ELECTRONICS & COMMUNICATION ENGINEERING DEPARTMENT

B.Tech. ELECTRONICS & COMM.

Course of Study & Scheme of Examination

2016-17

Maulana Azad National Institute of Technology

Bhopal

SCHEME

B.Tech. Third Semester

Course No.	Subject	Scheme of Studies Periods per Week			Credits
		L	T	P	
MTH 212	Computational Techniques	3	-	-	3
EC 211	Electronic Devices & Circuits	3	-	-	3
EC 212	Digital Circuits	3	-	-	3
EC 213	Network Analysis and Synthesis	3	-	-	3
EC 214	Signals and Systems	3	-	-	3
EC 215	Instrumentation and Control	3	-	-	3
EC 216	Electronic Circuit and Digital Circuits (Lab 1)	-	-	**4**	2
EC 217	Network and Instrumentation & Control (Lab 2)	-	-	**4**	2
					Total Credit 22

B.Tech. Fourth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 221	Linear Integrated Circuits	3	-	-	3
EC 222	Microprocessors and Microcontrollers	3	-	-	3
EC 223	Analog Communication	3	-	-	3
EC 224	Comm. Networks & Transmission Lines	3	-	-	3
EC 225	EM Fields	3	-	-	3
EC 226	Data Structures	3	-	-	3
EC227	Linear Integrated Circuits & Microprocessors and Microcontrollers (Lab 1)	-	-	**4**	2
EC 228	Analog Communication & Data Structure (Lab. 2)	-	-	**4**	2
					Total Credit 22

B.Tech. Fifth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 311	Digital Communication	3	-	-	3
EC 312	Digital Signal Processing	3	-	-	3
EC 313	VLSI Design	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
EC 314	Digital Comm. & DSP (Lab 1)	-	-	**4**	2
EC 315	CNTL & VLSI Design (Lab 2)	-	-	**6**	3
					Total Credit 23

B.Tech. Sixth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 321	Digital Image Processing	3	-	-	3
EC 322	Optical Communication	3	-	-	3
EC 323	Microwave Engg.	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
EC 324	Digital Image Processing (Lab 1)	-	-	**2**	**1**
EC 325	Optical & Microwave (Lab 2)	-	-	**4**	**2**
EC 326	Minor Project	-	-	**4**	2
					Total Credit 23

List of Departmental-Electives for Third year

EC 331 Digital System Design
EC 332 Computer Network
EC 333 Neural Network
EC 334 Telecom Switching Systems
EC 335 Data Compression and Cryptography
EC 336 Design of Analog IC's
EC337 VLSI Technology

List of open electives for Third year

EC 351 Operating System **EC 352 Advance Instrumentation**
EC 353 TCP-IP **EC 354 Fuzzy Logic**
EC 355 Biometric Signal Processing **EC 356 Telecom Technology Management**

B.Tech. Seventh Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 411	Antenna and Wave Propagation	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
EC 412	Antenna and Wireless Comm. (Lab)	-	-	**4**	2
EC 413	Major Project	-	-	**4**	2
EC 414	Educational Tour & Training.	-	-	2	1
					Total Credit 20

B.Tech. Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC421	Wireless Communication	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
EC 422	Major Project	-	-	6	3
EC 423	General Proficiency	-	-	4	2
					Total Credit 20

List of Departmental-Electives for Fourth year

EC 431 Satellite Communication **EC 432 Broadband Optical Networks**
EC 433 Active RF Devices and Circuits **EC 434 RADAR and Navigation Systems**
EC 435 Statistical Signal Processing **EC 436 Video Signal Processing**
EC 437 Mobile Communication **EC 438 CAD of Digital Systems**
EC 439 Low Power VLSI Design

List of Open Electives for Fourth year

EC 451 Computer Vision and Pattern Recognition
EC 452 Biomedical Image Processing
EC 453 Nano Technology
EC 454 Optimization Techniques
EC 455 Multirate Signal Processing
EC 456 Internet Technology
EC 457 Micro Electro Mechanical Systems
EC458 Embedded System
HUM 451 Public Policy
HUM 452 Organizational Behavior

SYLLABUS

MTH 212 COMPUTATIONAL TECHNIQUES

Finite differences, forward differences, Backward difference, Central Difference, Symbolic Relations, Difference of a Polynomial, Newton's Formulae for interpolation, Central Difference, Stirling Formula, Bessel's Formula, Gauss Central Difference Formulae, Solution of linear algebraic equations, Lagrange's Interpolation Formula, Hermite Interpolation, Newton's General Interpolation Formula. Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's Rule, Numerical Solution of Ordinary differential equations Initial value problems, Boundary value conditions. Simultaneous and Higher order equations, two points boundary value problems. Numerical solution of partial differential equations, Eigen value and Eigen vector problems for Electromagnetic applications. Finite element method, Weighted Residual Method, Variational Methods. Finite elements, Brief overview of segmentation and desegmentation techniques.

References:

1. Elementary Numerical Analysis, 3rd edition, McGraw-Hill Book Company S.D Conte,
2. Numerical Solution of differential Equations, 2nd edition, New Age publisher, M.K. Jain
3. Introduction to Finite Element Method, East-West Student Edition, Desai & Abel
4. Numerical Recipes in C, 2nd edition Cambridge University press by William H. Press et. al.

EC 211 ELECTRONIC DEVICES AND CIRCUITS

Modeling devices: Static characteristics of ideal two terminal and three terminal devices; Small signal models of non-linear devices.
Introduction to semiconductor equations and carrier statistics: poisson's and continuity equations, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics.
Semiconductor Diodes: Barrier formation in metalsemiconductor junctions, PN hom o- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. Field Effect Devices : JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models.
Bipolar transistors : IV characteristics and elers-Moll model; small signal models; Charge storage and transient response.
Discrete transistor amplifiers : Common emitter and common source amplifiers; Emitter and source followers.

References:

1. D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group, Chicago) 1997.

2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
4. J. Millman and A. Grabel, Microelectronics, McGraw Hill, International, 1987.
5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
6. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997.

EC 212 DIGITAL CIRCUITS

Number system, simplification of Boolean expressions, minimization techniques, Karnaugh map, Quine Mc–clusky method, combinational circuits design, Flip flops, sequential circuits design, Registers, Logic families: RTL, DTL, TTL, ECL, basic gates, fanout , power dissipation

References:

1. Digital Logic and Computer Design — M.Morris Meno, Pearson Education
2. Digital Fundamentals — Floyd and Jain, Pearson Education
3. Digital Electronics Principles and integrated Circuits — A.K.Maini, Wiley India.
4. Modern Digital Electronics — RP Jain
5. Fundamentals of digital circuits — A Anand Kumar, PHI

EC 213 NETWORK ANALYSIS AND SYNTHESIS

Time and frequency domain representation of continuous and discrete time signals(signal classification, signal operations, singularity functions, complex exponentials and geometrics, Fourier representations, Laplace and Z transforms, sampling).Time and frequency domain analysis of continuous and discrete linear systems (system classification,continuous-time linear time invariant (LTI) and discrete-time linear shift invariant (LSI) systems, Signal transmission through LTI/LSI systems, impulse response and step response, response to an arbitrary input, convolution. System representation using differential and difference equations; Eigen functions of LTI/ LSI systems, frequency response and its relation to the impulse response.

References:

1. Signals and Systems — A.V. Oppenheim, A.S. Willsky and I.T. Young.
2. Analog and Digital Signal Processing — Ashok Ambardar
3. Signals and Systems — Simon Haykin, Barry Van Veen
4. Digital Signal Processing: Principles Algorithms & Applications — John G. Prokis
5. Signals and Systems — A. Anand Kumar

EC 214 SIGNALS AND SYSTEMS

Classification of signals and systems, various system representation techniques, Fourier transforms and series, application to analysis of systems, Laplace transform its properties and applications to system analysis, Linear Time Invariant (LTI) systems and their properties, Random variables and random process, characterization of random variables and random process, random signals.

