

M. Tech. in Electronics Engineering
(Specialization: Microwave Engineering)

Subject	<u>Contact Hours (Per Week)</u>		Credits
	L & T	P	
<u>First Semester</u>			
Theory:			
*1. EC-5101 : Signal Processing	03		03
2. EC-5102 : Electromagnetic Field Theory and Microwave antennas	03		03
3. EC- 5103: Microwave O-Type Tubes	03		03
4. EC- 51-- :Elective-I	03		03
5. : Elective-II	03		03
Practical:			
6. EC-5171 : Practical		03	02
	15	03	
Total for First semester	18		17

<u>Second Semester</u>			
Theory:			
1. :Open elective (from other Departments/ School- approved by the Department)	03		03
2. EC-52-- :Elective-III	03		03
3. EC-52-- :Elective-IV	03		03
4. EC-52-- :Elective-V	03		03
5. EC-52-- :Elective-VI	03		03
Practical:			
6. EC-5271 : Practical/Project		03	02
7. EC-5272: Seminar		02	01
	15	05	
Total for Second semester	20		18

* Common to all specializations

<u>Third Semester</u>	
1. EC-6171: Seminar on Dissertation	05
2. EC-6172: Dissertation-Interim Evaluation	05
Total for Third semester	10

<u>Fourth Semester</u>	
1. EC-6271: Dissertation Open Defence	05
2. EC-6272: Dissertation Evaluation	10
Total for Fourth semester	15
Course Total	60

Note: Dissertation topic should be allotted to students in the IInd Semester

Electives: I & II (any approved two from the following):

1. AM-5105A: Mathematics
2. EC-5111: Microwave Circuits and Measurements
3. EC-5112: Vacuum and Tube Technology
4. EC-5113: MIC and MMIC
5. EC-5114: Remote Sensing
6. EC-5134: Microwave Solid State Devices and Applications

Electives: III, IV, V & VI (any approved two from the following):

1. EC-5211: Computer Aided Design of Microwave Tubes
2. EC-5212: Microwave M-Type Tubes
3. EC-5213: Radar Systems
4. EC-5214: Microwave Communication Systems
5. EC-5215: Countermeasures
6. EC- 5216: Satellite Communication
7. EC- 5217: Fast wave Devices
8. EC- 5241: Mobile Communication System and Wireless Network
9. EC- 5250: Optical Communication

M. Tech. in Electronics Engineering
(Specialization: Digital Techniques and Instrumentation)

Subject	Contact Hours (Per Week)		Credits
	L & T	P	
<u>First Semester</u>			
Theory:			
*1. EC-5101 : Signal Processing	03		03
2. EC-5104 : Switching Theory and Logic Design	03		03
3. EC-5105: Microprocessor Engineering & Applications	03		03
4. EC-51-- : Elective-I	03		03
5. EC-51-- : Elective-II	03		03
Practical:			
6. EC-5176: Practical		03	02
	15	03	
Total for First semester	18		17

<u>Second Semester</u>			
Theory:			
1. :Open elective (from other Departments/ School- approved by the Department)	03		03
2. : Elective-III	03		03
3. EC-52--: Elective-IV	03		03
4. EC-52-- : Elective-V	03		03
5. EC-52-- : Elective-VI	03		03
Practical:			
6. EC-5276 : Practical/Project		03	02
7. EC-5277 : Seminar		02	01
	15	05	
Total for Second semester		20	18

* Common to all specializations

<u>Third Semester</u>	
1. EC-6176: Seminar on Dissertation	05
2. EC-6177: Dissertation-Interim Evaluation	05
Total for Third semester	10

<u>Fourth Semester</u>	
1. EC-6276: Dissertation Open Defence	05
2. EC-6277: Dissertation Evaluation	10
Total for Four semester	15
Course Total	60

Note: Dissertation topic should be allotted to students in the IInd Semester

Electives: I & II (any approved two from the following):

1. EC-5121: Artificial Intelligence
2. EC- 5133: Reliability Engineering
3. EC- 5109: Data communication and Networks
4. EC- 5141: DSP Architecture and Application
5. EC- 5142: Computer Networking

Electives: III, IV, V & VI (any approved two from the following):

