3EC1A ELECTRONIC DEVICES & CIRCUITS (Common to EE, EC & EIC)

Class: III Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 1**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	Contents of the subject
I	**SEMICONDUCTOR PHYSICS -** Mobility and conductivity, Charge densities in a semiconductor, Fermi Dirac distribution, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics, Carrier concentrations and Fermi levels in semiconductor, Generation and recombination of charges, Diffusion and continuity equation, Transport equations, Mass action Law, Hall effect.
II	**JUNCTION DIODES** - Formation of homogenous and hetrojuntion diodes and their energy band diagrams, Calculation of contact potential and depletion width, V-I characteristics, Small signal models of diode, Diode as a circuit element, Diode parameters and load line concept, C-V characteristics and dopant profile. Applications of diodes in rectifier, Clipping, Clamping circuits and voltage multipliers, Transient behavior of PN diode, Breakdown diodes, Schottky diodes, and Zener diode as voltage regulator, Construction, Characteristics and operating principle of UJT.
III	**TRANSISTORS** - Characteristics, Current components, Current gains: alpha and beta. Variation of transistor parameter with temperature and current level, Operating point, Hybrid model, DC model of transistor, h-parameter equivalent circuits. CE, CB and CC configuration. DC and AC analysis of single stage CE, CC (Emitter follower) and CB amplifiers AC & DC load line, Ebers-Moll model. Biasing & stabilization techniques. Thermal runaway, Thermal stability.
IV	**JFET & MOSFET** - Construction and operation, Noise performances of FET, Parasitic of MOSFET, Small signal models of JFET & MOSFET, Biasing of JFET's & MOSFET's, Low frequency single stage CS and CD (source follower) JFET amplifiers, FET as voltage variable resistor and FET as active load.
V	**SMALL SIGNAL AMPLIFIERS AT LOW FREQUENCY** - Analysis of BJT and FET multistage amplifier, DC and RC coupled amplifiers. Frequency response of single and multistage amplifier, mid-band gain, gains at low and high frequency. Analysis of DC and differential amplifiers, Miller's Theorem, use of Miller and bootstrap configuration. Cascade and cascode configuration of multistage amplifiers (CE-CE, CE-CB, CS-CS and CS-CD), Darlington pair.

Text/References:

1. Integrated Electronics, Millman Halkias, T.M.H
2. Diffenderfer – Electronic devices : systems and applications, Cengage learning

3. Electronic devices & circuits theory, R.L. Boylestad, Louis Nashelsky , Pearson education
4. Electronic devices & circuits, David Bell, Oxford Publications
5. M Rashid – Microelectronic circuits : Analysis & Design, Cengage learning
6. Digital Electronics: Principles and Integrated Circuits, Maini, Wiley
7. Millman, Electronics Devices and Circuits, TMH
8. Electronic Devices,7e, Floyd, Pearson
9. Electronic Devices and Circuits–I, R.Tiwari, Genius publications
10. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing

3EC2A DATA STRUCTURES & ALGORITHMS (Common to EC & EIC)

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	**Contents of the subject**
I	**DEFINITION & CHARACTERISTICS OF ALGORITHMS** – Structures, Difficulties in estimating exact execution time of algorithms, Concept of complexity of program, Asymptotic notations: Big-Oh, theta, Omega- Definitions and examples, Determination of time and space complexity of simple algorithms without recursion, Representing a function in asymptotic notations viz $5n^2-6n=\theta(n^2)$ **ARRAYS:** Array as storage element, Row major & column major form of arrays, computation of address of elements of n dimensional array
II	**ARRAYS AS STORAGE ELEMENTS** for representing polynomial of one or more degrees for addition & multiplication, Sparse matrices for transposing & multiplication, stack, queue, Dequeue, Circular queue for insertion and deletion with condition for over and underflow, Transposition of sparse matrices with algorithms of varying complexity (Includes algorithms for operations as mentioned) **EVALUATION OF EXPRESSION** - Concept of precedence and associativity in expressions, Difficulties in dealing with infix expressions, Resolving precedence of operators and association of operands, Postfix & prefix expressions, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix forms using stack. Recursion
III	**LINEAR LINKED LISTS** - Singly, doubly and circularly connected linear linked lists- insertion, Deletion at/ from beginning and any point in ordered or unordered lists, Comparison of arrays and linked lists as data structures Linked implementation of stack, queue and dequeue, Algorithms for of insertion, deletion and traversal of stack, Queue, Dequeue implemented using linked structures. Polynomial representation using linked lists for addition, Concepts of Head Node in linked lists **SEARCHING -** Sequential and binary search
IV	**NON-LINEAR STRUCTURES -** Trees definition, Characteristics concept of child, Sibling, Parent child relationship etc, Binary tree: different types of binary trees based on distribution of nodes, Binary tree (threaded and unthreaded) as data structure, insertion, Deletion and traversal of binary trees, constructing binary tree

