SYLLABUS
UNDERGRADUATE PROGRAMME
B.Tech

DEPARTMENT OF
ELECTRONICS AND COMMUNICATION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, MANIPUR
TAKYELPAT, IMPHAL-795001
MANIPUR, INDIA

2014

BTECH (ECE) SYLLABUS 2013 ONWARD

Semester – III

Course No.	Course Name	L-T-P	Credit
EC201	Network Analysis	3-0-0	6
EC203	Semiconductor Device and Circuits	3-0-0	6
EC205	Analog Circuits	3-0-0	6
MA201	Math III	3-0-0	6
HS2xx	HSS Elective II	2-0-0	4
EC231	Network Analysis Lab	0-0-3	3
EC233	Semiconductor Device and Circuits Lab	0-0-3	3
EC235	Analog Circuits Lab	0-0-3	3
SA201	NSS/NCC/Sport	0-0-2	0
	Total	**14-0-11**	**37**

Semester – IV

Course No.	Course Name	L-T-P	Credit
EC202	Digital Electronics and Computer Architecture	3-0-0	6
EC204	Analog Communication	3-0-0	6
EC206	Electronics and Electrical Measurement & Instrumentation	3-0-0	6
EC208	Signals and Systems	3-0-0	6
MA202	Probability and Random Process	3-0-0	6
EC232	Digital Electronics Lab	0-0-3	3
EC234	Analog Communication Lab	0-0-3	3
EC236	Electronics and Electrical Measurement & Instrumentation Lab	0-0-3	3
SA202	NSS/NCC/Sport	0-0-2	0
	Total	**15-0-11**	**39**

Semester – V

Course No.	Course Name	L-T-P	Credit
EC301	Microprocessors	3-0-0	6
EC303	Digital Communication	3-0-0	6
EC305	Electromagnetic Theory	3-0-0	6
EC307	Digital signal processing	3-0-0	6
EC309	Control Systems	3-0-0	6
EC331	Microprocessor Lab	0-0-3	3
EC333	Digital Communication Lab	0-0-3	3
EC337	Digital signal processing Lab.	0-0-3	3
EC339	Control Systems Lab	0-0-3	3
	Total	**15-0-15**	**42**

Semester – VI

Course No.	Course Name	L-T-P	Credit
EC302	VLSI Design	3-0-0	6
EC304	Embedded system	3-0-0	6
EC306	Industrial Electronics	3-0-0	6
EC308	Antenna Design	3-0-0	6
EC310	VHDL	3-0-0	6
EC332	VLSI and VHDL Lab.	0-0-3	3
EC334	Embedded system Lab.	0-0-3	3
EC336	Industrial Electronics Lab	0-0-3	3
EC338	Antenna Design Lab	0-0-3	3
	Total	**15-0-12**	**42**

Semester – VII

Course No.	Course Name	L-T-P	Credit
HS401	Industrial Management	2-0-0	4
EC401	Microwave Engineering	3-0-0	6
EC403	Computer Networks	3-0-0	6
EC5XX	Departmental Elective I	3-0-0	6
EC5XX	Departmental Elective II	3-0-0	6
EC405	Project Work- I	0-0-3	3
EC431	Microwave Engineering Lab.	0-0-3	3
EC433	Computer Networks Lab	0-0-3	3
	Total	**14-0-9**	**37**

Semester – VIII

Course No.	Course Name	L-T-P	Credit
EC5XX	Departmental Elective – III	3-0-0	6
EC5XX	Departmental Elective – IV	3-0-0	6
XX4XX	Open Elective	3-0-0	6
HS402	Soft Skills	2-0-0	4
EC432	Project Work- II	0-0-9	9
	Total	**11-0-9**	**31**

Credits for 1st Year	80
Credits for ECE(III to VIII Semester)	228
Total Credits	**308**

EC201 NETWORK ANALYSIS [3-0-0-6]

Network Graphs; Matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevnin and Norton's maximum power transfer, Wye-Delta transformation. Steady State sinusiodal analysis using phasors. Linear constant coefficent differential equations: time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for network

Transient analysis using transform methods, high pass, low pass, band pass, band stop, all pass filters and frequency dependent negative resistors, Applications of active networks (op-amp, BJT, FET, tunnel diode etc.)and systems, Non-linear network analysis and systems.