1. AM-5205A: Mathematics
2. EC-5221: Microprogramming
3. EC-5222: Computer Graphics
4. EC-5223: Fault tolerance Digital System Design
5. EC-5224: Neural Networks
6. EC-5231: LSI/VLSI Design
7. EC-5236: Digital Design and Modeling with VHDL
8. EC-5244: Multi-resolution Image Processing

M. Tech. in Electronics Engineering
(Specialization: Communication System Engineering)

Subject	Contract Hour (Per Week)		Credit
	L & T	P	
<u>First Semester</u>			
Theory:			
* 1. EC-5101: Signal Processing	03		03
2. EC-5108: Information and Coding Theory	03		03
3. EC-5109: Data communication and Networks	03		03
4. EC-51-- : Elective-I	03		03
5. EC-51-- : Elective-II	03		03
Practical:			
6. EC-5186: Practical		03	02
	15	03	
Total of First semester		18	17

<u>Second Semester</u>			
Theory:			
1. : Open Elective (from other Departments/ School- approved by the Department)	03		03
2. : Elective- III	03		03
3. EC-52-- : Elective- IV	03		03
4. EC-52-- : Elective-V	03		03
5. EC-52-- : Elective-VI	03		03
Practical:			
6. EC-5286: Practical/Project		03	02
7. EC-5287: Seminar		02	01
	15	05	
Total of Second semester		20	18

* Common to all specializations

<u>Third Semester</u>			
1. EC- 6186: Seminar on Dissertation			05
2. EC- 6187: Dissertation- Interim Evaluation			05
Total of Third semester			10

<u>Fourth Semester</u>			
1. EC- 6286: Dissertation Open Defence			05
2. EC- 6287: Dissertation Evaluation			10
Total of Third semester			15
Course Total			60

Note: Dissertation topic should be allotted to students in the IInd Semester.

Electives: I & II (any approved two from the following):

1. EC-5105: Microprocessor Engineering and Applications
2. EC-5121: Artificial Intelligence
3. EC-5133: Reliability Engineering
4. EC-5141: DSP Architecture and Application
5. EC-5142: Computer Networking

Electives: III, IV, V & VI (any approved four from the following):

1. AM-5205A: Mathematics
2. EC-5216: Satellite Communication
3. EC-5231: LSI/VLSI Design
4. EC-5241: Mobile Communication Systems and Wireless Network
5. EC-5242: Broadband Networks and Network Management
6. EC-5243: Multimedia Communication
7. EC-5244: Multiresolution Image Processing
8. EC-5245: Data Compression
9. EC-5246: Pattern Recognition
10. EC-5247: Spread Spectrum Technique
11. EC-5248: Digital Telephony
12. EC-5249: Photonics and Optical Switching
13. EC-5250: Optical Communication
14. EC-5251: Decision and Estimation Theory

M. Tech. in Electronics Engineering
(Specialization: Microelectronics)

Subject	<u>Contract Hour (Per Week)</u>		Credit
	L & T	P	
<u>First Semester</u>			
Theory:			
* 1. EC-5101: SignalProcessing	03		03
2. EC-5106: IC-Technology	03		03
3. EC-5107: Analysis and Design of integrated Circuits	03		03
4. EC-51-- : Elective-I	03		03
5. EC-51-- : Elective-II	03		03
Practical:			
6. EC-5181: Practical		03	02
	15	03	
Total of First semester	18		17

<u>Second Semester</u>			
Theory:			
1.	: Open Elective (from other Departments/ School- approved by the Department)	03	03
2.	EC-52--: Elective- III	03	03
3.	EC-52--: Elective- IV	03	03
4.	EC-52--: Elective-V	03	03
5.	EC-52--: Elective-VI	03	03
Practical:			
6.	EC-5281: Practical/Project	03	02
7.	EC-5282: Seminar	02	01
		15	05
Total of Second semester		20	18

* Common to all specializations

<u>Third Semester</u>		
1.	EC- 6181: Seminar on Dissertation	05
2.	EC- 6182: Dissertation- Interim Evaluation	05
Total of Third semester		10

