COURSE STRUCTURE OF SEMESTER I

Course structure for Semester-I is same as that of other branches of engineering at Jorhat Institute of Science and Technology, Jorhat and at Jorhat Engineering College, Jorhat under Dibrugarh University which has already been approved and adopted by Dibrugarh University with effective from academic session 2016-17

COURSE STRUCTURE OF SEMESTER II

Course structure for Semester-II is same as that of other branches of engineering at Jorhat Institute of Science and Technology, Jorhat and at Jorhat Engineering College, Jorhat under Dibrugarh University which has already been approved and adopted by Dibrugarh University with effective from academic session 2016-17

COURSE STRUCTURE OF SEMESTER-III:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS301	Mathematics-III	3	1	0	4	4
02	ET302	Network Theory	3	1	0	4	4
03	ET303	Digital Circuits & Logic Design	3	1	0	4	4
04	ET304	Electronic Devices and Circuits	3	1	0	4	4
05	ET305	Advanced Computer Programming	3	0	0	3	3
06	PI 306	Electrical Engineering Materials	3	1	0	4	4
07	ME301	Thermodynamics	2	0	0	2	2
Practicals							
08	ET303L	Digital Circuits & Logic Design Laboratory	0	0	2	2	1
09	ET304L	Electronic Devices and Circuits Laboratory	0	0	2	2	1
10	ET305L	Advanced Computer Programming Laboratory	0	0	2	2	1
		Total	20	5	6	31	28

COURSE STRUCTURE OF SEMESTER-IV

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS 401	Mathematics-IV	3	1	0	4	4
02	ET 402	Analog Electronics	3	1	0	4	4
03	ET 403	Signals and Systems	3	1	0	4	4
04	ET 404	Probability & Random Processes	2	1	0	3	3
05	PI 405	Electrical Machines	3	1	0	4	4
06	ET 406	Computer Architecture and Organization	4	0	0	4	4
Practicals /projects							
07	ET 402L	Analog Electronics Laboratory	0	0	2	2	1
08	ET 403L	Signals and Systems Laboratory	0	0	2	2	1
09	PI 405L	Electrical Machines Laboratory	0	0	2	2	1
10	ET 407L	Mini Project	0	0	2	2	2
		Total	18	5	8	31	28

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Member **Member** **Member**

COURSE STRUCTURE OF SEMESTER-V:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS 501	Mathematics-V	3	1	0	4	4
02	PI 501	Control Systems	3	1	0	4	4
03	ET 502	Linear ICs and Applications	3	1	0	4	4
04	ET 503	Analog Communication	3	1	0	4	4
05	ET 504	Electromagnetic Field Theory	3	1	0	4	4
06	ET 505	Electronics Measurement and Instrumentation	3	1	0	4	4
Practicals							
07	PI 501L	Control Systems Laboratory	0	0	2	2	1
08	ET 502L	Linear ICs and Applications Laboratory	0	0	2	2	1
09	ET 503L	Analog Communication Laboratory	0	0	2	2	1
10	ET 505L	Electronics Measurement and Instrumentation Laboratory	0	0	2	2	1
		Total	18	6	8	32	28

COURSE STRUCTURE OF SEMESTER-VI:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	HS 601	Introduction to Accountancy & Management	3	1	0	4	4
02	ET 601	Digital Signal Processing	3	1	0	4	4
03	ET 602	Microwave Engineering	3	1	0	4	4
04	ET 603	Digital Communication	3	1	0	4	4
05	ET 604	Microprocessor and Applications	3	1	0	4	4
06	ET 605	Communication Networks	4	0	0	4	4
Practicals							
07	ET 601L	Digital Signal Processing Laboratory	0	0	2	2	1
08	ET 602L	Microwave Engineering Laboratory	0	0	2	2	1
09	ET 603L	Digital Communication Laboratory	0	0	2	2	1
10	ET 604L	Microprocessor and Applications Laboratory	0	0	2	2	1
		Total	19	5	8	32	28

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COURSE STRUCTURE SEMESTER-VII:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ET701	Antennas and Wave propagation	3	1	0	4	4
02	ET702	Fiber Optic Communication	2	1	0	3	3
03	PI 703	Power Electronics Devices and Circuits	3	1	0	4	4
04	ET 704	Microcontrollers and Embedded systems	3	1	0	4	4
05	OE….	Elective-I (Open)	4	0	0	4	4
Practical/Projects/Seminar/ Viva							
06	ET702L	Fiber Optic Communication Laboratory	0	0	2	2	1
07	PI 703L	Power Electronics Devices and Circuits Laboratory	0	0	2	2	1
08	ET705	Industrial Summer Training Report/Viva	0	0	2	2	1
09	ET706	General Seminar	0	0	2	2	2
10	ET707	Project work– I	0	0	4	4	4
		Total	15	4	12	31	28

Elective-I (Open):

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	OE 01	Engineering Risk–Benefit Analysis	4	0	0	4	4
02	OE 03	Disaster Management	4	0	0	4	4
03	OE 04	Project Management	4	0	0	4	4
04	OE 05	Rural Technology and Community Development	4	0	0	4	4
05	OE 71	Database Management Systems	4	0	0	4	4
06	OE 72	Information Theory and Coding	4	0	0	4	4
07	OE 73	Design and Analysis of Algorithms	4	0	0	4	4
08	OE 74	Optimization Techniques	4	0	0	4	4
09	OE 75	Cloud Computing	4	0	0	4	4
10	OE 76	Software Engineering	4	0	0	4	4
11	OE 77	Engineering System Analysis and Design	4	0	0	4	4
12	OE78	Soft Computing	4	0	0	4	4
13	OE79	Mechatronics	4	0	0	4	4
14	OE80	Industrial Economics	4	0	0	4	4
15	OE81	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

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COURSE STRUCTURE SEMESTER-VIII:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ET 801	VLSI Design	3	1	0	4	4
02	ET 802	Wireless Communication	2	1	0	3	3
03	ETL 2..	Elective-II	4	0	0	4	4
04	ETL 3..	Elective-III	4	0	0	4	4
Practical/Project/Viva-voce							
05	ET 801L	VLSI Design Laboratory	0	0	2	2	1
06	ET 805	Comprehensive Viva Voce	0	0	0	0	2
07	ET 806	Project Work– II	0	0	8	8	8
08	ET 807	Project Viva-voce	0	0	0	0	2
		Total	13	2	10	25	28

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Elective-II:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ETL21	Communication Switching Systems	4	0	0	4	4
02	ETL22	Robotics and Industrial Automation	4	0	0	4	4
03	ETL23	Pattern Recognition	4	0	0	4	4
04	ETL24	Multimedia Communication Technology	4	0	0	4	4
05	ETL25	Principle of RADAR	4	0	0	4	4
06	ETL26	IC Technology	4	0	0	4	4
07	ETL27	Digital System Design	4	0	0	4	4
08	ETL28	Bio-Medical Electronics	4	0	0	4	4
09	ETL29	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

Elective-III:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ETL31	MEMS and Microsystems Technology	4	0	0	4	4
02	ETL32	Speech and Audio Processing	4	0	0	4	4
03	ETL33	Digital Image Processing	4	0	0	4	4
04	ETL34	Satellite Communications	4	0	0	4	4
05	ETL35	Mixed Signal Design	4	0	0	4	4
06	ETL36	Fuzzy Logic and Neural Network	4	0	0	4	4
07	ETL37	Adaptive Signal Processing	4	0	0	4	4
08	ETL38	Artificial Intelligence and Robotics	4	0	0	4	4
09	ETL39	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

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COURSE STRUCTURE OF SEMESTER-III:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS301	Mathematics-III	3	1	0	4	4
02	ET302	Network Theory	3	1	0	4	4
03	ET303	Digital Circuits & Logic Design	3	1	0	4	4
04	ET304	Electronic Devices and Circuits	3	1	0	4	4
05	ET305	Advanced Computer Programming	3	0	0	3	3
06	PI 306	Electrical Engineering Materials	3	1	0	4	4
07	ME301	Thermodynamics	2	0	0	2	2
Practical							
08	ET303L	Digital Circuits & Logic Design Laboratory	0	0	2	2	1
09	ET304L	Electronic Devices and Circuits Laboratory	0	0	2	2	1
10	ET305L	Advanced Computer Programming Laboratory	0	0	2	2	1
		Total	20	5	6	31	28

MATHEMATICS-III

SEMESTER: THIRD SEMESTER
COURSE CODE : BS301
L:T:P : 3:1:0 Credits:4

VECTOR CALCULUS: Vector functions, variable vectors and preliminaries, differentiation, different ial operators, identities, gradient, divergence, curl, their physicals meaning. Line,surface and Volume integrals, Gauss, Green and Strokes Theorem. Simple applications of Engineering problems. PARTIAL DIFFERENTIAL EQUATIONS: First order linear equation, Four standard forms of non – linear equation, linear equation with constant coefficient, Solution by separation of variables, Laplace E quation, Wave Equation Heat Equation, Solution of boundary value problems.

STATISTICS:
Measure of central tendency (mean, median, mode) Measures of dispersions, variance, moments, skewn ess and Kurtos' theory of probability-addition law, multiplication law, conditional probability, independent events. Theoretical discrete distribution-binomial, Poisson distribution, Normal distribution, method of least square and curve fitting.

GRAPH THEORY: Definition, Directed and undirected graphs, basic terminologies, finite and infinite graph, incidence and degree of vertex, isolated and pendent vertices, null graph, Handshaking th eorem, types of graphs, sub graphs, graphs isomorphism,operations of graphs, connected graph, disconn ected graphs and components. Walk, path and circuits, Eulerian graphs, Hamiltonian graphs, Dirac's theorem, Ore's, theorem, Konigsberg's Bridge problem, Representation of graphs, matrix representation of graph, adjacency matrix, Incidence matrix, Linked representation of graphs. Trees, Spanning trees, Minimal spanning tree

Text Books/ Reference books:

[1] A Text book of Engineering Mathematics by N.P. Bali & Dr. Manish Goyal.
[2] Graph Theory with application to Engineering and computer Science; Narasingh Deo, Prentice Hal l of India, New Delhi, 2006. Page 29 of 31
[3] Graph Theory with Application; C. Vasudev, New Age International Publishers.
[4] Fundamentals of Mathematical Statistics; V.K. Kapoor, S.C.Gupta, Sultan Chand & Sons.
[5] Fundamentals of Applied Statistics;V.K. Kapoor, S. C. Gupta, Sultan Chand & Sons TMGH.
[6] Advance Differential Equation; M D Raisinghania, S Chand Company.
[7] Introduction to Partial Differential Equation; K. Sankara Rao, Prentice-Hall of India.
[8] Advance Engineering Mathematics: Erwin Kreysig(Willey)
[9] A text book of vector calculus; Shanti Narayan, J. N. Kapur, S. Chand and Company, N. Delhi.
[10\ Theory and Problems of Vector !nalysis, MurrayR.Spiegel, Schaum's outline series, Mc Graw Hill Book Company.

NETWORK THEORY

SEMESTER:THIRD SEMESTER
COURSE CODE : ET 302
L:T:P : 3:1:0 Credits:4

Module 1: Sinusoidal Steady state Analysis : Phasor representation of sinusoidal functions; Frequency domain diagram; phasor diagram, Node and loop analysis; steady state response using network theorem Superposition, reciprocity, Thevenin's, Nortons, Maximum power Transfer, compensation and Tallegen's theorem; Magnetically coupled circuits; duality of Network

Module2:Resonance and locus diagrams: Series and parallel resonance - Selectivity - Bandwidth - Q factors –Times circuits. Locus diagrams for RL and RC circuits with AC excitation for parametric and frequency variations under steady state conditions.

Module 3: Circuit Transients: Concept of Circuit Transients: Transient response and steady state response; Laplace transforms of various signals of excitation -Waveform synthesis, Laplace transformed networks - Determination and representation of initial conditions-Response for impulse function only and its relation to network admittance - convolution integral and applications.

Network Synthesis: Hurwitz polynomial, positive real functions, reactive networks, separation property of reactive networks, The fur –reactance function form, specification of reactance function. Foster form of reactive networks Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms

Module 4: Two-port network parameters, Interconnection of two port networks, condition of reciprocity and symmetry; Relation between the parameter sets; equivalent T &II section represantation. Barlett's bisection theorem. Image and Iterative parameters. Design of attenuators.

Module 5:Two port Reactive network(filter):Classification of filters, Characteristic impedance, Constant K-filter-derived filter. Composite filters. Band pass and Band elimination filters. Problem of termination, Lattice filters, Introduction to active filters.

Module 6 :Non sinusoidal periodic waves: Periodic waves; Fourier analysis of non- sinusoidal periodic waves; Waveform symmetry Frequency spectrum; average value; Root mean square value Average power of non sinusoidal periodic functions.

Module 7:Graph Theory: Graph of a network and it parts:; Oriented graph; Tree; Co-tree Loop; Tie-sets; Cut set matrix; Incidence matrices; Network equilibrium equations

Reference Book:

1. Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition.,2007.
2. Valkenberg V., "Network Synthesis,
3. Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.,2008.
4. Chakraborty A,"Circuit Theory"
5.Roy Chudhury D, "Network and System"

DIGITAL CIRCUITS & LOGIC DESIGN

SEMESTER:THIRD SEMESTER
COURSE CODE : ET303
L:T:P : 3:1:0 Credits:4

Module 1: INTRODUCTION, NUMBER SYSTEMS AND CODES.
Digital Systems; Number Systems: Positional number system- Decimal, binary, octal and hexadecimal number systems and their base conversions; Binary arithmetic- Addition, subtraction, multiplication and division; 1's and 2's complement; Representation of signed numbers; Fixed and floating point numbers; Codes: Binary coded decimal codes, Gray codes, Error detection and correction codes - parity check codes and Hamming code.

Module 2: BOOLEAN ALGEBRA AND LOGIC GATES.
Boolean Algebra: Definition, basic postulates and fundamental theorems of Boolean Algebra; De-Morgan's theorem; Logic Gates: Types, symbols, logic operations and their truth tables; Sum of product(SOP) and product of sum(POS) forms; Canonical forms; minterm and maxterm; Simplification of switching functions – Algebraic and Karnaugh map(K-map) methods; Realization of simplified switching functions using logic gates; Don't-care condition;

Module 3: COMBINATIONAL LOGIC CIRCUITS.
Design of combinational logic circuits; Adders -Half and Full adder, parallel binary adder(ripple carry adder), carry look-ahead adder; Subtractors- Half and Full subtractor; Combined adder/subtractor; ALU; comparators; Parity circuits- Generator and checker; Decoders, encoders, multiplexers, demultiplexers and their applications; Code converters; Design examples.

Module 4: SEQUENTIAL LOGIC CIRCUITS.
Latches; Flip-flops- SR, D, JK, T and Master Slave JK, EDGE Triggered; Registers, Shift-registers- SISO, SIPO, PIPO, PISO, Bidirectional; Counters- Ring counter, Johnson(Twisted ring) counter, ripple(Asynchronous) counter, synchronous counters, up-down counters, timing diagrams and specifications; Clocked sequential circuit: Synchronous circuit analysis and design- Mealy and Moore circuits, transition(excitation) table, state diagram, state table, state reduction, state assignment, Lockout condition; design and analysis of synchronous and asynchronous state machine, concept of race, critical race and hazards,

Module 5: LOGIC FAMILIES
Introduction to different logic families; TTL inverter; CMOS inverter Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product.

Module 6: MEMORIES.
ROM,PROM,EPROM; RAM- S(Static) RAM and D(Dynamic) RAM; Programmable Logic Devices- PLAs, PALs and their applications; FPGA.

