet Protocol: Internetworking, IPV4 datagram, IPV6 packet format and advantages. Network Layer Protocols: ARP, RARP, IGMP and ICMP. Routing: Unicast Routing Protocols and Multicast Routing Protocols.

Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

**Module – IV (08Hrs)**

Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet, Resolution and Dynamic Domain Name System (DDNS), Remote logging, Electronic Mail (SMTP) and file transfer (FTP), WWW: Architecture & Web document, HTTP: Transaction & Persistent vs. Nonpersistent connection.

Introduction to Wi-Fi and Li-Fi Technology.

**Text Books:**

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill.
2. Computer Networks, A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson.
3. Data Communication and Networks, Bhushan Trivedi, Oxford University Press.

**Reference Book:**

1. Network for Computer Scientists & Engineers, Zheng, Oxford University Press.
2. Computer Networks A system Approach, Larry L, Peterson and Bruce S. Davie, Elsevier.
3. Computer Networks, Natalia Olifer, Victor Olifer, Willey India.
4. Data and Computer Communications, William Stallings, Prentice Hall, Imprint of Pearson.

# PET6J003 MOBILE COMMUNICATION

**MODULE-I**

**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.

**MODULE-II**

**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, 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-III**

**Wireless Application and Standards**- Fundamentals of WLAN transmission technology, WLAN applications, IEEE 802.11, 802.11 systems performance; WiMAX standards, WiFi standards, Zigbee.

**MODULE-IV**

**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).

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

**Modulation schemes-** 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. Wireless Communication and Networking, Essential Reading, V K Garg, Morgan Kaufman Publishers India; 2008
2. Wireless and Mobile Communication, Upena Dalal and Manoj K. Shukla, Oxford University Press, 2016
3. Wireless communication & networks, Upena Dalal, Oxford University Press, 2014

**REFERENCE BOOKS**

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

# PET6J004 BIOMEDICAL ELECTRONICS

**MODULE-I**

**Bioelectric Signals and Electrodes-** Sources of biomedical signals, basic medical instrumentation system, PC based medical instruments, general constraints in design of medical instrumentation systems; origin of bioelectric signals, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG); Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes; Electrocardiograph-block diagram, ECG leads, effects of artifacts, multi-channel,

**MODULE-II**

**Pacemakers & Defibrillator-** Need for cardiac pacemaker, external pacemaker, implantable pacemakers-types, ventricular synchronous demand pacemaker, programmable pacemaker, power sources for implantable pacemakers; Need for defibrillator, DC defibrillator, automatic external defibrillator, implantable defibrillators.

**MODULE-III**

**Blood Flow & Cardiac Output Measurement-** Electromagnetic blood flow meter-principle, square wave electromagnetic flow meter, Doppler shift ultrasonic flow meter
**Advanced Diagnostic & Therapeutic Instruments-** Principle of surgical diathermy &surgical diathermy machine, Electro diagnosis-Electrotherapy-functional block diagram and working, interferential current therapy.

**MODULE-IV**

**Biosensors-** Electrochemical transducers, Electrode potential and reference electrodes, potentiometric sensors, amperometric sensors, electrochemical gas sensors; chemical transducers of acoustic and thermal principles. Biosensors – Enzyme based biosensors, immune sensors, and microbial sensors.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

1. ECG machine, vector cardiograph, phono cardiograph-origin of heart sounds; Microphones and amplifiers for PCG; Artificial kidney-Principle and haemodialysis machine; Continuous measurement of chemical quantities.

**TEXT BOOK**

1. Biomedical signal processing :Principles and Technique, D.C Reddy Tata McGraw- Hill Education Pvt.Ltd, 2005

# PET6J006 ROBOTICS AND COMPUTER VISION

**MODULE-I**

**Robotics Fundamentals**- Components, degrees of freedom, joints, reference frames, characteristics.
**Kinematics**- Transformations and their representation using matrix, forward and inverse kinematic equations; Denavit- Hardenberg representation, degeneracy and dexterity.

**MODULE-II**

**Computer Vision Fundamentals**- Relationships to other fields, image geometry, definitions, levels of computation.
**Binary image processing**- Geometric processing, binary algorithms (e.g., component labelling, distance transforms, medial axis)

**MODULE-III**

**Regions and segmentations**- Thresholding, region representation, split and-merge.
**Hough Transform**- Theory and applications

**MODULE-IV**

**Differential motions and velocities-** Jacobian, differential motions of a frame, Jacobian and the differential operator.
**Image filtering-** Histograms, linear systems, mean and median filters, Gaussian smoothing

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

1. **Trajectory Planning-** Joint-space and Cartesian-space trajectories.
2. **Edge detection**- Gradients, first and second derivative operators

**TEXT BOOKS**

1. Industrial Robotics Technology Programming and Applications, M.P.Groover, McGraw-Hill, 2001.

## PET6J007 PATTERN ANALYSIS AND MACHINE INTELLIGENCE

**MODULE-I**

1. **Statistical Pattern Classification-**Linear discriminant analysis, Bayesian classification, model-free technique including the K-nearest neighbours method.

**MODULE-II**

2. **Feature Minimization Techniques-** Principal component analysis, Independent component analysis.
3. **Intelligent Search-** Problem solving by search, Heuristic search.

**MODULE-III**

4. **Reasoning Using Logic-** Propositional and predicate logic, unification and resolution principle, deductive and abductive reasoning, fuzzy reasoning.
5. **Perception-** Visual and linguistic perception.

**MODULE-IV**

6. **Clustering Techniques-** K-means, Fuzzy C-means, SOFM Neural net, Hopfield neural net.
7. **Machine Learning Techniques-** Decision tree learning, analogy based learning, inductive learning, Q-learning.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

8. **Neural Classifiers-** Perceptron, Multi-layered perceptrons and back propagation algorithm, support vector machine classifier.

**TEXT BOOK**

1. Pattern Recognition and machine learning – Christopher M.Bishop, Springer
2. Pattern Recognition-J.P. Marques de sa, Springer,2001
3. Artificial Intelligence –Stuart Russel, Peter Norvig-third edition

# PET6J008 ANALOG VLSI DESIGN

**MODULE – I (10 HOURS)**

1. **Introduction to Analog Design-** General Concepts, Levels of Abstraction, Robust Analog Design.
2. **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.
3. **Differential Amplifiers-** Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell.

**MODULE – II (12 HOURS)**

4. **Passive and Active Current Mirrors-** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties.
5. **Band gap References-** General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, Bandgap Reference.

**MODULE-III (7 HOURS)**

6. **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.
7. **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.

**MODULE – IV (7 HOURS)**

8. **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.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

9. **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.

**TEXT BOOKS**

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, Tata McGraw-Hill Publishing Company Limited, 2002.
2. CMOS Analog Circuit Design, D. Holberg and P. Allen, Oxford University Press, 2013.

**REFERENCE BOOKS**

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

# PET6J009 CRYPTOGRAPHY AND NETWORK SECURITY

## MODULE-I

**Security Problems-** Security problem in computing; Security Attacks; Security Services; Security Mechanisms; OSI security attack-Standards and standard setting organizations.

## MODULE-II

**Data Security-** Basic encryption and decryption; Substitution, Transposition, Block ciphers, Data encryption, standard encryption and decryption; Differential and linear crypto analysis; Advanced encryption; Block cipher models-Triple DES with two keys-Stream cipher, RC4- RSA algorithm, Diffie-Hellman key exchange algorithm.

## MODULE- III

**Network Security-** IP security overview, IP security architecture, Authentication header, Encapsulating security pay load, combining security association, Key management-Web security considerations, Secure socket layer, Secure electronic transaction.

## MODULE- IV

**Message Authentication-** Hash Functions, MD5-Hash algorithm, SHA 512 logic; Authentication Protocols, Digital signature standards.

## ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)

**System Security:** Intruders and intrusion detection-Malicious software, Viruses and related threats, virus counter measures, distributed denial of services attack-Firewalls design principles-Trusted systems.

## TEXT BOOKS

1. Cryptography and Network Security – Principles & Practice, William Stallings, Pearson Education, 3rd edition, 2002.
2. Everyday Cryptography- Fundamental Principles and Applications, Keith M. Martin, Oxford University Press

## REFERENCE BOOKS

1. Security in Computing, Charles P. Pleeger, PHI Learning, 1998.
2. Cryptography and Network Security, Behrouz Forouzan, Tata McGraw-Hill, 1st edition, 2007.
3. Cryptography & Network Security, Atul Kahate, TMH, 2nd edition, 2008.