References:

1. Signals and Systems — A.V. Oppenheim, A.S. Willsky and I.T. Young.
2. Analog and Digital Signal Processing — Ashok Ambardar
3. Signals and Systems — Simon Haykin, Barry Van Veen
4. Digital Signal Processing: Principles Algorithms & Applications — John G. Prokis
5. Signals and Systems — A. Anand Kumar

EC 215 INSTRUMENTATION AND CONTROL

Types of Instruments, Types of error, Measurement and error, Static and Dynamic characteristics of measurement. Measurement of voltage, current, impedance and power. Transducers, Digital Measurements and displays devices.
Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

References:

1. Electronics Instrumentation & Measurement System — A.K. Shawney
2. Electronics Measurement and Instrumentation — Kalsi, PHI
3. Control System Engineering — Nagrath & Gopal
4. Linear Control System — B.S.Manke
5. Modern Control System — R.C. Dorf & R.N. Bishop
6. Modern Control Engineering — K. Ogata

EC 216 Lab I (Selected experiments in the area of Electronic Circuits and Digital Circuits)
Electronics Circuit Lab Experiments

1. Study of BASIC ELECTRONICS COMPONENTS
2. Study of CRO, FUNCTION GENERATOR, MULTIMATE, D.C. POWER Supply
3. Study and plot Diode Characteristics of Si.
4. Study and plot Diode Characteristics of Ge.
5. Study and plot Bipolar Junction Transistor (BJT) Characteristics in CE configuration.
6. Study and plot Bipolar Junction Transistor (BJT) Characteristics in CB configuration.
7. Study and plot Bipolar Junction Transistor (BJT) Characteristics in CC configuration.

8. Study and plot Field Effect Transistor (FET) Characteristics.
9. Study and plot Metal Oxide Field Effect Transistor (MOSFET) Characteristics.
10. Study and plot Uni-Junction Transistor (UJT) Characteristics.
11. Design Half wave rectifier using diode.
12. Design Full wave rectifier using diode.
13. Design Clipper using diode.
14. Design Clamper using diode.
15. Study of PCB and layout.
16. How an industry works – A survey.
17. Survey of electromagnetic spectrum.
18. Assembling an electronic circuit on PCB and testing it.
19. Simulation of a electronic circuit using simulation software

Digital Circuits - Lab Experiments

1. Experiment to study and implement all the logic gates and to verify their outputs.
2. Experiment to study and implement NAND gate as universal gate.
3. Experiment to study and implement NOR gate as universal gate.
4. Experiment to study and implement XOR gate.
5. Experiment to study and implement binary code conversion to grey code conversion.
6. Experiment to study and implement grey code to binary code conversion.
7. Experiment to study and implement HALF-ADDER circuit.
8. Experiment to study and implement FULL-ADDER circuit.
9. Experiment to study and implement HALF –subtractor circuit.
10. Experiment to study and implement JK-Flip Flop.
11. Experiment to study about the working of multiplexer and its operation as a logic level generator.
12. Study of logic gates using ICs and discrete components.
13. Verify 8:1 MUX and 1:8 DEMUX
14. Study of RAM using IC 7489
15. Study of CMOS Inverter
16. Interface CMOS to TTL and viceversa
17. Study of FFs – RS, D, T and JK
18. Study of decade counter IC 7490
19. Study of 4-bit ripple counter IC 7493
20. Study of shift register IC 74194/195
21. Study of 4-bit comparator IC – 7485
22. Working project made by the student at the end of Lab.

EC 217 Lab II (Selected experiments in the area of Network and Instrumentation & Control)

Network Lab Experiments

1. Study of Superposition Theorem
2. Study of cascaded 2 port network
3. Study of Reciprocity Theorem
4. Study of Tellegans theorem

5. Network theorems (superposition, Norton's, thevinins, maximum power transfer)
6. Study of Millman's theorem
7. Study of maximum power transfer theorem
8. Network theorem (Norton's & thevinins)

Instrumentation & Control Lab Experiments

1. Study different ac waveforms and measure peak, rms voltage and frequency using a Digital Storage Oscilloscope
2. Phase Difference Measurement using Lissajous plots on DSO
3. Design and analysis of Wheatstone bridge
4. Design a Schering Bridge to measure unknown capacitance
5. Temperature Detection using RTD
6. Load Measurement using Strain Gauge
7. Design Wein Bridge for frequency measurement
8. Design & Develop First Order Type zero system &determine its impulse response
9. Design a Derivative Controller
10. Design an Integral Controller
11. Design a 1st order low pass Butterworth Filter and determine its cut off frequency
12. Study of Lab View software for modeling and simulation of instrumentation circuits
13. Time domain analysis of first order control systems on simulation software 20-sim Version 4.4

B.Tech. Fourth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 221	Linear Integrated Circuits	3	-	-	3
EC 222	Microprocessors and Microcontrollers	3	-	-	3
EC 223	Analog Communication	3	-	-	3
EC 224	Comm. Networks & Transmission Lines	3	-	-	3
EC 225	EM Fields	3	-	-	3
EC 226	Data Structures	3	-	-	3
EC227	Linear Integrated Circuits & Microprocessors and Microcontrollers (Lab 1)	-	-	**4**	2
EC 228	Analog Communication & Data Structure (Lab. 2)	-	-	**4**	2
				Total	Credit 22

EC 221 LINEAR INTEGRATED CIRCUITS

Introduction to operational amplifiers: The difference amplifier and the ideal operational amplifier models, concept of negative feedback and virtual short ;Analysis of simple operational amplifier circuits; Frequency response of amplifiers, Bode plots.
Feedback: Feedback topologies and analysis for discrete transistoramplifiers; stability of feedback circuits using Barkhausen criteria.Linear application operational amplifiers: Instrumentation and Isolation amplifiers; Current and voltage sources; Active filters.Non-linear applications of operational amplifiers: Comparators, clippers and clampers;Linearization amplifiers; Precision rectifiers; Logarithmic amplifiers, multifunction circuits and true rms convertors.
Waveform Generation: sinusoidal feedback oscillators; Relaxation oscillators, square-triangle oscillators. Real operational amplifiers: Current sources and active loads, difference, intermediate and output stages including Miller capacitors for frequency computation; Operational amplifier parameters; Effects of real operational amplifier parameters on circuit performance.
Analog and Digital interface circuits: A/D, D/A Converters, S/H circuits and multiplexers.

References:

1. Introduction to Operational Amplifier theory and applications — J.V. Wait, L.P. Huelsman and GA Korn, 2nd edition, McGraw Hill, New York, 1992.
2. Microelectronics — J. Millman and A. Grabel, 2nd edition, McGraw Hill, 1988.
3. The Art of Electronic — P. Horowitz and W. Hill, 2nd edition, Cambridge University Press, 1989.
4. Microelectronic Circuits — A.S. Sedra and K.C. Smith Saunder's College Publishing, 1991.

EC 222 MICROPROCESSORS AND MICROCONTROLLERS

Microprocessors (8085) - internal architecture, Instruction set and assembly language programming. Introduction to 8086 microprocessor, internal architecture, pin description, memory segmentation, addressing modes, instruction set and assembly language programming. Basic Interfacing devices: Memory interfacing, 8255, 8253, 8259, 8257, 8251, Interfacing A/D and D/A converters, Case studies of microprocessor based systems. Salient features of advanced microprocessors: 80286,386,486, Pentium
Introduction to 8051 microcontrollers, its architecture, pin description, I/O configuration, interrupts, addressing modes, an overview of 8051 instruction set, Microcontroller applications.

References:

1. 8085 Microprocessor — Ramesh Goenkar, Prentice Hall
2. Microprocessor and Interfacing — D. V. Hall
3. The 8051 Microcontroller — Kenneth J Aya
4. THE INTEL MICROPROCESSORS — BARRY B. BREY, Pearson Prentice Hall

EC 223 ANALOG COMMUNICATION

Basic blocks in a communication system: transmitter, channel and receiver; baseband and passband signals and their representations; concept of modulation and demodulation. Continuous wave (CW) modulation: AM, DSB/SC, SSB, VSB, methods of generation; Demodulation techniques of CW modulation: coherent and non-coherent; Nonlinear modulation techniques: FM and PM, narrowband FM, wideband FM, methods of generation; FM spectrum; Demodulation techniques for FM; Frequency Division Multiplexing (FDM); Radio transmitters and receivers. Performance of analog modulation schemes in AWGN : CNR, post-demodulation SNR and figure of merit for AM, DSB/SC, SSB, FM, threshold effect in FM, pre-emphasis and de-emphasis in FM, FMFB. Noise in receivers; Noise figures; Radio link design**References:**

1. Modern Digital and Analog Communication Systems — B.P.Lathi,
2. Communication Systems — Simon Haykins
3. Communication Systems — A. B. Carlson
4. Analog & Digital Communication — R.P. Singh & Sapre
5. Communication Engineering — Rao

EC 224 COMMUNICATION NETWORK AND TRANSMISSION LINES

Lattice and bridge T networks, Attenuators and their design, Wave filters. Transmission Line Introduction, Transmission Line Analysis, Physical Interpretation of Voltage & Current Solution, Standing Waves on Transmission Line & Impedance Transformation, Loss less Transmission Line, Impedance Characteristics of Loss less Transmission Line, Graphical Approach for Transmission Analysis, Transmission Line Calculations Using Smith Chart, Transmission Line Analysis in terms of Admittance, Applications of Transmission Lines, Impedance Matching using Transmission Line, Measurement of characteristics parameters of various lines

References:

1. Network and Transmission Lines — J.D. Ryder
2. Network and Transmission Lines — G.K.Mithal
3. Network and Transmission line — Umesh Sinha

EC 225 EM FIELDS

Review of vector algebra, Electric and Magnetic field overview and applications, Maxwell's equations for static and time varying field, boundary conditions for conductor and dielectric.
Wave equations for free space, uniform plane waves, linear elliptical and circular polarization, wave equations for conducting medium, wave propagation in conductors and dielectric, depth of penetration, reflection and refraction of plane waves by conductor and dielectric, Poynting vector and flow of power, wave between parallel planes, concept of TE, TM & TEM waves.

