B.TECH. (ELECTRONICS ENGG.)

PART-II (III SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.AM-2105A:	Mathematical Methods	4		4
2.EE- 2105A:	Electrical Engineering	3		3
3.EE-2105B:	Electrical Circuits & Systems	3		3
4.EC-2101:	Electromagnetic Fields	3		3
5.EC-2102:	Electronic Devices & Components	4		4
6.EC-2103:	Signals & Systems	3		3
Practicals:				
7.EE-2305A:	Electrical Engg. Lab A. Circuits B. Machines		3	2
8.EC-2301:	Electronic Devices Lab		3	2
9.EC-2302:	Software Lab & Electronic Workshop		3	2
		20	9	
	Total		29	26

PART-II (IV SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.AM-2205A:	Numerical Methods	3		3
2.EE-2205A:	Network Analysis & Synthesis	3		3
3.EC-2201:	Analog Circuits & Systems	4		4
4.EC-2202:	Antennas & Propagation	3		3
5.EC-2203:	Analog Communication Systems	4		4
6.EC-2204	Materials Science	3		3
Practicals:				
7.EC-2401:			3	2
8.EC-2402:	Analog Circuits Lab Analog Communication Lab		3	2
		20	6	
	Total	26		24

PART-III (V SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.EE-3105A:	Power Electronics	3		3
2.EC-3101:	Digital Communication Systems	4		4
3.EC-3102:	Digital Circuits & Systems	3		3
4.EC-3103:	Microwave Engineering	3		3
5.EC-3104:	Electronic Measurements & Instrumentation	3		3
6.EC-3105:	Microprocessor Engineering	4		4
Practicals:				
7.EC-3301:	Digital Communication Lab		3	2
8.EC-3302:	Digital Circuits Lab		3	2
		20	6	
	Total		26	24

PART-III (VI SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.HU-3205A-F:	Open Elective (Humanities)	3		3
2.EE -3205A:	Control Systems	3		3
3.EC-3201:	Logic Design of Switching Circuits	4		4
4.EC-3202:	Architecture & Organization of Microprocessor Based Systems	3		3
5.EC-3203:	Digital Signal Processing	4		4
6.EC-3204:	Reliability Engineering	3		3
Practicals:				
7.EC-3401:	Microwave Engg. Lab.		3	2
8.EC-3402:	Microprocessor Lab		3	2
		20	6	
	Total		26	24

PART-IV (VII SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.ME-4105A:	Industrial Management	3		3
2.EC -4101:	Microelectronics	3		3
3.EC-4102:	Optical Communication	4		4
4.EC-41--:	Elective-I	3		3
Practicals:				
5.EC-4301:	Microelectronics Lab		3	2
6.EC-4302:	Optical Communication Lab		3	2
7.EC-4303:	Seminar /Group Discussion		3	2
8.EC-4304:	Project		3	2
9.EC-4305:	Training/Tour Viva-voce		--	2
	Total	13	12	
		25		23

PART-IV (VIII SEMESTER)

	Subject	Contact Hours/week L&T	P	Credits
Theory:				
1.EC-4201 :	LSI& VLSI Design	3		3
2.EC-4202:	Radar Engineering	3		3
3.EC-42--:	Elective –II	3		3
4.EC-42--:	Elective-III	3		3
Practicals:				
5.EC-4401:	CAD Lab		3	2
6.EC-4402:	DSP Lab		3	2
7.EC-4403:	Comprehensive Viva		--	2
8.EC-4404:	Project		9	6
	Total	12	15	
		27		24

LIST OF ELECTIVE SUBJECTS

1. Open Elective-Humanities (for Semester VI- Any approved one) **(Credits – Each 3)**

1. HU-3205A: History of Science & Technology
2. HU-3205B: Industrial and Organizational Psychology
3. HU-3205C: Environmental and Ecology
4. HU-3205D: Energy Management
5. HU-3205E: Industrial Sociology
6. HU-3205F: Ethics, Philosophy

2. Electives I (To be offered in the VII Semester) **(Credits – Each 3)**

1. EC-4103: Switching Theory and Finite Automata
2. EC-4104: High Speed Devices and Circuits
3. EC-4105: Microwave Tubes
4. EC-4106: Satellite Communication

3. Elective II & III (To be Offered in the VIII Semester) **(Credits - Each 3)**

1. EC-4203: CCD & SAW Devices
2. EC-4204: Vacuum and Tube Technology
3. EC-4205: Counter Measures
4. EC-4206: Information Theory and Coding
5. EC-4207: Quantum Electronics
6. EC-4208: Intelligent Instrumentation
7. EC-4209: Computer Networks
8. EC-4210: Speech Signal Processing
9. EC-4211: Microwave Solid state Devices
10. EC-4212: Integrated Optics
11. EC-4213: Microwave Communication Systems
12. EC-4214: Spread Spectrum Systems

AM-2105A : MATHEMATICAL METHODS (Credits 4)

Ordinary and partial Differential equations and their applications : Power series solutions of second order equations, Lagendre's equation, Bessel equation, recurrence relations, Orthogonality of Lagendre polynomials, Hermite polynomials and Bessel Functions of first and second kinds; Strum Liouville problem; Partial Differential equations; Separation of variables, one dimensional wave and heat equations, Laplace's equation.