# PET6J010 ADVANCE DIGITAL SIGNAL PROCESSING

**Module:-1**

Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate Conversion by a rational factor I/D, Implementation of Sampling rate Conversion, Multistage implementation of Sampling rate Conversion, Sampling rate Conversion of Band pass Signals, Sampling rate Conversion by an Arbitrary Factor, Digital Filter Banks, Two-channel Quadrature Mirror Filter Bank.

**Module:-2**

Linear Prediction and Optimum Linear Filters: Random Signals, Correlation Functions, and Power Spectra , Innovation Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the normal equations: The Levinson-Durbin Algorithm. Properties of the Linear Prediction Error filters. Wiener filters for filtering and Prediction.

Adaptive Filters: Applications of Adaptive filters, Adaptive Direct-Form FIR filters-The LMS Algorithm.

**Module:-3**

Power Spectrum Estimation: Estimation of Spectra from Finite Duration Observations of Signals, Nonparametric Methods for Power Spectrum estimation, Relationship between the Autocorrelation and the model parameters. Bayes Theorem, Maximum Likelyhood detection.

**Module:-4**

The Yule-Walker Method for the AR Model Parameters, The Burg Method for the AR model Parameters, Unconstrained Least-Squares Method for the AR model parameters, MA Model for Power Spectrum Estimation, ARMA model for Power Spectrum Estimation.

**Additional Module (Terminal Examination-Internal)**

Filter Bank Methods, Eigenanalysis Algorithms for Spectrum Estimation

**Text Book:**

1. *Digital Signal Processing, John G.Proakis, Dimitris G. Manolakis, Pearson Education, New Delhi, 4th Edition, 2013.*

**Reference Book:**

1. *Adaptive Filter Theory, Simon Haykin, Pearson Education, 5th Edition 2017.*
2. *Adaptive Signal Processing, Bernard Widrow, Samuel D Stearns, Pearson Education,*

**PROFESSIONAL ELECTIVES (PE-II)**

## PET6J011 OPERATING SYSTEM

**MODULE-I**

1. **Introduction to operating system-** About an Operating System, Simple Batch Systems, Multiprogramming and Time Sharing systems; Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.
2. **Operating System Structures**- Operating System Services, System components, Protection system, Operating System Services, system calls.
3. **Process management**- Process Concept, Process Scheduling, Operation on Processes, Inter process communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms,

**MODULE-II**

4. **Process coordination-** Synchronization; The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.
5. **Deadlocks-** System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

**MODULE-III**

6. **Memory management**- Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation
7. **Virtual Memory-** Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms; Allocation of frames, Thrashing, Demand Segmentation.

**MODULE-IV**

8. **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.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

9. Thread Scheduling,
10. **Case studies**; The LINUX System, Windows , POSIX compliant

**TEXT BOOKS**

1. Operating System Concepts**,** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley-India, 8thEdition, 2009.
2. Principles of Operating Systems, Naresh Chauhan, Oxford University Presss,1st Edition,2014
3. Modern Operating Systems**,** Andrew S. Tanenbaum and HerbertBos, Pearson publication, 3rdEdition, 2014.

**REFERENCE BOOKS**

1. Operating Systems**:** A Spiral Approach, Elmasri, Carrick, Levine, McGraw-Hill, TMH Edition,2009.
2. Understanding Operating Systems **,**Ida MFlynn, Ann McHoes, Cengage Learning,7th Edition,2013.
3. Operating Systems **,**Pabitra Pal Choudhury, PHI, Eastern Economy Edition,2009.
4. Operating Systems**,** William Stallings, PHI,5th Edition,2007.
5. Operating Systems**,** H.M. Deitel, P. J. Deitel, D. R. Choffnes, Pearson, 3rd Edition,2002.

# PET6J012 ANTENNAS & WAVE PROPAGATION

**MODULE- I**

**Electromagnetic radiation and antenna fundamentals-** Review of electromagnetic theory: Vector potential, Solution of wave equation, retarded case, Hertizian dipole. Antenna characteristics: Radiation pattern, Beam solid angle, Directivity, Gain, Input impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture, Vector effective length, Antenna temperature.

**MODULE-II**

**Wire antennas-** Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication, Two-element Array, Uniform Array, Polynomial representation, Array with non-uniform Excitation-Binomial Array

**MODULE- III**

**Aperture Antennas-** Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna

**MODULE- IV**

**Special Antennas-**Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas.

**Antenna Measurements-** Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber measurement.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

**Radio wave propagation-** Calculation of Great Circle Distance between any two points on earth, Ground Wave Propagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction, Wave propagation in complex Environments, Tropospheric Propagation, Tropospheric Scatter. Ionospheric propagation: Structure of ionosphere, Sky waves, skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects of earth's magnetic fields, Faraday rotation, Whistlers.

**TEXT BOOKS**

1. **Electromagnetic Waves and Radiating Systems**, E. C. Jordan and K. G. Balmain Pearson Education Publications,1968
2. **Antennas and Wave Propagation**, A.R.Harish, M. Sachidanada, Oxford University Press,2007
3. **Antenna Theory Analysis and Design,** C. A. Ballanis, John Wiley Publications, Second Edition,2005

**REFERENCES BOOKS**

1. **Antennas for all Applications**,J.D.Kraus, Ronald J Marhefka and Ahmad S Khan, Tata McGraw-Hill Book Company. Third Edition,2008
2. **Antenna Wave Propagation**, G.S.N.Raju, Pearson Education,2006
3. **Antenna and Radio Wave Propagation**, R. E. Collin, McGraw Hill Publications,1985.
4. **Antenna Analysis and Design**,W.L Stutzman and G.A. Thiele, John WileyPublications,2012

# PET6J013 SPEECH PROCESSING

**MODULE- I**

**Mechanics of speech-** Speech production: Mechanism of speech production, Acoustic phonetics - Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM - Auditory perception: psycho acoustics.

**MODULE- II**

**Time domain methods for speech processing-** Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function.

**MODULE- III**

**Frequency domain method for speech processing-** Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Homomorphicvocoder speech analysis: Cepstral analysis of Speech, Formant Estimation, Homomorphic and speech vocoder.

**MODULE- IV**

**Linear predictive analysis of speech-** Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm,
Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

**Application of speech & audio signal processing-** Algorithms: Dynamic time warping, K-means clusering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification – Voice response system – Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis – VOIP

**TEXT BOOKS**

1. Discrete-Time Speech Signal Processing, Thomas F, Quatieri, Prentice Hall / Pearson Education, 2004.

**REFERENCE BOOKS**

1. Speech and Audio Signal Processing, Ben Gold and Nelson Morgan, John Wiley and Sons Inc., Singapore, 2004
2. Digital Processing of Speech signals, L.R.Rabiner and R.W.Schaffer, Prentice Hall 1979
3. Fundamentals of Speech Recognition, L.R. Rabiner and B. H. Juang, Prentice Hall, 1993.
4. Discrete Time Processing of Speech Signals, J.R. Deller, J.H.L. Hansen and J.G. Proakis, John Wiley, IEEE Press, 1999.
5. Speech Communication Human and Machine, Douglas O Shaughnessy.S BSP BOOKS PVT LTD, 2nd edition.

# PET6J014 TELE COMMUNICATION SYSTEM MODELING AND SIMULATION

**MODULE-I**

**Simulation methodology-** Introduction, Aspects of methodology, Performance Estimation, Sampling frequency, Low pass equivalent models for band pass signals, multicarrier signals, Non-linear and time varying systems, Post processing, Basic Graphical techniques and estimations

**MODULE-II**

**Simulation of random variables random process-** Generation of random numbers and sequence, Gaussian and uniform random numbers Correlated random sequences, Testing of random numbers generators, Stationary and uncorrelated noise, Goodness of fit test.

**MODULE-III**

**Modelling of communication systems-** Radio frequency and optical sources, Analog and Digital signals, Communication channel and models, Free space channels, Multipath channel and discrete channel noise and interference.

**MODULE-IV**

Quality of estimator, Estimation of SNR, Probability density function and bit error rate, Monte Carlo method, Importance sampling method, Extreme value theory.

**ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)**

Simulation and modeling methodology- Simulation environment, Modelling considerations, Performance evaluation techniques, error source simulation, Validation

**TEXT BOOKS**

1. Simulation of communication Systems: Modeling, Methodology and Techniques, MC. Jeruchim, P.Balaban and Sam K Shanmugam, , Plenum Press, New York, 2001.

**REFERENCE BOOKS**

1. Simulation Modeling and Analysis, Averill.M.Law and W. David Kelton, McGraw Hill Inc., 2000.
2. System Simulation, Geoffrey Gorden, 2nd Edition, Prentice Hall of India, 1992.
3. Performance Analysis of Digital Communication Systems,W.Turin, Computer Science Press, New York, 1990.
4. Discrete Event System Simulation, Jerry banks and John S.Carson, Prentice Hall of India, 1984
5. Principles of Communication Systems Simulation, William H. Tranter, K. Sam shanmugam, Theodore S. Rappaport, K. KurtL. Kosbar, Pearson Education (Singapore) Pvt Ltd, 2004. .