Text/Reference Books:

1. Anand Kumar: Fundamentals of Digital Logic, PHI
2. G.K. Kharate: Digital Electronics, Oxford University Press
3. M. Morris Mano: Digital Logic and Computer Design, PHI
4. J. F. Wakerly: Digital Design, Principles and Practices, Pearson Education
5. Charles H Roth: Digital Systems Design using VHDL, Thomson Learning

ELECTRONIC DEVICES AND CIRCUITS

SEMESTER:THIRD SEMESTER
COURSE CODE : ET304
L:T:P : 3:1:0 Credits:4

Module 1: Semiconductors: Review of Band Theory of solids, intrinsic semiconductors, Generation and Recombination of electrons and holes. Thermal equilibrium, Doped semiconductors n and p types, Fermi level and carrier concentrations of n and p type semiconductors. Carrier mobility and conductivity, diffusion, Mass-action law, continuity equation.

Module 2: P-N Junction Diodes: The open circuited junction, space charge region, the biased p-n junction, the Volt-Ampere characteristics, effect of temperature on V-I characteristics, Breakdown of junctions on reverse bias, Transition and diffusion capacitance of p-n junction diodes, junction diode switching times

Module 3: Diode Circuits: Half wave and Full wave single phase rectifiers and their analysis, peak inverse voltage, various types of filters and their analysis and applications, voltage multiplier circuits, Clipping and Clamping circuit

Module 4: Special purpose diodes: Zener diode, Light Emitting diodes, Photo diodes, Solar cells, Varactor diodes and their applications

Module 5: Bipolar Junction Transistors (BJT): PNP and NPN junction transistors, different configurations of BJT and their input & output characteristics, different modes of operation, the Ebers-Moll representation of BJT, (Early effect), Avalanche breakdown & Punch through, . BJT biasing: The operating Point , DC & AC load lines, different biasing circuits analysis and problems, Stabilization, various stabilization circuits, Thermal runaway and thermal stability, BJT as a switch and amplifier,

Module 6: The Field Effect Transistor (FET): Differences between BJT and FET, the construction and operation of the Junction Field Effect Transistor, the drain and transfer characteristics, MOSFET: construction and operation of Depletion and Enhancement MOSFET, the drain and transfer characteristics, Biasing of FETs, CMOS devices

Module 7: Small Signal low frequency Transistor Amplifier circuits: Transistor hybrid model, Analysis of transistor amplifier circuits using 'h' parameters, Effect of bypass and coupling capacitors on the low frequency response of the amplifier, Emitter follower, FET amplifiers - low frequency and high frequency models, Amplifier configurations, Low and high frequency response of amplifier circuits, Analysis of single stage FET amplifier circuits. Cascaded BJT amplifier, Darlington pair.

Text/Reference Books:

1. *D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group*
2. *B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.*
3. *J. Millman and Halkias, Integrated Electronics, TMH*
4. *R. Boylested and Nashlsky, Electronic Device and Circuits, Pearson*
5. *David Bell, Electronic Devices and Circuits, Oxford University Press*
6. *J. Millman and A. Grabel, Microelectronics, McGraw Hill, International.*
7. *A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.*

ELECTRICAL ENGINEERING MATERIALS

SEMESTER:THIRD SEMESTER
COURSE CODE: PI 306
L:T:P : 3:1:0 Credits:4

Module1: Crystal Structure of Materials
Atomic bonding, Crystallinity, Miller Indices, X-ray crystallography, Structural imperfections, Crystal growth.
Module2: Conductivity of Metals:
Free electron theory of metals, factors affecting electric conductivity of metals, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, Superconductivity.
Module3: Dielectric Properties of Materials:
Polarization mechanism and dielectric constant, behaviour of polarization under impulse and frequency switching, dielectric loss, spontaneous polarization, Piezoelectric.
Module4: Magnetic Properties of Materials
Origin of permanent magnetic dipoles in materials, classification, diamagnetism, paramagnetic, ferrimagnetism, antiferromagnetic, and ferrimagnetism, magnetostriction.
Module5: Mechanism of conduction in Semiconductor:
Energy band theory, classification of materials using energy band theory, Hall effect, drift and diffusion current, continuity equation, P-N diode, Volt-Ampere equation and its temperature dependence, display units LED, LCD and monitors, effect of environment on components
Module6: Electrical Engineering Materials:
Properties and applications of electrical conducting, semiconducting, insulting and magnetic materials, cables, calculation of capacity of cables, charging currents, stress grading and heading of cables, construction and characteristics of HV and EHV cables
Module7: Processes:
Basic processes used in the manufacturing of integrated circuits such as epitaxy, masking, photolithography, diffusion, oxidation, etching, metallization, scribing wire bounding and encapsulation, induction and dielectric heating, Electron beam welding and cutting

Text/Reference Books:

1. Decker "Electrical Engineering Materials" PHI
2. S. O. Kasap"Principle of Electrical Engineering Materials" MGH.
3. Mahajan. "Principle of Growth and Procesing of Semiconductors"MGH
4. Dhir"Electronic components and Materials and Maintenance"TMH
5. S.P. Seth "Electrical Engineering Materials"Dhanpat Rai Publication
6. C. S. Indulkar"Electrical Engineering Materials" S. Chand

ADVANCED COMPUTER PROGRAMMING

SEMESTER:THIRD SEMESTER
COURSE CODE : ET305
L:T:P : 3:0:0 Credits:3

Module1: – INTRODUCTION TO OOP

Evolution of object oriented languages, need of Objects, definition of Object-Oriented Language, Programming methodologies, Comparison, Object Oriented concepts, basics of C++ environment.

Module2: – OBJECT AND CLASSES

Core object concepts: (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) , data members, member functions, access specifiers, C++ object as data types constructor, object as function arguments, Constructors: multiple constructors, parameterized constructors, copy constructors , constructors with default arguments, Destructors, Static members , This pointer, pointer to derived class, Constant members, Free store operators.

Module3: – INHERITANCE AND POLYMORPHISM

Introduction to Inheritance, defining derived classes, single inheritance, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, friend functions and classes, Polymorphism: Runtime and Compile time polymorphism, overloading functions and operators, virtual function, pure virtual function, virtual base classes.

Module 4: – TEMPLATES AND EXCEPTION HANDLING

Class templates, class templates with multiple parameters, function templates, function templates with multiple parameters, Exception handling: throwing and catching mechanism.

Module5: – JAVA FUNDAMENTALS

Introduction to programming languages, the evolution of java, object-oriented programming concepts and java, differences between c++ and java, the primary characteristics of java, the architecture,

Module6: – PROGRAMMING WITH JAVA

Tokens, expressions, data types, declarations, control statements, classes, working with objects, methods, packages, inheritance, interfaces, Exception handling, threads, multithreading, streams and I/O, applets.

Text and References:

1. *Herbert Schildt, "The Complete Reference to C++", Tata McGraw Hill Education.*
2. *E. Balaguruswamy, "Object oriented Programming with C++", Tata McGraw Hill Education.*
3. *Lippman S. B., Josee Lajoie, Barbara E. Moo, "C++ Primer", Pearson Education.*
4. *Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley.*
5. *R. Lafore , Object Oriented Programming using C++, Galgotia Publications..*
6. *Herbert Schildt, "**Java: A Beginner's Guide"**, Tata McGraw Hill Education.*
7. *E. Balaguruswamy, "Programming in JAVA a Primer", Tata McGraw Hill Education.*
8. *Herbert Schildt, "The complete reference to JAVA", Tata McGraw Hill Education.*
9. *Robert Sedgewick and Kevin Wayne, "Introduction to Programming in Java: An Interdisciplinary Approach", Pearson Education.*

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THERMODYNAMICS

SEMESTER: THIRD SEMESTER
COURSE CODE: ME 301
L:T:P : 2:0:0 , Credits:2

Module1: Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

Module2: First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady- Flow Engineering Devices. Energy Balance for Unsteady-Flow

Module3: Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. Energy - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, energy change of a system, energy transfer by heat, work, and mass, the decrease of energy principle and energy destruction, energy balance: closed systems and control volumes energy balance.

Module 4: Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule –Thomson coefficient.

Text/ Reference Books:

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, „Thermodynamics – An Engineering Approach" Tata McGraw Hill, New Delhi.
3. Sonntag, R. E., Borgnakke, C., &Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering Thermodynamics:John Wiley & Sons.
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
6. *Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for Engineers, McGraw-Hill.*

DIGITAL CIRCUITS & LOGIC DESIGN LABORATORY

SEMESTER:THIRD SEMESTER
COURSE CODE : ET303L
L:T:P : 0:0:2 Credits:1

Objectives: The main objectives of this course are:

- To give Introduction to Digital Laboratory Equipments & IC's
- To study basic logic gates and verify their truth tables.
- To study sop and pos forms of Boolean function and implement it using logic gates .
- To study and construct basic flip-flops
- To study and implement encoder and decoder
- To study and implement multiplexer
- To study and implement demultiplexer
- To study adder, subtractor circuit using a 4-bit adder IC
- To study and construct of Synchronous Counter
- To study and construct Asynchronous counter
- To realize basic gates (AND,OR,NOT) from Universal Gates(NAND & NOR).
- To study about full adder & verify its truth table.

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

SEMESTER:THIRD SEMESTER
COURSE CODE : ET304L
L:T:P : 0:0:2 , Credit:1

Course objectives:

The main objective of this course is to make the students well versed with basic electronic components and circuits. The objective are

- To operate the CRO and Function Generator
- To study and realize the Characteristics of PN junction diode and Zener diode
- To study Applications of PN junction diode like Rectifiers, Clippers etc.
- To study and perform experiments for application of Zener diode as voltage regulator
- To study and realize Characteristics of different configurations of BJT and its usage in applications like amplifiers
- To study and realize Characteristics of FET

ADVANCED COMPUTER PROGRAMMING
LABORATORY

SEMESTER:THIRD SEMESTER
COURSE CODE : ET305L
L:T:P : 0:0:2 , Credit:1

OBJECTIVES:

1. To make the student to learn C++ programming language.

2. To teach the student the implementation of object oriented programming features.

3. To teach the student to write programs to understand
   i) structure and Union,
   ii) Pointer Arithmetic, Inline functions
   iii) Different function call mechanism
   iv) Constructor and Destructors

4. To teach the student to write programs to implement inheritance and function overriding, Friend function and Friend class, Class templates.

5. Developing Applets using core JAVA

COURSE STRUCTURE OF SEMESTER-IV

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS 401	Mathematics-IV	3	1	0	4	4
02	ET 402	Analog Electronics	3	1	0	4	4
03	ET 403	Signals and Systems	3	1	0	4	4
04	ET 404	Probability & Random Processes	2	1	0	3	3
05	PI 405	Electrical Machines	3	1	0	4	4
06	ET 406	Computer Architecture and Organization	4	0	0	4	4
Practical /projects							
07	ET 402L	Analog Electronics Laboratory	0	0	2	2	1
08	ET 403L	Signals and Systems Laboratory	0	0	2	2	1
09	PI 405L	Electrical Machines Laboratory	0	0	2	2	1
10	ET 407L	Mini Project	0	0	2	2	2
		Total	18	5	8	31	28

MATHEMATICS-IV

SEMESTER: FOURTH SEMESTER
COURSE CODE: BS401
L:T:P : 3:1:0, Credits:4

Module 1: SERIES SOLUTION: Series Solution of ordinary differential equation. Bessel's equation, Bessel's function, Legendre Polynomials.

Module 2: FUZZY MATHEMATICS:
Introduction to fuzzy set theory: Crisp set and Fuzzy set, Types of fuzzy sets, some basic definitions, U nion and intersection of fuzzy sets. Operations on fuzzy sets: Some important theorems, Decomposition theorems, Fuzzy numbers and arithmetic: Fuzzy numbers, triangular fuzzy numbers, Trapezoidal fuzz y numbers, Fuzzy Arithmetic, Arithmetic operation on fuzzy numbers, Fuzzy Equations. Fuzzy Relatio ns: Fuzzy relation and basic definition, Equivalent fuzzy relations, Composition of fuzzy relation (MA X- MIN operation, MAX PRODUCT composition and MAX AVERAGE composition) Fuzzy systems and Fuzzy controlling:Fuzzy rule based system, Fuzzification and Defuzzification (Centre of A rea Method, Centre of Sums method, Mean of Maxima Method, Centre of maxima method, weighted av erage Method) Fuzzy Control, Assumption and Design of fuzzy controllers, some examples (Air conditi oner controller, Aircraft Landing Control Problem), Fuzzy Neural networks.

Module 3: TENSOR ANALYSIS:
Introduction: Summation convention, Transformation of coordinates.
Tensor of order zero. Kronecker delta, contravariant and covariant vectors, contravariant and covariant t ensors of order two. Symmetric and skew symmetric tensors, addition of tensors, outer product and inne r product of tensors. Quotient law, Riemamnnian space, metric tensor, conjugate tensor, Christoffel sy mbols, Transformation of Christoffel symbols.

Module 4: LINEAR PROGRAMMING PROBLEM:
LP Model Formulation and Graphical method, Feasible solution, Basic solution of a Linear Programmi ng Problem, Theory of Simplex Algorithm and simplex method; Standard form of an L P Problem; Co mplimentary slackness theorem, Degeneracy; Fundamental theorem of Duality, Cycling, Transportation Problem, Elements of Dynamic Programming problem.

Text Books/ Reference books:

1. Advance Differential Equation; M D Raisinghania, S Chand Company.
2.Fuzzy Sets and Fuzzy Logic, Theory and Applications. (George J.Klir and Bo Yuan)
3. Fuzzy Set Theory and its application (H. J. Zimarmen, Boston)
4. Fuzzy Sets and Their Application (Dr. Sudhir K. Pundir and Dr. Rimple Pundir)
5. A Text Book of Engg. Math.: By N.P. Bali & Dr. Manish Goyal(Laxmi Publication).
6. Linear Programming and Theory of Game; P. M. Karak, New Central Book Agency(P) Ltd.
7. Linear Programming and Game Theory; Dipak Chatterjee, Prentice Hall of India (P) Ltd.
8. Linear Programming; G. Hadley, Narosa Publishing House.
9. Vector Analysis and an Introduction to Tensor Analysis(Schaum Outline Series) by M. R. Spiegel.

ANALOG ELECTRONICS

SEMESTER: FOURTH SEMESTER
COURSE CODE: ET402
L:T:P : 3:1:0 , Credits:4

Module 1: INTRODUCTION: Scope and applications of analog electronic circuits. Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Procedure for particular specifications

Module 2: MULTISTAGE AMPLIFIERS: Classification of amplifiers, Distortion in amplifiers, Frequency response of an Amplifier, Bode plots, Step response of an amplifier, Analysis of Multistage amplifier, Design of two stage amplifier, Common Source and Common Drain amplifier at high frequencies, Frequency response of cascaded stages, Cascode amplifiers (CE-CB),The effect of coupling and bypass capacitors, RC coupled amplifier and its low frequency response Differential amplifiers, Analysis of Differential amplifiers

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Module3: FEEDBACK AMPLIFIERS: Classification and representation of amplifiers, Feedback concept, The transfer gain with feedback, General characteristics of negative feedback amplifiers. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

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Module 4: OSCILLATORS: Sinusoidal oscillators, Barkhausen Criterion, Analysis and design of RC phase shift (FET/ BJT) oscillator, Wien bridge oscillators, Resonant circuit oscillators, General form of oscillator circuit (Hartley & Colpitts), Crystal oscillators, non-sinusoidal oscillators.

Module 5 : POWER AMPLIFER: Class A, B, AB, and C power amplifiers, push – pull and complementary symmetry push-pull amplifier. Design of heat sinks, power output, efficiency, crossover distortion and harmonic distortion.