Operations on Matrix: Diagonalisation of matrices, Inner product of Matrices, Norms of Matrices, unitary and orthogonal matrices, convergence, functions of matrices, and Jordon Canonical form, Bilinear form, Symmetric Bilinear forms. Quadratic forms, Canonical representation of Unitary operator liner diodes and applications.

Statistical Methods in Science & Engineering: Elements of Probability theory, sample space and probability distribution, Events, Independence, addition and multiplication laws, Bayes theory. Random variables, discrete and continuous probability distributions, Binomial, poisson, negative binomial, exponential, normal (Gaussian)laws. Mean, Median, range, variance, moment generating function, characteristic function. Joint distribution of two variables, conditional normal distribution. Random sampling and estimation of parameters. Tests of hypotheses. Goodness of fit. Introduction to stochastic processes and queuing theory.

Integral transforms and their applications: Laplace transform, inverse transform, linearity and other properties, periodic functions; partial fractions. Convolution. Applications to solution of differential equations. Fourier transforms of L1, L2 functions, band-limited functions, frequency - limited functions. Fast Fourier transform. Other integral transforms; initial value and boundary value problems, Laplace equation, heat equation and wave equation and their solutions by operational methods.

Complex Analysis: Residue theorem, calculation of residues. Evaluation of real valued integrals by contour integration, Bromwitch contour integrals. Conformal mapping and their applications in potential problems and steady-state temperature distributions.

EE-2105A: ELECTRICAL ENGINEERING (Credits 3)

A.C.Circuits: Network elements, voltage and current sources, loop and nodal analysis, superposition theorem, Theveinin's theorem. Transient and steady state response of R-L-C circuits for step and sinusoidal inputs, impedance concept. Phasor diagram. Single phase series and parallel circuits, resonance. Mutual inductance and coefficient of coupling. Three phase balanced circuits and power measurements.

Electromechanical Energy Converters: Construction, working principles and characteristics of d.c. generators and motors, transformers, three-phase and single-phase induction motors, synchronous generators and motors, universal motors. Starting and speed control of motors. Selection of motors.

Principles of Power Distribution: Introduction with the general layouts of 3 phase distribution systems. House and factory wirings. Protection of equipment, Earthing.

Elements of Power Economics: Load and diversity factors. Tariff Power Factor improvement.

Measurements and Instruments: Construction and working principles of ammeters, voltmeters, watt meters and energy meters, testing and calibration, Instrument transformers.

EE-2105B: ELECTRICAL CIRCUITS & SYSTEMS (Credits 3)

System and their models: Basic concepts, mathematical modeling of electrical, mechanical, thermal another systems; electrical analogies of non-electrical systems.
Classification of systems: Linearity principle. Linear and non-linear, dynamic and static, time invariant and time varying, continuous time and discrete time, lumped parameter and distributed parameter, deterministic and stochastic systems.
Analysis of second order systems: General form of second order equations, second order response, standard test signals.
Fourier Series: Representation of commonly encountered non-sinusoidal signals, convergence, exponential form, power and r.m.s.values. Analysis using Fourier series.
Fourier Transform: Fourier integral, Fourier transform for common signals, frequency spectrum, and analysis using Fourier transforms.
Laplace Transform: Theorems, properties, inversion; Analysis using Laplace transform; impulse response, convolution and superposition.
Transfer functions, complex frequency plane, pole-zero diagrams and transient response.
Analog computer simulation of linear differential equations and transfer functions; time and amplitude scaling.
State variables: Basic concepts, choice of state variables, formulation of state equations, state transition matrix and solution of state equations.

EC-2101 : ELECTROMAGNETIC FIELDS (Credits 3)

Time-varying fields*:* Maxwell's equations and boundary conditions. Poynting vector and energy flow. Wave equation. Propagation of uniform, plane waves in conductor, dielectric and gyro-tropic media.
Polarization, reflection and refraction of waves for parallel and perpendicular polarization. Retarded potential. Infinitesimal dipole. Green's function and identities. Transmission lines, Waveguides and Resonators.

EC-2102 : ELECTRONIC DEVICES AND COMPONENTS (Credits 4)

Semiconductors: Energy band diagram, bulk properties, conduction mechanism.
Haynes-Shockley experiment, Rectifying and Ohmic contacts.
p-n junction : characteristics, low frequency model, transient response and breakdown mechanism.
Zener diode, Step-recovery diode, Tunnel diode, Backward diode, Schottky diode, LED and photodiodes. Solar cells.
Bipolar Junction Transistor*:* Conduction mechanism, characteristics, transient, low and high frequency models.
BJT : CE, CB & CC configuration, biasing techniques and stability.
UJT and JFET
MOSFET*:* Physical mechanism, characteristics and models.

EC-2103 : SIGNALS AND SYSTEMS (Credits 3)

Types of signals: Periodic, quasi-periodic, and aperiodic, deterministic and random signals, pseudo random signals, continuous and discrete time signals, time, frequency and space domain signals, power and energy limited signals.
Orthogonal functions, Fourier series and Fourier Transforms.
Signal and Noise. Types and Noise, characteristics and representation. Random variables and probabilistic review theory.
Stationary and non-stationary processes*:* stochastic and ergodic processes. Auto and cross correlation. Noise spectral density. Gaussian white noise, Noise equivalent bandwidth, Noise figure and Noise Temperature. Band pass Noise representation.
Signal transmission: Impulse response and transfer function.
Time and amplitude digitization: Nyquist's sampling theorem, Nyquist rate, noise effects and Aliasing. Frequency domain effects of time domain sampling and vice-versa.