# PMG6M001 ENVIRONMENTAL SCIENCE AND ENGINEERING

**Module I**

**Multidisciplinary nature of environmental studies**

Definition, scope and importance, Need for public awareness.

**Natural Resources:**

Renewable and non-renewable resources:

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.

**Module II**

**Ecosystems**

Concept of an ecosystem.

- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :-

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Environmental Pollution Definition**

- Cause, effects and control measures of :-

a) Air pollution

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

**Module III**

**Social Issues and the Environment**

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rahabilitation of people; its problems and concerns. Case Studies
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

**Module IV**

**Human Population and the Environment**

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

**References**

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. R. Rajagopalan, Environmental Studies, Oxford University Press
3. Ajith Sankar, Environmental Mangement, Oxford University Press
4. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
5. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
6. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
7. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
8. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
9. Down to Earth, Centre for Science and Environment (R)

# PEN6E101 BUSINESS COMMUNICATION AND SKILL FOR INTERVIEW

**Course Objectives**

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To develop report writing skills.
- To equip them to face interview & Group Discussion.
- To inculcate critical thinking process.
- To prepare them on problem solving skills.
- To provide symbolic, verbal, and graphical interpretations of statements in a problem description.
- To understand team dynamics & effectiveness.
- To create an awareness on Engineering Ethics and Human Values.
- To install Moral and Social Values, Loyalty and also to learn to appreciate the rights of others.
- To learn leadership qualities and practice them.

**MODULE I**

**Communication Skill:** Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.

**MODULE II**

**Critical Thinking & Problem Solving:** Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats, Mind Mapping & Analytical Thinking.

**Teamwork:** Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

**MODULE III**

**Ethics, Moral & Professional Values:** Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

**MODULE IV**

**Leadership Skills:** Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation.

**Expected outcome:**

The students will be able to

- Communicate effectively.
- Make effective presentations.
- Write different types of reports.
- Face interview & group discussion.
- Critically think on a particular problem.
- Solve problems.
- Work in Group & Teams

- Handle Engineering Ethics and Human Values.
- Become an effective leader.

**References:**

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.
3. Larry James (2016); "The First Book of Life Skills"; First Edition; Embassy Books.
4. Shalini Verma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company
5. John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc.

***HONOURS SPECIALIZATION:***

**MINOR SPECIALIZATION:**

## PET6G001 SIGNALS & SYSTEMS

**MODULE – I (10 HOURS)**

1. 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: Cross correlation and Autocorrelation Sequences, Properties.

**MODULE – II (10 HOURS)**

1. The Continuous-Time Fourier Series:
   Basic Concepts and Development of the Fourier series; Calculation of the Fourier Series, Properties of the Fourier Series.
2. The Continuous-Time Fourier Transform:
   Basic Concepts and Development of the Fourier Transform; Properties of the Continuous-Time Fourier Transform.

**MODULE- III (10 HOURS)**

1. 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.

**MODULE- IV (6 HOURS)**

1. 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.

**ADDITONAL MODULE (TERMINAL EXAMINATION-INTERNAL) (04 HOURS)**

1. Properties of Continuous-Time Systems:
   Block Diagram and System Terminology; System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality.

**TEXT BOOKS**

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

**REFERENCE BOOKS**

1. Signals and Systems - P. Ramakrishna. Rao, TMH.
2. Signals and Systems – A NagoorKani, TMH
3. Signals and Systems, Chi-Tsong Chen, Oxford
4. Principles of Signal Processing and Linear Systems, B.P. Lathi, Oxford.
5. Principles of Linear Systems and Signals, B.P Lathi, Oxford

## HONOURS SPECIALIZATION:

## PET6D001 SOFTWARE DEFINED RADIO ARCHITECTURE SYSTEM AND FUNCTION

**MODULE-1(10 HRS)**

**Introduction to SDR:**The Need for Software Radios. What Is a Software Radio? Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.

**Radio frequency implementation issues:**The Purpose of the RF Front-End. Dynamic Range: The Principal Challenge of Receiver Design. RF Receiver Front-End Topologies. Enhanced Flexibility of the RF Chain with Software Radios. Importance of the Components to Overall Performance. Transmitter Architectures and Their Issues. Noise and Distortion in the RF Chain. ADC and DAC Distortion.

**MODULE-2(10 HRS)**

**Multirate signal processing:**Introduction. Sample Rate Conversion Principles. Polyshase Filters. Digital Filter Banks. Timing Recovery in Digital Receivers Using Multirate Digital Filters.

**Digital generation of signals:**Introduction. Comparison of Direct Digital Synthesis with Analog Signal Synthesis. Approaches to Direct Digital Synthesis. Analysis of Spurious Signals. Spurious Components due to Periodic Jitter. Band pass Signal Generation. Performance of Direct Digital Synthesis Systems. Hybrid DDS-PLL Systems. Applications of direct Digital Synthesis. Generation of Random Sequences. ROM Compression Techniques.

**MODULE-3 (10HRS)**

Analog to digital and digital to analog conversion: Parameters of ideal data converters; Parameters of practical data converters; Techniques to improve data converter performance; Common ADC and DAC architectures

Smart antennas: Vector channel modeling; Benefits of smart antennas; Structures for Beamforming Systems; Smart Antenna Algorithms. Diversity and Space-Time

Adaptive Signal Processing; Algorithms for Transmit STAP; Hardware Implementation of Smart Antennas; Array Calibration.

**MODULE-4 (6 HRS)**

Digital hardware choices: Introduction; Key Hardware Elements; DSP Processors; Field Programmable Gate Arrays; Trade-Offs in Using DSPs, FPGAs, and ASICs; Power Management Issues; Using a Combination of DSPs, FPGAs, and ASICs.

**ADDITONAL MODULE (TERMINAL EXAMINATION-INTERNAL) (04 HOURS)**

Object-oriented representation of radios and network resources: Networks; Object-Oriented Programming; Object Brokers; Mobile Application Environments; Joint Tactical Radio System

**TEXT BOOKS**

1. Software Radio: A Modern Approach to Radio Engineering, Jeffrey H. Reed, Prentice Hall PTR; May 2002, ISBN: 0130811580

**REFERENCE BOOKS**

1. Software Radio Architecture: Object-Oriented Approaches to Wireless Systems Engineering by Joseph Mitola Wiley-Interscience; 1st edition 2000
2. Software Defined Radio: Architectures, Systems and Functions: M. Dillinger, K. Madani, N. Alonistioti, John Wiley & Sons, 05-Aug-2005

| Seventh Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Theory | | | | | Practical | | |
| **Code** | **Course Name** | **Hours/ week L/T** | **Credit Theory** | **University Marks** | **Internal Evaluation** | **Hours/ week L/T** | **Credit Practical** | **Marks** |
| GS | Nano Science & Bio Technology | 3-1 | 4 | 100 | 50 | | | |
| PE | Wireless Communication Systems/Satellite Communication Systems/Digital Image Processing/Adaptive Signal Processing/Advanced Control Systems/Embedded System Design/Electronics Design Automation/Database Management System | 3-1 | 4 | 100 | 50 | | | |
| PE | Wireless Sensor Networks/Optical Communication Networking/System Design Using Integrated Circuits/CMOS based Design/Mobile Computing/Biomedical Signal Processing | 3-1 | 4 | 100 | 50 | | | |
| OE | Soft Computing */ Other subjects | 3-1 | 4 | 100 | 50 | | | |
| PC | Advance Lab-II/ Project | | | | | 8 | 4 | 200 |
| | | | | | | | | |
| | Projects on Internet of Things | | | | | 8 | 4 | 200 |
| Total | | 16 | 16 | 400 | 200 | 16 | 8 | 400 |
| Total Marks: 1000 | | | | | | | | |
| Total Credits: 24 | | | | | | | | |
| Honours | Telecommunication Network and Optimization | 4 | 4 | 100 | 50 | | | |
| Minor | VLSI Design | | | | | | | |