<u>Fourth Semester</u>		
1.	EC- 6281: Dissertation- Open Defence	05
2.	EC- 6282: Dissertation Evaluation	10
Total of Fourth semester		15
Course Total		60

Note: Dissertation topic should be allotted to students in the IInd Semester

Electives: I & II (any approved two from the following):

1. EC-5105: Microprocessor Engineering and Applications
2. EC-5121: Artificial Intelligence
3. EC-5131: Solid State Devices
4. EC-5132: Heterojunction Devices and Technology
5. EC-5133: Reliability Engineering
6. EC-5142: Computer Networking

Electives: III, IV, V & VI (any approved four from the following):

1. EC-5223: Fault Tolerant Digital System Design
2. EC-5231: LSI/VLSI Design
3. EC-5232: Analog VLSI Design
4. EC-5233: Hybrid Integrated Circuits
5. EC-5234: Semiconductor Power Devices
6. EC-5235: Characterization and Limitation of Devices and Circuits
7. EC-5236: Digital Design and Modeling with VHDL
8. EC-5237: High Speed Devices and Circuits
9. EC-5238: Optoelectronics Devices and Systems
10. EC-5250: Optical Communication

AM -5205A: Mathematics (Credits -3)

Hilbert and Banach Spaces. Linear Operators, Spectral decomposition. Sequences of independent random variables: Central limit theorem, applications, Markov chains, Chapman–Kolmogorov equation, Classification of states. Stationary distribution. Limit theorems. Stationary process: Continuity, differentiability and integrability, Filtering. Kalman Filters. Reliability and life testing. Failure laws systems with several components. Stand-by Systems. Reliability of large systems. Theory of groups and finite fields. Galois fields. Field extensions, Vector spaces over finite fields. Error detecting and correcting codes, Bose–Raychaudhuri codes. Graph and network trees, cycle and cut sets. Planar graphs Crossing numbers. Covering problems.

AM-5105A: Mathematics (Credits -3)

Calculus of Variations-Functional. First Variation, Euler's equation, Second Variation. Constraints, Lagrange Multipliers, Rayleigh - Ritz - Galerkin Method. Numerical Methods-System of Linear Equation, Gauss-Jordan Method, Triangularization Method, Cholesky Methods, Gauss–Seidel Method. Successive Over–relaxation Methods, Sparse Matrix. Finite Element Methods–Finite element meshes. Boundary Conditions and Solution of Linear Equations, Convergence of finite element methods.

EC-5101: Signal Processing (Credits -3)

Models and Measurement of signals. Signal space representation. Integral transforms and operators, functions and properties of signal processes and transmission systems. Invert systems. Digital signal processors. Numerical filters and applications.

EC-5102: Electromagnetic Field Theory and Microwave Antennas (Credits -3)

Waves, scattering and diffraction. Methods and techniques (analytical and numerical) to the solution of electromagnetic field problems. Methods of coupling, transitions. Aperture and patch antennas. Rectangular and circular waveguides and reflector antennas. Artificial metal lens antennas Feed mechanism. Design aspects of Microwave antennas.

EC-5103: Microwave O –Type 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. RF-wave and beam interaction: localized and continuous. Transit time O-type Microwave Tubes: reflex klystrons, Klystrodes, multi-cavity klystrons, traveling wave tube amplifiers, Backward Wave Oscillators, Device operation, gain and efficiency calculations, operational characteristics, design criteria, and future trends. Efficiency enhancement and Bandwidth techniques.

EC-5104: Switching Theory and Logic Design (Credits-3)

Vector switching algebra and Vector switching functions. Special class of switching functions: Threshold, Symmetric functions. Functions with decomposable properties, majority and monotonic functions. Logical completeness of switching functions and complete set of logic primitives. Hazards in combinational circuits and hazard free realization. Boolean differential calculus: Computation of Boolean derivatives and differentials. Fault detection and location in combinational circuits: Tabular, ENF, Path Sensitizing and Boolean Difference methods. Experiments on Sequential machines: Initial uncertainty, successor tree and terminal nodes. Homing, distinguishing and synchronizing sequences. Identifications of Sequential machines – checking experiments. Special classes of Sequential machines: Information lossless machine, definitely diagnosable machine and linear sequential circuits.