References:

1. Elements of Electromagnetics — Mathew N.O. Sadiku,
2. Engineering Electromagnetics — W.H. Hayt,
3. Introduction to Electrodynamics — David J. Griffithe
4. Engineering Electromagnetics, Mc Graw Hill — John D Kraus

EC 226 DATA STRUCTURES

Introduction: Data Structure and Abstract data types, Organization of Arrays, Structures, Pointers, Recursion.

Stacks: Stack Implementation and Applications, Prefix Postfix and Infix Conversion, Use of Stack in Recursion.

Queues: Linear Queue and Circular Queue, Applications of Queue.

Linked Lists: Type of Linked Lists, Implementation of Stack and Queue using Linked list.

Trees: Tree Concept, Binary Tree and it's Representations, Applications of Binary Tree, Huffman Coding, Binary Search Tree.

Graphs: Graph and it's Representations, Algorithms on graph.

Sorting and Searching: Fundamental Searching algorithms (Sequential Search, Binary Search etc) Fundamental Sorting Algorithms (Selection Sort, Bubble Sort, Insertion Sort etc).

References:

1. Data Structure Using C by Tanenbaum.
2. Data Structures by Horowitz and Sahni

EC 227 Lab I (Selected experiments in the area of Linear Integrated Circuits and Microprocessors & Microcontroller)

Linear Integrated Circuits Lab Experiments

1. **CE , CB , CC Amplifiers.**
   a. To measure the voltage gain and plot the frequency response characteristics of CE Amplifier.
   b. To measure the voltage gain and plot the frequency response characteristics of CC Amplifier.
   c. To measure the voltage gain and plot the frequency response characteristics of CB Amplifier.
2. **Transistor Biasing methods.**
   a. To measure voltage gain for Fixed bias condition of the transistor.
   b. To measure voltage gain for Collector Base bias condition of the transistor.
   c. To measure voltage gain for Emitter Base bias condition of the transistor.
3. **Narrow Band Amplifier.**
   a. To measure the voltage gain of the Narrow Band Amplifier.
4. **Push Pull Amplifier.**
   a. To measure the voltage gain(AV) of the class B push pull Amplifier.
   b. To find out the Power gain of the class B push pull Amplifier.
5. **Wide Band Amplifier.**
   a. To measure voltage gain of Wide Bnad Amplifier and observe its bandwidth.
6. **MOSFET Amplifier.**

a. To measure the voltage gain of the MOSFET Amplifier.

7. **Thermal Stability of Transistor.**
   a. First connect the given connector has shown.
   b. Now increase the different values of transistor parameters as given.
   c. Measure Ve , Vc , Vb , Vbe , Ic of transistors and note down.
   d. Now increase the temperature of transistors of some degree and measure the above value again and make the conclusion according to theory of thermal stability.
8. **Negative Feedback Amplifier.**
   a. To measure the voltage gain of the amplifier with or without feedback.
   b. To plot frequency response with and without feedback for transistor amplifier.

Micro Processor & Micro Controller-Lab

1. Write C program to interface stepper motor.
2. Write C program to interface DC motor.
3. Write C program to interface traffic light controller.
4. Write C program to interface Elevator.
5. Write C program to interface ADC-DAC controller.
6. Write C program to interface temperature controller.
7. Write C program to interface DAC controller.
8. Write a program to add two 8-bit BCD numbers.
9. Write a program to add 'n' 8-bit BCD numbers.
10. Write a program to add two 'n' byte BCD numbers.
11. Write a program to perform 8-bit binary subtraction.
12. Write a program to perform 8-bit binary subtraction by 1's compliment method.
13. Write a program to perform 8-bit binary subtraction by 2's compliment method.
14. Write a program to perform 8-bit binary subtraction by 9's compliment method.
15. Write a program to perform 8-bit binary subtraction by 10's compliment method.
16. Write a program to perform two 'n' byte binary subtractions.

EC 228 Lab II (Selected experiments in the area of Analog Communication and Data Structures)

Analog Communication Lab Experiments

1) Double side band AM Generation.
2) Double side band AM Reception.
3) Single side band AM Generation.
4) Receiver Characteristics (Selectivity, Sensitivity, Fadelity).
5) Frequency Modulation using Reactance Modulator.
6) Frequency Modulation using Varactor Modulator.
7) Quadrature Detector.
8) Operation of Phased locked loop Detector.
9) Operation of Foster – Seeley loop Detector.
10) Operation of Ratio Detector.

Data Structures Lab Experiments

1. Implement singly and doubly linked lists.
2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement stack and use it to convert infix to postfix expression
4. Implement array-based circular queue and use it to simulate a producer- consumer problem.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement priority queue using heaps
8. Implement hashing techniques.
9. Implement Dijkstra's algorithm using priority queues
10. Implement a backtracking algorithm for Knapsack problem
11. Implement the following searching and sorting algorithm Bubble Sort,insertion sort, selection sort, heap sort, quick sort merge sort, bin sort, binary search, Fibonacci search

B.Tech. Fifth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 311	Digital Communication	3	-	-	3
EC 312	Digital Signal Processing	3	-	-	3
EC 313	VLSI Design	3	-	-	3
	Departmental Elective 1	3	-	-	3
	Departmental Elective 2	3	-	-	3
	Open Elective 1	3	-	-	3
EC 314	Digital Comm. & DSP (Lab 1)	-	-	**4**	2
EC 315	CNTL & VLSI Design (Lab 2)	-	-	**6**	3
					Total Credit 23

EC 311 DIGITAL COMMUNICATION

Introduction to Digital Communication, Sampling ,Quantization , PCM ,DPCM, Delta Modulation, ADM. Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density, random process. Digital modulation schemes: Binary modulation schemes- ASK, PSK, FSK, DPSK; M-ary modulation schemes: QPSK,MSK,QAM: generation and demodulation schemes, matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Carrier recovery techniques,BER analysis of digital modulation systems. Spectral efficiency of digital modulation

schemes. Basics of TDMA, FDMA and CDMA and GSM. Concepts of information and entropy; Source coding: Coding theorem, fixed length codes; variable length codes,Line coding techniques: Binary and multilevel line codes.

References:

1. Principles of communication systems — H. Taub and D.L. Schilling
2. Modern digital and analog communication systems — B.P. Lathi
3. Digital Communication — Simon Haykin
   Communication Systems — A B Carlson

EC 312 DIGITAL SIGNAL PROCESSING

Discrete time systems, linear time invariant (LTI) systems and important properties. Z-transform. Signal flow graphs and digital system representation Discrete Fourier transform (DFT) and its properties. Fast Fourier transforms, Introduction to transformation matrices in a general form. Digital filters, FIR and IIR. FIR filters, structure, designs. IIR filters, Applications of DSP.

References:

1. Digital Signal Processing: — S. Mitra,
2. Digital Signal Processing, Algorithm and Applications — John C. Proakis & Dimities Manolakis
3. Discrete Time Signal Processing — Oppenheim and Schafer

EC 313 VLSI Design

Introduction of VLSI Design Methodologies – Design Description domains, Introduction to HDL – HDL Design Examples, CMOS Circuits & Logic design – basic physical design of simple logic gates, CMOS logic Structures, clocking strategies, I/O Structures, System design and methods – CMOS design methods, CMOS design options, layout and stick diagrams.

References:

1. VLSI Technology — Wyne wolf
2. Principles of CMOS VLSI design — Neil H.E. Weste & Kamraneharghian
3. CMOS VLSI Design — Harris, Weste, Banerjee

EC 314 Lab I (Selected experiments in the area of Digital Communication & DSP)

Digital Communication Lab Experiments

1) Pulse Amplitude Modulation using Natural and Flat-Top Sampling.
2) Pulse Amplitude Demodulation.
3) Pulse Position Modulation and Demodulation.
4) Pulse Width Modulation and Demodulation.