Texts:

1 Network Analysis, Van Valkenburg, PHI Pbs, 2010

2 Circuit Theory, Kuriakose-PHI Pbs, 2005

References:

1 Network Analysis, Bakshi & Bakshi, Technical Publications, 2009

2 Network Analysis and Synthesis, Wadhwa, New Age Publications, 2008

EC203 SEMICONDUCTOR DEVICE AND CIRCUITS [3-0-0-6]

Energy Bands in Silicon, intrinsic and extrinsic silicon. Carrier transport in Silicon: diffusion current, drift current, mobility and resistivity. Generation and recombination of carriers. P-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin tub CMOS process

1-D, 2-D, 3-D and 0-D nanostructures, influence of external fields on the nano-devices, quantized systems (magnetic quantization, magneto size quantization, magneto inversion layers), scattering mechanisms for bulk, 0-D, 1-D, 2-D and 3-D systems

Texts:

1 Solid State Electronic Devices by Streetman & Banerjee

References:

1 Semiconductor Devices: Jasprit Singh

2 Integrated Electronics: Millman & Halkis

3 Semiconductor Physics and Devices: Donald Neaman

4 Semiconductor Devices: Kanan Kano

5 Semiconductor Optoelectronic Devices: Pallab Bhattacharaya

EC205 ANALOG CIRCUITS [3-0-0-6]

Small signal equivalent circuits of diodes, BJTs, MOSFETs and Analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single and multi-stage, differential and operational, feedback and power. Frequency response of amplifiers. Single opamp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single transistor and opamp configurations. Function generators and wave shaping circuits, 555 Timers. Power Supplies. Network synthesis of active analog devices.

Texts:

1 Donald A. Neamen, Electronic Circuit Analysis and Design, Irwin Publications, 1996.

References:

1. Op-AMPS and Lenear Integrated Circuits- Ramakant A. Gayakwad-Prentice Hall of India.
2. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', Tata McGraw Hill Book Company, 3rd Edn., 2002.
3. Jacob Baker R., Li H.W. & Boyce D.E., 'CMOS- Circuit Design, Layout & Simulation', PHI, 2000.
4. VLSI Technology, 2nd edition, S M Sze.
5. Semiconductor Devices & Circuits - B.P. Singh
6. Electronics Devices and Circuits - Allen Mottershead
7. Integrated Electronics - Millman & Halkias

MA201	**MATHEMATICS**	**[3-0-0-6]**

HS2XX	**HSS ELECTIVE I**	**[2-0-0-4]**

EC231	**NETWORK ANALYSIS LAB**	**[0-0-3-3]**

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC201
Laboratory will be set in consonance with the material covered in EC201
Verification of all network theorems

EC233	**SEMICONDUCTOR DEVICE AND CIRCUITS LAB**	**[0-0-3-3]**

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC203
Laboratory will be set in consonance with the material covered in EC203
Fabrication and characterization of thin films

EC235	**ANALOG CIRCUITS LAB**	**[0-0-3-3]**

Pre-requisites: Nil

Syllabus: Experiments using BJTs, FETs, op-amps and other integrated circuits: Multistage amplifiers, frequency response of amplifiers; waveform generators; filters.
Experimental verification of frequency dependent negative resistors.

EC202	**DIGITAL ELECTRONICS AND COMPUTER ARCHITECTURE**	**[3-0-0-6]**

Combinational logic analysis and design: logic minimization methods, Combinational design using MSI, LSI and PLDs, Number systems and arithmetic, Logic families, Delay, Hazards. Sequential logic design: latches and flipflops, Setup and Hold time , Clock frequency, Finite state machine design, state minimization, state assignment, synthesis using D-FF and JK-FF, counters, shift registers, MSI devices as state machines. All types of digital filters. Introduction to computer architecture: Instruction Set Architecture, System Software; Processor Design: Data path, Control unit, Instruction types, addressing modes.

Texts:

1. J.F.Wakerly, Digital Design Principles and Practices, PH, 1999.

References:

1. D.D. Givone, Digital Principles and Design, TMH, 2002
2. M. Raffiquzzman & Rajan Chandra, Modern Computer Architecture, Galgotia Publications, 1990.
3. David Patterson and John Hennessy, Computer Organization and Design, Elsevier, 2007.
4. David Harris Money and Sarah Harris, Digital Design and Computer Architecture, Morgan Kaufman,

2007.