	from traversal results. Threaded binary Tree. Time complexity of insertion, deletion and traversal in threaded and ordinary binary trees. AVL tree: Concept of balanced trees, balance factor in AVL trees, insertion into and deletion from AVL tree, balancing AVL tree after insertion and deletion. Application of trees for representation of sets.
V	**GRAPHS -** Definition, Relation between tree & graph, directed and undirected graph, representation of graphs using adjacency matrix and list. Depth first and breadth first traversal of graphs, Finding connected components and spanning tree. Single source single destination shortest path algorithms **SORTING** - Insertion, quick, Heap, Topological and bubble sorting algorithms for different characteristics of input data. Comparison of sorting algorithms in term of time complexity, NOTE: 1. Algorithm for any operation mentioned with a data structure or required to implement the particular data structure is included in the curriculum.

Text/References:

1. Malik – Data structures using C++, Cengage Learning
2. Drozdek – Data structures and algorithms in C++ , Cengage learning
3. An introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH
4. Data Structures in C/C++, Horowitz, Sawhney, Galgotia
5. Gilberg & Forouzan – Data structures: A pseudocode approach with c, Cengage learning
6. Data Structures in C/C++, Tanenbaum, Pearson
7. Data Structures in C++, Weiss, Parson

3EC3A DIGITAL ELECTRONICS (Common to EC & EIC)

Class: III Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	Contents of the subject
I	**NUMBER SYSTEMS, BASIC LOGIC GATES & BOOLEAN ALGEBRA -** Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, Fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra, Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vica-versa, Converting logic diagrams to universal logic. Positive, Negative and mixed logic, Logic gate conversion.
II	**DIGITAL LOGIC GATE CHARACTERISTICS -** TTL logic gate characteristics. Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families, Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET, Interfacing logic families to one another
III	**MINIMIZATION TECHNIQUES -** Minterm, Maxterm, Karnaugh Map, K-map upto 4 variables, Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions, Variable mapping. Quinn-Mc Klusky minimization techniques.
IV	**COMBINATIONAL SYSTEMS -** Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, Demultiplexer, Encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.
V	**SEQUENTIAL SYSTEMS -** Latches, Flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops, Counters: Synchronous & Asynchronous ripple and decade counters, Modulus counter, Skipping state counter, Counter design, State diagrams and state reduction techniques, Ring counter, Counter applications, Registers: Buffer register, Shift register.

Text/References:

1. Digital integrated electronics, By Herbert Taub, Donald L. Schilling, TMH
2. Ghoshal – Digital Electronics, Cengage Learning
3. Roth – Fundamentals of Logic design, Cengage learning
4. Digital Logic and Computer Design By M. Morris Mano, Pearson
5. Pulse Switching and Network By Millman Taub, TMH
6. Roth – Digital system design using VHDL, Cengage learning
7. Fundamentals of Digital circuits, A. Anand kumar, PHI
8. Digital Electronics, Jain and Agrawal, Genius publications
9. Leach, Digital Principles and Applications, TMH
10. Digital Electronics: Principles and Integrated Circuits, Maini, Wiley

3EC4A CIRCUIT ANALYSIS & SYNTHESIS (Common to EC & EIC)

Class: III Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. Schedule per Week Lectures: 3 Tutorial: 1	Examination Time = Three (3) Hours Maximum Marks = 100 [Mid-term (20) & End-term (80)]