AM-2205A: NUMERICAL METHODS (Credits 3)

Absolute, relative, round-off, truncation errors, significant digits, estimation of errors. Tabulation of a function.
Interpolation: Ordinary differences, Operators E and A, sub-tabulation, divided differences, formulae of Gauss, Bessel, Everett: method of ordinary least squares; cubic splines.
Solution of algebraic and transcendental equations: Graphical method. Inverse interpolation; interactive methods, regulafalsi, Newton-Rapson method: multiple and complex roots.
Solution of systems of linear equations: Methods of culmination, method of relaxation, iterative methods; ill-conditioned systems. Computing the inverse matrix, eigen values and eigen vectors, matrix decomposition (SVD and Q QR).
Numerical integration: Finite-difference methods, Gaussian quadrature Euler-Maclauring series, asymptotic expansions.
Numerical solution of ordinary differential equations: Series solution, methods of Miline, Adams-Bashforth, Miline-Simpson multistep and Runge-Kutta methods.
Difference equations: Numerical solution, relaxation method. Solution of partial differential equations by difference methods. Numerical solutions of elliptic, parabolic and hyperbolic differential equations.

EE-2205A : NETWORK ANALYSIS AND SYNTHESIS (Credits 3)

Analysis: Graph theory, Graph theoretical models of electric network, KCL, KVL and Tallegen's theorem, trees, fundamental cut-set and loop-set, incidence matrices, relationship between the matrices.
Planar graphs, planarity testing algorithms, dual graphs and dual-netwoks,complete graphs and crossing number, computer methods.
Two port networks: Various characterizations, scattering and imaging parameters, insertion loss, relationship among the parameters, computer methods, interconnection of two port networks.
Analysis of Filters: Transient response and reduction of overshoot, sensitivity, active filters, poles and zeroes of filter transfer functions. Introduction to filter design.
Synthesis: Introduction, positive real functions, physical realizability conditions, properties of one port admittance functions and their synthesis.
Foster and Cayor forms, Bruno and Bott-Duffin methods.
Introduction to two port network synthesis.

EC-2204 : MATERIALS SCIENCE (Credits 3)

The Crystalline State: Atomic bonding, Bravos lattices, Miller indices, X-ray crystallography. Structural imperfections. Imperfections. Binary plane diagram, Microstructure.
Electron theory of solids: Free electron theory of metals, Zone and band theory of solids. Brillouin zones. Classification of conductors. Conductivity, Hall effect.
Mechanical properties*:* Elastic and plastic deformation. Strength hardness, croup, fatigue and fracture of materials. processing of materials.
Magnetic materials : Dia, Para, Ferro and Antiferro and ferri magnetism. Soft and hard materials. Ferrites. Metallic glasses.
Super conducting Materials: zero resistance and missner effect. Superconductor Magnets. Soft and hard superconductors. The Josephson Junction. High T_c superconductors.
Dielectric materials: Polarization mechanisms. Behavior under impulse, switching power frequency and d.c. voltages. Effect of polarization and aging. Breakdown. Piezoelectric and Ferro- electric materials.
Materials for transformer, cables, capacitors, resistors, busing etc. Electric breakdown, tracking and partial discharges.

EC-2201 : ANALOG CIRCUITS & SYSTEMS (Credits 4)

Semiconductor diodes, Bipolar Junction Transistors and MOSFETs.
Half-wave and full-wave rectifiers. Filters and regulated power supplies.
Biasing circuits of BJT, FET and MOSFET, RC and DC coupled amplifiers, wide-band and tuned amplifiers. Active impedance transformers, power amplifiers, impedance matching.
Feedback Amplifiers. RC and LC Oscillators, Blocking Oscillators.
Characteristics, limitations and applications of OP-AMPS. Internal structure of OP-AMPs.
Special purpose amplifiers. Analog multipliers.
Voltage regulators, Timers, VCO, PLL and function generators.
Analog switches and multiplexers. ADC and DAC.

EC-2202 : ANTENNAS & PROPAGATION (Credits 3)

Field regions: Near Field Distribution and Far-Field Pattern. Directive Gain, Directivity and Power Gain. Reciprocity, Induction and Equivalence Theorems. Functions and Properties of Antennas, Basic Antenna elements, Radiation mechanism, Radiated power and Radiation resistance of Current element.
Hertizian Dipole, Monopole, Half-wave Dipole Antennas.
Antenna arrays: Linear Arrays – Two-element Uniform array, Uniform Linear Array, Broadside and Endfire Arrays, Binomial Arrays, Effect of Earth on Vertical pattern and on Radiation Resistance, Array Synthesis: Schelkunoff Polynomial and Fourier Transform Methods.
Methods of Excitation of Antennas, Impedance Matching Techniques, Antenna Temperature and Signal-to-Noise Ratio.
HF, VHF and UHF Antennas: Folded dipole, V-Antenna, Rhombic Antenna, Yagi-Uda Antenna, Log-Periodic Antenna, Loop Antenna, Helical Antenna, etc.
Wave Propagation: Propagation Characteristics and Factors Involved in the Propagation of Radio Waves.
Different aspects of Surface Wave, Space Wave, Troposcatter and Ionospheric Propagation.
Duct Propagation, Radio Horizon, Line of Sight. Fading and Diversity Techniques.