EC204 ANALOG COMMUNICATION [3-0-0-6]

Introduction to Analog Communication, amplitude modulation, circuits for AM generation / detection, AM receiver systems and circuits, Angle modulation (FM/PM), Circuits for (FM/PM) generation and detection, commercial applications, frequency division multiplexing systems, noise performance of analog communication system (AM / FM / PM). Communication using non linear and time variant systems.

Texts:

1 S. Haykin, Communication systems, John Wiley, 2001.

References:

1 W. Tomasi, Electronic Communication systems, Pearson-Education, 2003.

2 Lathi B P, "Digital and Analog Communication Systems", Oxford University Press

3 George Kennedy, "Electronic Communication System", McGraw- Hill.

4 Roddy and Coolen, "Electronic Communication", PHI .

EC206 ELECTRONICS AND ELECTRICAL MEASUREMENT & INSTRUMENTATION [3-0-0-6]

Basic Measurement Techniques: Construction and principle of operation of Moving coil,Moving Iron, dynamometer, Wattmeter, Electro-static Instruments, Thermal and Rectifier type deflecting instruments, extension of instrument ranges using shunts, multipliers and instrument transformers

Errors in Measurement: Definition of accuracy, precision, Fidelity, speed of response,non-linearity, techniques of linearization, classification of errors. Statistical analysis. *Measurements of Resistances*: Measurement of low, medium and high resistances, Kelvins double bridge, multimeters, megger, D.C. and A.C. potentiometers.

Localization of cable faults: Murray and Varley loop methods.

AC Bridges: measurement of inductances, capacitance and frequency by A.C. Bridges—Maxwell, Schering, Anderson, De-Sauty, Wien.

Measurement of power & Energy: Measurements of power in polyphase circuits, various wattmeter connections. A.C. and D.C. energy meters.

Cathode Ray Oscilloscope: C.R.O. construction & principle of operation.

Sensors & Transducers: piezoelectric sensors, LVDT, Stain Gauges, Actuators A/D, D/A conversion techniques; S/H and multiplexers; isolation amplifiers; Data Acquisition system.

Digital Instrumentation – Block diagram of Instrumentation schemes, DVM, DMM, frequency counter

Frequency domain instruments : Wave analyzer, spectrum analyzer

Special Purpose Instruments: Signal generators, Q-meter

Texts:

1 Bell, David : Electronic Instrumentation & Measurement, Reston Publishers

References:

1 H.S. Kalsi :Electronic Instrumentation, Tata Mc-Graw Hill

2 Sawhney A K:A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co

3 Golding E.W. & Wides F.C. : Electrical Measuring Instruments & Measurements ; Wheeler

4 SK Singh :Industrial Instrumentation & Control , Tata McGraw Hill.New Delhi

EC208 SIGNAL AND SYSTEMS [3-0-0-6]

Definitions and properties of Laplace transform, continous time and discrete time Fourier series, continous-time and discrete-time Fourier Transform, DFT and FFT, Z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response,

convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems. Non linear signals and non-linear systems.

Texts:

1 M.J Roberts, “Fundamentals of Signals and Systems”, Tata McGraw Hill, 2007

References:

1 A.V. Oppenheim, A.S. Willsky and H.S. Nawab, "Signals and Systems", Prentice Hall of India, 2006.. B.

2 P. Lathi,"Signal Processing and Linear Systems", Oxford University Press, 1998.

3 R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete",4/e, PrenticeHall,1998

4 Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons, 1998

MA202 PROBABILITY AND RANDOM PROCESS [3-0-0-6]

EC232 DIGITAL ELECTRONICS LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Realisation of Basic logic gates, Combinational Circuit design using gates, MUX, decoders, arithmetic circuits, ALU Sequential Circuits design - counters, shift registers, sequence generators, signature detectors.