EC-5105: Microprocessor Engineering & Applications (Credits-3)

Architecture, organization and instruction repertoire of contemporary 16/32 bit processors.
Memory and storage hierarchies: implementation techniques, Cache. Coherence.
Multiprogramming, Array processing, Vector processing and Multiprocessing.
Pipelining: ILP, Register renaming, Loop unrolling, Static and dynamic scheduling. Super scalar and Super pipeline structures. IA 32 bit architectures. BTAs.
Standard Bus structures: CAMAC, CAN and IEEE 488.
Typical applications with special reference to signal processing and Instrumentation.
Special Architecture for DSP applications. Microprocessors Development Systems.

EC-5106: Integrated Circuit Technology (Credits-3)

Integrated Circuit Technology–Basic classification and comparison. Monolithic Technology-wafer preparation .Oxidation, isolation, Diffusion, ion implantation and masking techniques. Design and fabrication of Bipolar and MOS active and passive devices.
Thin –Film Technology-Different deposition techniques. Thinness measurement and monitoring. Design and fabrication of active and passive components.
Thick-Film Technology-Material process, design and fabrication of thick film components.
Hybrid Integrated Circuits. Application.

EC-5107: Analysis And Design Of Integrated Circuits (Credits-3)

Monolithic Integrated Circuits. Parasitics, general design principles and circuits layout,
Design of transistors, operational amplifier and other linear integrated circuits. Design of logic circuits using bipolar and MOS devices.
Hybrid integrated circuits- circuits and layout design thermal considerations and packaging

EC-5108: Information and Coding Theory (Credits-3)

Information and its measure, Entropy, Eiensteins Axiomatic Approach. Source Entropy and its extensions. Binary Symmetrical and Binary Erase Channel, Mutual Information and Channel Capacity, Cascaded and Special Channels. Markov processes and their Entropy.
Coding for noiseless and noisy Channels. Error Detection and Correction, Group Codes, Cyclic Codes, Special Coding Techniques, TCM, Vitervi decoding.

EC – 5109: Data Communication and Computer Networks (Credits-3)

Ideal Bit Pipe, Practical Media Types and their characteristics, Techniques for converting real Media into IBP , Synchronous and Asynchronous Data Communication. Bit and Character oriented Protocols. Data transmission over LP & BP channels. Channel Coding. Effect of Random and Burst errors. Error Detection & Correction Codes. Data Buffering and its applications in Interface Design . Circuit, Message and packet switching, Packetization and Re-assembly. Data Multiplexing and Concentration. Data Compression-Techniques & Standards. Data Security & Encryption.Intra Chip & Inter Chip Communication, Network of Systems. Queuing Theory, Networking Models.

EC-5111: Microwave Circuits and Measurements (Credits -3)

Passive Devices and matching. Measurement of Q factor, Impedance, Power, Noise figure, S-parameters, dielectric constant and permeability. Swept frequency measurement. Network analyzers. Spectrum analyzers and TDR.

EC-5112: 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-5113: MIC and MMIC (Credits -3)

Design aspects of strip lines, fin lines, Bandwidth, Power and frequency optimization.

Impedance Matching. Micro-strip lines MIC & MMICs. MIC active devices.

EC-5114: Remote Sensing (Credits -3)

Matter energy interactions, passive microwave radiometry, imaging radar systems, remote sensors, communication and data transmission systems, data processing and reprocessing, pattern recognition and classification, software systems, digital hardware , fundamentals of image analysis-visible, thermal infra-red and microwave data , applications.

EC-5121: Artificial Intelligence (Credits-3)

Definition, history of AI, study of AI techniques, problem definition as state-space search.

Search techniques- generate and test, hill climbing, problem reduction, means and analysis.

Knowledge representation- representing facts in logic, predicate logic, resolution, forward versus backward reasoning.

Game playing, minimax algorithm, alphabeta heuristics.

Natural language processing - introduction, syntactic processing, semantic analyses.

Introduction to expert systems

EC-5131: Solid State Devices (Credits -3)

Metal semiconductor contact . transport phenomenon and barrier height measurement.