5) Study of Signal Sampling and Reconstruction Techniques.
6) Reconstruction and comparison of Sampled Output with 2^{nd} and 4^{th} Order Low Pass Filter.
7) Pulse Code Modulation.
8) Delta Modulation.
9) Generation of RZ and NRZ Data Formats.
10) Study of Digital Modulation Schemes.

DSP Lab Experiments

1. Getting started with MATLAB
2. Matrices and array operations
3. Graphical operation using MATLAB
4. Programming with MATLAB
5. Creating Graphical user interface
6. Basic Signal Processing Concepts
7. Design a Filter with fdesign and filterbuilder
8. Spectral Analysis using MATLAB
9. Filtering, Linear Systems and Transforms Overview
10. Filter Design and Implementation

EC 315 Lab II (Selected experiments in the area of CNTL & VLSI Design lab)

CNTL Lab Experiments

1. Verification of Thevinins theorem
2. Verification of Norton's theorem
3. M-derived T type passive Low Pass & High Pass Filter
4. RC Low Pass, High Pass, Band Pass and Band Stop Filters
5. Twin T Active notch filter using OP-AMP
6. T Type passive Low pass, High Pass, Band Pass & Band Stop Filters
7. Transient Response of RLC circuits
8. T type passive Low Pass, High Pass, Band pass and Band stop filters
9. T, Pi & Bridge T-type Attenuators

VLSI Design lab experiments

Write a VHDL program to implement a half adder using logic gates.

1. Write a VHDL program to implement a full adder using
    i) Basic logic gates
    ii) Using half adder
2. Write a VHDL program to implement a 4X1 MUX
    i) Using case statement
    ii) Using "?:" statement
    iii) Using If-Else Statement
3. Write a VHDL program to implement a simple 4-bit adder.
4. Write a VHDL program to implement a BCD to Gray Code Converter.
5. Write a VHDL program to implement a 4-bit unsigned comparator

6. Write a VHDL program to implement a D flip-flop using process statement.
7. Write a VHDL program to implement a JK flip flop.
8. Write a VHDL program to implement a 0 to 15 counter.
9. Write a VHDL program to implement a BCD counter.

B.Tech. Sixth Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 321	Digital Image Processing	3	-	-	3
EC 322	Optical Communication	3	-	-	3
EC 323	Microwave Engg.	3	-	-	3
	Departmental Elective 3	3	-	-	3
	Departmental Elective 4	3	-	-	3
	Open Elective 2	3	-	-	3
EC 324	Digital Image Processing (Lab 1)	-	-	**2**	**1**
EC 325	Optical & Microwave (Lab 2)	-	-	**4**	**2**
EC 326	Minor Project	-	-	**4**	2
					Total Credit 23

EC 321 DIGITAL IMAGE PROCESSING

Digital Image Fundamentals, Sampling and Quantization, Image Enhancement in spatial domain, Image Enhancement in frequency domain, Image denoising, estimation of image degradation, Image segmentation, Thresholding, Region growing , Region splitting, Image Compression, Digital water marking, object recognition.

References:

1. Digital Image Processing — Gonzalez and Woods
2. Digital Image Processing: — A.K Jain

EC 322 OPTICAL COMMUNICATION

Overview of Optical Fiber Communication: Basic concepts, laws and definition, mode theory analysis for optical communication, optical fiber modes and configuration, wave propagation in optical fiber, operating wavelength, single mode and multimode fibers, V–numbers, mode field diameter, numerical aperture, refractive index profiles. Losses in optical fibers. Dispersion in optical waveguides, group delay, Design optimization of advance single mode fibers and dispersion compensating fibre. Trends in fiber design.

Optical Sources & Optical Detectors: Structure, principle and their characteristics, BER. Overview of analog and digital optical link, Point to point link system consideration: Link power budget and risc time analysis .Line coding Fiber Optic Networks**,**optical amplifiers, WDM & DWDM Optical System, Optical Networks – SONET/SDH, Optical Layer, future of fiber–optic network

References:

1. Optical Fiber Communication — G. Keiser
2. Fiber Optic Communication Technique — D.F. Mynbacv and L. Scheiner
3. Optical Fiber Communication — John M Senior
4. Introduction to fiber Optics — A. Ghatak & K. Tyagrajan

EC 323 MICROWAVE ENGINEERING

Characteristic, features and applications of microwaves, waveguides, Microwaves generators. Scattering matrix representation of microwave networks, properties of scattering matrices, S-matrices for directional coupler, E plane H plane and magic tee, isolator, circulators, directional couplers. Ferrite devices, Gunn effect, Gunn Diode oscillators, Avalanche effect, diodes and their applications. Planer transmission lines such as stripline, microstrip line, slotline etc., Technology of hybrid MICs, advantages of MICs. VSWR measurement, microwave power measurement, impedance measurement, frequency measurement, transmitter and receiver architectures, terrestrial communication.

References:

1. Microwave Devices and Circuits — Liao
2. Microwave Engineering and Applications — O. P.Gandhi
3. Microwave and Radar Engineering — M. Kulkarni
4. radio-frequency and microwave communicationCircuits — Devendra k. Misraa john wiley & sons, inc., publication

EC324 Lab I (Digital Image Processing LAB)

List of Digital Image Processing LAB Experiments

1. Introduction of Image processing Toolbox
2. Reading and Writing Image Data
3. Displaying and Exploring Images
4. Spatial Transformations
5. Designing and Implementing 2-D Linear Filters for Image Data
6. Image Transforms
7. Morphological Operations
8. Analyzing and Enhancing Images
9. ROI-Based Processing
10. Neighborhood and Block Operations

EC325 Lab II (Selected experiments in the area of Optical & Microwave)

Optical Communication Lab Experiments

1. Setting up a fiber optic analog link
2. Setting up a fiber optic digital link
3. Losses in optical fiber
4. Measurement of numerical aperture
5. Time division multiplexing of signals
6. Framing in time division multiplexing

7. Marker in time division multiplexing
8. Manchester coder/decoder
9. Voice digitization: a law
10. Electromagnetic/ radio frequency interference

Microwave Lab Experiments

1 To get familiar with Microwave bench and study of Its components
2 Measurement and study of Reflex klystron (Microwave source)
3 Study of variable ATTENUATOR and its characteristics
4 Frequency measurement using Frequency meter
5 Frequency measurement using Slotted line and VSWR meter
6 Low VSWR measurement using VSWR meter
7 High VSWR measurement using VSWR meter and SS tuner
8 To determine Gain, beam width and field pattern of Horn antenna
9 Measurement of Coupling and directivity of DIRECTIOANL COUPLER
10 Study of ISILATOR, CIRCULATOR, E-plane, H-plane, Magic Tee

EC326 Minor Project

List of Departmental-Electives for III year

EC 331 Digital System Design **EC 332 Computer Network**
EC 333 Neural Network **EC 334 Telecom Switching Systems**
EC 335 Data Compression and Cryptography **EC 336 Design of Analog IC's**
EC 337 VLSI Technology

EC 331 DIGITAL SYSTEM DESIGN

Review of sequential circuits, Mealy & Moore Models, Analysis & Synthesis of Synchronous sequential circuits, Digital system design Hierarchy, ASM charts, Reduction of state tables, State Assignments, Analysis and synthesis of Asynchronous sequential circuits, critical and non-critical races, Essential Hazard, Digital system design implementation options: ASICs – Full custom, gate array based, standard cell based and Programmable ASICs, Antifuse, SRAM, EEPROM/EPROM Technologies for Programmable ASICs.

Combinational and sequential circuit design with PLD's , Introduction to CPLD's & FPGA's, Digital system modeling: Behavioral, structural and physical domains, Fault Modeling.