Module 6: TUNED AMPLIFIER: Design and analysis of single tuned amplifier circuit with a capacitor coupled load, Double tuned inter-stage design. Stability consideration, Class B and class C tuned power

Text/Reference Books:

1. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
2. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV
4. Paul R.Gray & Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition McGraw Hill, 1992.

SIGNALS AND SYSTEMS

SEMESTER: FOURTH SEMESTER
COURSE CODE : ET403
L:T:P : 3:1:0, Credits:4

Module 1: Signals: Signals and their Examples; Signal classifications: continuous time and discrete time signals- Deterministic and non deterministic, periodic and non periodic, even and odd, energy and power signals; Elementary signals: unit step, unit impulse, unit ramp, the sinusoid, the complex exponential; Basic operations: Time shifting, time scaling, time reversal, amplitude scaling, signal addition, signal multiplication.

Module 2: Systems: Systems and their Examples; System classifications: continuous time and discrete time systems- static and dynamic, causal and non causal, linear and non linear, time invariant and time variant, stable and unstable, invertible and non invertible systems; Linear Time Invariant (LTI) systems and their properties.

Module 3: Fourier Series Representation Of Periodic Signals: Fourier series representation of periodic signals- Trigonometric Form, cosine form and exponential form; Fourier spectrum- amplitude and phase spectra; Properties of Fourier Series.

Module 4: LTI - Continuous Time Systems: Fourier transforms; magnitude and phase representation of CTFT; existence of Fourier transforms; CTFT of standard signals; Properties of CTFT; CTFT of signals; Inverse CTFT; system representation by differential equation; system analysis with CTFT.
Laplace transforms- unilateral and bilateral; Region of Convergence (ROC); existence of LT; unilateral LT of some commonly used signals; Properties and theorems of LT; Inverse LT; system representation by differential equation; System analysis with LT.

Module 5: Sampling: Sampling theorem; Nyquist rate; Effect of under sampling- Aliasing; Anti-Aliasing filter; Sampling techniques- Impulse sampling, Natural sampling, Flat Top sampling; Data reconstruction- Ideal reconstruction filter, Zero order hold, Transfer function of a zero order hold

Module 6: LTI - Discrete Time Systems: Z-Transformation; ZT of some commonly used sequences; ZT and ROC of finite duration sequences; Properties of ROC; Properties and theorems of ZT; Inverse ZT; system representation by difference equation; System analysis with ZT.

Text/ Reference:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young: Signals and Systems, PHI
2. A.Anand Kumar: Signals and Systems, EEE
3. B. P. Lathi: Signal Processing and Linear Systems, Oxford University Press
4. Douglas K. Lindner: Introduction to Signals and Systems, McGraw-Hill International Edition
5. Simon Haykin, Barry van Veen: Signals and Systems, John Wiley and Sons (Asia) Private Limited

PROBABILITY AND RANDOM PROCESSES

SEMESTER: FOURTH SEMESTER
COURSE CODE: ET404
L:T:P : 2:1:0 , Credit:3

Module 1: Sets and set operations; Probability space; Conditional probability and Bayes theore m; Combinatorial probability and sampling models;

Module 2: Discrete random variables, probability mass function, probability distribution functi on ; Continuous random variables, probability density function,probability distribution function : Bionomial, Poission, Geometric, Exponential, Gamma and Normal distribution and their moment generating functions.

Module 3:Joint distributions, functions of one and two random variables, moments of random variables;Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

Module 4: Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large num bers, central limit theorem.

Module 5: Random process. Stationary processes. Auto correlation and cross correlation functions of input and output, Ergodicity,Transmission of random process through LTI, Noises in communication system, Power spectral density.

Text/Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing,'' Third Edition, Pearson Education
2. A. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes,'' Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International,
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

COMPUTER ARCHITECTURE AND ORGANIZATION

SEMESTER: FOURTH SEMESTER
COURSE CODE : ET406
L:T:P : 4:0:0, Credit:4

Module 1 : The Computer System: Computer interconnection structure - Computer components Functions, interconnection structures. Performance of a computer, Memory organization- Internal and external memory - Overview of computer memory Systems, Semiconductor main memory, virtual memory concept, cache memory, Improving cache performance ,magnetic disc, magnetic tape, large storage memories. Operating System - Operating Systems Overview, Scheduling and memory management.

Module 2: The Central Processing Unit: Computer arithmetic, ALU, integer and floating point numbers representations and arithmetic. Instruction Sets - Machine instruction characteristics - types of operands and Operations, addressing modes – Instruction set architectures, CISC and RISC architectures, Super scalar Architectures.

Module 3: The Control Unit: Control Unit Operation - Micro Operations, Control of the CPU, hardware implementation. Micro programmed control - Sequencing and execution of Micro instructions, bit slice architecture, applications. Recent Trends in Computer Systems: Parallel organization - Multiprocessing, Vector Computation, Faulty tolerant Systems.

Module 4: I/O Organization: Accessing I/O devices, Input/output programming, Interrupts, Exception Handling, DMA, Buses, I/O interfaces-Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini band, I/O peripherals.

Text Books/ Reference:

1. Computer Organization and Design, by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
2. Computer Architecture and Organization, 3rd Ed., by John P. Hayes, TMH.
1. Operating Systems Internals and Design Principles by William Stalling, Prentice Hall.
2. Computer Organization 5th Ed., by Carl Hamacher, Zvonko Vranesic, 2002, Safwat Zaky.
3. Mano M.M., Computer System Architecture, PHI (EEE).
4. Structured Computer Organization by A.S. Tanenbaum, 4th Ed., PHI. .

ELECTRICAL MACHINES

SEMESTER: FOURTH SEMESTER
COURSE CODE: PI 405
L:T:P : 3:1:0 , Credit:4

Module 1: **DC Generator**: Construction and principle of operation, armature winding, armature reaction and commutation, interpoles and compensating winding, E.M.F. equation, classification, characteristics and uses, losses and efficiencies, condition of maximum efficiency.
Module 2: D.C. motor: Principle of operation, classification, characteristics and uses, losses and efficiency, condition for maximum power output, starting and speed control.
Module 3: Transformer: Construction and core type, shell type and berry type transformers, classification, working principle, e.m.f. equation, phasor diagram, leakage reactance, equivalent circuits, voltage regulation, losses and efficiency, open circuit and short circuit tests, all day efficiency.
Module 4: Polly phase induction motor: Construction ,type of induction motor, principle of operation, equivalent circuit, torque equation, slip-toque curves, losses and efficiency, condition of maximum torque, no load and blocked rotor tests, methods of starting and speed control.
Module 5: Synchronous Machines: Construction, classification, working principle, armature winding and winding factors, e.m.f. equation, armature reaction, synchronous reaction and impedance, phasor diagram, open circuit and short circuit tests, voltage regulation by synchronous impedance method,
Synchronous motor- principle of operation-curve, vector diagram, starting methods, Hunting, Application of Synchronous converter.
Module 6: Single phase induction motor: Construction, Principle of operation on the basis of double revolving field theory, characteristics, types of starting methods
Module 7: Special Machines : Shades pole motor, universal motor, repulsion type motor, Hysteresis type motor, Stepper motor.

Texts

1. Stephen Chapman, Electric Machinery Fundamentals, McGraw-Hill, 4/e, 2003.
2. R. K. Rajput, Electrical Machines, 3/e, Laxmi Publications (P) Ltd., 2003.
3. Cotton,H., "Advanced Electrical Technology", CBS Publishers and Distributors, New Delhi, 1984.
4. Nagrath I.J. and Kothari, D.P., "Electrical Machines", TMH, New Delhi, 2001.
5. Yamayee,Z.A and Bala, JL, Electromechanical Energy Devices an Power Systems, John Wiley & Sons Inc., 1994

References

1. I. L. Kosow, Electrical Machinery and Transformers, 2/e, Prentice- Hall of India Pvt. Ltd., 2003.
2. B. S. Guru and H. R. Hiziroglu, Electrical Machinery and Transformers, 3/e, Oxford University Press, 2003

ANALOG ELECTRONICS LABORATORY

SEMESTER: FOURTH SEMESTER
COURSE CODE : ET402L
L:T:P : 0:0:2 ,Credit:1

Objectives:

The main objective of this course are:

- To learn Voltage gain and frequency response of RC coupled amplifier
- To learn Oscillators(e g. Hartly, Colpits, wein bridge oscillators)
- To learn power amplifiers(Class A,B, C)
- T0 learn differential amplifier

SIGNALS AND SYSTEMS LABORATORY

SEMESTER: FOURTH SEMESTER
COURSE CODE : ET403L
L:T:P : 0:0:2, Credit:1

Objectives: The main objectives of this course are:

- To Introduce students to MATLAB
- To study the continuous and discrete time signals using MATLAB
- To study the continuous and discrete time systems using MATLAB
- To study the Fourier series using MATLAB
- To study the Fourier transforms using MATLAB
- To study the Convolution of signals using MATLAB
- To study the Laplace transforms using MATLAB
- To study the Z-transforms using MATLAB
- To study the sampling using MATLAB

ELECTRICAL MACHINES LABORATORY

SEMESTER: FOURTH SEMESTER
COURSE CODE : PI405L
L:T:P : 0:0:2, Credit:1

Objectives: The main objectives of this course are:

To learn open circuit and Load characteristics of D.C shunt generator, Load characteristic of the D.C shunt / compound motor and speed reversal, Regenerative braking of D.C series motor, Methods of start ing and speed control of the 3-Phase induction motor, Parallel operation of 3phas e transformer, Synchronous motor V curves.

MINI PROJECT

SEMESTER: FOURTH SEMESTER
COURSE CODE : ET407L
L:T:P : 0:0:2 , Credits:2

The object of miniproject is to enable the student to take up preliminary study in the field of El ectronics & Telecommunication Engineering,either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on students in a group, under the guidance of a Supervisor.

The assignment to normally include:

- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility
- Preparing a Written Report in format on the project
- Final Presentation/viva before a Departmental Committee.

COURSE STRUCTURE OF SEMESTER-V:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	BS 501	Mathematics-V	3	1	0	4	4
02	PI 501	Control Systems	3	1	0	4	4
03	ET 502	Linear ICs and Applications	3	1	0	4	4
04	ET 503	Analog Communication	3	1	0	4	4
05	ET 504	Electromagnetic Field Theory	3	1	0	4	4
06	ET 506	Electronics Measurement and Instrumentation	3	1	0	4	4
Practicals							
07	PI 501L	Control Systems Laboratory	0	0	2	2	1
08	ET 502L	Linear ICs and Applications Laboratory	0	0	2	2	1
09	ET 503L	Analog Communication Laboratory	0	0	2	2	1
10	ET 506L	Electronics Measurement & Instrumentation Laboratory	0	0	2	2	1
		Total	18	6	8	32	28

MATHEMATICS-V

SEMESTER: FIFTH SEMESTER
COURSE CODE : BS501
L:T:P : 3:1:0, Credit:4

NUMERICAL ANALYSIS: Interpolation: Finitedifference. Newton Grogory forwards and backward interpolation, Newton's and Lagranges formulae for unequal intervals, Stirling ande Bessels interpolation formulae.Numerical differentiation and Integration:Numerical differentiation, Trapezoidal and Simpson's rule for Numerical Integration. Solution of Ordinary differential equations: Taylor's series, Range-Kuta (4thorder) andMilne's predicator-corrector method. Solution of Transcendental and Polynomial Equation: Bisection, Regula Falsi and Newton-Rapsons methods. Solution of simultaneous linear equations:Gauss elimination and Gauss-Seidal Iterative method.

COMPLEX ANALYSIS: Functions of Complex Variables, Elementary function, Analytic function. Ca uchy-Riemann equations. Harmonic functions and their application to two dimensional problems. Conformal transformation, complex line integral, Cauchy- Goursat theorem, Cauchy Integral formula, Liouville's theorem, Taylor's and Laurent's series, singularities, Residue theorem and applications.

Text books/Reference :

1. Numerical Mathematical Analysis, J. Scarborough
2. Numerical Analysis; G. Shanker Rao, New Age International Publisher
3. Theory of Functions of a Complex Variable; Shanti Narayan & P.K. Mittal ,S. Chand & Company (Revi se d Edition)
4. Complex Variable and Application; R.V. Churchill, Mc Graw Hill book Company.
5. Complex Variables; Murray R. Spiegel: McGraw Hill.

CONTROL SYSTEMS

SEMESTER: FIFTH SEMESTER
COURSE CODE : PI 501
L:T:P : 3:1:0 , Credits:4

Module 1: INTRODUCTION : Concept of automatic control systems-classifications-
open loop and closed loop systems, linear and non linear systems, continuous and discrete time system s, SISO and MIMO systems, time-invariant and time varying systems, servo systems and automatic regulating systems, adaptive control systems.

Module 2: MATHEMATICAL MODELLING OF PHYSICAL SYSTEMS: Differential equations and transfer function - mathematical model of electrical- mechanical and electro mechanical systems-
Analogous systems. Block diagram representation of physical systems- BD reduction techniques-
Signal flow graph(SFG)- definition, terminology, SFG representation of physical systems, Mason's Gain formula-BD reduction using SFG techniques

Module 3: TIME RESPONSE: Time response Time domain specifications Types of test input signals – Ist and IInd order system response – Error coefficients – Generalized error series –
Steady state error – P, PI, PID modes of feed back control.

Module 4. FREQUENCY RESPONSE ANALYSIS: Frequency Response Bode Plot, Polar Plot, Nyqu ist Plot - Correlation between frequency domain and time domain specifications-
Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart.

Module 5: STABILITY ANALYSIS: Characteristics equation – Location of roots in S-
plane for stability Routh Hurwitz criterion Root locus method Angle and magnitude conditions, constru ction of omplete root locus, stability analysis -Effect of addition of pole, zero – Relative Stability -
Gain margin and phase margin – Nyquist stability criterion.

Module 6.COMPENSATOR DESIGN: Performance criteria – Lag, lead and lag-lead networks – Compensator design using Root locus and Bode plots methods.

Module 7: STATE VARIABLE METHOD OF SYSTEM ANALYSIS: Concept of state and state vari ables- State model-State-space representation of physical systems-BD representation-
state transition matrix and its properties-Relation between state equation and transfer function-
Solution of state equation-Characteristic equation-Eigen values & eigen vectors-
Concept of controllability and observability of linear systems.

Module 8: CONTROL SYSTEM COMPONENTS: Potentiometer, Synchros, DC and AC servomotors , Rotating amplifier, Stepper motor, Tachogenerators.

Text/ Reference Books:

1) Ogata K-Modern Control Engineering (PHI).
2) Nagrath I J&Gopal M-Control System Engg.
3) Kuo B C-Automatic Control Systems (PHI).
4) S. Ghosh –Control Systems (Pearson Education).
5) M.Gopal – Control Systems –Principles & Design (TMH)

LINEAR ICs AND APPLICATIONS

SEMESTER: FIFTH SEMESTER
COURSE CODE : ET502
L:T:P : 3:1:0, Credits:4

Module 1: Introduction to Integrated Circuits : Integrated circuits and its types, Classification of IC's, SSI, MSI, LSI, VLSI, Packaging of IC's, Basic outline of IC fabrication.

Module 2: Introduction to op-amps, ideal Characteristics, Pin configuration of 741 op-amp. Bias, offsets and drift, bandwidth and slew rate. Offset and Frequency compensation. calculation of differential gain, common mode gain, CMRR and ICMR Exercise problems. Inverting and non-inverting amplifiers and their analysis.