MISFET: Si – SiO₂ interfaces, characteristics, sub-threshold condition, short geometry

Effects, CCD, MESFET, IMPATT, BARITT, Gunn devices, Photodetectors, Solar cell,

Semiconductor laser, LED.

EC-5132: Heterojunction Devices & Technology (Credits-3)

Isotype and anisotype heterojunctions

III-V and Si-SiGe technology: LPE, VPE, MOCVD, MBE, Ion-implantation, Bandgap Engineering, nanostructures.

III-V HBT, MODEFT, Nano-structure devices, Superlattice APD

Semiconductor heterostructure laser and LED, Wave guiding structures.

EC-5133: Reliability Engineering (Credits -3)

Quality and reliability, importance of reliability, reliability parameters, Methods of achieving reliability, Measure of central tendency and dispersion system reliability with constant and variable failure rates, Serial and parallel reliability maintainability and availability failure mechanisms, reliability data and analysis. Reliability improvement methods.

VLSI reliability: reliability screening and modeling, electrostatic discharge damage,

Metal Electro-migration phenomena, dielectric breakdown, instabilities in ICs

EC -5134: Microwave Solid State Devices and Applications (Credits-3)

Varactor diode and parametric amplifiers, Gunn diode, logic circuits using Gunn diode IMPATT, BARITT, TRAPATT, Phase locking, phase shifter, harmonic Generation, power amplifiers MESFET, MODFET, MMIC.

EC- 5141: DSP Architecture and Application (Credits-3)

Architectural difference between Microprocessor, Microcomputer, and Digital Signal Processor. Harvard Architecture & Modified Harvard Architecture. Integer Arithmetic and Pipelining, Vector Processor and Systolic Array Processor Architecture, Massively Parallel Processors, Connection Machine and Pyramid Machine Architecture. DSP Interfacing and I/O Management, Processor Interrupts. Sensor Interfacing.

Speech, Image & Graphics Input handling , File and Data Structure, Local and Global memory Management, Tight and Loose Coupling of parallel Multi-DSP systems.

Example of Commercial DSP chips and their Development Tools.

EC-5142: Computer Networking (Credits-3)

Network Topology, Connectivity and delay analysis. Back bone and local access network design. Data link and protocols. Virtual circuits and data grams. Routing algorithm and congestion. Satellite and packet radio network. Network security and privacy. Text compression and file transfer protocols. ARPANET, ETHERNET AND DECNET examples.

EC-5211: Computer Aided Design of Microwave Tubes (Credits -3)

Numerical Integration and Differentiation.

Numerical solution of linear and non-linear differential equations of higher orders.

Finite difference, finite element and method of moments applied to microwave / millimeter wave electron beam device problems.

High power, high efficiency and broadband considerations.

Non linear analytical and numerical methods using disk, deformable disk and ring models of electron beam.

CAD of subassemblies including spent electron beam collector.

Simulation and optimization techniques for electron beam and RF wave interaction.

PIC simulation techniques.

EC 5212 Microwave M-Type Tubes (Credits -3)

Electron beam wave interactions. Performance and design principle of amplifiers and oscillators.

Magnetrons: device operation, Pi-mode of operation, strapping, mode jumping, frequency pulling and pushing, Performance Chart and Rickie Diagram. Design and Testing of Magnetrons.

Crossed field amplifiers: operating principle, device gain and efficiency.

Coaxial Magnetrons, Inverted Coaxial Magnetrons, Frequency Agile, Voltage Tunable Magnetrons, Carcinotrons, Amplitrons.

Millimeter wave generation and amplification: Peniotrons, Ubitrons, Gyrotrons and Free Electron Lasers, Application, efficiency and bandwidth enhancements and future trends.

EC-5213 Radar Systems (Credits -3)

Radar equations for tracking, volume search, jamming and cluttering. Non coherent MTI, MTI from moving platform, Pulse compression radar. Phased array, synthetic aperture radars.

Radar antenna systems, ECCM techniques.

EC-5214: Microwave Communication System (Credits-3)

LOS Propagation and System performance, Active and passive repeater design.

Troposcatter propagation. FM/Digital. AM/FDM and AM/TDM systems.

Satellite Communication Systems, Earth Station design criteria and direct reception system.

Multiple access TDMA, FDMA and SSMA.