EC234 ANALOG COMMUNICATION LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC204 Laboratory will be set in consonance with the material covered in EC204

EC236 ELECTRONICS AND ELECTRICAL MEASUREMENT & INSTRUMENTATION LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC206 Laboratory will be set in consonance with the material covered in EC206

EC301 MICROPROCESSORS [3-0-0-6]

Evolution of digital computer, evolution of microprocessor. Microprocessor architecture: 8-bit (8085) and 16-bit (8086). Addressing modes of microprocessors, instruction set of 8-bit (8085) and 16-bit microprocessors (8086). Instruction cycle, timing diagram. Subroutine, assembly language and machine language programming. Types of memories and their organizations (RAM, ROM, stack, secondary etc.). Interrupt, DMA, principle of data transfer (synchronous and asynchronous). Serial data communication, RS-232 standard. Peripheral interface: PPI, DMA controller, interrupt controller, programmable timer, USART.

Introduction to advanced microprocessors (16 bit, 32 bit & 64 bit). Architecture of advanced microprocessors-80186, 80286, 80386, 80486. Memory management system. Introduction to Pentium microprocessor.

Texts:

1 Microprocessor architecture, programming and application with the 8085- Gaonkar

References:

1 Microprocessors – Bahadure

2 Microprocessors and Microcontrollers – Senthil kumar, Saravanan, Jeevanan

3 Microprocessor & Interfacing- Hall

4 Datasheet: Intel Microprocessor 8085, Intel Microprocessor 8086.

EC303 DIGITAL COMMUNICATION [3-0-0-6]

Introduction to digital communication systems, Pulse modulation systems, Non-uniform quantization and companding, Waveform coding techniques; Line codes; Base band pulse transmission, Matched filter and Inter symbol interference; Pass Band digital transmission, Digital modulation schemes; Digital signaling over a channel with inter-symbol interference and additive Gaussian noise, Signal design for band limited channels. Optimum demodulator for inter-symbol interference and additive Gaussian noise, coded modulation for bandwidth constraint channels-PSK, QAM & Trellis coded modulation, Linear equalization, decision feedback equalization, adaptive equalization. Introduction to spread spectrum systems. Introduction to coding theory – Entropy, mutual information, Shannon encoding algorithm Shannon Hartley law, source and channel coding theorems, Huffman and Shannon Fano coding, Error control coding: Linear block codes - Hamming Codes, Cyclic codes and Convolutional codes.

Texts:

1 Haykin Simon, "Communication Systems", 4th Edition, Wiley publication.

References:

1 Lathi B P, "Digital and Analog Communication Systems", Oxford University Press

2 Tomasi, "Electronic Communication Systems", 4thedition, Pearson Publications.

3 Proakis J J, "Digital Communications", 2nd Edition, Mc Graw -Hill.

EC305 ELECTROMAGNETIC THEORY [3-0-0-6]

Vector algebra, Cartesian, Cylindrical and Spherical co-ordinate system. Transformation of variables from Cartesian to cylindrical and spherical coordinate system. Coulomb's law, Electric field intensity, Field of 'n' point charges, Field of line and sheet of charge. Electric flux density, Gauss's law and it's applications. Divergence and Divergence theorem. Definition of potential difference and potential, Potential of point charge and system of charges. Potential gradient, Energy density in electrostatic field. Poisson's and Laplace's equations. Current and current density, Continuity of current. Biot-Savart and Amperes circuital laws and their applications, Curl, Stoke's theorem. Magnetic flux density, Scalar and Vector magnetic potential. Maxwell's equations in steady electric and magnetic fields. Force on moving charge and differential current element, Force and torque on a closed circuit. Time varying fields and Maxwell's equations. Uniform plane waves, wave motion in free space, perfect dielectric, lossy dielectric and good conductor, skin effect. Poynting vector and power considerations. Reflection of uniform plane waves, Standing ratio.

Texts:

1 William H.Hayt Jr. and John A. Buck, 'Engineering Electromagnetics, Tata McGraw-Hill, 2011.

References:

1 K. K. Shah, 'Introduction to Electromagnetic's', Dhanpat Rai, 2006.

2 Mathew N. O. Sadiku, 'Elements of Electromagnetics', Oxford University press, 2007.

3 Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', Prentice-Hall, 2008.