Module 3 :Linear Applications: inverting and non- inverting summers, difference amplifier, differentiator and integrator, scale changer ,Phase shifter, Voltage to current converter, , current to Voltage converter, Exercise problems. Instrumentation amplifier, solving differential equations using analog computing blocks

Module 4: Non-Linear Applications: Voltage comparator, Comparator Applications, Sample and Hold Circuits, Peak Detetors, Precision rectifier, Log and antilog amplifiers, Schmitt trigger and its applications, PLL- basic block diagram and operation, capture range and lock range; applications of PLL, Analog Multipliers and applications. Multi Vibrators.

Module 5: Active Filters:Low pass, High pass, Band pass and Band Reject filters, Butterworth, Chebychev filters, Bessel filters, Different first and second order filter Topologies, Frequency Transformation.

Module 6 : Signal Generators: Sine wave Generator, Triangular Wave generator, Sawtooth wave generator, V-F and F-V converter.

Module 7: D-A and A-D Converters: Weighted resistor DAC, R-2R and inverted R-2R DAC. IC DAC-08. counter type ADC, successive approximation ADC, Flash ADC, dual slope ADC, conversion times of typical IC ADC.

Module 8: Special Function ICs: 555 Timer functional diagram, bistable, monostable and astable operation, applications. Voltage Regulator, Series op amp regulator, Three terminal IC voltage regulator exercise problems, Audio Power amplifier LM380

Text books/references:

1. Nergio Franco - Design with Operational Amplifiers and Analog Integrated Circuits, McGraw Hill Book Company.
2. R.F.Coughlin, F.F.Driscoll - Operational Amplifier and Linear Integrated Circuits, Prentice Hall of India.
3. Ramakant A. Gayakwad- Op-Amps and Linear Integrated Circuits, PHI.
4. D.Roy Choudhury and S. B. Jain- Linear Integrated Circuits, New Age Int.
5. Salivahanan: Linear Integated Circuits, TMH.

ANALOG COMMUNICATION

SEMESTER: FIFTH SEMESTER
COURSE CODE : ET503
L:T:P : 3:1:0, Credits:4

Module 1: **Introduction:** Definition of communication; Basic blocks diagram of Communication System; need of modulation; Review of Signals and Systems; concept of modulation; base band and pass band signals; concept of demodulation(detection); classification of modulation – single tone and multi tone.

Module 2: **Linear Modulation:** Amplitude Modulation (AM) – definition, general expression, message signal, carrier signal, frequency spectrum, bandwidth, USB and LSB; single tone and multi tone AM - modulation index(μ), frequency analysis, power, modulation efficiency(η), current relation, voltage relation; Generation of AM – square law modulator, switching modulator; Detection of AM – square law demodulator, envelope detector, synchronous detector; Quadrature null effect (QNE); Double sideband suppressed carrier (DSBSC) modulation - general expression, frequency spectrum, bandwidth, single tone and multi tone DSBSC - modulation index(μ), frequency analysis, power, modulation efficiency(η); Generation of DSBSC – balanced modulator, ring modulator; Detection of DSBSC – synchronous detector; single Sideband suppressed carrier (SSBSC) modulation - general expression, frequency spectrum, bandwidth, single tone and multi tone SSBSC - frequency analysis, power, modulation efficiency(η); % of power saved in DSB and SSB vs AM; Generation of SSBSC – frequency discrimination method, phase discrimination method; Detection of SSBSC – synchronous detector; Vestigial sideband (VSB) modulation - frequency spectrum, bandwidth; Comparison of bandwidth and power in AM, DSBSC, SSBSC and VSB; Frequency Division Multiplexing (FDM).

Module 3 Angle Modulation: Frequency Modulation (FM) - definition, general expression, Narrow Band FM (NBFM) – general expression, spectrum, bandwidth, power, generation; Wide Band FM (WBFM) - Bessel function, general expression, spectrum, power, bandwidth, Carson's rule, modulation efficiency(η); generation of FM – Direct method, indirect method (armstrong method); detection of FM – Frequency discrimination method, Phase discrimination method; Phase Modulation (PM) - definition, general expression, modulation index(β), bandwidth, power; generation of PM from FM and FM from PM; Mixer.

Module 4: **Radio Receivers:** tuned radio frequency receiver, superheterodyne receiver, receiver sensitivity, receiver selectivity, image frequency, image rejection ratio (IRR).

Module 5: **Noise:** sources of noise, shot noise, thermal noise (Johnson noise), white Gaussian noise, noise temperature, pre-emphasis and de-emphasis,

Text/ Reference:

1. Simon Haykin, "Communication Systems", John Wiley and Sons.
2. J. Proakis& M. Salehi, "Communication System Engineering", Pearson Education Asia.
3. B. P. Lathi, "Modern Analog and Digital Communication Systems", Oxford University Press.
4. G. Kennedy, "Electronics communication system", McGraw- Hill.

ELECTROMAGNETIC FIELD THEROY

SEMESTER: FIFTH SEMESTER
COURSE CODE : ET504
L:T:P : 3:1:0 , Credits:4

Module 1: **Vactor Analysis:**Scalar and Vector field, Vector algebra, Vector Calculus-gradient, divergence and curl of a vector, Cartesian, Cylindrical and Spherical systems of vectors, Transformation between vectors, Line and Surface integral, Divergence theorem, Stokes theorem and Green's theorem.
Module 2: **Steady Electric Current**: Current density and ohm's law, EMF and Kirchoff's voltage law, continuity equation and Kirchoff's current law, power dissipation and Joule's law, boundary conditions.
Module 3: **Static Magnetic Fields**: Fundamental Postulates, Vector magnetic potential, Biot-Savart Law and Application, Magnetic dipole, Behaviour of magnetic materials, Boundary conditions, Inductances and inductors, Energy in Magnetic field.
Module 4: **Time varying fields & Maxwell's Equations**: Faraday's Law of electromagnetic induction, Maxwell's equations, electromagnetic boundary conditions, wave equations and their solutions, time harmonic fields.
Module 5: **Electromagnetic Waves**: Plan wave in loss less media, plan waves in lossy media, pointing vector and power flow in electromagnetic field. Wave polarization, plan wave reflection from a media interface.

Text/ Reference Books:

1. *J Griffiths, "Introduction to Electrodynamics", 2/e PHI, 1995.*
2. *W.H.Hayt,"Engineering Electromagnetics", (7/e), McGraw Hill, 2006.*
3. *Mathew N O Sadiku, " Elements of Electromagnetic", 3/e, OxfordUniversity Press, 2001.*
4. *S. Ramo, J R Whinnery and T V Duzer, "Fields and Waves in Communication Electronics", 3/e John Willey, 1994.*
5. *David K Cheng, "Field and Wave Electromagnetic", 2/e, Pearson Education Asia, 2001.*
6. *N.NarayanaRao, Elements of Engineering Electromagnetics, (6/e), Pearson, 2006.*
7. *E C Hordan and K G Balmain, "Electromagnetic Waves and Radiating Systems", 2/e PHI 1995.*
8. *S. P. Seth, "Elements of Electromagnetic Fields", Dhanpat Rai.*
9. *Joseph A Edminister, " Electromagnetics", Schaum's Series.*

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

SEMESTER: FIFTH SEMESTER
COURSE CODE:ET506
L:T:P : 3:1:0, Credits:4

Module 1: Introduction:
Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards

Module 2: Measurement of Parameters:
Measurement of power and energy; Instrument transformers, Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter, Measurement of frequency, phase, time interval and group delay. RF power measurement.

Module 3:Digital Measurement of Electrical Quantities:
Concept of digital measurement, block diagram Study of digital voltmeter, Electronic Multimeter

Module 4 :Cathode Ray Oscilloscope:
Basic CRO circuit (Block Diagram),Cathode ray tube (CRT) & its components , application of CRO in measurement ,Lissajous Pattern.; Dual Trace & Dual Beam Oscilloscopes

Module 5 :Recorders:
Construction and working principle of strip-chart recorder, X-Y recorder

Module 6 :Transducers:
Classification, selection criteria, construction, working principles and application of the following transducers-RTD, Thermocouples, Thermistors, LVDT, Strain gauges, Bourdon Tubes, Bellows, Diaphragms, Piezoelectric Transducers

Module 7: Special instruments:
Data Loggers, Wave Analyzer, Harmonic Distortion Analyzer, Spectrum Analyzer

Module 8: Data Acquisition System
Data Acquisition: Components of Analog and Digital Data Acquisition, Multiplexing Systems, Uses of Data Acquisition System, Use of recorders, Digital Data Acquisition System

Text/Reference Books:

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.H. Wheeler& Co. India.
2. A.K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons
3. Forest K. Harries,"Electrical Measurement",Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,"Basic Electrical Measurement" Prentice hall of India.
5. W.D. Cooper," Electronic Instrument & Measurement Technique " Prentice Hall International.
6. Rajendra Prashad ,"Electrical Measurement &Measuring Instrument" Khanna Publisher.
7. J.B. Gupta, "Electronics &Electrical Measurements and Instrumentation", S.K. Kataria & Sons

Control Systems Labratory

SEMESTER: FIFTH SEMESTER
COURSE CODE : PEI 501L
L:T:P : 0:0:2, Credit:1

LINEAR ICs AND APPLICATIONS Labratory

SEMESTER: FIFTH SEMESTER
COURSE CODE:ET502L
L:T:P : 0:0:2, Credit:1

1. Measure the parameters of IC 741 Op-amp.
2. Realize analog filters using Op-amp.
3. Design monostable and astable multivibrators using 555 IC.

Analog Communication Labratory

SEMESTER: FIFTH SEMESTER
COURSE CODE:ET503L
L:T:P : 0:0:2, Credit:1

Electronic Measurements and Instrumentation Labratory

SEMESTER: FIFTH SEMESTER
COURSE CODE:ET505L
L:T:P : 0:0:2, Credit:1

COURSE STRUCTURE OF SEMESTER-VI:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	HS 601	Introduction to Accountancy & Management	3	1	0	4	4
02	ET 601	Digital Signal Processing	3	1	0	4	4
03	ET 602	Microwave Engineering	3	1	0	4	4
04	ET 604	Digital Communication	3	1	0	4	4
05	ET 604	Microprocessors and Applications	3	1	0	4	4
06	ET 605	Communication Networks	4	0	0	4	4
Practicals							
07	ET 601L	Digital Signal Processing Laboratory	0	0	2	2	1
08	ET 602L	Microwave Engineering Laboratory	0	0	2	2	1
09	ET 603L	Digital Communication Laboratory	0	0	2	2	1
10	ET 604L	Microprocessors and Applications Laboratory	0	0	2	2	1
		Total	19	5	8	32	28

INTRODUCTION TO ACCOUNTANCY & MANAGEMENT

SEMESTER: SIXTH SEMESTER
COURSE CODE : HS601
L:T:P : 3:1:0 ,CreditS:4

ACCOUNTANCY

Module1: Accounting-Objectives, Advantages and limitations, Uses of Accounting information, Concept and Classification of accounts, Transitions, Double Entry System of Book Keeping, Golden rules regarding Debit and Credit, Journal-Definition, Journalizing of transaction. Ledger- Definition, Advantages, Rules regarding posting, Balancing of ledger accounts. Trail Balance-Definition, Objectives and Preparation of Trial Balance.

Module2: Subsidiary Books, Types of Cash Book, Preparation of Cash Book, Bank Reconciliation Statements Meaning, Reasons of disagreements of balances, Preparation of Bank Reconciliation Statements.

Module3: Concept of Capital expenditure and Revenue expenditure, Bad debts, Provision for bad and doubtful debits, Provision for discount on debtors, Outstanding expenses, Accrued income, Depreciation-Meaning, definition Need for providing depreciation, Methods of recording depreciation.

Module4: Final Account-Preparation of trading account, Profit and Loss account, Balance sheet with adjustments.

Module5: Cost Sheet or Cost Statement-Preparation of cost Sheet with adjustment of Raw Materials, Work in progress, Finished products, Items excluded from cost statement. Different Techniques of Projects Appraisal and Evaluation-Pay-back period, Average Rate Return, Net Present Value method, Internal Rate of Return.

MANAGEMENT

Module1: Introduction
Definition, nature, importance, evolution of management thoughts pre & post scientific era, contributio ns made by taylor, fayol, gilbreth,elton mayo, mcgregor, maslow covering time & motion study, hawthr one experiments; is management a science or art? Functions of manager, ethics in managing and social responsibility of managers.

Module2: Planning & Control
Why Management process starts with planning, steps in planning, planning premises, types of planning, barriers to effective planning, operational plan, strategic planning, Mckinsey's 7's Approach, SWOT analysis, Controllingconcept,Planningcontrol relationship, process of control, human response to control, dimension of control, MBO.

Module3: Decision making & Organizing
Nature, process of decision making, decision making under Certainty and Uncertainty, decisiontree, group-aided decision, brain-storming. Organizing –concept, nature and process of organizing, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentation.

Module4: Staffing & Motivation
Concept, Manpower planning, Job design, recruitment & selection, training and development, performance appraisal, motivation, motivators and satisfaction, motivating towards organ izing objectives, morale building.

Module5: Leadership & Communication
Defining leadership and its role, should managers lead, leadership style, leadership development, Leade rship behaviour.Communication- Process, Bridging gap-using tools of communication, electronic media in Communication.

Module6: Financial Management
Definition and scope of financial management, Objectives of financial management, Different techniques of project appraisal and evaluation, Management of Working Capital, Sources of Finance, Tools of financial management & control.

TEXTBOOKS/REFERENCE BOOKS:

1. Robbins & Caulter, Management, Prentice Hall of India.
2. John R.Schermerhorn, Introduction to Management, Wiley-India Edition.
3. Koontz, Principles of Management, Tata-McGrew Hill.
4. Richard L. Daft, New Era of Management, Cengage Learning.
5. Stoner, Freeman and Gilbert. Jr., Management, Prentice Hall of India.
6. Koontz, Weihrich, Essentials of Management, Tata-McGrew Hill.
7. D.C. Bose, Principles of Management and Administration, Prentice Hall of India.

DIGITAL SIGNAL PROCESSING

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET601
L:T:P : 3:1:0, Credits:4

Module1: Discrete Fourier Transform:

DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Filtering of long data sequences; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Linear filtering approaches to computation of DFT.

Module2: Digital Processing of Continuous-Time Signals:
Sampling of Continuous Signals, Analog Filter Design, Anti-aliasing Filter Design, Sample-and Hold circuits, A/D & D/A converter, Reconstruction Filter Design.

Module 3: IIR and FIR Filter Structures:
Signal flow graph representation, basic filter structures, structures for linear phase

Module 4: Design of Digital Filters:
Linear Phase FIR filters; Design methods for FIR filters, FIR filter design using windows; IIR filter design by Impulse Invariance, Bilinear Transformation, Frequency Transformation in the Analog and Digital Domain

Module 5: Finite Precision Effects:
Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles

Module6 : Multirate Digital Signal Processing:
Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D.

Text Books/References:

1. *Oppenhein A.V., Schafer R.W. & Buck J.R.,- Discrete Time Signal Processing, PHI/Pearson Education*
2. *Mitra S.K., Digital Signal Processing: A Computer Based Approach, Tata McGraw Hill*
3. *Proakis T.G. &Manolakkis D.G., Digital Signal Processing – Principles, Algorithms and Applications, Prentice Hall of India Pvt. Ltd.*

MICROWAVE ENGINEERING

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET602
L:T:P : 3:1:0,Credits:4

Module 1: Module Introduction: Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves

Module 2: Transmission Lines: Lumped element circuit model for a transmission line, characteristics impedance, standing wave, reflection coefficient, VSWR, Field analysis of transmission lines, Terminated lossless lines, Lossy transmission line, Smith chart, stub matching, Quarter wave transformer.