EC-2203 : ANALOG COMMUNICATION SYSTEMS (Credits 4)

Introduction: Transmissions of signals through linear systems: Distortion less transmission, amplitude and delay distortion, ideal low pass and band pass filters, band pass signals and their representations.
Amplitude Modulations: Need for modulation and frequency translation, analysis and representation of the modulated signals for the amplitude modulation (AM), double sideband suppressed carrier (DSB-SC) modulation, single side band (SSB) and vestigial sideband (VSB) modulation, generation and demodulation techniques of various AM schemes. Angle Modulation: Definitions of frequency modulation (FM) and phase modulation (PM), Narrowband and wideband FM and PM, spectrum of single tone modulated FM signal, bandwidth of FM using Curson's rule and 1% rule, FM generation and detection techniques. Random Variables: Definitions and classifications, cumulative distribution and probability density functions, Gaussian or normal, Binomial, Poisson, Laplace, Exponential, Rayleigh, Gamma and Chi-square density functions, mean, variance, moments and characteristic functions; functions of single and two random variables, transformation of random variables, Joint moments; conditional distribution and density functions; central limit theorem (CLT). Random Processes: strict sense, wide sense and nonstationary random processes, mean, autocorrelation and cross-correlation functions, ergodicity; binary random wave, Gaussian random process and its properties, power spectral density, transmission of a random process through a linear filter. Noise in analog receiver systems: atmospheric, extraterrestrial and industrial noises; shot noise; thermal noise and available noise power; white noise; equivalent noise bandwidth of a system, mathematical representation and properties of narrowband noise; noise performance and SNR calculations for AM, SSB, DSB-SC, and FM receivers; threshold effects in AM and FM; pre-emphasis and de-emphasis filters in FM systems; comparison of the CW modulation schemes in terms of their noise performance and bandwidth requirements.

EC-3101: DIGITAL COMMUNICATION SYSTEMS (Credits 4)

Review of the sampling theorem. Recovery of signals from it sampled version, minimum sampling rate required for band pass signals and frequency domain sampling. Modulation and demodulation schemes and representation of relevant signals for pulse and analog modulation: PAM, PWM, and PPM.
Pulse code modulation (PCM), Differential pulse code modulation (DPCM), Delta Modulation(DM), Adaptive Delta Modulation (ADM). Noise performance of PCM and DM. Comparison of PCM, DPCM and DM.
Digital Modulation techniques: ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, QASK, BFSK. Comparison of noise performances of ASK, PSK and FSK.
Detection of binary signals: The matched filter study. Coherent representation of PSK, FSK, DPSK. Non-coherent detection of binary signals.
The concept of Information: arrange information. Information rate, entropy, mutual information, channel capacity, Bandwidht-SNR tradeoff, use of orthogonal signals to achieve shannon's limit. Source coding. Shannon's two coding theorem. Error detecting and correcting codes.
Linear block codes- syndrome calculation and Hamming distance. Convolution codes, decoding in presence of noise. Sequential decoding.
Introduction to spread spectrum communication system.

EE-3105A : POWER ELECTRONICS (Credits 3)

Semiconductor power devices: Thyristor characteristics, rating, commutation methods, series and parallel operations.
Thyristor control and protection: Gate characteristics, firing control circuits, three phase controller. A.C. voltage controllers: Analysis of single phase controllers, gating signals, harmonics, Three phase controllers.
Controlled rectifiers: Analysis of single phase controlled rectifiers with different types of loads, effect of transformer leakage resistance. Three phase controlled rectifiers.
D.C. choppers: Analysis of chopper circuits, time ratio control and current limit control. Four quadrant chopper
Inverters: Single phase circuits, analysis with resistive and inductive loads, feed-back diodes, voltage. Three phase inverters. Cycloinverters.

EC-3102 : DIGITAL CIRCUITS & SYSTEMS (Credits 3)

Wave shaping circuits: Clipper and Clamper.
Wave generating circuits: Multi-vibrators and Schmitt Trigger, Frequency division and synchronizing techniques.
Sweep generating circuits: Errors in sweep waveforms, Miller Integrator, Bootstrap techniques.
Digital Logic families: Bipolar and MOS Integrated circuits: Characteristics, limitations and applications.
Synthesis of Combinational functions using standard Logic gates./ MSI modulo.
Binary, BCD, Excess 3, Gray codes. Error detection and correction codes.
Flip Flops and Memory devices: RAM – Static and Dynamic, ROM, PROM, EPROM, EEPROM.
Counters and Shift registers: Binary, BCD and programmable modulo counters, Shift register counters.
Sequential circuit design. System design using SSI and MSI building blocks.