References:

1. Digital principles and design–By Donald D.Givone
2. Digital Design – By Morris Mano- 3rd Edition, PHI
3. An Engineering Approach to Digital Design: William I. Fletcher (PHI)
4. Digital Design Principles and Practices - John F Wakerly, Pearson Education, Fourth Edition
5. Digital Design using VHDL - Charles H Roth, Jr. Lizy Kurien John, Cengage Publishers, India Second Edition
6. Introduction to Digital Systems- Ercegovac. Lang & Moreno, John Wiley (1999).
7. Digital system Design using FPGA & CPLD 'S - Grout ,Elsevier

EC 332 COMPUTER NETWORKS

Introduction Concepts: Goals and Applications of Networks, Network Topologies and architecture, The OSI reference model .Physical Layer, Transmission Media, Line coding: Uni-polar, Bi-polar, RZ, NRZ, Menchester and Differential Menchester codes, Switching methods: Circuit, message, packet switchings. Functions of Data link layer – Framing, Error control, Flow Control, Sliding window protocols, Medium Access control (MAC) sub layer: MAC protocols: ALOHA, Slotted ALOHA, Token bus, Token Ring, Round Robin, CSMS/CA, Bit mapped protocol, Carrier Sense Multiple Access (CSMA): Collision Avoidance, Collision Detection, p-Persistent, 1-Persistent, Non-Persistent spectrum sensing, Ethernet frame, Network Layer, logical addressing (i.e. IPv4 addresses and header), Routing algorithms, Least cost routing algorithms: Dijkstra and Bellman Ford algorithms. Transport Layer: TCP and UDP, Application Layer, Other application. Overview of IEEE standards – IEEE 802.3(LAN), IEEE 802.11a,b,g,n (WLAN), IEEE 802.15 (PAN), FDDI. Networking Devices: Bridge, Hub, Switch, Router, Gateway, Servers. Example of Networks – Internet, Public Switched Network (PSTN), ISDN, B-ISDN and ATM Networks.

References:

1. Data Communication and Networking — Forouzen
2. Computer Networks — A.S. Tanenbaum
3. Data and Computer Communication — W. Stallings.
4. Data Networks — D.P. Bertsekas, R.G. Gallager
5. ISDN and B-ISDN — W. Stallings

EC 333 Neural Network

Introduction of artificial neural networks, fundamental models of artificial neurons, artificial neural network architectures, feed forward and feedback neural networks, neural networks learning methods, radial basis function networks, Hopfield network, self organizing map (SOM), application of neural networks.

References:

1. Neural Networks: A Comprehensive Foundation — Simon Haykin,.
2. Fundamentals of Artificial Neural Networks — Mohamad H. Hassoun
3. Neural Networks: A class room approach — Satish Kumar,

EC 334 TELECOM SWITCHING SYSTEMS

Basics of switching system, signaling tones, touch tone dial telephone, exchange organization. Four wire concept, operation of hybrid, echo suppressors. Centralized and distributed SPC, software architecture, application software, enhanced services offered by SPC. Space Division Switching, Time Division Switching, Combination Switching, PBX switching, PBX networking, digital PBX, Traffic Engineering, Telephone Networks, Data Networks, mobile communication, IP telephony.

Local Access Techniques :- Digital subscriber lines, DSL, ADSL etc, WLL, FIL.

References:

1. Telecommunication Switching Systems and Networks — Thiagarajan Viswanathan
2. Digital Telephony — John C. Bellamy
3. Telecommunication switching traffic and networks — J. E. Flood

EC 335 DATA COMPRESSION AND CRYPTOGRAPHY

Introduction. Basic motivating scenarios for cryptography. History. Information-theoretic secrecy.Block ciphers. Standard modes of operation.Pseudorandom functions. Pseudorandom permutations. The birthday paradox. Applications. One-way functions.Symmetric encryption schemes. Definitions. IND-CPA. Security of standard modes of operation. IND-CCA2.Message authentication. MACs. Definitions. PRFs as MACs. CBC-MAC.Authenticated encryption. INT-PTXT. INT-CTXT. Non-malleability.Commitment schemes. Hard-core predicates. Goldreich-Levin theorem.Pseudorandom generators. PRG's from OWF's. Blum-Micali-Yao.PRF's from PRG's. Goldreich-Goldwasser-Micali.Basics on number theory. Number-theoretic primitives. RSA. Rabin's function. Definition of trapdoor one-way functions.Public-key encryption. Definitions. Semantic security. Message indistinguishability. Goldwasser-Micali cryptosystem. Hybrid encryption.Digital signatures. Trapdoor signatures. RSA. Random oracles. Full-domain hash. PSS.Zero knowledge proofs. Proofs of knowledge.Foundations. Constructions of signatures based on any one-way function. Oracles and separations.

References:

1. Cryptography and Network Security: Principles and Practice by E William Stalling,
2. Understanding Cryptography:A Textbook for Students and Practitioners, Christof Paar, Jan Pelzl ,Springer

EC 336 DESIGN OF ANALOG IC's

Introduction to Analog Design, Single stage Amplifier, Differential Amplifier, Passive and Active current Mirror , Frequency Response of Amplifier, Noise, Feedback, Operation Amplifier, Stability and Frequency Compensation, switched capacitor circuits.

References:

1. Design of Analog CMOS Integrated Circuits — Behzad Razavi, McGrawHill,
2. Analysis and Design of Analog Integrated Circuit — Paul R. Gray, Paul J. Hurst,
3. Analog Design Essentials — Willy Sansen, Springer, 2006.

EC 337 VLSI TECHNOLOGY

Design and Technology overview, Fabrication process – crystal growth, epitaxy, oxidation, lithography, etching, film deposition, diffusion, ion implantation, metallization.
VLSI process integration – NMOS, CMOS, BJT. Assembly techniques, packing of VLSI devices.

References:

1. VLSI Technology — C.Y. Chang and S.M.Sze,
2. VLSI Fabrication Principles — S.K. Ghandhi,
3. VLSI Technology — S.M. Sze,

LIST OF OPEN ELECTIVES FOR III YEAR

EC 351 Operating System	**EC 352 Advance Instrumentation**
EC 353 TCP-IP	**EC 354 Fuzzy Logic**
EC 355 Biometric Signal Processing	**EC 356 Telecom Technology Management**

EC 351 OPERATING SYSTEM

Introduction to Operating Systems: Operating system definition and functions, Types of operating systems: Batch processing, time sharing and multiprogramming operating system.
Processor and processor scheduling: Process concept, process states and state transition diagram, CPU scheduling algorithms.
Process synchronization: Need for process synchronization, classical problems on process synchronization (producer consumer problem, critical section problem, etc), semaphores.
Deadlock: Characterization, prevention and avoidance schemes, deadlock detection and recovery.
Memory management: Contiguous memory management schemes, Non- contiguous memory management schemes, virtual memory, demand paging, page replacement algorithms.
Secondary storage management: Disk structure, disk scheduling, directory organization, file allocation and access methods.

References:

1. Operating system — Silberschatz and Galvin,
2. Operating system — D.M. Dhamdhare,
3. Operating system — Andrew S. Tanenbaum,
4. Operating system — William Stallings.

EC 352 ADVANCE INSTRUMENTATION

Conductivity measurement. Smart sensors-block diagram, Smart transmitter. Recent trends in sensor technology **–** Semiconductor sensors**–**Film sensors-MEMS-Nanosensors.
Voltage, Time, Phase measurement using digital techniques –Input circuits of digital voltmeter–auto zero circuit–bipolar operation–buffer circuit–protection–auto ranging–tracking method. Ratiometric Measurements-Applications–Measurement of modulation index, Q of a coil Noise in instrumentation systems, electromagnetic interference, methods of noise coupling, noise sources, grounding.
Virtual Instrumentation–concepts–historical perspective–virtual versus real instrumentation–advantages of virtual instrumentation–block diagram and architecture of a virtual instrument–Physical quantities and analog interfaces– Hardware and software–User Interfaces–Applications of virtual instrumentation.

Common Instrument Interfaces – RS232C, RS422A, RS 432A, RS485A, USB, General Purpose
Interface Bus (GPIB), Standard Commands for Programmable Instrumentation (SCPI), VME Extensions for Instrumentation (VXI), Multisystem Extension Interface (MXIbus), Enhanced Parallel Port. Virtual Instrument Software Architecture.

References:

1. Principles of Industrial Instrumentation, D. Patranabis, 2nd ed., Tata McGraw Hill
2. Digital Measurement Techniques, T. S. Rathore, 2nd ed., Narosa Publishing House,
3. LabVIEW Graphical Programming: Practical Application in Instrumentation and Control, G. W. Johnson

EC353 TCP-IP

Introduction to TCP/IP, TCP/IP Reference model, OSI Reference Model, The TCP/IP Model vs. the OSI Model, IP Addressing (IPv4 and IPv6), IPv4 & IPv6 Protocols and headers, TCP and UDP protocols and headers, Port numbers and Sockets, Internet Control Message Protocol (ICMPv4 & ICMPv6). TCP, UDP and their headers, Domain Name System (DNS), Dynamic Host Configuration Protocol (DHCP), HTTP, Simple Mail Transfer Protocol (SMTP), Securing TCP/IP Environments (IPsec), Introduction to Network Management System (NMS), SNMP. Assignment-Web development using HTML, Java Script

References:

1. Internetworking with TCP/IP, 4th Edition PHI, Douglas E. Comer
2. TCP/IP Illustrated, Volume 3 W. Richard Stevens
3. Internet Routing Architectures, 2nd Edition Sam Halabi
4. Interconnections, 2nd Edition: Bridges, Routers Radia Pe
   Switches, and Internetworking Protocols

EC 354 Fuzzy Logic

Classical sets and fuzzy set, classical relation and fuzzy relation, properties of membership functions, fuzzification and defuzzification, logic and fuzzy systems, development of membership functions, fuzzy classification, decision making with fuzzy information, fuzzy optimization.