Semester : 7th

| | | | | |
|---|---|---|---|---|
| 1. | PET7C001 GS(CP) | Nano & Bioscience | 4-0-0 | 4 |
| 2. | PET7D001 Honours(CP) | Telecommunication Network and Optimization | 4-0-0 | 4 |
| 3. | PET7G001 Minor(CP) | VLSI Design | 4-0-0 | 4 |
| 4. | PET7H001 OE(O4) | Soft Computing | 4-0-0 | 4 |
| 5. | PET7H002 OE(O4) | Other subjects | 4-0-0 | 4 |
| 6. | PET7H201 FE(CP) | Projects on Internet of Things | 0-0-4 | 4 |
| 7. | PET7I201 PC(O3) | Advance Lab - II | 0-0-4 | 4 |
| 8. | PET7I202 PC(O3) | Project | 0-0-4 | 4 |
| 9. | PET7J001 PE(O1) | Wireless Communication Systems | 4-0-0 | 4 |
| 10. | PET7J002 PE(O1) | Satellite Communication Systems | 4-0-0 | 4 |
| 11. | PET7J003 PE(O1) | Digital Image Processing | 4-0-0 | 4 |
| 12. | PET7J004 PE(O1) | Adaptive Signal Processing | 4-0-0 | 4 |
| 13. | PET7J005 PE(O1) | Advanced Control Systems | 4-0-0 | 4 |
| 14. | PET7J006 PE(O1) | Embedded System Design | 4-0-0 | 4 |
| 15. | PET7J007 PE(O1) | Electronics Design Automation | 4-0-0 | 4 |
| 16. | PET7J008 PE(O1) | Database Management Systems | 4-0-0 | 4 |
| 17. | PET7J009 PE(O2) | Wireless Sensor Networks | 4-0-0 | 4 |
| 18. | PET7J010 PE(O2) | Optical Communication Networking | 4-0-0 | 4 |
| 19. | PET7J011 PE(O2) | System Design Using Integrated Circuits | 4-0-0 | 4 |
| 20. | PET7J012 PE(O2) | CMOS based Design | 4-0-0 | 4 |
| 21. | PET7J013 PE(O2) | Mobile Computing | 4-0-0 | 4 |
| 22. | PET7J014 PE(O2) | Biomedical Signal Processing | 4-0-0 | 4 |
| | | | | 28 |

*7th Semester*

## PET7C001 NANO SCIENCE & BIO TECHNOLOGY

**"will be uploaded soon"**

# PET7H001 SOFT COMPUTING

**MODULE – I (8 hours)**

**Basic tools of soft Computing**: Fuzzy logic, Neural Networks and Evolutionary Computing, Approximations of Multivariate functions, Non – linear Error surface and optimization.

**MODULE – II (8 hours)**

**Fuzzy Logic Systems:** Basics of fuzzy logic theory, Crisp and fuzzy sets; Basic set operations; Fuzzy relations, Composition of Fuzzy relations, Fuzzy inference, Zadeh's compositional rule of inference; Defuzzificaiton ; Fuzzy logic control; Mamdani and Takagi and Sugeno architectures. Applications to pattern recognition.

**MODULE—III (16 hrs)**

**Neural networks:** Single layer networks, Perceptron; Activation functions; Adalinc- its training and capabilities, weights learning, Multilayer perceptrons; error back propagation, generalized delta rule; Radial basis function networks and least square training algorithm, Kohenen self – organizing map and learning vector quantization networks; Recurrent neural networks, Simulated annealing neural networks; Adaptive neuro-fuzzy information; systems (ANFIS),

**MODULE—IV (08 hrs)**

**Evolutionary Computing**: Genetic algorithms: Basic concepts, encoding, fitness function, reproduction. Differences of GA and traditional optimization methods. Basic genetic, basic evolutionary programming concepts Applications, hybrid evolutionary algorithms.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Applications to Different Engineering problems.

**Text Books**

1) *F. O. Karry and C. de Silva, "Soft Computing and Intelligent Systems Design – Theory, Tools and Applications". Pearson Education. (Printed in India).*

**Reference Books**

2) J. S. R. Jang. C. T. SUN and E. Mizutani, "Neuro-fuzzy and soft-computing". PHI Pvt. Ltd., New Delhi.

3) Fredric M. Ham and Ivica Kostanic, "Principle of Neuro Computing for Science and Engineering", Tata McGraw Hill.

4) S. Haykins, "Neural networks: a comprehensive foundation". Pearson Education, India.

5) V. Keeman, "Learning and Soft computing", Pearson Education, India.

6) R. C. Eberhart and Y. Shi, "Computational Intelligence Concepts to Implementation". Morgan Kaufmann Publishers (Indian Reprint).

*7th Semester*

## SOFT COMPUTING LAB
## (All the experiments are compulsory)

**List of experiments:**

1) Study of fundamental of Fuzzy Logic and Basic Operations.
2) Study of Fuzzy Weighted Average and Application.
3) Solve a given problem (operations) using Fuzzy logic in MATLAB.
4) Solve a given problem (Max-Min composition) using Fuzzy logic in MATLAB.
5) Study of Neural Networks and Perceptron Example.
6) Study of Radial Basis Function and Application
7) Study of Probabilistic Neural Networks and Application.
8) Study of GA tool in MATLAB.
9) Development of genetic algorithms for domain specific Engineering applications.
10) Development of different evolutionary algorithms for domain specific Engineering applications.

*7th Semester*

## PROFESSIONAL ELECTIVES (PE-I):

### PET7J001 WIRELESS COMMUNICATION SYSTEMS

**MODULE-I**

**History of wireless communication:** Concept of mobile and personal communication, wireless cellular platform, the design fundamentals of cellular networks, frequency reuse, spectrum capacity enhancement techniques, co-channel and adjacent channel interference, location management, handoff management; Concept of mobile IP for mobility management issues.

**MODULE-II**

**Propagation Models for Wireless Networks:** Two-ray ground reflection model, a micro-cell propagation model, a macro-cell propagation model, shadowing model, large scale path loss and shadowing, multi path effects in mobile communication, linear time variant channel model; Concept of coherent bandwidth, Coherent time, Doppler Shift - Effect of velocity of the mobile, models for multi path reception, mobile communication antennas.

**MODULE-III**

**Multiple access techniques in wireless communications:** frequency division multiple access technology (FDMA), time division multiple access (TDMA), space division multiple access (SDMA), code division multiple access (CDMA); spectral efficiency of different wireless access technologies, spectral efficiency in FDMA system, spectral efficiency in TDMA system, spectral efficiency for DS-CDMA system.

**MODULE-IV**

**Second Generation Mobile Networks-GSM:** Architecture and protocols, access technology, call set up procedure, 2.5 G networks; evolution to GPRS, concept of data communication on GPRS, session management and PDP Context, data transfer through GPRS network and routing.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Evolution of modern mobile wireless communication systems:** Personal area networks (PAN), Public wide-area wireless networks, wireless Local Area Networks; Brief introduction to 3G – The universal mobile telecommunication system (UMTS) Basic idea of satellite mobile communication systems.

***Text Books***

1) Wireless Communications- Principles and Practice, T S Rappaport, Pearson Education India, Second Edition 2003

2) Wireless Communication and Networks, Upen Dalal, Oxford university Press, First Edition, 2015.

3) Wireless Communication and Networks 3G and Beyond, Iti Saha Misra, Tata McGraw Hill Education Pvt. Ltd, Second Edition, 2009.

4) Mobile Communication Engineering – Theory and Applications W C Y Lee, TMH Publication, Second Edition, 2008.

***Reference Books***

1) Fundamentals of Wireless communication , David Tse and Pramod Viswanath, Cambridge University Press, 2005

2) Wireless Communication, Andrea Goldsmith, Cambridge University Press, 2005

*7th Semester*

# PET7J008 DATABASE MANAGEMENT SYSTEM

**MODULE-I**

**Introduction** - Evolution of database systems, overview of database management systems.

**Entity-relationship model** - Basic Concepts, Constraints, Keys, Design Issues, Entity-Relationship Diagrams, The Unified Modeling Language (UML), Class Diagrams.

**MODULE-II**

**Relational Model** - Structures of relational databases, integrity constraints; Logical database design – ER to relational, relational algebra, relational calculus, functional dependencies, multi-valued dependencies, normal forms, Decompositions into normalized relations.

**MODULE-III**

**SQL** – Simple queries, queries with more than one relation, sub queries, full relation operations, Database modifications, View definitions.

**MODULE-IV**

**Issues in Physical Database Design** – physical data storage, raid disk organization technique; file structures – sequential file organization, indices, b-trees, hash tables.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Details of Relational Algebra** – Basic operators, extended operators, constraints.

**Text Books**


1. Data Base Management System Raghu Ramakrishnan, McGraw-Hill , 3rd edition,2002 .
2. Reading in Data Base Systems, Joseph M. Hellerstein, The MIT Press,4th Edition,2005.