4 Joseph. A. Edminister, 'Theory and Problems of Electromagnetics', Schaum Series, Tata McGraw Hill, 1993.

EC307 DIGITAL SIGNAL PROCESSING [3-0-0-6]

DFT & its properties. Decimation in time and decimation in frequency FFT algorithms, discrete cosine transform. IIR filter design: Butterworth design, bilinear transformation. Low Pass, High Pass, Band Pass and Band Stop Digital Filters. Spectral transformation of IIR filters. FIR filter design: Symmetric and Asymmetric linear phase. FIR filter by rectangular, traingular and Blackman window functions. Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors. Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions.

Texts:

1 Oppenheim A V & Sehafer R W, "Discrete Time Signal Processing", Prentice Hall

References:

1 J.G.Proakis and D.G.Manolakis, Introduction to Digital Signal Processing, PHI, 2007
2 Ashok Ambardar, “Digital Signal Processing – A Modern Introduction”, Thomson, 2007
3 Sanjit K. Mitra, Digital Signal Processing: A computer based Approach, TMH, 2006
4 Andrias Antonion, “Digital Filters, Analysis, Design and Applications”, Second Edition, Tata Mcgraw Hills.

EC309 CONTROL SYSTEMS [3-0-0-6]

Introduction- feedback and its effects-linearization Mathematical Modelling of Physical Systems- Block diagram Concept and use of Transfer function. Signal Flow Graphs Mason's gain formula. Time Domain Analysis of Control Systems - BIBO and absolute stability, Routh-Hurwitz Criterion. P, PI and PID controllers, State Variable Analysis of Linear Dynamic Systems- controllability and observability Root Locus Techniques- zero and pole. Frequency Domain Analysis of Control Systems- polar plots, Nyquist stability criterion, Bode plots, application M&N circles, Nichols charts Design of Compensators. Non-linear control systems.

Texts:

1 J. Nagrath, M. Gopal, ‘Control Systems Engineering’, New Age International Publishers, 2008.

References:

1 K. Ogata, ‘Modern Control Engineering’, Prentice Hall, 2010.
2 Samarjit Ghosh, ‘Control System: Theory & Applications’, Pearson Education, 2007.
3 B. C. Kuo, Automatic Control Systems, 8/e, Wiley, 2002.

EC331 MICROPROCESSORS LAB [0-0-3-3]

Pre-requisites: Knowledge of C programming language and assembly language
Syllabus: Introduction to assembly language programming, C language programming, use of evaluation Boards, interfacing various peripherals and using them.

EC333 DIGITAL COMMUNICATION LAB [0-0-3-3]

Pre-requisites: Nil
Syllabus: Laboratory exercises and assignments to provide additional support to EC303 Laboratory will be set in consonance with the material covered in EC303.

EC337 DIGITAL SIGNAL PROCESSING LAB [0-0-3-3]

Pre-requisites: Knowledge of MATLAB
Syllabus: Simulation exercises on linear equation solvers: Digital Filter Design, DFT and spectral analysis, identification of sinusoids in noise. Speech processing, Image processing, Digital Filter Implementation – FIR and IIR filter, Implementation of FFT.

EC339 CONTROL SYSTEMS LAB [0-0-3-3]

Pre-requisites: Knowledge of MATLAB
Syllabus: Laboratory exercises and assignments to provide additional support to EC309 Laboratory will be set in consonance with the material covered in EC309

EC302 VLSI DESIGN [3-0-0-6]

Introduction to MOSFETs, MOSFET Equivalent circuits. MOSFET logic circuits: NMOS Inverter, CMOS Inverter, CMOS processing technology, Layout Design Rule, CAD tools for VLSI Design. MOSFET logic gates. CMOS combinational, sequential logic circuits, Flip-Flop and Latch timings, Clocking. Circuit characterization and performance estimation: Resistance, capacitance estimation, Switching characteristics, Delay Models. Power Dissipation, Packaging, Scaling of MOS transistor dimensions. CMOS subsystem design. Datapath operation: Addition, Multiplication, Counters, Shifters, Memory Elements. non-linear systems.