EC-3103 : MICROWAVE ENGINEERING (Credits 3)

Advantages and Applications of Microwaves and millimeter Waves.
Microwave Transmission Lines: Reflection and Transmission Coefficients, Standing Wave Ratio, Line Impedance and Matching.
Microwave Integrated Circuits: Basics, losses, Strip line, Microstrip line, Monolithic MICs
Microwave Network Analysis: Scattering Matrix, Properties of Scattering Matrix, Measurement of Scattering Parameters, Determination of scattering matrix for Microwave Components
Microwave Passive Devices: Impedance transformer, filters, sliding shorts, adapters, matched loads, variable attenuators, phase shifters, E-Plane, H-Plane and Hybrid Tees, Ratrace, directional couplers, Isolators, circulators, frequency and wave meters, etc.
Microwave Solid-State Active Devices: Point Contact (Crystal) Diodes, Schottky Barrier Diodes, PIN Diodes, Tunnel Diodes, Gunn Diodes, IMPATT , TRAPATT, and BARITT Diodes, Parametric amplifiers.
Microwave Electron-Beam Devices: High-Frequency Limitation of Conventional Devices, Reflex Klystrons, Klystrons, Travelling Wave Tube Amplifiers, Backward Wave Oscillators, Magnetrons, Crossed Field Amplifiers, Free Electron Lasers and Gyrotrons
Microwave Measurements: measurement of frequency, Phase, Wavelength, Reflection Coefficients, Voltage Standing Wave Ratio, Impedance.
Introduction to TDR, Spectrum Analysers and Vector Network Analysers.
Recent advances in microwave devices and applications.

EC-3104 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (Credits 3)

Precision and accuracy. Errors in measurements.
DC and AC Bridges and their applications-Wheat stone bridge, Kelvin's Double bridge, Maxwell's Bridge, Hay's bridge, Schering bridge, Wien bridge.
Q-Meter: -Basic Q-meter circuit. Applications of Q-meter, The series connection of Q-meter, The parallel connection of Q-meter. Sources of Error.
Measurement of frequency, phase, time interval and group delay. RF power measurement.
Measurements on antennas - Gain and radiation pattern, Measurements on transmission lines-Attenuation and phase constant, VSWR, Impedance. Measurements on Amplifiers- distortion and noise figure. Measurements on Receivers- sensitivity, selectivity, image rejection ratio, and fidelity.
Measurements and instrumentation of non-electrical quantities.
Transducers-Classification of transducers, Selection of transducers, Strain gauge, Unbounded strain gauge, Displacement transducers, Capacity transducers, Inductive transducers, Linear variable Differential Transformer (LVDT), Piezoelectric transducer, Velocity transducer, Temperature Measurements, Resistance Thermometer, Thermocouples, Thermistor.
Multiplexers and Demultiplexers. Display devices (CRT,LED and LCD).
Introduction to advanced measuring instruments: Spectrum Analyzer and Network Analyzer.

EC-3105: MICROPROCESSOR ENGINEERING (Credits 4)

Organization and Architecture of contemporary 16/32 bit processors.
Addressing modes, Instruction Format and Instruction Repertoire. Assembly Language Programming.
Memory and I/O interfacing techniques.
Support chips: 8254, 8255-A, 8259-A, 8251-A, 8237 and 8279 and their interfacing with processor.
8 and 16 bit Embedded controllers.
Paging, virtual memory, cache and cache coherence.
Real and protected mode operation of contemporary 32 bit processors.

OPEN ELECTIVE (HUMANITES)

(To be announced by the Office of the Dean, Faculty of Engineering & Technology)

EE-3205A: CONTROL SYSTEMS (Credits 3)

Feedback principles: Examples of open-loop and closed-loop control systems. Formulation of equations. System representations, Transfer functions, Block diagrams, signal flow graphs, state variable representation. Time domain analysis.
Stability Routh-Hurwitz criterion, Nyquist criterion, Bode plots, M and N circles, Nichol's charts, root-locus method.
Servo specifications in time and frequency domain; type 0,1,2 systems, error coefficients.
Introduction to design: compensation of feedback control systems, state variable feedback.
Introduction to Non-linear control systems.

EC-3201: LOGIC DESIGN OF SWITCHING CIRCUITS (Credits 4)

Combinational functions: SOP and POS representation. Synthesis of combinational functions: Function minimization and realization concepts, Prime Implicants.
Advanced concepts in Combinational circuits: Multi Output and Multi Level circuits. Decomposition of Switching Functions. Modular realization of Switching circuits.
Special Class of Combinational Functions: Unate, Self Dual, Threshold and Symmetric functions.
Sequential Functions and Circuits: Memory elements. Standard representation of Sequential Functions – Sequential machines. Analysis and Synthesis of sequential circuits.
State redundancies and internal states reduction of machine. Structurally simple realization of machines – Decompositions and State assignment problems.
Linear Sequential machines. Experiments with sequential machines.

EC-3202: ARCHITECTURE AND ORGANIZATION OF MICROPROCESSOR BASED SYSTEMS (Credits 3)

Implementation of Von-Neumann and Harvard architectures.
Architecture and instruction repertoire of contemporary 32 bit processors.
I/O processors, memory and storage hierarchies: implementation techniques, consistency and coherence of cache; MESI protocol.
Multiprogramming, Array and Multiprocessing.
Pipelining: ILP, Register renaming, Loop unrolling, Static and dynamic scheduling. Super scalar and Super pipeline structures. iA 32 bit architectures.
Busses: CAMAC, CAN and IEEE 488.Typical applications with special reference to signal processing and Instrumentation.