Module 3: Waveguides: General solution for TEM, TE and TM waves, Rectangular and circular wave-guides, solution of wave equations for TE and TM modes, Dominant mode, Field pattern, cut off frequencies, wave impedance, power transmission, Waveguide resonator.

Module 4: Microwave network representation: Scattering matrix.

Module 5: Passive Microwave components: Directional Coupler, Power Divider- E, H and Magic Tee, Attenuators, Isolators, Circulators, Microwave Filters.

Module 6: Microwave tubes and Microwave solid-state devices: Limitations of conventional tubes in the microwave frequency ranges, Klystron amplifier, Reflex Klystron oscillator, Magnetrons, Traveling wave tubes, characteristics of microwave bipolar transistor and FET, Transferred electron devices, avalanche transit time devices, IMPATT diodes, BARITT diode, Tunnel diode, Quantum electronic devices- MASERS and LASERS

Text Books/References Books:

1. *R.E.Collin, Foundations for Microwave Engineering (2/e), McGraw-Hill,2002.*
2. *S. Y.Liao : Microwave Devices and Circuits,(3/e) PHI.*
3. *D.M.Pozar, Microwave Engineering (3/e) Wiley,2004*
4. *Annapoorna Das, Microwave Engineering, Tata McGraw Hill, 2000*

DIGITAL COMMUNICATION

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET603
L:T:P : 3:1:0 ,Credits:4

Module 1: Introduction: Analog communications versus digital communications, baseband signal, band pass signal, Definition of digital communication; Block diagram of digital communications.

Module 2: Coding of Analog Signals: conversion of analog signal to digital signal, sampling, nyquist rate, nyquist interval, anti-aliasing filter, quantizing, coding, classification of modulation, pulse analog modulation – PAM, PWM, PPM; Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM), Time Division Multiplexing (TDM).

Module 3: Baseband Pulse Transmission: Baseband transmission of binary data (Baseband binary PAM system), Intersymbol interference (ISI), Nyquist's criterion for distortionless baseband binary transmission, Correlative coding, Baseband M-ary PAM system, optimum receiver, matched filter, correlation receiver.

Module 4: Passband Digital Transmission: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK), Differential Phase Shift Keying (DPSK), Quadrature Carrier Multiplexing, M-ary signaling, Quadrature Phase Shift Keying (QPSK).

Module 5: Information Theory: information measure, average information, entropy, information rate, Channel capacity – Shannon Hartley law, capacity of AWGN (additive white Gaussian noise); Discrete memoryless channels.

Text/ Reference:

1. Simon Haykin, "Communication Systems", John Wiley and Sons.
2. J. Proakis& M. Salehi, "Communication System Engineering", Pearson Education Asia.
3. B. P. Lathi, "Modern Analog and Digital Communication Systems", Oxford University Press.
4. G. Kennedy, "Electronics communication system", McGraw- Hill.
5. P. Chakrabarti, "Principles of Digital Communication", Dhanpat Rai & Co.

MICROPROCESSORS AND APPLICATIONS

SEMESTER: SIXTH SEMESTER
COURSE CODE: ET604
L:T:P : 3:1:0, Credits:4

Module 1: Overview of microcomputer systems and their building blocks, Evolution of digital computer, evolution of microprocessor. Microprocessor architecture: 8-bit (e.g.8085) and 16 bit (e.g. 8086) Memory organizations (RAM, ROM, stack, secondary etc.)., Input/output, Pin layout and description of signals(8085 and 8086)-control and status ignals. Externally initiated signals, Power supply and system clock.

Module 2: Instructions and Execution: Addressing modes of microprocessors(8085), instruction set of 8-bit (8085) microprocessor. Flags, Execution and timing diagram-Instruction cycle, machine cycle, and states, Opcode fetch, memory read and write cycles, I/O read and write cycles. timing diagram. Stack and Subroutine, counter and time delay. Interrupt, assembly language programming

Module 3: Memory Interfacing, I/O mapped and memory mapped modes, interfacing of input and output devices , DMA, principle of data transfer (synchronous, asynchronous and interrupt driven data transfer). Serial data communication, RS-232 standard.

Module 4: Peripheral interface: PPI 8255; DMA controller 8257/8237, interrupt controller 8259, programmable interval timer/counter 8253/54, key board/CRT controller 8279, programmable communication interface 8251; ADC and DAC interface and applications.

Module 5: Microprocessor applications: Design of 8085 based systems. Interfacing the peripherals in a system

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/ Penram International Publishing, 1996
2.D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

COMMUNICATION NETWORKS

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET605
L:T:P : 4:0:0, Credits:4

UNIT 1

Introduction: Uses of Computer Networks, Network Hardware, Network Software, ISO model, OSI reference model (7 Layers)- Functions of each OSI model layer, Physical layer, Fourier analysis, Guided transmission media, Wireless transmission, Telephone system, mobile telephone system.

UNIT II

Data Link Layer: Framing, Error control, Flow control, Error Correcting codes(Hamming codes), Error Detecting codes (CRC), simplex Stop-And-Wait protocol, Sliding Window protocols, One-Bit Sliding Window protocol, protocol using Go Back N, finite state machine models, Petri Net models, HDLC.

UNIT III

The Medium Access Control Sub Layer: The channel allocation problem, static channel allocation in LANs and MANs, dynamic channel allocation in LANs and MANs, Multiple Access protocols, ALOHA, Carrier Sense Multiple Access protocol, Collision Free protocol, Ethernet, Wireless LAN, Broadband wireless, Data link layer switching.

UNIT IV

The Network Layer: Store-And-Forward Packet Switching, Routing Algorithms, the Optimality principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Routing, Routing for mobile hosts, Routing in Ad Hoc networks, Congestion control algorithms, Congestion prevention policies, Quality of Services, Internetworking.

UNIT V

The IP Protocol: IP Addressing, Subnets, Internet control protocols, the TCP protocol- the TCP Segment Header, TCP connection Management, the Application Layer- DNS, E-mail, www, multimedia, Network security, Cryptography.

Text/ Reference Books:

1. *Behrouz A. Forouzan, Data Communications and Networking, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003*
2. William Stallings, Data and Computer Communication, 6th Edition, Prentice Hall of India, New Delhi, 1999.
3. Andrew S. Tanenbaum, Computer Networks, 4th Edition, Prentice-Hall of India, New Delhi, 2000.
4. Douglas E Comer, Computer Networks and Internet, Pearson Education Asia, 2000.

DIGITAL SIGNAL PROCESSING LABORATORY

SEMESTER: SIXTH SEMESTER
COURSE CODE :ET601L
L:T:P : 0:0:2, Credits:1

MICROWAVE ENGINEERING LABORATORY

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET602L
L:T:P : 0:0:2,Credits:1

DIGITAL COMMUNICATION LABORATORY

SEMESTER: SIXTH SEMESTER
COURSE CODE : ET603L
L:T:P : 0:0:2 ,Credits:1

MICROPROCESSORS AND APPLICATIONS LABORATORY

SEMESTER: SIXTH SEMESTER
COURSE CODE: ET604L
L:T:P : 0:0:2, Credits:1

COURSE STRUCTURE SEMESTER-VII:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ET701	Antennas and Wave propagation	3	1	0	4	4
02	ET702	Fiber Optic Communication	2	1	0	3	3
03	PI 703	Power Electronics Devices and Circuits	3	1	0	4	4
04	ET 704	Microcontrollers and Embedded systems	3	1	0	4	4
05	OE….	Elective-I (Open)	4	0	0	4	4
Practical/Projects/Seminar/ Viva							
06	ET702L	Fiber Optic Communication Laboratory	0	0	2	2	1
07	PI 703L	Power Electronics Devices and Circuits Laboratory	0	0	2	2	1
08	ET705	Industrial Summer Training Report/Viva	0	0	2	2	1
09	ET706	General Seminar	0	0	2	2	2
10	ET707	Project work– I	0	0	4	4	4
		Total	15	4	12	31	28

ANTENNAS AND WAVE PROPAGATIONS

SEMESTER: SEVENTH SEMESTER
COURSE CODE : ET701
L:T:P : 4:0:0, Credits:4

Module 1:Electromagnetic Fields: Review of EM theory, Maxwell's equations, wave equations solutions, plane waves, pointing vector, power flow and potentials.
Module 2:Elementary Radiations: Hertzian and Half wave dipoles and loops, Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, beam width, effect of ground resonant and non-resonant antennas, Folded dipoles.
Module 3:Antenna Arrays: Two element array, broad side, End fired pattern, Beam width, pattern multiplication, multi element array and their properties, synthesis of an array using Schelkunoff polynomial method, Woodward-Lawson method.
Module 4:Various types of Antenna: Yagi-Uda antenna, Rhornbic antenna, Log-periodic and Helical antennas, Microwave antenna, Perabolic reflectors, Horns, Lens, Slot, Microstrip Patch antennas- their characteristics, beam-width, polarization and bandwidth, Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, Fixed weight beam forming basics, Adaptive beam forming.
Module 5: Matching Network: Antenna coupling and matching networks, Balnus.
Module 6:Wave Propagation: Propagation modes for different frequencies, Descriptions and salient features of ground waves, sky wave and space propagation, Tropospheric propagation, Ionospheric propagation, Determination of critical frequency, MUF, virtual height, skip distance, Fading, Microwave propagation, Super refraction.

Text Books/References:

1. C.*A. Balanis, "Antenna Theory - Analysis and Design", John Wiley& sons, 1982.*
2. *R.E.Collin, "Antennas and Radio Wave Propagation", McGraw – Hill,1985*
3. *R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005*
4. *F. C. Jordan, K. G. Balmain, "Electromagnetic Waves and Radiating Systems, PHI*
5. *R.E. Crompton, "Adaptive Antennas", John Wiley*
6. *J.D. Kraus, "Antennas", McGraw Hill, 1988*

FIBER OPTIC COMMUNICATION

SEMESTER: SEVENTH SEMESTER
COURSE CODE : ET702
L:T:P : 2:1:0, Credits:3

UNIT 1: Introduction to optical communication systems:

Motivation, electromagnetic spectrum used for optical communication, block diagram of optical communication system, key elements of optical fiber systems, advantages of optical fiber communication.
Optical fibers: Optical laws and definitions, ray theory transmission, optical fiber modes and configurations, single-mode fibers, step-index fiber, graded-index fiber, cut-off wavelength, fiber materials, photonic crystal fibers, fiber fabrication, fiber optic cables

UNIT 2: Signal degradation in optical fibers:
Attenuation: units, absorption, scattering losses, bending losses, core and cladding losses
Signal distortion in fibers: overview of distortion origins, modal delay, factors contributing to delay, material dispersion

UNIT 3: Optical sources:
Light emitting diodes (LEDs): structures, materials, quantum efficiency, LED power
Laser diodes: modes, threshold conditions, laser diode rate equations, external quantum efficiency, resonant frequencies, structure and radiation patterns, single mode lasers
Power launching and coupling: source to fiber power launching, fiber to fiber joints, fiber splicing, optical fiber connectors.

UNIT 4: Photo detectors:
Pin photo detector, Avalanche photo detector, photo detector noise, detector response time, avalanche multiplication noise. Fundamental Receiver Operation- preamplifiers, Error Sources -Receiver Configuration -Probability of Error - Quantum Limit.

UNIT 5: Optical components:
Optical couplers and isolators: types and functions, Optical switches, Beam splitter, Optical multiplexer and demultiplexer, Optical wavelength converter, Bragg grating, Optical Amplifiers-Semiconductor optical amplifier, Erbium Doped Fiber Amplifiers (EDFA)
UNIT 6: Optical technologies:
Wavelength division multiplexing (WDM) concepts: Overview of WDM, operational principles of WDM
Text Books/ References:

1. *G. Keiser: Optical Fiber Communications, TMH New Delhi*
2. *J.M. Senior: Optical Fiber Communication- Principles and Practices, Pearson Education*
3. *G.P. Agarwal: Fiber Optic Communication Systems, Wiley India Pvt. Ltd*
4. *J.C. Palais: Fiber Optics Communications, Pearson Education*
5. *R.P. Khare: Fiber Optics and Optoelectronics, Oxford University Press*
6. *A. Ghatak and K.Thyagrajan: Fiber Optics and Lasers, Mcmillan India Ltd*
7. *S. C. Gupta: Optoelectronic Devices and Systems, PHI Learning*

POWER ELECTRONICS DEVICES AND CIRCUITS

SEMESTER: SEVENTH SEMESTER
COURSE CODE : PI 703
L:T:P : 3:1:0 ,Credit:4

Module 1: Semiconductor Power Devices : Characteristics of power devices – diode, power transistor, thyristor and triac; Firing circuits for thyristor& triac; Rating , cooling & mounting of thyristor; Series & parallel connection of thyristor ; Protection of Thyristor; Gate trigger & commutation circuits; Gate turn-off thyristor (GTO) ; Power MOSFET; UJT ; Diac;Triac, IGBT.R, R-C and UJT firing circuit and other firing circuits based on ICs and microprocessors; pulse transformer and opto-coupler, commutation techniques.

Module 2: Rectfying Circuits: Circuit nomenclature, commutating diode, Single-phase half wave; bi-phase half wave; single phase bridge uncontrolled, fully controlled & half controlled rectifiers; 3-ph half wave, 6-ph half wave, 3-ph bridge & 12-ph circuits; Transformer rating; Rectified with R-L & R-C loads; power factor improvement; Excitation angle control; Symmetrical angle control; PWM & sinusoidal PWM.

Module 3: Inverter: Principle of operation of inverter; voltage driven inverter; current driven inverter; Forced-commutated inverter; Classification of circuits for forced commutation; parallel inverter; poly-phase inverter; self commutated inverter; Bridge inverter; Mc Murray –Bedford commutation; Bridge circuit using Mc Murray –Bedford commutation ; 3-ph bridge inverter; current source inverter; PWM inverter; voltage control of 3-ph inverter; Harmonics reduction; inverter applications.

Module 4: Chopper: Principle of operation of chopper; constant frequency operation; variable frequency operation; Classification- class A, class B, class C , class D & class E operation; Series turn-off chopper; Parallel capacitor turn-off chopper; Morgan chopper; Jones chopper.

Module 5:Cycloconverters:Basic principle of frequency conversion, types of cycloconverter, non-circulating and circulating types of cycloconverters.

Module 6: Mathematical analysis; Bridge configuration; control circuits; improved cycloconverter circuits; Harmonic analysis; input characteristics ; circulating current mode; control; Envelope cycloconverter.

Module 7: A.C Voltage Controllers: Introduction ; ON-OFF control ; phase angle control;Single phase bi-directional controller with resistive load.

REF.BOOKS:

1) *Integrated Electronics – J. Millman& C.C Halkias.*
2) *Power Electronics- C.L Lander*
3) *Power Electronics – P.C Sen*
4) *Power Electronics- P.S Bhimra.*
5) *Power Electronics-V.R.Moorthi , Oxford Higher Edn.*

MICROCONTROLLERS AND EMBEDDED SYSTEMS

SEMESTER:EIGHT SEMESTER
COURSE CODE :ET704
L:T:P : 3:1:0, Credits:4

Unit1: Introduction: Architecture and programming model, Internal RAM and registers, I/O ports, interrupts system and instruction sets.

Unit-2: A typical 8-bit microcontroller Architecture, e.g 8051, Programming model and Instruction set of 8051 Microcontroller. Addressing mode supported by 8051 instruction set. Assembly language programming, Timer operation, Serial data transfer using 8051. Interrupts in 8051, I/o ports and port expansion, DC motor, DAC, ADC, Stepper motor, LCD, sensor and key board interfacing to 8051 Microcontroller

Unit 3: A typical 16-bit microcontroller with RISC architecture and integrated A-D converter e.g. PIC18Cxxx family: advantages of Harvard architecture, instruction pipeline, analog input, PWM output, serial I/O, timers, in-circuit and self programmability. Instruction set. Typical application,

Unit 4: Data communication, parallel I/O, serial communication, serial interface and UART, modem, I/O devices, A/D interface, Special Devices.