Texts:

1 J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2/e, Prentice Hall of India, 2003.

References:

1 N. Weste and D. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3/e, Pearson Education India, 2007.

2 D. A. Hodges, H. G. Jackson, R. Saleh, Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3/e, McGraw Hill, 2004.

3 Kang and Leblebici, CMOS Digital Integrated Circuits Analysis and Design, 3/e, McGraw Hill, 2003.

4 J. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons (Asia), 2002.

5 W. Wolf, Modern VLSI Design - System on Chip design, 3/e, Pearson Education, 2004.

EC304 EMBEDDED SYSTEMS [3-0-0-6]

Introduction to Embedded Systems. Introduction to microprocessors and microcontrollers, 8-bit and 16- bit, von Neumann and Harvard architectures, CISC and RISC architectures, Microcontroller Architecture (8051), Addressing Modes, Programming, Memory interfacing, serial and parallel I/O interfacing, analog interfacing, interrupt synchronization, Timers and Counters. Design using microcontroller. Introduction to advanced microcontrollers – Atmega, PIC. Advanced RISC Machine (ARM) Architecture.

Texts:

1 Embedded Systems – Rao

References:

1 Embedded Systems Engineering – CR Sarma

2 Datasheet : 8051, ATmega 16, PIC18F

3 Jonathan W Valvano, “Embedded Microcomputer Systems: Real Time Interfacing” , Cengage Learning, Jan-2011.

EC306 INDUSTRIAL ELECTRONICS [3-0-0-6]

General Introduction of Power Electronics, Scope and Application, **Power Semiconductor Devices Power diodes** - power transistors - SCRs - Triac - GTO - Power MOSFETs - IGBTs- Principles of operation and characteristics, device specifications and ratings, methods of turning on SCR- gate triggering circuit, methods of turning off SCR- commutation circuits. Protection and gate drive circuits. **Control rectifiers (AC to DC converter):** Single phase converters: Principle of phase control, half wave controlled rectifier load, fully controlled bridge converter, half controlled (semi) converter, Effect of single phase full converter with source inductance, Dual converter, 3-phase half wave controlled rectifier, 3-phase fully controlled bridge converter, 3-phase semi converter. **Inverter:** Series inverter, parallel inverter, single phase bridge inverter, concept of VSI and CSI, 3-phase bridge inverter (120° and 180° conduction mode), concept of PWM inverter. **D.C. Choppers:** Principle of operation, control techniques, transient analysis of step down chopper, buck, boost & buck-boost regulator, voltage commutated chopper, current commutated chopper, load commutated chopper, jones chopper. **Cyclo converters:** Single- phase mid-point type and bridge type cyclo converter, Applications: HVDC transmission, UPS, Zero voltage switch, Zero current switch.

Texts:

1 P.S. Bimbhra, ‘Power Electronics’, Khanna Publication, 2012.

References:

1 M.H. Rashid, ‘Power Electronics’, Pearson Publication, 2003

2 P.C. Sen, ‘Power Electronics’, Tata McGraw-Hill, 1987

3 V.R. Moorthi, ‘Power Electronics’, Oxford University Press, 2005.

EC308 ANTENNA DESIGN [3-0-0-6]

Potential theory. Helmholtz integrals. Radiation from a current element. Basic antenna parameters. Radiation field of an arbitrary current distribution. Small loop antennas. Reciprocity relations. Receiving cross section, and its relation to gain. Reception of completely polarized waves. Linear antennas. Current distribution. Radiation field of a thin dipole. Folded dipole. Feeding methods.

Baluns. Array factorization. Array parameters. Broad side and end fire arrays. Yagi-Uda arrays Log-periodic arrays. Fields as sources of radiation. Horn antennas. Babinet's principle. Parabolic reflector antenna.Microstrip antennas. Nano antennas.

Texts:

1 C Balanis, Antenna theory, analysis and design, 2nd. Edn., John Wiley & Sons

References:

1 E.C. Jordan & K.G. Balmain, Electromagnetic waves and Radiating Systems.

2 R. Chatterjee, Antenna Theory and Practice - New age Publisher, 2004

3 J. D. Kraus, Antenna- Tata McGraw Hii, 2006.

4 R.E.Collin, Antennas and Radio Wave Propagation, McGraw – Hill,1985.

EC310 VHDL [3-0-0-6]