EC-3203 : DIGITAL SIGNAL PROCESSING (Credits 4)

Discrete Time systems: Discrete sequences, Linear coefficient difference equation, Representation of DTS, LSI Systems. Stability and causality, frequency domain representations and Fourier transform of DT sequences.
Z-Transform: Definition and properties, IZT and stability. Parseval's Theorem and applications.
System function: signal flow graph, its use in representation and analysis of DTS.
Techniques of representations. Matrix generation and solution for DTS evaluations.
Discrete Fourier Transform: DFT assumptions and IDFT. Computation of DFT. FFT Algorithms and processing gain, Decimation ,interpolation and extrapolation. Gibbb's phenomena. FFT of real functions interleaving and resolution improvement. Word length effects.
Digital Filters: Analog filter review. System function for IIR and FIR filters, network representation. Canonical and decomposition networks. IIR filter realization methods and their limitations. FIR filter realization techniques.
Discrete correlation and convolution; Properties and limitations.

EC-3204 : RELIABILITY ENGINEERING (Credits 3)

Quality and Reliability. Importance of reliability. Reliability parameters.
Methods of achieving reliability. Measures of control tendency and dispersion.
System reliability with constant and variable failure rates. Series and parallel reliability. Maintainability and availability.
Failure mechanisms. Reliability data and analysis. Reliability improvement methods and quality control.

ME-4105A: INDUSTRIAL MANAGEMENT (Credits 3)

Management and Industrial Engineering and relation with other fields. Management concepts.
Plant location and layout: General considerations.
Work analysis: Time and motion study. Work sampling. Selection of labour and wage payment. Incentives.
Financial Management: Differential elements of cost, depreciation, Break-even analysis.
Production planning & control: Methodology, aggregate planning, scheduling, materials requirement planning.
Quality control: Acceptance sampling. Control charts.
Material Management: Inventory. Deterministic model.
Project management: CPM and PERT. Cost consideration.

EC-4101: MICROELECTRONICS (Credits 3)

Epitaxy: Vapour phase and liquid phase epitaxy. Evaluation of epitaxial layers.
Oxidation: Thermal and anodic oxidation of silicon and GaAs. Evaluation of oxide layers.
Diffusion: Diffusion process and diffusion equation. Diffusion systems and techniques impurity diffusion in silicon and GaAs. Evaluation techniques for diffused layers.
Ion implantation: Implantation process and system.
Deposited films: Deposition techniques and characteristics of various films used for monolithic ICs.
Photolithography and etching: Optical, e-beam, ion-beam and x-ray lithography and etching techniques.
Monolithic Integrated Circuits: Isolation techniques. Bipolar, PMOS, NMOS, CMOS, BICMOS, VMOS, HMOS and SOI devices. Realization of passive components in monolithic ICs.
Thin-film and thick-film devices, their design and fabrication techniques.

EC-4102: OPTICAL COMMUNICATION (Credits 4)

Guided and space optical communication. Optical fibers: Structures, wave guiding and fabrication. Step and graded Index fibers. Single and multimode fibers. Fiberoptic components.
Signal degradation in optical fibers: Attenuation and dispersion.
Optical sources: Polar and spectral characteristics, LED and Laser diode, Light source linearity and reliability consideration, power launching and coupling, Fiber joints splicing,
Optical Detectors: PIN and APD. Photoresponse characteristics and Noise analysis.
Optical modulators and elements of integrated optics. Optical amplifiers: SLA and EDFA
Coherent optical communication: Optical receiver, homodyne and heterodyne systems, OOK, OTDR and DSA.

EC – 4201 : LSI/VLSI DESIGN (Credits 3)

Evolution of circuit Integration.
MOS Transistors – fabrication and characteristics. MOSFET scaling and short-channel effects.
Layer representation and layout rules.
Analysis and design of inverters and inverter based circuits. Circuit and interconnection delays.
Driving large loads. Super buffers
Combinational and sequential logic circuits. Dynamic logic circuits. Memories.
VLSI design strategies – Full custom, Standard Cell and Gate Array design. FPGAs.
Subsystem design. Testing and testabilities. CAD for VLSI.

EC-4202: RADAR ENGINEERING (Credits 3)

CW, Pulse and MTI Radars- illustration of CW radar, sign of radial velocity and applications, CW radar principle, FM-CW altimeter, difference between pulse and MTI radars, MTI radar with power- amplifier transmitter, MTI radar with power- oscillator transmitter, delay line cancellers, range-gated Doppler filters, digital MTI processing. Phased Array systems. Elementary treatment of the radar system design, Extraction of information and waveform design- theoretical accuracy of radar measurements, ambiguity diagram. Basics of PCR, SAR, SLAR, mm wave and laser radars. Introductory ECM and ECCM techniques, LPI radar. Navigational aids- loran, radio ranges, instrument landing system, ground-controlled approach system, radio direction finding.

ELECTIVE-I

EC- 4103: SWITCHING THEORY & FINITE AUTOMATA (Credits 3)

Vector switching algebra and functions. Boolean difference calculus. Special switching functions. Combinational networks. Iterative and Universal logic modules. Fault detection in combinational circuits.