References:

1. Fuzzy Logic with Engineering Applications T. Ross,
2. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and B. Yuan
3. Introduction to Fuzzy Sets and Fuzzy Logic M. Ganesh.

EC 355 Biometric Signal Processing

Introduction to biometric signals, Types of biometric signals. Bio-indicators, Biomarkers, Fingerprint analysis, face recognition, Iris pattern analysis, Retina identification systems, Signature verification, Additional Biometric Traits, Multi-biometrics.

References:

1. 1.Introduction to Biometrics — Anil Jain, Arun A. Ross and Karthik Nanda kumar, Springer Science & Business Media,
2. Biometric Systems: Technology, Design and Performance Evaluation — James L. Wayman, Anil Jain, Davide Maltoni, Maio, Springer Science & Business Media, 2005
3. Biometrics: Personal Identification in Networked Society — Anil Jain, Ruud Bolle, Sharath Pankanti, Springer Science & Business Media,

EC 356 TELECOM TECHNOLOGY MANAGEMENT

Objectives of course: To facilitate the understating of Techo-managerial issue of telecommunications domain with specific focus on Indian Telecom sector.

Course outline:

Basic understanding of Global telecom scenario with specific focus Indian telecom market.Policy related issues (spectrum auctions) of Indian Telecom market and value chain analysis of telecom sector, with stake holders analysis. Procurement of various telecom technologies(state –of –art) Project management of Telecom communication projects for Smart cities and smart nation, including rural India. Various business models for Telecom companies including private and public companies. Five force analysis of Global and Indian telecom market. HR related issues like Technology adoption and technology diffusion etc, and marketing models of telecom services. Future Trends & challenges of Telecom services in view of global economic scenario.

B.Tech. Seventh Semester

Course No.	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC 411	Antenna and Wave Propagation	3	-	-	3
	Departmental Elective 5	3	-	-	3
	Departmental Elective 6	3	-	-	3
	Open Elective 3	3	-	-	3
	Open Elective 4	3	-	-	3
EC 412	Antenna and Wireless Comm. (Lab)	-	-	**4**	2
EC 413	Major Project	-	**-**	**4**	2
EC 414	Educational Tour & Training.	-	-	2	1
					Total Credit 20

EC411 ANTENNA AND WAVE PROPAGATION

Radiation, radiation field from current element antenna, radiation power and radiation resistance of short dipole and half dipole antenna, field and phase of point sources, directivity and gain, direction and gain calculation of short and half wave antenna. Introduction to antenna as an aperture, effective length, resonant and traveling wave antenna for different wave length, antenna arrays of point sources, two element array, end fire and broad side arrays, uniform linear arrays of N elements, patterns and principal of pattern multiplication, loop and helical antennas, Yagi-Uda antenna, folded dipole, turn side, rhombic antenna. Huyggen's principle, Babinet's principles & complimentary antenna, horn antennas, reflector antennas, log periodic antenna, slot antenna, polarization measurements, field strength measurement, Feeders for exciting resonant antenna, center fed and end fed, Ground wave propagation surface wave propagation, space wave propagation, reflection of wave by earth's surface, reflection coefficient of vertically and horizontally polarized wave, space wave propagation, range of propagation, propagation beyond the line of sight, duct propagation. Troposphere, scatter, field strength of tropospheric wave, ionosphere, virtual heights, critical frequencies, refractive index of ionized region, reflection and refraction of radio waves in ionosphere, influence of earth's magnetic field, loss of energy in ionosphere, single hop and multiple hop transmissions, skip distance and maximum usable frequency (MUF).

References:

1. Antennas — John D Krauss
2. Electromagnetic waves & Radiating Systems — Jordan & Balman
3. Antenna & Wave Propagation — K.D. Prasad.
4. Antennas for all applications — J D Kraus & Ronald J. Marhefka
5. Antenna theory — C.A. Balanis
6. Antenna & Wave Propagation — A.R. Harish & M. Sachidananda

EC412 Lab (Selected experiments in the area of Antenna & wireless Communication Lab)

Antenna Lab Experiments

1 To get familiar with Different types of ANTENNAS and Kits

2 Field pattern, beam width and directivity measurement of Dipole antenna

3 Field pattern, beam width and directivity measurement of Yagi-Uda antenna

4 Field pattern, beam width and directivity measurement of Horn antenna

5 Field pattern, beam width and directivity measurement of Loop antennas (Circular, square and rectangular loops)

6 Field pattern, beam width and directivity measurement of Microstrip Antennas (Dipole, Yagi-Uda, Circular, square and rectangular Microstrips)

7 Field pattern, beam width and directivity measurement of Helical and Sprial antennas

8 Introduction to Network Analyzer

9 Antenna Testing using network Analyzer

10 Antenna Design using CADFEKO Software (Horn, Dipole, Yagi-Uda, Loop and Micro strip antennas)

Wireless Communication Lab Experiments

Selected experiments in the area of OFDM , Multiple Input and Multiple Output (MIMO) for Multiple Access,Mobile Adhoc Network Cognitive, Radio Network etc

EC413 Major Project

EC414 Educational Tour And Training

B.Tech. Eight Semester

Course Number	Subject	Scheme of Studies Periods per week			Credits
		L	T	P	
EC421	Wireless Communication	3	-	-	3
	Departmental Elective 7	3	-	-	3
	Departmental Elective 8	3	-	-	3
	Open Elective 5	3	-	-	3
	Open Elective 6	3	-	-	3
EC 422	Major Project	-	-	6	3
EC 423	General Proficiency	-	-	4	2
					Total Credit 20

EC421 WIRELESS COMMUNICATION

Multiple Access and Channels: Orthogonal Frequency Division Multiplexing (OFDM), OFDMA, Fading channels, Multiple Input and Multiple Output (MIMO).

Mobile Adhoc Network(MANet) : Infrastructure less network, Medium access Protocols for MANet, Routing Protocols, Wireless Sensor Networks: Distributed Sensing Nodes, Power saving medium access protocols, IEEE 808.15.4.

Cognitive Radio Network (CRN): Spectrum Sensing Techniques: Energy Detector, Cyclostationary Detector, Marched Filter Detector, Radio Identification Detector, Cyclo-Energy Detector etc. Cooperative spectrum Sensing: Data and Decision cooperative spectrum sensing, Fusion Center, Spectrum Allocation Techniques, IEEE 802.22 (WRAN).

Wireless Access Networks: WLAN, IEEE 802.11, WiMAX, IEEE 802.16, LTE, Ultra Wide-Band (UWB).

1. **References:**
2.
3. "Wireless Communications:Principles and Practice", by T.S. Rappaport, Prentice Hall publication.
4. "Introduction to Wireless and Mobile Systems", by Dharma Prakash Agrawal, Qing-An Zeng, Cengage Learning publication.
5. "Ad Hoc Networking", by Perkins, Pearson publication, 2008 Edition
6. "Ad Hoc Mobile Wireless Networks", by Sudhir K. Sarkar, T.G. Basavraju, C. Puttamadappa, CRC publication.
7. "A survey of spectrum sensing algorithms for cognitive radio Applications", Tevfik Yucek, Huseyin Arslan, IEEE communications survey & tutorials, vol. 11, no. 1, 2009, pp. 116-129.
8. "Cyclo-energy detector for spectrum sensing in cognitive radio", Lei Yang, Zhe Chen, Fuliang Yin, International Journal of Electronics and Communications (AEÜ), 66 (2012), pp. 89-92.
9. "Wireless and Cellular Communications", by William C.Y. Lee, McGRAW-HILL Publication.