Unit 5: Developing Microcontroller based products: Introduction to design process, preparing the specifications, developing a design, implementing and testing the design, regulatory compliance testing, Development tools

References Books:

1. *Kenneth J. Ayala, The 8051 microcontroller, Cengage Learning, 2004*
2. *Dogan Ibrahim, Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series, Elsevier, 2008*
. Mazidi M. A. & J. G. Mazidi - The 8051 Microcontroller and embedded systems, Pearson, 2002.
3. Kenneth J Ayala – the 8051 Microcontroller architecture programming and applications, 2nd Edition Penram International publishing.
4. J.B. Peatman – Design with PIC microcontrollers , PH Engg. 1998.
5. Hintz – Micro controllers, Architecture, implementation and programming McGraw Hill.
6. Evesham - Developing Real - Time Systems - A Practical Introduction , Galgotia Publications, New Delhi, 1996.
7. Ball S.R - Embedded microprocessor systems - Real World Design, Prentice Hall, 1996.
8. Herma K - Real Time Systems – Design for Distributed Embedded Applications, Kluwer Academic, 1997.
9. Micro chip datasheets for PIC16F877
10.Raj Kamal, Embedded Systems Architecture, Programming, and Design. (2/e), Tata McGraw Hi ll, 2008.
11. K.V. Shibu, Introduction To Embedded Systems, Tata McGraw, 2009.

. FIBER OPTIC COMMUNICATION LABORATORY

SEMESTER: SEVENTH SEMESTER
COURSE CODE : ET702L
L:T:P : 0:0:2, Credits:1

POWER ELECTRONICS DEVICES AND CIRCUITS LABORATORY

SEMESTER: SEVENTH SEMESTER
COURSE CODE : PI 703L
L:T:P : 0:0:2 ,Credit:1

Industrial Summer Training

SEMESTER: SEVENTH SEMESTER
COURSE CODE : ET 705
L:T:P : 0:0:2 ,Credit:1

Industrial Summer Training: Training of 4 weeks duration carried out during the summer break after the 6th semester. The report on training will have to be submitted in the 7th semester in the department

Project work– I

SEMESTER: SEVENTH SEMESTER
COURSE CODE : ET 707
L:T:P : 0:0:4 ,Credit:4

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Telecommunication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on students in a group, under the guidance of a Supervisor.
The assignment to normally include:
 Survey and study of published literature on the assigned topic;
 Working out a preeliminary Approach to the Problem relating to the assigned topic;
 Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility
 Preparing a Written Report in format on the project conducted for presentation to the Department;
 Final Seminar, as oral Presentation before a Departtmental Committtee.

COURSE STRUCTURE SEMESTER-VIII:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ET 801	VLSI Design	3	1	0	4	4
02	ET 802	Wireless Communication	2	1	0	3	3
03	ETL 2..	Elective-II	4	0	0	4	4
04	ETL 3..	Elective-III	4	0	0	4	4
Practical/Project/Viva-voce							
05	ET 801L	VLSI Design Laboratory	0	0	2	2	1
06	ET 805	Comprehensive Viva Voce	0	0	0	0	2
07	ET 806	Project Work– II	0	0	8	8	8
08	ET 807	Project Viva-voce	0	0	0	0	2
		Total	13	2	10	25	28

VLSI DESIGN

SEMESTER:EIGHT SEMESTER
COURSE CODE :ET 801
L:T:P : 3:1:0, Credits:4

Module 1: Issues and challenges in digital IC design: General overview of design hierarchy, layers of abstraction, integration density and Moore's model, NMOS, CMOS and BICMOS circuit fabrication, Layout design rules. Stick diagram. Latch up.

Module 2: Basic electrical properties of MOS and Bi-MOS circuits: MOS transistor operation in linear, saturated, non- saturated regions, MOS transistor ,threshold voltage, Basic CV Characteristics,Non ideal I-V Characterics;

Module 3: MOS and BiCmos Circuit Desgn Process-MOS switch and inverter, Bi- CMOS inverter, latchup in CMOS inverter, inverter properties (robustness, dynamic performance, regenerative property, inverter delay times, switching power dissipation), sheet resistance and area capacitances of layers, dri ving large capacitive loads, supperbuffers, propagation delay models of cascaded pass transistors, Pseudo NMOS, Dynamic CMOS logic circuits, power dissipation, wiring capacitances, MOSFET scaling: constant voltage and constant field scaling; limitations of scaling;

Module 4: VLSI logic circuits using design process and layout- Pass transistor and tranmision gates-NAND gate an d NoR gate for NMOS, CMOS and BiCMOS-parity generator-multiplexers –code converters- PLA –clocked sequential circuits- 4 bit adder- design of ALU-memories and registers.

Module 5: Ultra fast VLSI circuits and systems-introduction to GaAs technology-GaAs fabrication, programmable ASIC's-Actel, Altera and Xiinx FPGA devices.

Module 6: Introduction to VHDL, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits. Introduction to Verilog HDL and it's different style of modeling.

Module 6: An overview of the features of advanced FPGAs, IP cores, Softcore processors, Various fact ors determining the cost of a VLSI, Comparison of ASICs, FPGAs , PDSPs and CBICs . Fault tolerant VLSI architectures

Text/Reference Books:

1. N. Weste and K. Eshranghian, Principles of CMOS VLSI Design, Addison Wesley. 1985
2. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985
3. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
4. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
5. D. Perry, VHDL, 2nd Ed., McGraw Hill International, 1995.
6. D. A. Pucknell & K. Eshraghian, Basic VLSI Design, Prentice Hall of India, 3rd Ed. 2001.
7. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits-A deign perspective.

WIRELESS COMMUNICATION

SEMESTER: EIGHT SEMESTER
COURSE CODE : ET 802
L:T:P : 3:1:0, Credits:4

UNIT I

Introduction to Wireless Communication Systems: Evolution of mobile radio communications, mobile radio systems around the world, examples of wireless communication systems, paging systems, cordless telephone systems, cellular telephone systems, Cellular Communications from 1G to 4G, Wireless Local Loop (WLL), Wireless Local Area Network (WLAN), Bluetooth technology, personal area network (PAN)

UNIT II

Concept of Cellular Mobile Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of service, Improving Coverage and Capacity in cellular systems.

UNIT III

Mobile Radio Propagation: Signal propagation- Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing**,** outdoor propagation model (Okumura model)Small scale multipath propagation, fading, factors influencing small scale fading and Doppler shift, parameters of mobile multipath channels (time dispersion, coherence bandwidth, Doppler Spread and Coherence time), types of small scale fading (Flat and Frequency Selective Fading), types of fading due to Doppler spread (Fast and Slow fading)

UNIT VI

Multiple Access Techniques for Wireless Communication: Introduction to multiple access techniques, FDMA, TDMA, Spread Spectrum Multiple Access, Space Division Multiple Access, Packet Radio protocols (Pure Aloha and Slotted Aloha)

UNIT V

Wireless Networking: Introduction, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic Routing in Wireless Networks, Common Channel Signaling, Broadband ISDN and ATM, Signaling System No. 7 (SS-7)

UNIT VI

Wireless System and Standards: AMPS, GSM (Architecture, services and features), GSM frame structure, GSM channel types (TCH and CCH), CDMA digital cellular standards (IS-95), frequency and channel specifications, Forward CDMA channel, Reverse CDMA channel, CDMA 2000, WCDMA

UNIT VII

Diversity Techniques: Concept of diversity, diversity mechanisms (Space, Polarization, Time, Frequency diversity), RAKE receiver.

Text/Reference Books:

1. Theodore S. Rappaport, Wireless Communication, Pearson Edn
2.W. C. Y Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
3.Aymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4.AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5.VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.
6. Andrea Goldsmith, Wireless Communications, Cambridge University Press

Project Work– II

SEMESTER: EIGHT SEMESTERS
COURSE CODE : ET 806
L:T:P : 0:0:8, Credits:8

The object of Research Project Work II is to enable the students to extend further the investigative study theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department . This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to nor mally include:

- In depth study of the topic assigned.
- Review and finalization of the Approach to the Problem relating to the assigned topic;
- Preparing an Action Plan for conducting the investigation, including team work;
- Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- Final Seminar Presentation before a Departmental Committee.

VLSI DESIGN lab

SEMESTER:EIGHT SEMESTER
COURSE CODE :ET 801
L:T:P : 0:0:2, Credits:1

Project Viva voce

SEMESTER:EIGHT SEMESTER
COURSE CODE :ET 807
L:T:P : 0:0:0, Credits:2

Viva-voce marks of 2(two) credits will be awarded by the external examiner, appointed by Dibrugarh University based on his/her assessment.

Elective-I (Open):

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	OE 01	Engineering Risk–Benefit Analysis	4	0	0	4	4
02	OE 03	Disaster Management	4	0	0	4	4
03	OE 04	Project Management	4	0	0	4	4
04	OE 05	Rural Technology and Community Development	4	0	0	4	4
05	OE 71	Database Management Systems	4	0	0	4	4
06	OE 72	Information Theory and Coding	4	0	0	4	4
07	OE 73	Design and Analysis of Algorithms	4	0	0	4	4
08	OE 74	Optimization Techniques	4	0	0	4	4
09	OE 75	Cloud Computing	4	0	0	4	4
10	OE 76	Software Engineering	4	0	0	4	4
11	OE 77	Engineering System Analysis and Design	4	0	0	4	4
12	OE78	Soft Computing	4	0	0	4	4
13	OE79	Mechatronics	4	0	0	4	4
14	OE80	Industrial Economics	4	0	0	4	4
15	OE81	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

ENGINEERING RISK – BENEFIT ANALYSIS

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 01

L:T:P : 4:0:0, Credits:4

Module 1: Introduction- Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model
Module 2: System Definition and Structure: System Definition Models, Hierarchical Definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems 65
Module 3: Consequence Assessment-Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, Consequence Propagation. Engineering Economics: Time Value of Money, Interest Models, Equivalence
Module 4: Decision Analysis: Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models
Module 5: Data Needs for Risk Studies: Elicitation Methods of Expert Opinions, Guidance

Text Books:

1. *Risk Analysis in Engineering and Economics, B. M. Ayyub, Chapman-Hall/CRC Press, 2003.*

Reference Books:

1. Probability, Statistics, and Reliability for Engineers and Scientists, Ayyub & McCuen, 2003.
2. Probabilistic Risk Assessment and Management for Engineers and Scientists, by H. Kumamoto and E. J. Henley, Second Edition, IEEE Press, NY, 1996.
3. Bedford, T. and Cooke, R. Probabilistic Risk Analysis: Foundations and Methods. New York: Cambridge University Press, 2001.
4. Normal Accidents, Living with High-Risk Technologies, C. Perrow, Princeton University Press, 1999.
5. Accident Precursor Analysis and Management - Reducing Technological Risk

DISASTER MANAGEMENT

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 03

L:T:P : 4:0:0, Credits:4

Module 1: Introduction (3 lectures)- Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).

Module 2: Disasters (12 lectures)- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Module 3: Disaster Impacts (5 lectures)- Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

Module 4: Disaster Risk Reduction (DRR) (15 lectures)- Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Module 5: Disasters, Environment and Development (5 lectures)- Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental-friendly recovery; reconstruction and development methods.

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management ,APH Publishing Corporation.

PROJECT MANAGEMENT

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 04

L:T:P : 4:0:0, Credits:4

Module 1: Introduction to Project management**:** Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.
Module 2: Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.
Module 3: Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.
Module 4: Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management.
Module 5: Post-Project Analysis.

Text/Reference Books:

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
2. Lock, Gower, Project Management Handbook.
3. Cleland and King, VNR Project Management Handbook.
4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia
5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
6. S. Choudhury, Project Scheduling and Monitoring in Practice.
7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT

SEMESTER:SEVENTH SEMESTER

COURSE CODE :OE 05

L:T:P : 4:0:0, Credits:4

Module 1: Data Analysis and Measures of Central Tendency- Meaning, nature, scope and limitations of statistics, collection of statistical data, classification, tabulation and diagrammatic representation of data, Measures of central tendency : Statistical averages Mean, Median, Mode.

Module 2: Data, Information and Knowledge; concept of information, need of information (professional, educational, research), qualities of information, value of information, difference between data and information, properties of the needed information. Information and Management; planning, organizing, co-ordinating and controlling,

Module 3: Concepts of marketing; difference between marketing selling and retailing; marketing mix, market-segmentation, marketing planning. Strategy and Approaches; modern concept of marketing.

Module 4: Community development; concept, definition, meaning, need, history, principles, objectives and scope. Community Building: Coming of Age, Regenerating Community, Community Model.

Module 5: Consensus Organizing Model, What's Behind Building Healthy Communities? Participatory Democracy, The Role of various NGOs in Community Development. The Role of Business and Government in Community Development Initiatives How to Form a Non profit Corporation Fund Raising and Grant Writing.

Text/Reference Books:

1. Biddle, William Wishart. 1968. Encouraging Community Development: A Training Guide for Local Workers. New York: Holt, Rinehart and Winston.
2. Clark, Kenneth B. and Jeannette Hopkins, eds. 1969. A Relevant War Against Poverty: A Study Community Action Programs and Observable Social Change. New York: Harper and Row.
3. Clinard, Marshall Barron. 1970. Slums and Community Development: Experiments in Self-Help. New York: Free Press.
4. Creevey, Lucy E., ed. 1986. Women Farmers in Africa: Rural Development in Mali and the Sahel. Syracuse, NY: Syracuse University Press.
5. Dobyns, Henry F., Paul L. Doughty, and Harold D. Lasswell, eds. 1971. Peasants, Power, and Applied Social Change: Vicos as a Model. Beverly Hills, CA: Sage.
6. Edwards, Allen David and Dorothy G. Jones. 1976. Community and Community Development. The Hague, Netherlands: Mouton.
7. Green, Tova and Peter Woodrow. 1994. Insight and Action: How to Discover and Support a Life of Integrity and Commitment to Change. Philadelphia, PA: New Society Publishers.
8. Heskin, Allen David. 1991. The Struggle for Community. Boulder, CO: West view Press.
9. Kramer, Ralph M. and Harry Specht. 1975. Readings in Community Organization Practice. 2d ed. Englewood Cliffs, NJ: Prentice-Hall.
10. Lean, Mary. 1995. Bread, Bricks, and Belief: Communities in Charge of Their Future. West Hartford, CT:

Kumarian Press.
11. Sustainable Rural Technology, by M.S. Virdi, Daya Publishing House, ISBN: 8170355656
12. Rural Technology, (Paperback, Egnlish), by Punia Rd Roy, Publisher: Satya Prakashan (2009)

DATABASE MANAGEMENT SYSTEMS

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 71

L:T:P : 4:0:0, Credits:4

Module 1: Introduction -
Database Systems versus File Systems, View of Data, Data Models, database languages, Database User s and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System. Distributed Processing and Client- Server Architecture. Entity-Relationship Model – Basic Concepts, Constraints,Keys, Design Issues, E-R Diagrams.

Module 2: Relational Model-
Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security an d Authorization. Query By Example (QBE), User Interfaces and Tools, Forms and Graphical User Inter faces. Report enerators. Overview of Relational Query Optimization.

Module 3: Relational Database Design- Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL:1999.

Module 4: Internet Databases-
World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML –Structure of XML Data,XML Document Schema, XQuery,Storage of XML Data, XML Applications.