Why HDL? , A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog. Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors, Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements. Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements. Highlights of Procedures, tasks, and Functions, Procedures and tasks, Functions. File Processing, Examples of File Processing. Why Mixed-Type Description? VHDL UserDefined Types, VHDL Packages, Mixed-Type Description examples. Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process and Always in the Hardware Domain

Texts:

1 HDL Programming (VHDL and Verilog)- Nazeih M.Botros- John Weily India Pvt. Ltd. 2008.

References:

1 Fundamentals of HDL – Cyril P.R. Pearson/Sanguin 2010.

2 VHDL -Douglas perry-Tata McGraw-Hill.

3 A Verilog HDL Primer- J.Bhaskar – BS Publications

EC332 VLSI and VHDL LAB [0-0-3-3]

Pre-requisites: Knowledge of VHDL or Verilog programming language

Syllabus: Design, Simulation and layout of basic digital blocks. Tools to be used: TANNER, CADENCE, MAGIC, SPICE, ELECTRIC
Design, simulation and implementation of simple digital system on FPGA, interfacing.

EC334 EMBEDDED SYSTEMS LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC304
Laboratory will be set in consonance with the material covered in EC304.

EC336 INDUSTRIAL ELECTRONICS LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC306
Laboratory will be set in consonance with the material covered in EC306.

EC338 ANTENNA DESIGN LAB [0-0-3-3]

Pre-requisites: Nil

Syllabus: Laboratory exercises and assignments to provide additional support to EC305
Laboratory will be set in consonance with the material covered in EC305.

HS401 INDUSTRIAL MANAGEMENT [3-0-0-6]

EC401 MICROWAVE ENGINEERING [3-0-0-6]

Introduction to and application of Microwaves, Microwave Tubes, travelling wave tube amplifier, backward wave oscillator, Cavity magnetron and crossed field amplifier, Microwave solid state devices, Introduction to MMICs, Microwave components, Microwave circuits, Scattering matrix and its properties, Power measurement, VSWR and impedance measurement, Reflectometers. Time varying transmission lines and transients in transmission lines.

Texts:

1 D M Pozar, Microwave Engineering, John Wiley & Sons, 2004

References:

1 S Liao, Microwave Devices & circuits, Prentice halls, India, 2004

2 M.I. Skolnik - Introduction to Radar Systems, McGraw Hill, 2004

3 G. Stimson, Introduction to Airborne Radar, IEE Press, 2002

EC403 COMPUTER NETWORKS [3-0-0-6]

Basics of circuit switching, packet switching, cell switching. ISO-OSI model, need for the model, reasons, advantages etc. Link layer & local area network, Computer network architecture, TCP/IP protocol suite, Routing protocols, Asynchronous transfer mode (ATM), Frame relay concepts, Wireless LAN, Multicasting, Internet security, Voice over IP (VOIP), Storage networks, Socket programming, IPV6, need for IPV6, addressing space, difference between IPV6 and IPV4 etc

Texts:

1 Andrew S. Tanenbaum Computer Networks, PHI, 2003

References:

1 James F. Kurose, Keith W. Ross, Computer Networking A Top – Down Approach, Featuring the Internet, Pearson Education, 2005

2 D. E Comer, Internetworking with TCP / IP – Vol. I, Prentice Hall, 2006

EC5XX DEPARTMENTAL ELECTIVE I [3-0-0-6]

EC5XX DEPARTMENTAL ELECTIVE II [3-0-0-6]

EC405 PROJECT WORK I [0-0-3-3]

EC431 MICROWAVE ENGINEERING LAB [0-0-3-3]

Pre-requisites: Nil
Syllabus: Laboratory exercises and assignments to provide additional support to EC401
Laboratory will be set in consonance with the material covered in EC401

EC433 COMPUTER NETWORKS LAB [0-0-3-3]

Pre-requisites: Nil
Syllabus: Laboratory exercises and assignments to provide additional support to EC403
Laboratory will be set in consonance with the material covered in EC403

EC5XX DEPARTMENTAL ELECTIVE III [3-0-0-6]

EC5XX	**DEPARTMENTAL ELECTIVE IV**	**[3-0-0-6]**
XX4XX	**OPEN ELECTIVE**	**[3-0-0-6]**
HS402	**SOFT SKILLS**	**[2-0-0-4]**
EC432	**PROJECT WORK II**	**[0-0-9-9]**