EC422 Major Project
EC423 General Proficiency

List of Departmental-Electives for IV Year

EC 431 Satellite Communication
EC 432 Broadband Optical Network
EC 433 Active RF Devices and Circuits
EC 434 RADAR and Navigation Systems
EC 435 Statistical Signal Processing
EC 436 Video Signal Processing
EC 437 Mobile Communication
EC 438 CAD of Digital Systems
EC 439 LOW POWER VLSI DESIGN

EC431 SATTELITE COMMUNICATION

Introduction, History of Satellites, Kepler's law, Elements of orbital mechanics.Equations of motion. Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Geostationary Satellites, Satellite System Parameters Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.
Multiple access techniques. FDMA, TDMA, CDMA. Random access techniques. Satellite onboard processing.
Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, Intelsat and Inmarsat. Satellite - based personal communication.
Earth station design. Configuration. Antenna and tracking systems. Satellite broadcasting.

References:

1. Satellite Communication D.Roddy
2. Satellite Communication T.Pratt & C.W.Bostain,
3. Design of Geosynchrons Spacecraft B.N.Agrawal

EC 432 BROADBAND OPTICAL NETWORKS

Fundamentals of telecom systems, Principles of communication and signaling, Fundamentals of transmission; mathematical models for networks, Protocols, Architectures for Broadband Networks, Access and Hybrid Networks; All optical networks. SDH, SONET; Fiber-optic LAN architectures and protocols- ring, star and bus architectures, DQDB, FDDI; High speed bus protocols- RATO-net, WDM networks- LAMBDA-net, coherent star, PASS-net, shuffle-net. Photonic Switching: Switching architectures single and multistage switching, space switching, time switching, combinations of space and time switching, SEED arrays WDM Network design - Lightpath Topology, Optical Line Terminal, Optical Add / Drop multiplexers, Optical Cross connects, Wavelength conversion.

References:

1. High Speed Networks & Internet William Stalling
2. Optical Networks Rajiv Ramaswamy and Kumar N. Sivarajan

EC433 ACTIVE RF DEVICES AND CIRCUITS

Technology Review for RF Applications, Complex Modulation; Transreceiver Architectures, Amplifier design for Power Gain, Low noise amplifier design, Fundamental of Mixers; Active Current Commutating Mixers, oscillators.

References:

1. RF Microelectronics B. Razavi, Prentice Hall of India
2. Analysis and Design of Integrated Circuits Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer,
3. The design of CMOS radio-frequency integrated circuits Thomas H. Lee

EC 434 RADAR AND NAVIGATION SYSTEMS

Introduction to Radar, Radar Equation, Radar Block Diagram, Radar Frequencies, Applications of Radar.Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, Pulse Repetition Frequency, Radar system losses. Introduction to Doppler and MTI Radar, Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target
Detector, Limitations to MTI Performance, MTI from a Moving Platform (AMIT) – Pulse Doppler Radar, Tracking with Radar –Monopulse Tracking, Conical Scan and Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking, Tracking Range, Comparison of Trackers, Automatic Tracking with Surveillance Radars (ADT). The Radar Antenna, Reflector Antennas, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency-Scan Arrays, Radar Transmitters and Receivers, Receiver noise Figure, Radar Displays. Radio Direction Finder, An Aural Null Direction Finder, The Goniometer , Adcock Direction finder, Errors in Direction Finding, Automatic Direction Finders, The Commutated Aerial Direction Finder, Hyperbolic Systems of Navigation (Loran and Decca), Loran-A , Loran-A Equipment, Range and precision of Standard Loran, Loran-C ,The Decca Navigation System

Decca Receivers, Range and Accuracy of Decca, DME and TACAN – Distance Measuring Equipment, Operation of DME – TACAN Equipments, Satellite Navigation System, Navstar Global Positioning System (GPS)

References:

1. Introduction to Radar Systems — Merrill I. Skolnik
2. Elements of Electronic Navigation Systems — N.S.Nagaraja

EC435 STATISTICAL SIGNAL PROCESSING

Power Spectrum Estimation-Parametric and Maximum Entropy Methods, Wiener, Kalman Filtering, Levinson-Durban Algorithms Least Square Method, Adaptive Filtering, Nonstationary Signal Analysis, Wigner-Ville Distribution, Wavelet Analysis. Power Spectrum Estimation, model order selection, Prony, Pisarenko, MUSIC, ESPRIT algorithms, least square estimation, cholesky, LDU-OR, SV decomposition.
Transversal & reasnic least square lattice filters, Signal Analysis with Higher order Spectra, Array processing, Beamforming, Time-delay estimation.

References:

1. Statistical Digital Signal Processing and Modelling M. Hays, John Willey and Sons, 1996.
2. Statistical Signal Processing with Applications M.D. Srinath, P.K. Rajasekaran and R. Viswanathan

EC436 VIDEO SIGNAL PROCESSING

Introduction to Video Processing , Analysis and synthesis of Video Signal, Composite video signal, Video Formation, Spatial and Temporal resolution, Signal BW, Colour Signal Generation and coding, Video display, Video camera, Video Coding, Motion Analysis and Motion Compensation, Motion Estimation techniques, Video Coding standards, Video compression standards .

References

1. Digital Video Processing A M Tekalp PH Publication
2. Image and Video Compression for Multimedia Engineering Yun Q. Shi, Huifang Sun, CRC Press
3. Multi Dimensional, Signal, Image and Video Processing and Coding John W Woods, Academic Press

EC437 MOBILE COMMUNICATION

Concepts of cellular communication, System design fundamentals, Geometry of hexagonal cells; Co-channel interference, Cell splitting, Frequency allocation in mobile, Handoff , Frequency Reuse,Mobile radio wave propagation; reflection, diffraction, fading. Path loss prediction. Multipath propagation. Statistical characterization of multipath fading. Diversity. Link design. Design parameters for base station. Antenna location, spacing, heights and configurations. Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum. Power control. WCDMA. CDMA network design. GSM. 3G systems. WLAN technology.

WLL. HiperLAN. Ad hoc networks. Bluetooth. OFDM and MC-CDMA, WiMAX, LTE, Study on radiation hazards

References:

1. Wireless Communication Principles — T.S.Rappaport
2. Mobile Communication Engineering — W.C.Y.Lee,
3. Wireless Communications — A.F.Molisch
4. Principles of Mobile Communications — G.L. Stuber
5. Wireless Communications — Andrea Golsmith

EC 438 CAD OF DIGITAL SYSTEMS

Introduction to VLSI CAD: VLSI design methodologies, use of VLSI CAD tools, Algorithmic Graph Theory, brief concept of Partitioning and placement, floorplaning and routing.Static Timing Analysis.

References:

1. Algorithms for VLSI Physical Design Automation — N.A. Sherwani,
2. Algorithms for VLSI Design Automation — S.H. Gerez

EC 336 LOW POWER VLSI DESIGN

Modeling and sources of power consumption Power estimation at different design levels (mainly circuit, transistor, and gate) Power optimization for combinational circuits Power optimization for sequential circuits Circuit and layout level for low power Software design for low power Low power random access memory circuits Leakage power consumption in deep sub-micron technologies Power analysis and design at system level Case studies.

References:

1. Low Power Design in Deep Sub-micron Electronics — W. Nebel and J. Mermet, Kluwer
2. Practical Low Power Digital VLSI Design — Gary Yeap
3. Low Power CMOS VLSI Circuit Design — Kaushik Roy, Sharat Prasad

List of Open Electives

EC 451 Computer Vision and Pattern Recognition EC 452 Biomedical Image Processing

EC 453 Nano Technology **EC 454 Optimization Techniques**

EC 455 Multirate Signal Processing **EC 456 Internet Technology**

EC 457 Micro Electro Mechanical Systems **EC458 Embedded System**

HUM 451 Public Policy **HUM 452 Organizational Behavior**

EC451 Computer Vision and Pattern Recognition

Image Formation and Image Models, Radiometry; Sources, Shadows and Shading; Color Cameras, Segmentation and Fitting; Tracking with Linear Dynamic Models, Correspondence and Pose; Registration in Medical Imaging Systems, Bayesian Decision Theory, Bayesian Networks, Maximum Likelihood Estimation, Dimensionality Reduction, Feature Selection,

Bayesian Estimation, Linear Discriminant Functions, Support Vector Machines (SVMs), Expectation-Maximization (EM) Algorithm, Non-parametric Estimation, Building Classifiers from Class Histograms; Feature Selection; Artificial Neural Networks

References:

1. Pattern Classification Duda, Hart, and Stork, 2nd edition, John Wiley Interscience,
2. Computer Vision: a Modern Approach, D.A. Forsyth and J. Ponce, Prentice-Hall,
3. The Elements of Statistical Learning T. Hastie et al., Springer-Verlag
4. Machine Learning: A probabilistic Perspective K. Murphy, NIT Press
5. Computer Vision L.G. Shapiro and G. Stockman, Prentice-Hall, 2001.