Noise consideration.

EC-5215: Counter Measures (Credits-3)

General Introduction to Electronics Warfare. Intercept Systems. Signal Detection, Analysis and Environment Study, Dumb and Smart Jammers. Confusion Reflectors. Target Masking and Decoys. Infrared Countermeasures. ECCM system.

EC-5216: Satellite Communication (Credits-3)

Passive and Active Satellites, Polar, Geosynchronous and Geostationary Satellites. Frequency Allocation and reuse Path Loss and Fading. Earth Station Design, Sattellite station house keeping and control, Tracking Tellimetry and Coummraond. Transponder and their Access, FDMA,TDMA, DAMA and SSMA, SSPC and Radio Networking.

EC-5217: Fast Wave Devices (Credits-3)

Limitation of slow-wave devices for high power and high frequency applications.
Classification and sub-assemblies of fast wave electron beam devices
Relativistic bunching, waveguide mode and beam-mode dispersion relation.
Small-orbit, Large-orbit and quasi-optical configurations.
Excitation of desired mode, Mode suppressions, CRM and Weibel instabilities.
Principle of operation, Electron beam RF wave interaction mechanism, performance evaluation and design principles of fast-wave devices like: Gyrotron, gyro-klystron, gyro-Travelling-wave tubes, Slow Wave Cyclotron Amplifier and CARM. Peniotron effects, Ubitron, Free Electron Laser. Application, efficiency and bandwidth enhancements and future trends.

EC-5221: Microprogramming (Credits-3)

Control Unit organization and microprogramming concepts. Control stores. Micro-instruction formats and field, micro-code design and instruction sequencing, microprogramming aids and design automation.
Application of microprogramming, Microprogrammable bit slice processors.

EC-5222: Computer Graphics (Credits-3)

Introduction, Point plotting, Line drawing, raster graphics and vector display. Two dimensional transformation, clipping & windowing, graphic input devices and input techniques. Graphic packages, segmented display files, geometric models and picture structures. Three dimensional graphic curves and surfaces, transformation & perspective projection.

EC-5223: Fault Tolerant Digital System Design (Credits-3)

Faults their types and characteristics. Test generation and Fault Detection techniques. Self-checking and Fail-safe logic design. Reconfigurable and self-repairing Fault Tolerant Networks. Design for testability. Fault Tolerant Design of VLSI and Systems.

EC-5224: Neural Networks (Credits-3)

Introduction to neural computing, Fundamental Concepts and models of artificial neural systems, Neural processing and network learning rules, Single-layer perceptron classifiers, nonparametric training concepts, discrete perceptron: algorithm, example. Multilayer feed-forward neural networks, Learning techniques in neural networks. Back propagation algorithm, feed-forward recall and error back-propagation training, learning factors, functional link networks, Error correction and gradient based rules. Associative memories: performance analysis and spatio-temporal patterns Self-organizing feature maps.. Hamming Net and MAXNET, feature mapping, applications of neural algorithms and systems

EC-5231: LSI/VLSI design (Credits -3)

Evolution of circuit integrations.
Modeling of MOSFETs. Device scaling, effect of short geometry.
Pass transistor, transmission gate and inverter based logic circuits. Their analysis and design.
Stick diagrams, λ -based design rules and layout designs.
Super buffers and buffer chains for driving large off chip capacitive loads.
Structural design concepts. Semi and full custom design. Gate arrays and standard cells.
Design of subsystems, PLA and FSM.
CAD tools for VLSI design

EC-5232: Analog VLSI Design (Credits -3)

Potential of analog VLSI, analog MOS technology, OP-AMP design technology and CMOS, high performance OP-AMP, switched capacitor filters, A/D, D/A converters.
Analog VLSI interconnects, CAD of analog VLSI design testing.

EC-5233: Hybrid Integrated Circuits (Credits -3)

Monolithic, thin-film and thick-film circuits, hybridization components, circuits and Layout design, fabrication techniques. Bonding and interconnections, packaging, system partitioning. Reliability of hybrid integrated circuits and their applications.