**Reference Books**


1) Database system concepts, Abraham Silberschatz, Henry F Korth and Sudharshan S McGraw Hill Publishin Company Limited,1St Edition,2004.
2) Database Management System - Post, Gerald V ,Tata McGraw-Hill, 2004.
3) Fundamentals of Database Syste,Elmasri,R.A.,Navathe,Shyam B.Narosa Publishing House,2nd Edition ,1997.
4) An introduction to Database Systems - Bipin C Desai Galgotia Publication ,4th Edition, 2005

*7th Semester*

## PET7J007 ELECTRONIC DESIGN AUTOMATION

**MODULE-I**

MOSFET small signal model, MOSFET parasitic capacitance value and modification in model. Scaling of MOS structure; SPICE level -1, level-2 and level 3 model; BSIM and CSIM models; Comparison between models. Layout generation, Design checking rules, Lamda, beta rule, routing: auto routing,

**MODULE-II**

Advance programming using VHDL. Component level programming. Library files, type\ declaration and usage, parameter types and overloading, types and type related issues, predefined and user-defined attributes, package declaration and usage.

**MODULE-III**

Introduction to CADENCE, Use of CADENCE, Basic modeling using CADENCE, Layout generation using CADENCE. Introduction to low power IC design using CAD tools,

**MODULE-IV**

Delta delay modeling, insertion and transport delay. Use of signal drivers. Multiple processes

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Device floor planning basics, Case study of a low power OPAMP design and layout generation.

## Text book

1) Electronics Design Automation: Synthesis, verification & Test (System on Silicon)- Laung-Terng Wang, Morgan Kaufmann,2009

2) Essential Electronics design Automation (EDA)- Mark D.Birnbaum, Prentice Hall,2004

*7th Semester*

## PET7J003 DIGITAL IMAGE PROCESSING

**MODULE-I**

**Fundamentals** – Steps in digital image processing, sampling and quantization, relationship between pixels, imaging geometry

**Image Transforms** – Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform, Hotelling Transform.

**MODULE-II**

**Image Enhancement –** Point processing, spatial filtering (smoothing and sharpening filters), enhancement in frequency domain.

**Filtering in the Frequency Domain:** preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening.

**MODULE-III**

**Image Restoration and Reconstruction:** Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function.

**Color Image Processing:** Color models, Color transformation.

**MODULE-IV**

**Wavelets and Multi-resolution Processing:** multiresolution expansions, wavelet transforms in one and two dimension.

**Image Compression:** Fundamentals, Some basic compression methods (Chapt: 8 of Text book 1)

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Morphological Image Processing:** Erosion and Dilation, opening and closing.

**Text books**

1) Digital Image Processing, R.C. Gonzalez, R.E. Woods, Pearson Education , 3rd Edition, 2007

2) Digital Image Processing, S. Sridhar, Oxford University Press,2011

3) Digital Image Processing And Analysis, B. Chanda, Dutta D. Majumder ,PHI

**Reference Books**

1) Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods Pearson Education, Inc., Seventh Edition, 2004.

2) Digital Image Processing, William K. Pratt, John Wiley, New York, 2002

*7th Semester*

## PET7J002 SATELLITE COMMUNICATION SYSTEMS

**MODULE-I (12 Hours)**

**Introduction to satellite communication:** Orbital mechanics and parameters look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System ; Transponders,

**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 Accesses: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA; Spread Spectrum Transmission and Reception; Estimating Channel requirements, SPADE, Random access

**MODULE-III (12 Hours)**

5. 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,

**MODULE-IV**

**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.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Equipment reliability and space qualification.

Application of Satellite communication: Network distribution and direct broad casting TV, fundamentals of mobile communication satellite

**Text Books**

1) Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2nd Edition.

2) Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016

**Reference Books**

1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI
2. Satellite Communication, Robert M. Gagliardi, CBS Publishers
3. Satellitte Communication Systems, Richharia. BSP BOOKS PVT LTD.
4. Satellitte Communication Engg., MichealKolawole, BSP BOOKS PVT LTD

*7th Semester*

# PET7J004 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.

**MODULE-III (16 Hours)**
Gradient Estimation and its effects on Adoption: The performance penalty, Variance of the gradient estimate, Misadjustment.

Adaptive Algorithms and Structures: The LMS Algorithm, Convergence, learning Curve, Performance analysis, Filtered X LMS algorithm,

**MODULE-IV**
**Applications:** Adaptive Modelling and System Identification using adaptive filter, Inverse Adaptive Modelling, Deconvolution, and equalization using adaptive filter.

**ADDITIONAL MODULE (Terminal Examination-Internal)**
Adaptive Control Systems using Filtered X LMS Algorithm, Adaptive Noise Cancellation using Adaptive filter

**Text Books**

1. *Adaptive Signal Processing*, Bernard Widrow and Samuel D. Stearns, Pearson Education, 2nd impression, 2009.

**Reference Books**

2. *Adaptive Filter Theory*, Simon Haykin, Pearson Education, 4th Edn.

*7th Semester*

# PET7J005 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 critgion, Jury stability Test.

## 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: Eigen values and Eigen vectors, Generalized Eigen vectors.

*7th Semester*

**MODULE -III (12 Hours)**

**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.

**MODULE-IV**

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.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Jump Resonance. Liapunov's Stability Analysis:

Introduction, Liapunov's Stability Criterion: Basic Stability Theorem, Liapunov Functions, Instability.

Direct Method of Liapunov& the Linear System: Methods of constructing Liapunov functions for Non linear Systems.

**Text Books**

1. Discrete-Time Control System, K.Ogata, PHI ,2nd Edition, 2009.
2. Control Systems Engineering, I.J. Nagrath and M.Gopal, New Age International (P) Ltd. Publishers, 5th Edition, 2007/ 2009.

**Reference books**

1) Design of Feedback Control Systems, Stefani,
2) , Oxford University Press, Fourth Edition,2009.
3) Modern Control Systems, K.Ogata, PHI, 5th Edition,2010.
4) Modern Control Systems Richard C. Dorf. And Robert, H.Bishop, Pearson Education Inc. Publication, 11th Edition,2008.
5) Control Systems (Principles & Design), M.Gopal, Tata Mc. Graw Hill Publishing Company Ltd, 3rd Edition,2008.
6) Control Systems Engineering, Norman S.Nise, Wiley India (P) Ltd, 4th Edition,2008.

*7th Semester*

## PET7J006 EMBEDDED SYSTEM DESIGN

**MODULE – I** **(8 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.

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.

Hardware Software Co-Design and Program Modelling: Fundamental Issues in Hardware Software Co-Design.

**MODULE – II** **(8 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.

**MODULE – III** **(8 Hours)**

**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 – IV** **(8 Hours)**

Design and Development of Embedded Systems:

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.

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

**ADDITIONAL MODULE (Terminal Examination-Internal) (8 Hours)**

Major Application Areas of Embedded Systems.

**Embedded Systems: Application and Domain Specific:** Washing Machine: Application Specific Embedded System, Automotive: Domain Specific Example for Embedded System; Computational Models in Embedded Design, Introduction to Unified Modelling Language (UML), Hardware Software Trade-offs; Programming in Embedded 'C'.

**An Introduction to Embedded System Design with VxWorks and MicroC/OS-II (μCOS-II) RTOS:** VxWorks, MicroC/OS-II (μCOS-II); Boundary Scan;

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

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

**Reference Book:**

2) An Embedded Software Primer, David E. Simon, Addison Wesley, 1999.

3) The Art of Designing Embedded Systems, Jack Ganssle, Newnes, 2000

4) Embedded Microprocessor System Design, K. Short, Prentice Hall, 1998.

5) Embedded System Applications, C. Baron, J. Geffroy and G. Motet, Kluwer, 1997.

6) Embedded Systems – Architecture, Programming and Design, Raj Kamal, Tata McGraw Hill Publishing Company Limited, New Delhi, 12th reprint 2007.

7) Embedded system design. Modeling synthesis and verification, Daniel Gajski. BSP BOOKS PVT LTD.

*7th Semester*

## PROFESSIONAL ELECTIVES (PE-II)

## PET7J009 WIRELESS SENSOR NETWORK

**MODULE-I** **(8 Hours)**

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.

**MODULE-II** **(6 Hours)**

Localization and Tracking: Issues and approaches, Problem formulations: Sensing model, collaborative localization. Coarse-grained and Fine-grained node localization. Tracking multiple objects.

**MODULE-III** **(8 Hours)**

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.

**MODULE-IV** **(6 Hours)**

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,

**ADDITIONAL MODULE (Terminal Examination Internal)** **(8 Hours)**

State space decomposition; Synchronization: Issues and Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization; 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**

2) Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press

3) Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati, Springer.

4) Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, TaiebZnati, Wiley Inter Science.