Units	Contents of the subject
I	**NETWORK THEOREMS AND ELEMENTS** - Thevenin's, Norton's, Reciprocity, Superposition, Compensation, Miller's, Tellegen's and maximum power transfer theorems. Networks with dependent sources. Inductively coupled circuits – mutual inductance, coefficient of coupling and mutual inductance between portions of same circuits and between parallel branches. Transformer equivalent, inductively and conductively coupled circuits
II	**TRANSIENTS ANALYSIS** - Impulse, Step, Ramp and sinusoidal response analysis of first order and second order circuits. Time domain & transform domain (frequency, Laplace) analysis. Initial and final value theorems. Complex periodic waves and their analysis by Fourier analysis. Different kind of symmetry. Power in a circuit
III	**NETWORK FUNCTIONS** - Terminals and terminal pairs, Driving point impedance transfer functions, Poles and zeros, Restrictions on pole and zero location in s-plane. Time domain behavior from pole and zero plot, Procedure for finding network functions for general two terminal pair networks, Stability & causality, Hurwitz polynomial, positive real function
IV	**TWO PORT NETWORKS** - Two Port General Networks: Two port parameters (impedance, admittance, hybrid, ABCD and S parameters) and their inter relations. Equivalence of two ports. Transformer equivalent, interconnection of two port networks. The ladder network, image impedance, image transfer function, application to L-C network, attenuation and phase shift in symmetrical T and pi (π) networks.
V	**NETWORK SYNTHESIS** - The four-reactance function forms, specification for reactance function. Foster form of reactance networks. Cauer form of reactance networks Synthesis of R-L and R-C and L-C networks in Foster and Cauer forms

Text/References:

1. Circuits And Networks: Analysis And Synthesis, Sudhakar, TMH
2. Sivanagaraju – Electrical circuit analysis, Cengage learning
3. Robbins – Circuit analysis : Theory and Practice, Cengage Learning
4. Electrical Networks, Singh, TMH
5. Electric Circuits, Nilsson, Pearson
6. Linear Circuits Analysis, Decarlo, Oxford

7. Basic Engineering Circuit Analysis, Irwin, Wiley
8. Network Analysis & Synthesis, Kuo, Wiley
9. Network Theory: Analysis And Synthesis, Smarjit Ghosh, PHI
10. Electric Circuit Analysis, Xavier, S.P. Eugene, New Age

3EC5A ELECTROMAGNETIC PROPERTIES OF MATERIALS (Common to EC & EIC)

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 0**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	Contents of the subject
I	**DIELECTRICS MATERIALS -** Introduction, Polarization, Polarizability, Different types of polarization, Electronic, ionic, Orientation and space polarization, frequency and temperature dependence of different polarization, Dielectric loss and loss tangent, energy store and loss in dynamic polarization, Phenomenon of spontaneous polarization and ferro-electricity, Ferroelectric hysteresis loop, Piezoelectricity, piezoelectric materials: Quartz, Rochelle salt and PZT , Applications of dielectrics
II	**MAGNETIC MATERIALS -** Introduction, magnetization, theory of Dia, Para, Ferro- Ferrimagnetism and antiferromagnetism, Weiss field and magnetic domains, BH hysteresis loop, soft and hard magnetic materials and their applications, magnetic energy. Magnetostriction, giant magnetostriction resistor (GMR) and engineering applications of it. Magnetic spin, new electronic devices based on magnetic spin
III	**SEMI CONDUCTOR MATERIALS** - Introduction, Energy band gap structures of semiconductors, Classifications of semiconductors, Degenerate and nondegenerate semiconductors, Direct and indirect band gap semiconductors, Electronic properties of Silicon, Germanium, Compound Semiconductor, Gallium Arsenide, Gallium phosphide & Silicon carbide, Variation of semiconductor conductivity, resistance and bandgap with temperature and doping. Thermistors, Sensitors
IV	**CONDUCTIVE & SUPERCONDUCTIVE MATERIALS -** Electrical properties of conductive and resistive materials. **,** Energy bandgap structures of metals, resistivity of conductors and multiphase solids, Matthiessen's rule, Important characteristics and electronic applications of specific conductor & resistance materials, Superconductor phenomenon, Type I and Type II superconductors. Theory of superconductors, High temperature superconductors and their applications.
V	**NANOMATERIALS -** Introduction, Change in band structure at nano-stage. Structure of Quantom dots (nano-dots) & Quantom wires, Fabrication & Characterization of nanomaterials, Structure of single wall and multi-wall carbon nanotube (CNT), Change in electrical, Electronic and optical properties at nano stage, Potential applications of nano materials.