EC-5234: Semiconductor Power Devices (Credits -3)

Carrier transport and break-down voltages, junction termination. Power BJT, JFET and MOSFET: DMOS and VMOS, Thyristor, MOS-Bipolar devices MOS gated thyristor and insulated gate transistor.
Power integrated circuits.

EC-5235: Characterization and Limitation of Devices & Circuits (Credits -3)

Device performance at extreme current and voltage, temperature and power limitations of various solid state devices and components, speed limitations, design aspects of low-noise devices and circuits, comparative operating features of discrete and integrated circuit devices and components, modeling and equivalent circuits and parameter extraction

EC-5236: Digital Design and Modeling with VHDL (Credits -3)

Introduction to digital design automation, CAD software requirements and features supported by VHDL, VHDL terminology and constructs: entity declaration, architectural body, configuration declaration, package declaration and package body.
Language elements identifiers: identifiers, data object, data type operators.
Digital design using behavioral, data flow and structural description design case studies of combinational and sequential circuits. Simulation of clock, signal assignment, wait statement, test bench and testing

EC-5237: High Speed Devices and Circuits (Credits -3)

MESFET, MODFET, HBT, Superlattice devices.
Logic and functional devices, MMIC, Digital ICs.
Fabrication techniques of high speed devices.

EC-5238: Optoelectronics Devices and Systems (Credits-3)

LCD, LED & Lasers. Photodetectors: PIN, APD, superlattice structure, Photo-transistor, OPFET.
Optical amplifier: Fiber amplifier, Brillouin amplifier, Raman amplifier, Optical switching devices, Kerr cell and Golay cell, optical fiber and wave guiding structures. Optical communication systems, Optical processors and optical computing.

EC -5241: Mobile Communication Systems and Wireless Networks (Credits-3)

Wireless Transmission: Frequencies, regulations, Signals, Antennas.
Signal Propagation, path loss, Multi path and other effects.
Multiplexing: SDM, FDM, TDM, and CDMA.
Modulation Techniques: ASK, FSK, PSK, Multi-carrier and Spread Spectrum: their use in Mobile and Wireless Communication Systems.
Access Control Mechanisms: SDMA, FDMA, TDMA, CDMA and their performance evaluation.
Wireless Networks: Satellite networks, Wireless LAN, Wireless ATM. OSI, Mobile Network and transport layers, their protocols and implementation.
Wireless Application Protocol.

EC -5242: Broadband Network and Network Management (Credits-3)

Synchronous and Asynchronous Networks, Optical Fiber based Backbone and Information Superhighways, SONET & SDH standards. IP over SONET and WDM, STS & STM Framing, ATM and STM systems, ATM Layers. User Network & Network-Network Interfaces. Virtual paths and Virtual circuits, Cell Loss Effects, Intelligent Networks.
Network Management and Control, TMN Architecture and Functional Requirements. Interface and Protocol Requirements, Information Modeling and Model representations.
System Management Functions, OSI System Management, Internet SNMP, ODP/OMG. COBRA as technologies for TMN.

EC-5243: Multimedia Communication (Credits-3)

Multimedia basics. Signal Processing for video & audio integration, Compression and Transmission . Compression standards and their implementation. Multimedia Storage, Database and Distribution.
Multimedia Networking requirements, Services and QOS parameters. Wireless and Wired Broadband Networks. IEEE 802.11, Hyper-LAN, Magic-WAND, MMAC standards.
CDMA, OFDM and Multi-carrier CDMA,. Synchronization techniques, Rake receiver, Multipath effects and Models, Mobile systems.

EC 5244: Multi- Resolution Image Processing (Credits-3)

Image representation, Space Variant and Space Invariant Linear Operations, Multidimensional sampling. Projections in Hilbert space, Multiscale methods, Image Operators and Transforms. Spatial and Transformed domain techniques, Multi-grid structures , Multi-Resolution Support and Pyramid Technique.

Wavelets and Wavelet Transforms, Basic selection and CWT, Dyadic Transformation and DWT, Properties and Inverse Transforms, Mallat's Algorithm, FIR Implementation, Image Recovery, Applications of Wavelet transform for Image compression and De-noising.

EC-5245: Data Compression (Credits-3)

Random signals and sources, sampling techniques and quantization, source coding, Lossy and loss-less compression and optimality.