*7th Semester*

## PET7J010 OPTICAL COMMUNICATION AND NETWORKING

**MODULE-I** **(9 Hours)**

**Introduction:** Introduction, Ray theory transmission,Total internal reflection-Acceptance angle,Numerical aperture; Skew rays; Electromagnetic mode theory of optical propagation: EM waves, modes in Planar guide, phase and group velocity; cylindrical fibers , SM fibers.

**MODULE-II** **(9 Hours)**

**Transmission characteristics of optical fibers:** Attenuation – Material absorption losses in silica glass fibers, Linear and Non linear Scattering losses, Fiber Bend losses; Mid band and far band infrared transmission; Intra and inter Modal Dispersion – Over all Fiber Dispersion; Polarization: non linear Phenomena; Optical fiber connectors, Fiber alignment and Joint Losses; Fiber Splices, Fiber connectors, Expanded Beam Connectors : Fiber Couplers.

**MODULE-III** **(9 Hours)**

**Sources and detectors:** Optical sources: Light Emitting Diodes, LED structures, surface and edge emitters, mono and hetero structures: internal; quantum efficiency; injection laser diode structures; comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties; Comparison of performance; Photo detector noise :Noise sources , Signal to Noise ratio , Detector response time.

**MODULE-IV** **(9 Hours)**

**Fiber optic receiver and measurements:** Fundamental receiver operation, Pre amplifiers, Error sources: Receiver Configuration Probability of Error Quantum limit; Fiber Attenuation measurements, Dispersion measurements, Fiber Refractive index profile measurements, Fiber cut- off Wave length Measurements, Fiber Numerical Aperture Measurements, Fiber diameter measurements.

**ADDITIONAL MODULE (Terminal Examination-Internal)** **(9 Hours)**

**Optical networks:** Basic Networks, SONET / SDH, Broadcast and select WDM Networks; Wavelength Routed Networks; Nonlinear effects on Network performance, Performance of WDM + EDFA system, Solutions; Optical CDMA; Ultra High Capacity Networks.

**Text Books**

1. Optical Fiber Communication, John M. Senior, Pearson Education, Second Edition, 2007.
2. Optical Fiber Communication, Gerd Keiser, McGraw Hill, Third Edition, 2000.
3. Optical Network, Rajib Ramaswamy & Kumar Sivarajan,M.K. Publication,2nd edition.

**Reference Books**

1. Optical Communication System, J. Gower, Prentice Hall of India, 2001.
2. Optical Networks, Rajiv Rama swami, Elsevier ,Second Edition, , 2004. 3. Fiber-optic communication systems, Govind P. Agrawal, John Wiley & sons, third edition, , 2004.
3. Fiber Optics and Optoelectronics, R.P. Khare, Oxford University Press, 2007.
4. Optical Communication Network, Viswanath Mukherjee, McGraw Hill Publication,2000.

*7th Semester*

## PET7J011 SYSTEM DESIGN USING INTEGRATED CIRCUITS

**MODULE- I** **(8 Hours)**

**Linear IC- Operational amplifier:** Introduction to linear ICs, Operational amplifier IC741, Block diagram and characteristics, DC and AC performance; Open loop configurations, Feedback configurations, Inverting, non inverting and differential amplifier, Summer, Subtractor, Integrator, Differentiator, Zero crossing detector, Schmitt trigger, Window detector; Astable and monostable multivibrators; V-I and I-V converters; Filter and its types, Instrumentation amplifier, Precision rectifiers, Logarithmic and antilog amplifiers; multiplier; Op amp voltage regulator, IC linear voltage regulator (series 7800 and 7900 ICs).

**MODULE- II** **(8 Hours)**

**Other LICs and Data Converters:** 555 timer, Block diagram and features, Astable multivibrator, applications, Square wave oscillator, Ramp generator, Triangular waveform generator and Voltage to frequency converter; Monostable multivibrator, applications, Frequency divider, PWM and PPM generators. XR2240 Programmable

Timer/Counter,Block diagram and operation, applications,Free running oscillator and frequency synthesizer; PLL565, Principle, Building blocks, applications, Frequency multiplication, Frequency translation, AM and FM detection. Data converters, DAC characteristics, Binary weighted DAC, R-2R DAC, Monolithic DAC-08, ADC characteristics, Flash ADC, Successive approximation ADC, dual slope integrating type ADC, Monolithic ADC AD670,Variable Voltage Regulators(LM317).

**MODULE- III** **(8 Hours)**

**Digital Integrated Circuits:** Digital IC characteristics, Digital IC families,RTL and DTL, HTL, I2L, TTL, ECL, MOS and CMOS logic circuits, Comparison of digital IC families.

**MODULE- IV** **(8 Hours)**

**Design of sequential machines:** Analysis and design of synchronous sequential machines, Mealey and Moore machines, State table, State diagram, State reduction and assignments, Analysis and design of asynchronous sequential logic, Race conditions, Design problems from specifications, Hazards in combinational and sequential circuits.

**ADDITIONAL MODULE (Terminal Examination-Internal)** **(8 Hours)**

**Processor and control unit design:** Registers, Register transfer logic, inter register transfer, bus transfer and memory transfer, Arithmetic logic and shift micro operations, Macro operations; Processor logic design, Processor organization, Bus organization, Processor unit employing a scratch pad memory, Accumulator, Design of ALU, Design of status register, Design of processor unit with control variables, Design of accumulator , Control logic design, Single flip flop/state method, Sequence register and decoder method, PLA control, Micro program control.

**Text Books**

1. Operational Amplifiers and Linear Integrated Circuits, Robert. F. Coughlin and Frederick F. Driscoll, PHI Learning Pvt. Ltd, Sixth Edition, 2008.

2. Digital Logic and Computer design, M. Morris Mano, PHI Learning Pvt. Ltd, 2008

**Reference Books**

1. Opamp and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI Learning Pvt. Ltd, Fourth Edition, 2008.

2. Digital Design, M. Morris Mano and Michael D. Ciletti, PHI Learning Pvt. Ltd, Fourth Edition,2008.

*7th Semester*

## PET7J012 CMOS BASED DESIGN

**MODULE-I** **(8 Hours)**

**Introduction to MOS Device-**MOS Transistor, MOS models;MOS Transistor under static conditions; threshold voltage; Resistive operation, saturation region,;channel length modulation; body effect; DC transfer characteristics; Tristate inverters, velocity saturation; Hot carrier effect, drain current Vs voltage charts, sub threshold conduction; MOS structure capacitance; CMOS logic, fabrication and layout, stick diagrams.

**MODULE-II** **(8 Hours)**

**CMOS Processing-**CMOS technologies, wafer formation photolithography channel formation, isolation, gate oxide, gate source, drain formation, contacts and metallization; layout design rules, design rule checking.

**MODULE-III** **(8 Hours)**

**Circuit Characterization & Performance Estimation-**Delay estimation; transistor sizing; power dissipation; Sheet resistance, area capacitance, design margin, reliability; Scaling models, scaling factor for device parameters, Advantages and Limitations of scaling.

**MODULE-IV** **(6 Hours)**

**Design of Combinational Logic-**Static CMOS design, complementary CMOS, static properties, complementary CMOS design, Power consumption in CMOS logic gates, dynamic or glitching transitions, Design to reduce switching activity; Radioed logic, DC VSL, pass transistor logic.

**ADDITIONAL MODULE (Terminal Examination-Internal)** **(6 Hours)**

Differential pass transistor logic;sizing of level restorer, sizing in pass transistor; Dynamic CMOS design; Domino logic, optimization of Domino logic; NPCMOS; Designing logic for reduced supply voltages.

**Reference Books**

1. CMOS VLSI DESIGN-Nail H.E. Weste & David Harris, Ayan Banerjee,Pearson Education,4th edition,2011
2. CMOS Digital integrated circuits , Sung-Mo-Kanga and Yusuf Leblebici,TataMc Graw Hill New Delhi -2003.
3. Modern VLSI Design,Wayne Wolf, Prentice Hall -2nd Edition, 1998.
4. CMOS VLSI Design: A Circuits and Systems Perspective, Nail H.E. Weste & David Money Harris,- Addison Wesley, 3rd edition,2005.

*7th Semester*

## PET7J013 MOBILE COMPUTING

**MODULE – I** **(10 Hours)**

**Introduction to Personal Communications Services (PCS):** PCS Architecture, mobility management, Networks signaling; Global System for Mobile Communication (GSM) System.

**Overview:** GSM Architecture, Mobility management, Network signaling; General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard.

**MODULE–II** **(14 Hours)**

**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.

**MODULE–III** **(4 Hours)**

**Global Mobile Satellite Systems;** case studies of the IRIDIUM, ICO and GLOBALSTAR systems.

**MODULE-IV** **(8 Hours)**

**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.

**ADDITIONAL MODULE (Terminal Examination-Internal)** **(6 Hours)**

Wideband Code Division Multiple Access (W-CDMA) and CDMA 2000; Mobile IP.