Text/References:

1. Robert M Rose, Lawrence A. Shepard and Jhon Wulff, The structure and peroperties of materials vol.4 (Electronic properties), Willey Eastern University press.
2. Askeland – The science and engineering of materials, Cengage learning
3. Kasap, Principles of Electronic Materials and Devices, TMH
4. Electronic Materials and Processes, Kaul Bhan & Jain, Genius publications
5. Allison, Principles of Electronic Materials and Devices, TMH
6. Neamen, Semiconductor Physics and Devices, TMH
7. Guozhong Cao, Ying Wang Nanostructures and Nanomaterials Synthesis, Properties and Applications, World Scientific Series in Nanoscience and Nanotechnology
8. Dekker, Electrical properties of materials

3EC6A ADVANCED ENGINEERING MATHEMATICS I (Common to EC & EIC)

Class: III Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3, Tutorial: 1**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	Contents of the subject
I	**LAPLACE TRANSFORM -** Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations.
II	**FOURIER SERIES & Z TRANSFORM –** Expansion of simple functions in fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM **-** Introduction, Properties, Inverse Z Transform.
III	**FOURIER TRANSFORM -** Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with specialreference to heat equation and wave equation.
IV	**COMPLEX VARIABLES -** Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy's integral formula.
V	**COMPLEX VARIABLES -**Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

Text/References:

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley
2. Datta – Mathematical methods of science and engineering, Cengage Learning
3. Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 3/e Croft, Pearson
4. O'neil – Advanced engineering mathematics, Cengage learning
5. Engineering Mathematics, T Veerarajan, TMH
6. Advance Engineering Mathematics, Potter, Oxford
7. Mathematical Methods, Dutta, D., New Age
8. Elementary Number Theory with applications: Thomas Koshy, 2nd Ed., Elsevier.
9. Engineering Mathematics III By Prof. K.C. Sarangi and others, Genius publications
10. Engineering Mathematics, Babu Ram, Pearson

11. 3EC7A Electronic Instrumentation Workshop (Common to EC & EIC)

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs : 2**	**Examination Time = Three (3) Hours** **Maximum Marks = 75** **[Sessional/Mid-term (45) & End-term (30)]**

S. No.	**List of Experiments**
1	Identification, Study & Testing of various electronic components : (a) Resistances-Various types, Colour coding (b) Capacitors-Various types, Coding, (c) Inductors (d) Diodes (e) Transistors (f) SCRs (g) ICs (h) Photo diode (i) Photo transistor (j) LED (k) LDR (l) Potentiometers
2	Study of symbols for various Electrical & Electronic Components, Devices, Circuit functions etc.
3	To study and perform experiment on CRO demonstration kit.
4	Soldering & Desoldering practice.
5	(a) To Design & fabricate a PCB for a Regulated power supply. (b) Assemble the Regulated power supply using PCB and test it.
6	To study and plot the characteristics of following Opto-Electronic devices – (a) LED (b) LDR (C) Photovoltatic cell (d) Opto-coupler (e) Photo diode (f) Photo transistor (g) Solar cell
7	To study the specifications and working of a Transistor radio (AM & FM) kit and perform measurements on it.
8	To study the specifications and working of a Public address System.
9	To prepare design layout of PCBs using software tools.
10	To fabricate PCB and testing of electronics circuit on PCB.
11	To design and test Switch Mode Power Supply using ICs
12	To study the specifications and working of a DVD Player.
13	To study the specifications and working of LCD TV.
14	To study the specifications and working of LED TV.