EC 452 BIOMEDICAL IMAGE PROCESSING

Introduction to biomedical images, Biomedical image modalities; X-ray, Computed Tomography, Magnetic resonance, Ultrasound. Histopathology images, Image formats. Enhancement of medical images, segmentation in medical images, medical image compression, noise removal in medical images, computer aided diagnostic techniques.

References:

1. Medical image processing G.R. Sinha, bhagwaticharanpatel, PHI
2. Biomedical Signal and Image Processin KayvanNajarian, Robert Splinter, CRC Press, 2016
3. Biomedical Image Processing Thomas M. Deserno, Springer Science & Business Media, 2011

EC453 NANO TECHNOLOGY

Introduction to nanoscale systems. Length energy and time scales. Top down approach to Nano lithography.Spatialresolution of optical,deep ultraviolet, X-ray, electron beam and ion beam lithography. Single electron transistors, coulomb blockade effects in ultra small metallic tunnel junctions. Quantum confinement of electrons in semiconductor nano structures. Two dimensional confinement (Quantum wells), Band gap engineering, Epitaxy, Landaeur,- Buttiker Formulism for conduction in confined geometries, one dimensional confinement, quantum point context, quantum dots and bottom of approach, introduction to quantum methods for information processing. Molecular Electronics, Chemical self assembly, carbon nano tubes, self assembled mono layers , Electomechanical techniques, Applications in biological and chemical detection, Atomic scales characterization techniques, scanning, tunneling microscopy, atomic force microscopy.

References:

1. Quantum Transport in Semiconductor Nanostructurenes in solid state Physics Beenaker and van Houten
2. Transport in Nano structures David Ferry
3. Introduction to Mesoscopic Physics Y.Imry

EC454 OPTIMIZATION TECHNIQUES

Motivation. mathematical review , matrix factorizations, sets and sequences, convex sets and functions, linear programming and simplex method, Weierstrass' theorem, Karush Kuhn Tucker optimality conditions, algorithms, convergence, unconstrained optimization, Line search methods, method of multidimensional search, steepest descent methods, Simplex algorithm, Gradient Search Methos, Newton's method, modifications to Newton's method , trust region methods, conjugate gradient methods, quasi-Newton's methods. constrained optimization, penalty and barrier function methods, augmented Lagrangian methods, polynomial time algorithm for linear programming, successive linear programming, successive quadratic programming.

References:

1. Practical Optimization — R.Fletcher,.
2. Nonlinear Programming, Theory and Algorithms, — M.S.Bazara, H.D.Sherali and C.Shetty

EC455 MULTIRATE SIGNAL PROCESSING

Fundamentals of Multirate Theory. The sampling theorem Basics. Multirate operations- Maximally decimated filter, M-channel perfect reconstruction filter banks, Polyphase representation- perfect reconstruction systems, Paraunitary PR Filter Banks. Filter Bank Properties induced by paraunitarity- Quantization Effects filter banks. Cosine Modulated filter banks. Polyphase structure- PR Systems.

References:

1. P.P.Vaidyanathan, Multirate Systems & Filter Banks, Prentice Hall, Englewood cliffs, NJ, 1993.
2. S.K. Mitra, Digital Signal Processing, A Computer Based approach, Tata McGraw Hill.
3. Multirate Signal Processing for Communication Systems, Fredric J. Harris, Prentice Hall PTR

EC 456 INTERNET TECHNOLOGY

Internetworking: - Internet reference model and Protocols. Transmissions media, Internet devices: Hub, Switch, Router, Gateway, Border Gateway Protocol, SMTP. Introduction to LAN, WLAN, WiMAX, LTE, IEEE802.xx standards. Introduction to Servers, Proxy Servers, Client-server interaction, Browser architecture, Search Engine, Online transaction issues. Internet of Things (IOT), Introduction to Cloud computing, Voice over IP (VoIP), Network Management System**:**- NMS, OSI network management model, MIT, MIB, ASN.1, SNMP Remote Access: Telnet, Remote Desktop connection, Assignment: Android Application development

References:

1. Computer Networks and Internet, 4th Edition D.E.Comer
2. Internet Technologies, Applications and Societal Impact Wojciech Cellary, Arun Iyengar,
3. Internet and World Wide Web" 4th edition Paul J. Deitel, Harvey M. Deitel
4. Network Management: Principles and Practice Mani Subramanian

EC457 MICRO ELECTRO MECHNICAL SYSTEMS

MEMS Overview, Dimensional analysis and scaling, complex 3D microstructure, technology considerations, material requirements, measured signal and performance. Patterning Technology, Micro Machining Technology, Packing and Integration Future Trends: Mechanical, Optical Transducers, Biomedical and Chemical Transducers

References:

1. The MEMS" handbook M.Gad-el-Hak,
2. An Introduction to Microelectromechanical systems engineering N. Maluf,

EC458 EMBEDDED SYSTEMS

Introduction to embedded systems, their characteristics, Hardware and Software Architectures, Standard peripherals, Common Interfacing techniques and protocols, Specification models and languages, Design Automation

References:

1. Embedded System Design: A unified Hardware / Software Introduction by Frank Vahid , Tony Givargis
2. Specification and design of Embedded Systems by David D Gajski, Frank Vahid, Sanjiv Narayan , Jie Gong,

HUM 451 PUBLIC POLICY

Introduction:

Nature, Scope and Importance of Public Policy, Evolution of Public Policy and Policy Sciences, Public Policy and Public Administration

Approaches to Public Policy Analysis:

The Process Approach, the Logical Positivist Approach, the Phenomenological Approach, the Participatory Approach and Normative Approach

Theories and Process of Public Policy Making:

Theories and Models of Policy Making, Perspectives of Policy Making Process, Institutions of Policy Making

Policy Implementation and Evaluation

Concept of Policy Implementation, Techniques of Policy Implementation, Concept of Policy Evaluation, Constraints of Public Policy Evaluation

Globalization and Public Policy

Global Policy Process, Transnational Actors: Impact on Public Policy Making, Impact of Globalization on Policy Making

References:

1. Anderson J.E., (2006) Public Policy-Making: An Introduction, Boston,Houghton

2. Birkland Thomas A., (2005), An Introduction to The Policy Process: Theories, Concepts, And Models of Public Policy Making, Armonk; M.E. Sharpe
3. Nachmias, David, (1979), Public Policy Evaluation: Approaches and Methods, New York: St. Martin's Press.
4. McCool, Daniel C. (ed.), (1995), Public Policy Theories, Models, and Concepts: An Anthology, NJ: Prentice-Hall

HUM 452 ORGANIZATIONAL BEHAVIOUR

Foundations of Individual Behavior:
The organization and the individual: Personality: Determinants and Attributes, Job Attitudes, Learning and Learning Theories, Perception, Cross cultural issues in OB

Motivation:
Definition and concept, theories of motivation- Maslow's Hierarchy of Needs, Herzberg's Two Factor theory, ERG theory, Vroom's Expectancy theory, Equity theory, Reinforcement theory and Behavior Modification.

Foundations of Group Behavior:
Defining and Classifying Groups, stages of group development, Group Structure, Group Processes, Group Dynamics, Group v/s Team, Team Effectiveness, Group and Intergroup Relations.

Leadership:
Nature and Significance of leadership, leadership in different cultures, leadership theories and Styles: Trait theories, Behavioral theories-- Ohio State Studies, Michigan Studies, and Managerial Grid. Contingency theories-- Fiedler's Model, Hersey and Blanchard's Situational theory, Path Goal theory, emotional intelligence and leadership effectiveness, Recent Development in Leadership Theory.

Conflict and Negotiation:
Transitions in Conflict Thought, Functional versus Dysfunctional Conflict, Conflict Process, Conflict Management Techniques, and Negotiation process, Bargaining strategies, Global implications.

Organizational Culture:
Concept, Relationship of Culture with organizational behavior, National and Global Culture, Levels of organizational culture, analyzing managing and changing organizational culture, Global Implications for manager.

Organizational Change and Stress Management:
Forces for Change, Resistance to Change, approaches to managing organizational change, Work stress and its management

References:

1. Stephen P. Robbins, Timothy A Judge, Seema Sanghi "Organizational Behaviour", Pearson Education, 13th Ed., 2009.
2. Nelson, Organisational Behaviour,1st Edition, Cengage Learning, India
3. R. S. Dwivedi, "Human Relations and Organizational Behavior: A Global Perspective", Macmillan 5 th edition,2009.
4. Jerald Greenberg and Robert A.Baron, Behaviour in Organisations, PHI Learning 9th edition 2009.