Module 5: Advanced Topics-
Fundamental Concepts of Transaction Management, XConcurrency Control, Recovery Systems, Data A nalysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geogra phic Databases, Temporal databases a,d Multimedia Databases.

Text Books:
1. Database Systems Concepts – Korth et. Al.
2. An Introduction to Database Design – Date
3. Object-Oriented Database Design – Harrington

Reference Books:
1. Fundamentals of Database Systems – Elmasri and Navathe
2. Database Management and Design – Hansen and Hansen .

INFORMATION THEORY AND CODING

SEMESTER:EIGHT SEMESTER
COURSE CODE : OE 72
L:T:P : 4:0:0, Credits:4

Unit – 1:Information Theory
Introduction, Measure of information, Average information contentof symbols in long independent sequences, Average information content of symbols in longdependent sequences. Mark-off statistical model for information source, Entropy andinformation rate of mark-off source

Unit – 2:Source Coding
Encoding of the source output, Shannon's encoding algorithm.Communication Channels, Discrete communication channels, Continuous channels

Unit – 3:Fundamental Limits on Performance
Source coding theorem, Huffman coding,Discrete memory less Channels, Mutual information, Channel Capacity

Unit – 4:Channel coding
Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Channel capacity Theorem

Unit – 5:Introduction to Error Control Coding
Introduction, Types of errors, examples, Typesof codes Linear Block Codes: Matrix description, Error detection and correction, Standardarrays and table look up for decoding

Unit – 6:
Binary Cycle Codes, Algebraic structures of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation. BCH codes.

Unit – 7:
RS codes, Golay codes, Shortened cyclic codes, Burst error correcting codes. Burst and Random Error correcting codes

Unit – 8:
Convolution Codes, Time domain approach. Transform domain approach.

Text Books/References:

1. Digital and analog communication systems, K. Sam Shanmugam, John Wiley,1996.
2. Digital communication, Simon Haykin, John Wiley, 2003.
3. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
4. Digital Communications - Glover and Grant; Pearson Ed. 2nd Ed 2008
5. Information Theory and coding- N.Abrahamson, McGraw Hill Book Co., 1963.

6. Information theory and reliable communication- R.G.Gallagar, Wiley New York, 1968.
7. Principles of Practices of Information Theory-Richard.E.Balhut, Addison Wesley Pub.Co.,1987

OPTIMIZATION TECHNIQUES

SEMESTER:EIGHT SEMESTER
COURSE CODE : OE 74
L:T:P : 4:0:0, Credits:4

1.INTRODUCTION TO OPTIMIZATION
Introduction, Historical development, Engineering Application of Optimization, Statement of an Optimization problem-Design Vector, Design Constraints, Constraint Surface, Objective Function Surfaces. Classification of Optimization Problems, Optimization techniques, Engineering Optimization Literature. Problems

2. CLASSICAL OPTIMIZATION TECHNIQUES
Introduction, single variable Optimization, multi-variable Optimization with no constraints, multivariable Optimization with equality constraints, multivariable Optimization with Inequality constraints, convex programming problems.

3. LINEAR PROGRAMMING I: SIMPLEX METHOD
Introduction, Application of Linear Programming, Standard form of a Linear Programming Problem, Geometry of a Linear Programming Problems, Definitions and Theorem, Solution of a system of Linear simultaneous equation, Pivotal reduction of a general system of equation, motivation of the simplex method, Simplex algorithm, two phases of the simplex method.

4. LINEAR PROGRAMMING II: ADDITIONAL TOPICS ANDEXTENSIONS
Revised simplex method, duality in linear programming, decomposition principle, sensitivity or post optimality analysis, Transportation problem, Karmarkar's Method, quadratic programming.

5. NON-LINEAR PROGRAMMING: ONE DIMENSIONAL MINIMIZATION METHODS
Introduction, unimodal function, Unrestricted search, exhaustive search, dichotomous search, Interval Halving method, Fibonacci method,

Textbooks/References:
1. Optimization Theory and Application – SS Rao, Wiley Eastern Ltd, 3
rd
edition
2. Optimization Techniques-Chander Mohan, Kusum Deep, New Age Science.
3. Optimization Techniques-Paban Kumar Oberoi, Global Vision Publishing House
4. Computer based Optimization Techniques-Tanweer Alam- A.B.Publications
5. Operation Research-An Introduction-TAHA H A,Prentice Hall

CLOUD COMPUTING

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 75

L:T:P : 4:0:0, Credits:4

Module 1: Introduction- Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment

Module 2: Cloud Computing Technology-Client systems, Networks, server systems and security from services perspectives; Accessing the cloud with platforms and applications; cloud storage

Module 3: Working with Cloud -Infrastructure as a Service – conceptual model and working Platform as a Service – conceptual model and functionalities. Software as a Service – conceptual model and working. Trends in Service provisioning with clouds

Module 4: Using Cloud Services-Cloud collaborative applications and services – case studies with calendars, schedulers and event management; cloud applications in project management.

Module 5: Case studies- Microsoft Azure, Google App Engine and Open source clouds-Open-Nebula and Eucalyptus

Text Books:

1. Anthony T.Velte, Toby J.Velte and Robert E, Cloud Computing – A Practical Approach, TMH 2010
2. Michael Miller, Cloud Computing – Web based Applications, Pearson Publishing, 2011

Reference Books:

1. *Resources from Internet /WWW. ..*

SOFTWARE ENGINEERING

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 76

L:T:P : 4:0:0, Credits:4

Module 1: Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers.

Module 2: Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model. Good Program Design Techniques – Structured Programming, 62 Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development.

Module 3: Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.

Module 4: Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process breakdown structure, COCOMO and COCOMO-II.

Module 5: Advanced Topics: Formal Methods in Software Engineering – Z notation, Hoare‟s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspect-oriented Programming.

Text Books:

1. Fundamentals of Software Engineering – Carlo Ghezzi et. al.
2. Software Engineering – Design, Reliability Management – Pressman.

Reference Books:

1. Software Engineering – Ian Sommerville.
2. Software Engineering - Shoeman.
3. Software Engineering with Abstraction – Berzins and Luqi

ENGINEERING SYSTEM ANALYSIS AND DESIGN

SEMESTER: SEVENTH SEMESTER

COURSE CODE :OE 77

L:T:P : 4:0:0, Credits:4

Module 1: Introduction- Systems, Elements of a system, Types of systems, Subsystems, Super systems, Need for system analysis and design, CASE tools for analysis and its limitations.
Module 2: System Analysis-Methods of system analysis, system development life cycle, structured approach, development tools, data base and networking techniques.
Module 3: System design- Design technologies, Design principles, Design tools and methodologies, feasibility survey, conversion and testing tools, design management and maintenance tools .
Module 4: Object oriented analysis and design- Introduction, Object modeling, Dynamic modeling, functional modelling, UML diagrams and tools.
Module 5: Case studies- Developing prototypes for systems like, online exam management, Computer gaming and online website management.

Text Books:

1. Perry Edwards, "System analysis and design", McGraw Hill international edition, 1993.
2. Len Fertuck, "System analysis and design with CASE tools", Wm C. Brown Publishers, 1992.

Reference Books:

1. Er. V.K. Jain, "System analysis and design ", Dreamtech Press.
2. Kenneth E.Kendall and Julie E.Kendall, "System analysis and design", Prentice Hall, India, 2007.

SOFT COMPUTING

SEMESTER:SEVENTH SEMESTER

COURSE CODE :OE 78

L:T:P : 4:0:0, Credits:4

UNIT 1: Artificial Neural Networks

Basic-concepts-single layer perception-Multi layer perception-Supervised and unsupervised learning back propagation networks, Application

UNIT 2: Fuzzy Systems

Fuzzy sets and Fuzzy reasoning-Fuzzy matrices-Fuzzy functions-decomposition-Fuzzy automata and languages- Fuzzy control methods-Fuzzy decision making, Adaptive Control, Applications

UNIT 3: Neuro-Fuzzy Modelling

Adaptive networks based Fuzzy interfaces-Classification and Representation trees algorithms-Rule base structure identification-Neuro-Fuzzy controls

UNIT 4: Genetic Algorithm

Survival of the fittest-pictures computations-cross over mutation-reproduction-rank method-rank space method, Application

UNIT 5: Soft Computing And Conventional AI

AI Search algorithm-Predicate calculu rules of interface - Semantic networks-frames objects-Hybrid models; Applications

Text Books/ References:

1. Neuro Fuzzy and Soft computing- Jang J.S.R., Sun C.T and Mizutami E, Prentice Hall
2. Fuzzy Logic Engineering Applications- Timothy J.Ross; McGraw Hill
3. Neural Networks- Simon Haykin, pearson Education
4.,Fuzzy Sets and Fuzzy Logic- George J.Klir and Bo Yuan, Prentice Hall
5. Artificial Intelligence- Nih.J.Ndssen Harcourt Asia Ltd.,Singapore

MECHATRONICS

SEMESTER:SEVENTH SEMESTER

COURSE CODE :OE 79

L:T:P : 4:0:0, Credits:4

INTRODUCTION

Introduction to Mechatronics-Systems-Measurement Systems-Control Systems-Mechatronics Approach.

SENSORS AND TRANSDUCERS

Introduction-Performance, Terminology-Displacement, Position and Proximity-Velocity and Motion-Fluid Pressure-Temperature Sensors-Light Sensors-Selection of Sensors-Signal Processing.

8085 MICROPROCESSOR

Introduction-Architecture-Pin Configuration-Instruction set-Programming of Microprocessors using 8085 instructions-Interfacing input and output devices-Interfacing D/A converters and A/D converters-Applications- Temperature control-Stepper motor control-Traffic light controller.

PROGRAMMABLE LOGIC CONTROLLERS

Introduction-Basic structure-Input/output Processing-Programming-Mnemonics-Timers, Internal relays and counters-Data handling-Analog Input/output-Selection of a PLC.

DESIGN AND MECHATRONICS

Stages in Designing mechatronic systems - Traditional and Mechatronic design -Possible design solutions-Case studies of mechatronic systems - Pick and place robot - automatic car park system - engine management system.

References:

1. W.Bolton, Mechatronics,Longman,Second Edition, 1999.
2. Michael B. Histand and David G.Alciatore, " Introduction to Mechatronics and Measurement Systems ", McGraw Hill International Editions, 1999.
3. HMT Ltd., " Mechatronics ", Tata McGraw Hill Publishing Co. Ltd., 1998.
4.Dan Necsulescu, "Mechatronics",Pearson Education Asia,2002(Indian reprint).

INDUSTRIAL ECONOMICS

SEMESTER:SEVENTH SEMESTER

COURSE CODE :OE 80

L:T:P : 4:0:0, Credits:4

Microeconomics.Demand and supply.Forecastingtechniques.Cost and revenues.Competitive nature of firms. Keynesian economics.Aggregate demand and supply. Employment determination.National income.Trade cycle.Inflation.Index numbers. Capital budgeting. Cash flow analysis. Balance sheet.Risk analysis and decision making. Impact of liberalization, privatization and globalization.Locating the firm in a global economy. Fiscal policy. Taxation-principles.Exchange rate determination.Monetarypolicy.Functions of banks.Credit creation by commercial banks. Department of Electronics and Communication Engineering 17 B.Tech.- ECE

Text Books: *M.Adhikari, Business Economics, Excel Books, 2004 S.K.Misra&V.K.Puri, Economic Environment of Business, HPH, 2003*
Reference Books: *Dewett.K.K:Modern Economic Theory,Chand.S&co,1998. Gupta C.B:BusinessOrganisation and Management, Chand.S& co,1998. Philip Kotler:Marking Management,PHI,1999.*

Elective-II:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ETL21	Communication Switching Systems	4	0	0	4	4
02	ETL22	Robotics and Industrial Automation	4	0	0	4	4
03	ETL23	Pattern Recognition	4	0	0	4	4
04	ETL24	Multimedia Communication Technology	4	0	0	4	4
05	ETL25	Principle of RADAR	4	0	0	4	4
06	ETL26	IC Technology	4	0	0	4	4
07	ETL27	Digital System Design	4	0	0	4	4
08	ETL28	Bio-Medical Electronics	4	0	0	4	4
09	ETL29	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

COMMUNICATION SWITCHING SYSTEMS

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 21
L:T:P : 4:0:0, Credits:4

Introduction, Switching systems, Classification of Switching Systems, Functions of Switching systems, Evolution of Digital Switching System, Stored Program Control(SPC), Digital Switching system fundamentals; Transmission Media: Guided and Unguided Basic elements of communication network.Switching systems. Signaling and signaling functions. Digital telephone network.T1 Carrier systems.TDM hierarchy.Data under voice.Digital switching. Echo cancellers. Synchronous versus asynchronous transmission. Line coding .Error performance.TDM.TDM loops and rings. Space and time divided switches. Multistage switches. Design examples. Path finding.Switching matrix control.Digital time division switch. Time Space switching. Time Space Time switching. Digital Switching in analog environment. Timing recovery. Jitter. Network synchronization.Digital subscriber access-
ISDN network.ADSL.Traffic analysis.

Text Books:
J.C. Bellamy, Digital Telephony, (3/e), Wiley, 2000.
E.Keiser&E.Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

Reference Books:
ThiagarajanViswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995
M.T. Hills ,Telecommunication Switching Principles, London : Allen and Unwin, 1979.

ROBOTICS AND INDUSTRIAL AUTOMATION

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 22
L:T:P : 4:0:0, Credits:4

Overview: Structure & components Industrial Automation systems. Architectural levels of Industrial controls Actuators & sensors: Servomotors, Stepper motors, Process I/O systems. Local & remote I/O systems.

Basic concepts: Definition and origin of robotics – different types of robots – various generations of robots – degrees of freedom – Asimov's laws of robotics – Dynamic stabilization of robots. Power sources and sensors: Hydraulic, pneumatic and electric drives – Determination of HP of motor and gearing ratio – variable speed arrangements – path determination – machine vision – ranging – laser acoustic– magnetic – fibre optic and tactile sensors.

Manipulators, Actuators and Grippers: Construction of manipulators – manipulator dynamic and force control – electronic and pneumatic manipulator control circuits – and effectors – various types of grippers –design considerations.

Robotic arm and Android hand

References Books:

1. *Ghosh Control in Robotics and Automation: Sensor Based Integration,Allied Publishers,Chennai.*
2. *Craig, John J., Introduction to Robotics: Mechanics & Control, 2nd Edition, Pearson Education, 1989.*
3. *Mittal and Nagrath,- Robotics and Control, Tata Mc. Graw Hill.*
4. *Fu, K.S., R.C. Gonzalez, C.S.G. Lee, Robotics: Control, Sensing, Vision & Intelligence, McGrawHill, 1987.*
5. *. Khafter, R.D., Chimelewski, T.A. and Negin, M. – Robot Engineering – An Integrated Approach,PHI, New Delhi, 1994.*
6. *Sponge, M., and Vidyasagar M- Robot Dynamics and Control, John Wiley New York 1989.*
7. *John Iovine,'Robots Androids and Animatrons', TAB electronics*

PATTERN RECOGNITION

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 23
L:T:P : 4:0:0, Credits:4

Unit-I Introduction: Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

Unit-II Statistical Patten Recognition: Bayesian Decision Theory, Classifiers, Normal density and discriminant functions,

Unit – III Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Unit - IV Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.

Unit - V Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

Texts and References:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.
3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Pres
4. S. Marsland, Machine Learning: An Algorithmic Perspective, Chapman & Hall/CRC, 2009.

MULTIMEDIA COMMUNICATION TECHNOLOGY

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 24
L:T:P : 4:0:0, Credits:4

Module 1: Components of multimedia system.Desirablefeatures.Applications of multimedia systems.In troduction to different types.Multimedia storage device.