Structure of Sequential machines. State identification and fault detection experiments. Memory definiteness and information lossless ness of finite automata. Linear sequential machines. Finite state recognizers.

EC-4104: HIGH SPEED DEVICES AND CIRCUITS (Credits 3)

Introduction on Heterostructure devices, Semi-Classical Theory, HBT.

QuantumTheory of Heterostructures andQuantumHeterostructure devices: Quantum well, RTD, superlattice

Scattering Processes and Scattering-Assisted Tunneling in Heterostructures devices and High-Frequency Response of Quantum devices (RTD, Infrared laser)

Charge Control of the Two-Dimensional Electron Gas in HEMT

High Electric-Field Transport in semiconductor devices

Current Voltage Models of the Short-Channel MOSFET, MESFET and HEMT

MOSFET Wave-Equation. Microwave Modeling and Noise modeling.

High frequency HBT.

EC-4105: MICROWAVE TUBES (Credits 3)

High Frequency limitations in conventional tubes, UHF miniature tubes;

Classification of Microwave tubes, O-type and M-type Tubes, Slow wave and Fast-wave devices.

Sub-assemblies of Microwave Tubes: Electron Gun (Parallel flow and convergent beam guns, MIG guns), RF Input/Output Couplers, RF Interaction Structures, Magnetic Focussing structures and Collectors

High Emission density Thermionic cathodes: Oxide coated, B-type, M-type and MM-Type cathodes.

Transit time tubes: klystrodes, reflex klystrons, multi-cavity klystrons, traveling wave tube amplifier, Backward Wave Oscillators, crossed field amplifier, Magnetrons, Coaxial Magnetrons, Inverted Coaxial Magnetrons, Frequency agile, voltage tunable magnetrons, Carcinotrons.

Efficiency enhancement and Boradbanding techniques.

High Power millimeter wave and sub-millimeter wave electron beam devices

EC-4106: SATELLITE COMMUNICATION (Credit 3)

Active and Passive satellite. Geosynchronous and geostationary satellites, Orbit, Telemetry, Command and Ranging. Earth station design- antenna, HPA, LNA, upconverter, downconverter, monitoring and control. Satellite link – basic link analysis, interference analysis, rain induced attenuation and rain-induced cross-polarization interference, satellite link design. Multiple access techniques- FDMA, TDMA including demand assignment and speech interpolation techniques, and SSMA.

ELECTIVES-II & III

EC- 4203: CCD AND SAW DEVICES (Credits 3)

CCD: charge transfer concept, Transient characteristics of MOS capacitor, Electrode arrangement and fabrication technology. Transfer efficiency. Buried-channel charge coupled devices. Integrated BBD. Charge coupled imagers and applications.

SAW Devices: Rayleigh waves, interdigital transducers, SAW scattering, device materials and applications.

EC-4204: VACUUM AND TUBE TECHNOLOGY (Credits 3)

Fundamentals of Vacuum Technology: vacuum nomenclature and definitions, gas properties, molecular process and kinetic theory, throughput, pumping speed, evacuation rate, outgassing rate, leak rate, gas flow, conductance, flow calculations.

Vacuum generation: diaphragm pump, rotary pump, diffusion pump, cryogenic pump, turbomolecular pump, sputter-ion pump and getter pumps.

Vacuum Measurement scale, gauges and leak detection. U.H.V. techniques, Mass Spectrometer.

Surface Physics and its Relation to Vacuum Science: adsorptions, chemisorptions, isotherms, desorptions and photoactivation.

Materials for Vacuum tubes, Chemical and Thermal Cleaning.

Sputtering Techniques. Brazing. Spot, Arc, Electron beam and Laser weldings.

Vacuum and Protected Atmosphere Furnaces. Jigs and Tools.

Processing of Electron-Beam Devices.

EC-4205: COUNTER MEASURES (Credits 3)

Electronics in defence and warfare objectives of intercept system. Signal detection, analysis and environmental study.

Jamming, Types of jammers and their effectiveness.

Programmed automatic jammers.

Deception, confusion reflectors, target masking and decoys. Infrared countermeasures. Underwater countermeasures. ECCM-Pulse compression and coherent system

EC-4206: INFORMATION AND CODING THEORY (Credits 3)

Signal analysis and types of signals. Orthogonal transforms. Distortion less transmission.

Types and classification of noise, random variable and stochastic process. Correlation and spectral density. Wide band and narrow band noise: Its representation and distribution. Stationary information sources. Entropy and Ergodicity. Markov processes. Communication channels, their classification, characteristics and behaviour.

Algebraic codes, Block codes, Shannon's two coding theorems. Error detecting and correcting codes.

EC-4207: QUANTUM ELECTRONICS (Credits 3)

Time dependent perturbation theory. Semi-classical treatment of two level and three level transition. Transition probabilities.

Atomic and molecular energy spectra. Quantization of electromagnetic field. Density matrix approach for interaction with matter. Raman photo scattering. Nonlinear interaction.

Quantum electronic devices lasers and masers. Gyratron.

Josephson junctions, Applications.

EC-4208: INTELLIGENT INSTRUMENTATION (Credits 3)

Intelligent data terminals and instruments. Multi programming and multiprocessing.
OFF/ON line editing, computing and processing.
Dedicated instrumentation system. Programmable data acquisition and logging.
Data base management.

