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