**Text Books**

1. Mobile Communication, J. Schiller, Pearson Education,2nd Edition,2003
2. Mobile Computing, Raj Kamal, Oxford University Press
3. Pervasive Computing, Burkhardt, Pearson Education,2002.
4. Mobile Computing, Talukder, TMH, 2nd Edition,2010.

**Reference Books**

1. Wireless Communication & Networking, Garg, Elsevier,1st Edition,2007.
2. Mobile Computing,P.K. Patra, S.K. Dash, Scitech Publications,2011
3. Principles of Mobile Computing, Hansmann, Merk, Springer, 2nd Edition,2003.
4. Third Generation Mobile Telecommunication Systems, P. Stavronlakis, Springer,1st Edition,2001.
5. The Wireless Application Protocol, Sandeep Singhal, Pearson Education,2000.

*7th Semester*

## PET7J014 BIOMEDICAL SIGNAL PROCESSING

**MODULE-I** **(8 Hours)**

**Introduction to Biomedical Signals:**Tasks in Biomedical Signal Processing, Computer Aided Diagnosis, Examples of Biomedical signals: ECG, EEG, EMG etc., Review of linear systems, Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals, Processing of Random & Stochastic signals, spectral estimation.

**MODULE-II** **(8 Hours)**

**Cardio-logical Signal Processing:**Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition, Heart rate variability analysis.

**MODULE-III** **(8 Hours)**

**Adaptive Noise Canceling:**Principles of Adaptive Noise Canceling, Adaptive Noise Canceling with the LMS adaptation, Algorithm, Noise Canceling Method to Enhance ECG Monitoring, Fetal ECG Monitoring.

**MODULE-IV** **(8 Hours)**

**Neurological Signal Processing:**Modeling of EEG Signals, Detection of spikes and spindles, Detection of Alpha, Beta and Gamma Waves, Auto Regressive (A.R.) modeling of seizure EEG, Sleep Stage analysis, Inverse Filtering.

**ADDITIONAL MODULE (Terminal Examination-Internal)** **(6 Hours)**

Properties and effects of noise in biomedical instruments;Filtering in biomedical instruments; Least squares and polynomial modeling;

**Reference Books**

1. Biomedical Signal Processing: Principles and techniques, D.C.Reddy, Tata McGraw Hill, New Delhi, 2005.
2. Biomedical Signal Processing, Willis J Tompkins, Prentice Hall, 1993
3. Biomedical Signal Analysis, R. Rangayan, Wiley, 2002.
4. Biomedical Signal Processing & Signal Modeling, Eugene N. Bruce, Wiley, 2001.
5. Biomedical Signal and Image Processing, K. Najarian and R. Splinter, The CRC Press, Second Edition.

*7th Semester*

## MATHEMATICS FOR COMMUNICATION ENGINEERS

**MODULE–I** **(10 hours)**

**Introduction and Foundations:** Mathematical Models, Models for Linear Systems andSignals, 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 NormedVector 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** **(10 hours)**

**Representation and Approximation in Vector Spaces:** The Approximation Problem inHilbert 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, TheCholeskyFactorization, Unitary Matrices and the QR Factorization. [Moon: 5.1 to 5.3]

**Eigenvalues and Eigenvectors:** Eigen Values and Linear Systems, Linear Dependenceof Eigenvectors, Diagonalization of a Matrix. [Moon: 6.1 to 6.3]

**MODULE–III** **(10 hours)**

**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]

**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]

**MODULE–IV** **(10 hours)**

**Detection Theory:** Introduction to Hypothesis Testing, Neyman-Pearson Theory, Neyman

Pearson testing with Composite Binary Hypotheses, Bayes Decession Theory, Some M-ary Problems, Maximum–Likelihood Detection. [Moon: 11.1 to 11.6]

**ADDITIONAL MODULE (Terminal Examination-Internal) (6 Hours)**

**Estimation Theory:** The Maximum-Likelihood Principle, ML Esimates and Sufficiency, Applications of ML Estimation, Bayes Estimation Theory, Bayes risk [Moon: 12.1 to 12.6].

**Text Books**

1. Mathematical Methods and Algorithms for Signal Processing, Todd K.Moon and W. C. Stirling, Pearson Education,1999.

**Reference Books**

2. Probability and Random Processes with Application to Signal Processing, Henry Stark, John Woods,4th edition, Pearson Education, 2011.
3. Probability, Random Variables and Random Process, P. Z. Peebles, McGraw Hill Publications,2002.
4. Introduction to Linear Algebra, Gilbert Strang, Cambridge Press, Fifth Edition, 2009.
5. Fundamentals of Statistical Signal Processing, Estimation Theory, S. Kay, Pearson Publication, 1993.

*7th Semester*

## OPEN ELECTIVE

# OPERATION RESEARCH

**MODULE-I**

**Introduction to Operations Research:** Definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem, Formulation of LPP, Graphical solution of LPP, Simplex method, slack, surplus and artificial variables, Concept of duality, big-M method two phase method, dual simplex method, degeneracy and unbound solutions, procedure for resolving degenerate cases.

**MODULE-II**

**Transportation Problem:** Formulation of transportation model, Optimality Methods, Unbalanced transportation problem, Basic feasible solution, Northwest corner rule, least cost method, Vogel's approximation method, Applications of Transportation problems, Assignment Problem, Formulation, unbalanced assignment problem, Traveling salesman problem, Optimality test, the stepping stone method, MODI method.

**MODULE-III**

**Sequencing Models:** Johnsons algorithm, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines, Graphical solutions priority rules.

**MODULE-IV**

**Dynamic programming:** Characteristics of dynamic programming, Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Games Theory:** Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

**Text Books**

1. Operations Research, P. SankaraIyer, Tata McGraw-Hill, 2008.
2. Operations Research, A.M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education, 2005.

**Reference Books**

1) Operations Research and Introduction, Taha H. A, Pearson Education edition.
2) Operations Research, S. D. Sharma ,Kedarnath Ramnath & Co 2002
3) Operation Research Theory & Applications, J K Sharma, Macmillan India Ltd, 2007
4) Operation Research, P K Gupta and D S Hira, S. Chand & co,2007

*7th Semester*

# INTERNET TECHNOLOGY AND APPLICATIONS

**MODULE – I**
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**
JAVA Script:

Programming Fundamentals, Statements, Expressions, Operators, Popup Boxes, Control Statements, Try…. Catch Statement, Throw Statement, Objects of Java script: Date object, array object, Boolean object, math object

**MODULE – III**
DOM:

HTML DOM, inner HTML, Dynamic HTML (DHTML), DHTML form, XML DOM

CGI/PERL:

Introduction to CGI, Testing & Debugging Perl CGI Script, Using Scalar variables and operators in Perl

**MODULE – IV**
Java Applet:

Introduction to Java, Writing Java Applets, Life cycle of applet

**ADDITIONAL MODULE (Terminal Examination-Internal)**
CSS:
External Style Sheets, Internal Style Sheets, Inline Style, The class selector, div & span tag

**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

*7th Semester*

# INDUSTRIAL AUTOMATION AND CONTROL

**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, Feed forward Control, Feed forward-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.

**MODULE-III** **(10 Hours)**

Motor Actuators and Control Valves. (Chapter 8 of Text Book 1)

**Industrial Automation: Programmable Logic Controllers:** Introduction, Principles of operation, Architecture, Programming (Programming Languages, Ladder Diagram, Boolean Mnemonics)

**MODULE - IV**

**Distributed Control:** Distributed vs. Centralized, Advantages, Functional Requirements, System Architecture.

**Real-time Programming:** Multi-tasking, Task Management, Inter-task Communication, Real-time Operating System. (Chapter 9 of Text Book 1)

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Distributed Control Systems (DCS), Communication options in DCS.

**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) SurekhaBhanot, Process Control: Principles and Applications, Oxford university Press, 2010

**Reference Books**

1) Smith Carlos and Corripio, "Principles and Practice of Automatic Process Control", John Wiley & Sons, 2006.
2) Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall, 2003.
3) C. Johnson, "Process Control Instrumentation Technology", PHI, New Delhi
4) D.R. Coughnowr, "Process System analysis and Control", McGraw Hill.

*7th Semester*

# COMPILER DESIGN

**MODULE-I**

The structure of a compiler, Lexical Analyzer: regular expression, finite automata, NFA, DFA, minimizing the number of states of a DFA, implementation issues

**MODULE-II**

Introduction to LEX. Syntactic specification of a programming language, context-free grammar, derivation and parse trees, ambiguity. Basic Parsing Techniques: shift reduce parsing, operator-precedence parsing. Top Down parsing, LL (1) parsers.