Module 2: Digital audio representation and processing-
time domain and transform domain representations. Coding
standards, transmission and processing of digital audio. Musical instrument synthesizers.

Module 3: Still image coding-
JPEG. Discrete cosine Transform. Sequential and Progressive DCT based encoding
algorithms, lossless coding, hierarchical coding. Basic concepts of discrete wavelet transform coding an d
embedded image coding algorithms. Introduction to JPEG 2000.

Module 4: Feature of MPEG 1, structure of encoding and decoding process, MPEG 2 enhancements, di fferent blocks of MPEG video encoder.

Module 5: Content based video coding-
overview of MPEG 4 video, motion estimation and compensation. Different
coding techniques and verification models. Block diagram of MPEG 4 video encoder and decoder. An overview of H261 and H263 video coding techniques.

TextBooks /Reference Book:

1. Y.Q.Shi&H.Sun, Image and Video Compression for Multimedia Engineering, CRC Press,2000.
2. S.V.Raghavan & S,K,Tripathi, Networked Multimedia Systems, Prentice-Hall,1998.
ReferenceBooks
3. J.F.K.Buford, Multimedia Systems, Pearson,2000.
4. Recent literature in Multimedia Communication Technology.

PRINCIPLES OF RADAR

SEMESTER:EIGHT SEMESTER
COURSE CODE : ETL 25
L:T:P : 4:0:0, Credits:4

Radar equation. Radar cross section. Cross section of small targets. Target scattering matrices. Area and volume targets. Radar signals. Ambiguity function and its properties. Uncertainty principle. Pulse compression. linear FM pulse. Pulse compression by Costas FM and binary phase coding.
Radar detection. Optimum Bayesian decision rules. Detection criteria for different target models. Range and Doppler measurements and tracking. Range and Doppler frequency resolutions. Optimum receivers. Optimum filters for Doppler measurements. Coherent and non coherent implementations. Angle measurement and tracking. Angle measurement and tracking by conical scan and monopulse. Optimum monopulse systems.

Text Books: *P.Z.Peebles, Radar Principles, Wiley, 1998. Merrill I. Skolink, Introduction to Radar Systems, (3/e), Tata MG Graw Hill, 2001*

Reference Books: *N.Levanon, Radar Signals, Wiley, 2005. D.Wehnar : High Resolution Radar (1987), Artech House. D.K.Barton : Radar systems Analysis (1976), Prentice Hall.*

IC TECHNOLOGY

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 26
L:T:P : 4:0:0, Credits:4

Module 1:
Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques.
Module 2:
Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles.
Module 3:
Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films. Oxidation technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI.
Module 4:
Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation.
Module 5:
Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modelling and technology.
Module 6:
Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal interconnects; Multi-level metallization schemes.
Module 7:
Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.
Module 8:
Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOS technologies.

Text/Reference Books:

1. *C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.*
2. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
3. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

DIGITAL SYSTEM DESIGN

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 27
L:T:P : 4:0:0, Credits:4

Module 1: Sequential circuit Design:
Analysis of clocked sequential circuits and modeling-state diagram, state table , state table assignment and state reduction, Design of Synchronous sequential circuits-design of iterative circuits-ASM chart, realization using ASM

Module 2: Asynchronous sequential circuits:
Analysis of Asynchronous sequential circuits-flow table reduction-race-state assignment-transition table and problems in transition table- design of Asynchronous sequential circuits -Static, dynamic and essential hazards-data synchronizers-mixed operating mode asynchronous sequential circuits-designing vending machine controller.

Module 3: Design Convention:
Register Transfer, biasing and sequencing of control. Electronic realization of hardware control unit. Conditional transfer.

Module 4: Synchronous circuits design Programmable Logic device:

Programmable Logic device families. Designing a Synchronous sequential circuits using PLA/PLD, Realizatin of Finite State Machine uing PLA-FPGA- xilinx FPGA- xilinx 4000

Module 5: Fault Diagnosis and Testability Algorithm:

Fault Table method- Path senitizatin method- Boolean difference method-D algorithm-Tolerance techniques-the compact algorithm- Fault in PLA-Test generation-DFT scheme-Build in self test.

Module 6: System design using VHDL:

VHDL operators- arrays-concurrent , sequential statements-packages-data flow, Behavioral , structural Modeling-compilation and simulation of VHDL codes-Test bench-realization of combination and sequential circuits using HDL-Registers-counters-sequential machine-serial adder-multiplier-Divider-design of simple microprocessor.

Text/ Reference:

1. Charlies. H, RothJr,"Digital System Design" using VHDL.Thomsion Learning 2004
2. Floyd "Digital Fundamental with PLD programming"Pearson Prentice Hall.
3. Comer." Digital Logic and State machine Design" Oxford UniversityPress.

BIO-MEDICAL ELECTRONICS

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL28
L:T:P : 4:0:0, Credits:4

Module 1: Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.

Module 2: Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Module 3: Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging.

Module 4: Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

Text/Reference Books:

1.W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2.J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3.A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Elective-III:

Sl No	Course Code	Course Title	L	T	P	Contact hrs/wk	Credits
01	ETL31	MEMS and Microsystems Technology	4	0	0	4	4
02	ETL32	Speech and Audio Processing	4	0	0	4	4
03	ETL33	Digital Image Processing	4	0	0	4	4
04	ETL34	Satellite Communications	4	0	0	4	4
05	ETL35	Mixed Signal Design	4	0	0	4	4
06	ETL36	Fuzzy Logic and Neural Network	4	0	0	4	4
07	ETL37	Adaptive Signal Processing	4	0	0	4	4
08	ETL38	Artificial Intelligence and Robotics	4	0	0	4	4
09	ETL39	Any other subject offered from time to time with the approval of the university	4	0	0	4	4

MEMS AND MICROSYSTEM TECHNOLOGY

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 31
L:T:P : 4:0:0, Credits:4

Overview of MEMS and Microsystem ;
Introduction: Historical background, development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines. Working Principle of Microsystem; Engineering Science for Microsystem Deign and Fabrication; Engineering Mechanics for Microsystem Design; Thermofluid Engineering and Microsystem Design; Scaling Laws of Miniaturization; Meterial for MEMS and Microsystem;
Microsystem Fabrication Processes:
MEMS Materials and Processing,Overview, metals, semiconductors, ceramic, polymeric and composite materials. Silicon micro machining – bulk: Introduction, etch-stop techniques, dry etching, buried oxide process, silicon fusion bonding, anodic bonding.

Silicon Micro Machining–Surface: Introduction, sacrificial layer technology, material systems in sacrificial layer technology, plasma etching, combined IC technology and anisotropic wet etching.

Overview of Micromanufacturing; Microsystem Design;Assembly , Packing and Testing of Microsystems; Introduction to Nanoscale Engineering.Applications of MEMS.

Micro Sensors: Introduction, thermal sensors, radiation sensors, mechanical sensors, magnetic sensors, biochemical sensors and flow sensors. SAW Devices: Introduction, saw devices development and history, transducers in SAW devices, acoustic waves.

Text/Reference:

1. S.D. Senturia, Microsystem Design, Kluwer Academic Publishers.
2. Tai-Ram Hsu, MEMS and Microsystem Design and Manufacture, McGraw Hill, 2002.
3. V. K. Varadan, K. J. Vinoy and S. Gopalakrishnan, Smart Meterial System and MEMS:Design and Developoment Methodologies, Wiley 2006

SPEECH AND AUDIO PROCESSING

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 32
L:T:P : 4:0:0, Credits:4

Module 1: Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Module 2: Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Module 3: Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Module 4: Speech Quantization- Scalar quantization – uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Module 5: Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Module 6: Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Module 7: Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Module 8: Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729 standards

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students "Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, Wiley Inter science, 2003.

DIGITAL IMAGE PROCESSING

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 33
L:T:P : 4:0:0, Credits:4

UNIT 1: Introduction and Digital Image Fundamentals

Digital Image Fundamentals, Human visual system, Image as a 2D data, Image representation – Gray scale and Color images, image sampling and quantization

UNIT 2: Image Enhancement

Spatial Domain-Gray Level transformations, Histogram, Arithmetic/Logical Operations, Spatial filtering, Smoothing & Sharpening Spatial Filters; Frequency Domain- 2-D Fourier transform, Smoothing and Sharpening Frequency Domain Filtering; Convolution and Correlation Theorems;

UNIT 3: Image Restoration and Reconstruction

Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering

UNIT 4: Image Compression

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard

UNIT 5: Image Segmentation

Point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Hough transform, binary morphology- erosion, dilation, opening and closing operations, applications

UNIT 6: Colour Image Processing

Color Fundamentals, Color Models, Pseudo color image processing

Text Books/ References:

1. Fundamentals of Digital Image processing- A. K. Jain, Pearson Education
2. Digital Image Processing- R. C. Gonzalez and R. E. Woods, Pearson Education
3. Digital Image Processing using MATLAB- R. C. Gonzalez , R. E. Woods and S. L. Eddins, Pearson Education
4. Digital Image Processing and Analysis- Chanda and Mazumdar, PHI
5. Digital Image Processing- Annadurai and Shanmugalakshmi, Pearson Education
6. Digital Image Processing- Castleman, Pearson Education

SATELLITE COMMUNICATION

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 34
L:T:P : 4:0:0, Credits:4

UNIT I

Overview of Satellite Communications: Origin of Satellite communications, basic concepts of satellite communications, frequency allocations for satellite services, INTELSAT, Polar orbiting satellites, Argos system, Cospas- Sarsat, applications, future trends of satellite communications.

UNIT II

Satellite orbit and launching: Kepler's laws, Earth satellite, orbiting satellite terms, orbital elements- orbital perturbations, Inclined orbits, Orbital Plane-Sun synchronous orbit, Geo stationary satellites, Antenna look angles, limits of visibility, Near Geostationary orbit, Launching of Geostationary Satellites.

UNIT III

Propagation effect and Polarization: Introduction, Atmospheric absorption, Ionospheric effects, rain attenuation, Antenna Polarization, Cross polarization discrimination, Ionospheric Depolarization, Ice Depolarization.

UNIT IV

Satellite Subsystems: Space Segment: Power supply, Altitude control, Station Keeping, Thermal control, TTT&C subsystems, Antenna subsystem, Transponders, Wideband receiver, Earth segment: Receive only home TV system, Community antenna TV system

UNIT V

Satellite Space Link: Introduction, general link design equation, system noise temperature, Uplink design, Downlink design, complete link design, Design for a specified C/N ratio, Atmospheric and rain effects on link performance.

UNIT VI

Modulation and Error Control: Digital Modulation for Satellite links: BPSK, QPSK, Error control coding, Block codes, Convolution codes, - Implementation of error detection on satellite links

UNIT VII

Multiple Access for Satellite Communications: Signal Access- FDMA assignments methods, FDMA downlink analysis, TDMA- reference bursts, Preamble, Postamble, Carrier recovery, Network synchronization, Preassigned TDMA, Demand Assigned TDMA, Spread system- CDMA.

UNIT VIII

VSAT Systems: Overview of VSAT systems, Network architectures, Access control, Multiple access selection

Text/Reference Books:

1. *Timothy Pratt, Charles BostianJermeyAllnutt, Satellite Communications, John Wiley, Singapore, 2nd Edition, reprint 2013.*
2. *M. Richharaia, Satellite Communication Systems, BS Publishers, 2nd Edition, 2008.*
3. *Tri.T. Ha, Digital Satellite Communications, McGraw-Hill, 2000*

MIXED SIGNAL DESIGN

SEMESTER:EIGHT SEMESTER
COURSE CODE :ETL 35
L:T:P : 4:0:0, Credits:4

Circuit Design and related issues, as follows:

Module 1: Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Module 2: Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Module 3: Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Module 4: Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Module 5: Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

FUZZY LOGIC AND NEURAL NETWORK

SEMESTER: EIGHT SEMESTER
COURSE CODE :ETL 36
L:T:P : 4:0:0, Credits:4

Module 1:FUZZY LOGIC :

Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, membership functions, operations of Fuzzy sets, Fuzzy if-then rules, Variables inference techniques, Fuzzicification and defuzzification techniques

Module 2: BASIC FUZZY INTERFERENCE ALGORITHM, APPLICATION OF FUZZY LOGIC ,FUZZY LOGIC CONTROL :
Mamdani and Takagi and sugeno Architectures. Application to pattern recognition. Fuzzy system desig n implementation , useful tools supporting design

Module 3: NEURAL NETWORKS CHARACTERISTICS :
History of Development in neural networks, Artificial neural networks terminology, model of a neuron, Topology, Types of learning.Supervised, Unsupervised learning.

Module4: BASIC LEARNING LAWS :
Hebb's rule, Delta rule, widrow and Hoff LMS learning rule, correlation learning rule instar and ouster learning rules. Unsupervised Learning: Competitive learning, K-means clustering algorithm, Kohonen's feature maps.

Module 5: RADIAL BASIS FUNCTION NEURAL NETWORKS :
Recurrent networks, Real time recurrent and learning algorithm. Introduction to Counter propagation Networks- CMAC Network, ART networks, Application of NN in pattern recognition, optimization, Control, Speech and decision making.

Textbooks / References :
1. Berkin Riza C and Trubatch, "Fuzzy System design principles- Building Fuzzy IF-THEN rule bases", IEEE Press.
2. Yen and Langari, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education.
3. Timothy J. Ross, Fuzzy Logic with Engineering Applications, MacGraw-Hill
4. Shivanandam and Deepa, Principles of Soft Computing, Wiley
5. Jang JSR, Sun CT, Mizutani E, Neuro-Fuzzy and Soft Computing, PHI
6. Kosko,Neural Networks and Fuzzy Systems, Pearson edu
7. Yegna Narayanan, "Artificial Neural Networks". 8th Printing. PHI (2003)
8. Patterson Dan W, "Introduction to artificial Intelligence and Expert systems", 3rd Ed., P
9. Simon Haykin, "Neural Networks" Pearson Education.
10. Jacek M Zaurada, "Introduction to artificial neural Networks Jaico Publishing Home, Fouth Impression

ADAPTIVE SIGNAL PROCESSING

SEMESTER:EIGHT SEMESTER

COURSE CODE :ETL 37

L:T:P : 4:0:0, Credits:4

Module 1: General concept of adaptive filtering and estimation, applications and motivation.

Module 2: Review of probability, random variables and stationary random processes; Correlation structures, properties of correlation matrices.

Module 3: Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued signals.

Module 4: The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

Module 5: Variants of the LMS algorithm : the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Module 6: Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

Module 7: Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Module 8: Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics : affine projection and subspaced based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. B. Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

ARTIFICIAL INTELLIGENCE AND ROBOTICS

SEMESTER:EIGHT SEMESTER
COURSE CODE : ETL 38
L:T:P : 4:0:0, Credits:4

Module 1: Scope of AI -Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

Module 2:. Problem solving - State space search; Production systems, search space control: depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

Module 3:. Knowledge Representation- Predicate Logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based Systems : Forward reasoning: conflict resolution, backward reasoning: use of no
backtrack. Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

Module 4: Handling uncertainty and learning- Non-Monotonic Reasoning, Probablistic reasoning, use of certainty factors, fuzzy logic. Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

Module 5: Robotics : Robot Classification, Robot Specification, notation; Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, Homogeneous Coordinates, Arm Equation of four Axis SCARA Robot, TCV, Inverse Kinematics of Four Axis SCARA Robot.

Text Books:
1. E. Rich and K. Knight,"Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

Reference Books:
1. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
2. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
*3. George Lugar, .Al-
Structures and Strategies for and Strategies for Complex Problem solving., 4/e, 2002, Pearson Educations.*