Scalar coding: scalar quantizer, its structure, companding, quantizer performance measurement, conditions for optimality, predictive quantization, Bit allocation and transform coding, Entropy coding.

Vector coding: vector quantizer (VQ), its structure and characterization, quantizer performance measurement, optimality conditions for VQ, various types of VQs, tree and Trellis encoding.

Compression standards: JPEG, MPEG, and MP.

EC-5246: Pattern Recognition (Credits-3)

Descriptions and representation of patterns, Linear and Non-linear classification, Feature selection and extraction, Supervised and Unsupervised Parameter estimation, Non-parametric Methods and Compound Decision Theory in pattern Recognition, Clustering Techniques, Contextual analysis in pattern recognition, Algorithms for pattern recognition, Artificial neural networks and pattern recognition, Pattern Recognition Systems.

EC- 5247: Spread Spectrum Technique (Credits-3)

Problem of low bandwidth communication system, concept of larger bandwidth systems, Spectrum Spreading. Maximal length sequence, auto-correlation and cross-correlation properties, Golay codes, m sequence, gold, Kasami & other sequences, selection, design, generation and application of MLS.

Types of SS system, DS, FH & TH. Comparative properties and relative advantages of DS, FH & TH. Receiver design for SS. Synchronization technique, application of SS in SSMA, LPI, CDMA, jamming resistance, TDR, secure communication and navigational aids, networking of SS system.

EC- 5248: Digital Telephony (Credits-3)

Review of voice digitization concept, PCM, DPCM, ADM and decoders. Code selection. Digital transmission and multiplexing. Digital switching. Space and time switching. Two-dimensional and multi-dimensional switching, custom switch design. Some aspects of traffic characterization, network blocking and its estimation.

ECE- 5249: Photonics and Optical Switching (Credits-3)

Electro-absorption modulators, quantum well EAM, electro-optic modulators, quantum well EOM, self electro-optic effect device, bipolar controller modulator, optoelectronic amplification. Programmable memory device. Switching speed and energy.

Opto-electronic integrated circuits: Hybrid and Monolithic integration, Integrated optical Transmitters and Receivers. Guided wave devices: Waveguides, couplers, splitters and combiners. Active guided wave Devices, Optical Bi-stability, Digital Optics.

Optical switches, temporal, spatial, wavelength and spectral domain switching, multidimensional and multilevel photonic switching. Self routing. ATM switching.

EC- 5250: Optical Communication (Credits-3)

Difference between bounded and free space optical communication, Propagation characteristics of IR, Visible, UV in Atmosphere and space, Optical fibre, preparation and transmission characteristics, loss and dispersion mechanisms, Single and Multimode fiber, Optical sources: principles of operation, modulation characteristics and driver circuits, photodetectors: principles of operation, circuits and performance, post detection amplifiers, optical receiver, fibre optic connectors, couplers, multiplexers and splices, wavelength converters, routers, fibre optic communication systems and link budget using direct detection, Optical Amplifiers, Modulators and switches, Coherent optical communication: Homodyne and Heterodyne receivers for optical communication.

EC- 5251 : Decision and Estimation Theory (Credits-3)

Introduction to statistical communication theory, Simple binary hypothesis tests: Bayes criteria and Neyman-Pearson tests, receiver operating characteristic and M hypotheses, Classical estimation theory: Bayes estimation, maximum likelihood estimation, Cramer- Rao Inequality and multiple parameter estimation. Representation of random processes: introduction to random variables, sequence of random variables, central limit theorem, transformation of random variables, characterization of random processes: Karhunen-Loeve expansion, Gaussian processes and their properties, Wiener process, White noise processes, optimum linear filters, periodic random processes and vector random process. Detection of signals and estimation of signal parameters in white noise: Binary and M-ary detections in Additive White Gaussian Noise (AWGN), decision spaces, matched filters, correlation receivers, linear and nonlinear estimations, nonwhite Gaussian noise, detections and estimations in nonwhite noise using Whitening approach and Karhunen-Loeve expansion method, estimation of signals with random amplitude and phase, Rayleigh channels, Rician channels, multiple channels, Wiener filters and Kalman-Bucy filters.