**MODULE-III**

Bottom up Parsing, LR parsers, LR (0) items, construction of SLR parsing table. Introductio canonical LR parsing, LALR parsing table. Use of ambiguous grammars for LR parser implementation

**MODULE-IV**

Introduction to YACC.Syntax Directed TranslationIntermediate code, postfix notation, three address codes – quadruples and triples. Translation of assignment statement, Boolean expressions, control structures, arrays. Run-time Storage Administration and symbol table management

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Data-flow analysis, Code Optimizations.

**Text Books**

1) Principle of Compiler Design- by Alfred Aho and Jeffrey Ullmen, Addison-Wesley

2) Compiler Design-by Muneeswaran, Oxford University Press.

**Reference book**

1) Principles of compiler design by Raghavan, TMH

*7th Semester*

# MULTIMEDIA SYSTEMS

**MODULE- I**
Multimedia components:

Introduction - Multimedia skills - Multimedia components and their characteristics Text, sound, images, graphics, animation, video, hardware

**MODULE-II**
Audio and video compression:

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression –principles-H.261-H.263- MPEG 1, 2, 4

**MODULE-III**
Text and image compression:

Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy. Encoding –source encoding -text compression –static Huffman coding dynamic coding –arithmetic coding –Lempel ziv-welsh Compression-image compression.

**MODULE-IV**
VoIP technology:

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods- VOIP applicability

**ADDITIONAL MODULE (Terminal Examination-Internal)**
Multimedia networking:

Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP

**Text books**

1. Fred HAlshall "Multimedia communication - applications, networks, protocol sand standards", Pearson education, 2007.
2. Tay Vaughan, "Multideai: making it work", 7/e, TMH 2007
3. Kurose and W.Ross" Computer Networking "a Top down approach, Pearson education

**Reference Books**

1. Marcus goncalves "Voice over IP Networks", McGraw hill
2. KR. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia
3. Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007
4. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education
5. Ranjan Parekh, "Principles of Multimedia", TMH 2006

*7th Semester*

# ENGINEERING ACOUSTICS

**MODULE-I**

**Acoustics waves:** Acoustics waves - Linear wave equation – sound in fluids – Harmonic plane waves – Energy density – Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales.

**Reflection and Transmission:** Transmission from one fluid to another normal and oblique incidence – method of images.

**MODULE-II**

**Radiation and reception of acoustic waves:**Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source - radiation impedance - Fundamental properties of transducers.

**Absorption and attenuation of sound:** Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

**MODULE-III**

**Pipes resonators and filters:**Resonance in pipes - standing wave pattern absorption of sound in pipes – long wavelength limit – Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters – low pass, high pass and band pass.

**Noise, Signal detection, Hearing and speech:** Noise, spectrum level and band level – combing band levels and tones – detecting signals in noise – detection threshold – the ear – fundamental properties of hearing – loudness level and loudness – pitch and frequency – voice.

**MODULE-IV**

**Architectural acoustics:**Sound in endosure – A simple model for the growth of sound in a room – reverberation time -Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design.

**Environmental Acoustics:**Weighted sound levels speech interference – highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Transduction:** Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker – loudspeaker cabinets – horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

**Text book**

2) Lawrence E.Kinsler, Austin, R.Frey, Alan B.Coppens, James V.Sanders, Fundamentals of Acoustics, 4th edition, Wiley, 2000.

**Reference Book**

3) L.Beranek , "Acoustics" - Tata McGraw-Hill

*7th Semester*

# REMOTE SENSING

## 3-1-0

**MODULE I**

**Remote sensing:**Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.

**MODULE-II**

**EMR interaction with atmosphere and earth materials:** Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectral characteristics.

**MODULE-III**

**Optical and microwave remote sensing:**Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

**MODULE-IV**

**Geographic information system:** GIS – Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Miscellaneous topics:** Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications- Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems. Global positioning system – an introduction.

**Text books**

1) M.G. Srinivas (Edited by), Remote Sensing Applications, Narosa Publishing House, 2001. (Units 1 & 2).

2) Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001 (Units 3, 4 & 5).

**Reference Books**

1) Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000.

2) Kang-Tsung Chang, "Introduction to Geographic Information Systems", TMH, 2002

3) Lille sand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, Inc, New York, 1987.

4) Burrough P A, "Principle of GIS for land resource assessment", Oxford MischaelHord, "Remote Sensing Methods and Applications", John Wiley & Sons, New York, 1986.

5) Singal, "Remote Sensing", Tata McGraw-Hill, New Delhi, 1990.

6) Floyd F. Sabins, Remote sensing, "Principles and interpretation", W H Freeman and Company 1996.

*7th Semester*

## *ADVANCE LAB-II*

## NETWORKING LAB

**List of Experiments:**

1) Study and measurement of attenuation and loss in optical fiber.
2) Study and measurement of bending loss in optical fiber.
3) Study and measurement of numerical aperture of optical fiber.
4) Measurement of optical power using optical power meter.
5) To Study the transmission of TDM signal through optical fiber.
6) To determine the bit rate of the optical fiber link.
7) Study of various multiplexing techniques.
8) Investigate the Power versus current curves and spectrum of different Lasers and observe the effects of different cavity characteristics.
9) Investigate the characteristics of PIN and Avalanche Photodiodes and understand the usage of the Light wave Analyzer component.
10) Investigate the effect of loss on optical system performance and characterize the system with the power budget equation. Use Opti System to optimize the fiber length of a communication system.
11) Determine the optical modes that exist for multimode step index fibers and investigate their performance on optical systems.
12) Characterize analytically and through simulation the effects of dispersion on optical systems.
13) Study the characteristics of EDFAs alone and in a system. Reanalyze the importance of receiver noise and the effect of amplification on the quality of an optical system.
14) Characterize analytically and through simulation the effects of nonlinearity on optical systems.
15) Investigate the method for measuring the BER accurately and the distortions present in coherent modulators.
16) Build a coherent receiver based on the 90-degree optical hybrid and further investigate the QAM format.
17) To determine the BER of wireless system using M-ARY (BPSK, QPSK, 8PSK, 16PSK) technique
18) To determine the BER of wireless system using QAM technique

*7th Semester*

***HONOURS SPECIALIZATION:***

## PET7D001 TELECOMMUNICATION NETWORKS AND OPTIMIZATIONS

## 4-0-0

**MODULE-I**

Network architectures – topology and hierarchy – evolution – layered architecture; Network Design Issues – application of graph theory – simplex algorithm and linear programming – binary and mixed integer linear programming;

**MODULE-II**

Core Networks – Routing principles – Shortest path algorithm – minimum spanning tree problem – flow control – max flow min cut theory – min cost network flow program – load balancing and optimization – congestion control .

**MODULE-III**

Advanced routing – Steiner trees and multicast – centralized routing (PCE), software defined network – distributed routing on ad-hoc networks, power aware MANET - reliability and route optimization.

**MODULE-IV**

Access Networks – Data link layer and media access control technologies – wireless and optical access – resource scheduling and optimization – Bipartite graph and stable matching algorithms – case studies (10);

**ADDITIONAL MODULE (Terminal Examination-Internal)**

Access core interface – case studies (5).

**Text Books**

1. Network Optimization by V. K. Balakrishnan
2. Linear Network Optimization: Algorithms and Codes by D. Bertsekas
3. Mathematical Aspects of Network Routing Optimization by C. A. S. Oliveira, P. M. Pardalos

**Reference Books**

1. Network Flows: Theory, Algorithm and Application by R. K. Ahuja, C. L. Magnanti, James B.
2. Optimization Algorithm for Networks and Graphs – vol. 1 by J. R. Evans, E. Mineka
3. Integer Programming and Network Models – H. A. Eiselt, C. L. Sandblom
4. Interconnections - R. Perlman 8. Computer Networks A. S. Tanenbaum

*7th Semester*

***MINOR SPECIALIZATION:***

## PET7G001 VLSI DESIGN

## 4-0-0

**MODULE–I (08 Hrs)**

**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.

**MODULE –II (14 Hrs)**

**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)

**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.

**MODULE – III (18 Hrs)**

**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)

**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.

**MODULE - IV**

**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.

*7th Semester*

**ADDITIONAL MODULE (Terminal Examination-Internal)**

**Design for Testability:** Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring $I_{DDQ}$ Test.

**Text Books**

1. Sung-Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 3rd Edn. Tata McGraw-Hill Publishing Company Limited, 2003.
2. K. Eshraghian and N.H.E. Weste, *Principles of CMOS VLSI Design – a Systems Perspective*, 2nd Edn. Addison Wesley, 1993.

**Reference Books**

1. Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, *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.