EC-4209: COMPUTER NETWORKS (credits 3)

Evolution of data networks, circuit message and packet switching. The concept of layering. The seven layer ISO model. IEEE-802 standards. Twisted pair, coaxial and fiber optic cables as channels for data transmission.

Error-detection, parity check and cyclic redundancy check codes. Strop-and-wait and various sliding window ARQ-strategies and their performance analysis.

Framing. Error Recovery at the network and transport layer. ATM. Queuing Models. Little's Theorem. M/M/1, M/M/n, M/M/m/n and M/G/1 systems. Pollazek-Kinching formula. Networks of transmission lines and networks of Queues.

Multi-access communication, Aloha and slotted Aloha system. Stabilized slotted Aloha. Splitting algorithms. Carrier Sensing. CSMA/CD and Ethernet. Token Ring. IEEE-8025 Token Ring Standard and IEEE-8024 Token Bus Standard. Packet Radio Networks.

Routing Network algorithms and Shortest Path Routing. Adaptive Routing. Optimal routing and its characterization. Flan-Wolfe Standard.

Flow control, Network algorithms and Shortest Path Routing. Adaptive Routing. Optimal routing and its characterization. Flan-Wolfe Standard.

Flow control, Window Flow Control. Flow control Strategies in some existing networks. Combined Optimal Routing and Flow Control.

EC-4210: SPEECH SIGNAL PROCESSING (Credit 3)

Model of speech, reproduction, speech analysis and synthesis based on short time spectral analysis.

Channel vocodor. Vocodor synthesizer.

Pitch detection and voiced-unvoiced decisions. Homomorphic processing of speech. Format synthesis.

Linear prediction of speech. Computer voice response system.

EC-4211: MICROWAVE SOLID STATE DEVICES (Credit 3)

Varactor diode and parametric amplifier, PIN diode.
Transfer electron devices.
Tunnel diode and applications.
Transit time devices: IMPATT, TRAPATT, DOVATT
Microwave MOSFET and MESFET and HBT.
Fabrication technology and applications.

EC-4212: INTEGRATED OPTICS (Credits 3)

Dielectric waveguides: Slabs and Thin film waveguides, cavities. Analysis, Circular Harmonic Analysis. Loss mechanism, Fabrication and testing.

Coupling and coupled Modes: Nonlinear Interactions, Photoelastic and Corrugated Surface Coupling.

Optical Directional Couplers. Periodic Couplers.

Modulatros: Characteristics, Analysis & Circuits.

Acoustics-optic Interactions: Applications, like Diffraction, Spectral Analysis, Convolution.

EC-4213: MICROWAVE COMMUNICATION SYSTEMS (Credits 3)

A survey of microwave communication. Review of distribution functions used in communication systems. Line of sight communication, Active and passive repeater design, LOS/FDM/FM radio relay systems. Troposcatter communication- troposcatter propagation, prediction of path loss, troposcatter objectives and design patrameters, tandem tropo-hop performance. Diversity techniques. Elements of FDM/FM digital communication systems for terrestrial and satellite communication. Basics of cellular communication.

EC-4214: SPREAD SPECTRUM SYSTEMS (Credits 3)

The concept and advantages of Spread Spectrum Systems. Spread Spectrum Techniques Direct Sequence systems. Maximal sequences. Autocorrelation and Crosscorrelation. Composite codes. Generation high rate Codes. Effect of pulsed interference on DS spread spectrum systems. Excision of Narrowband Interference. Frequency Hopped Spread Spectrum Signals. Performance of FM Spread Spectrum Signals in AWGN. Other Types of Spread Spectrum signals. Synchronization and Tracking in spread spectrum systems.

Application of Spread Systems to Navigation, Jamming, Message Protection, Data Networks etc.

SYLLABI FOR EXTERNAL CLASSES

EC- : ELECTRONICS AND INSTRUMENTATION (Credits 3)

(For External Departments/Schools excepting Computer Science & Engineeing)

Vacuum and Semiconductor diode characteristics and load line. Half-wave and Full-wave rectifiers, Filters and power supplies. Amplifying devices and their characteristics, Single and Multi stage RC coupled voltage amplifiers, high input impedance circuits, Oscillators, Operational amplifiers and their applications. Linear and non-linear wave shaping circuits, Multivibrators and counters, logic gates, transducers, ADCs and DACs, display devices, digital multimeters, Microprocessors.

EC-2100A: ELECTRONICS AND INSTRUMENTATION (Credits 3)

(For Computer Science & Engineering)

Semiconductor diode characteristics, load line, half-wave and full-wave rectifiers, filters, power supply, regulators (723, 78xx, 79xx) amplifying devices (vacuum tube, BJT, FET) and their characteristics, Amplifiers (including types of coupling) calculation of voltage gain, impedance, Frequency Response, Feedback; high impedance circuits, oscillators (RC, LC and their applications), Active filters, VCO and PLL timer and application to systems. Logic gates & basic logic circuits (Ssi, MSI and basic system ICs); Transducers, Load cell, strain gauge, LVDT, Optical shaft encoders, Display devices, A/D & D/A converters, CRO and multimeters (A & D) intersils A/D for instrumentation; typical instrumentation system, introduction to Microprocessors and peripherals