3EC8A COMPUTER PROGRAMMING LAB-I (common to EC & EIC)

Class: III Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs : 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 75** **[Sessional/Mid-term (45) & End-term (30)]**

S. No.	List of Experiments
1	Write a simple C program on a 32 bit compiler to understand the concept of array storage, size of a word. The program shall be written illustrating the concept of row major and column major storage. Find the address of element and verify it with the theoretical value. Program may be written for arrays upto 4-dimensions.
2	Simulate a stack, queue, circular queue and dequeue using a one dimensional array as storage element. The program should implement the basic addition, deletion and traversal operations.
3	Represent a 2-variable polynomial using array. Use this representation to implement addition of polynomials.
4	Represent a sparse matrix using array. Implement addition and transposition operations using the representation.
5	Implement singly, doubly and circularly connected linked lists illustrating operations like addition at different locations, deletion from specified locations and traversal.
6	Repeat exercises 2, 3 & 4 with linked structures.
7	Implementation of binary tree with operations like addition, deletion, traversal.
8	Depth first and breadth first traversal of graphs represented using adjacency matrix and list.
9	Implementation of binary search in arrays and on linked Binary Search Tree.
10	Implementation of insertion, quick, heap, topological and bubble sorting algorithms.

3EC9A ELECTRONIC DEVICE LAB (common to EC & EIC)

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs : 2**	**Examination Time = Three (3) Hours** **Maximum Marks = 75** **[Sessional/Mid-term (45) & End-term (30)]**

S. No.	**List of Experiments**
1	Study the following devices: (a) Analog & digital multimeters (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations) (d) Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
2	Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances.
3	Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
4	Plot frequency response curve for single stage amplifier and to determine gain bandwidth product
5	Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss & Vp
6	Application of Diode as clipper & clamper
7	Plot gain- frequency characteristic of two stage RC coupled amplifier & calculate its bandwidth and compare it with theoretical value.
8	Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
9	Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters
10	Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor.
11	Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

3EC10A DIGITAL ELECTRONICS LAB (COMMON TO EC & EIC)

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm.Engg. **Schedule per Week** **Practical Hrs : 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 75** **[Sessional/Mid-term (45) & End-term (30)]**

S. No.	**List of Experiments**
1	To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates with 2, 3, & 4 inputs)
2	To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR realized using NAND & NOR gates
3	To realize an SOP and POS expression
4	To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables
5	To realize a 4-bit ripple adder/ Subtractor using basic Half adder/ Subtractor & basic Full Adder/ Subtractor.
6	To verify the truth table of 4-to-1 multiplexer and 1-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer
7	Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven-segment display
8	Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table
9	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10	Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer. Note: As far as possible, the experiments shall be performed on bread board. However experiment Nos. 1-4 are to be performed on bread board only

3EC11A BUSINESS ENTREPRENEURSHIP

Class: III Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm.Engg. **Schedule per Week** **Practical Hrs : 2**	**Examination Time = Three (3) Hours** **Maximum Marks = 50** **[Sessional/Mid-term (30) & End-term (20)]**

S. No.	
1	**INTRODUCTION TO ENTREPRENEURSHIP** - Concept and need, Entrepreneurship and innovation, Entrepreneurship and economic growth.
2	**ENTREPRENEURIAL COMPETENCIES** - Leadership, Decision making, Motivation, Risk taking.
3	**BUSINESS ENTERPRISE PLANNING** - Identification of business opportunity, Idea generation, Demand estimation, Preparation of project report, Feasibility analysis.
4	**INTELLECTUAL PROPERTY** RIGHTS, Patents, Taxation- Central excise & Sales tax, VAT
5	**GOVERNMENT POLICIES -** for Entrepreneurs, Entrepreneurial career opportunities for Engineers, case studies.

Textbook:

1. Kuratko/Rao – Entrepreneurship : A South asian perspective, Cengage learning

References:

2. Bouchoux – Intellectual property: trademarks,copyrights, patents and trade secrets, Cengage learning
3. Daft – Leadership, Cengage learning

4EC1A ANALOG ELECTRONICS (Common to EC & EIC)

Class: IV Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 1**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	**Contents of the subject**
I	**FEEDBACK AMPLIFIERS** - Classification, Feedback concept, Feedback Topologies, Transfer gain with feedback, General characteristics of negative feedback amplifiers. Analysis of voltage-series, voltage-shunt, current-series and current-shunt feedback amplifier. Stability criterion. Compensation techniques, miller compensation.
II	**OSCILLATORS & Multivibrators** - Classification. Criterion for oscillation. Tuned collector, Hartley, Colpitts, RC Phase shift, Wien bridge and crystal oscillators, Astable, monostable and bistable multivibrators. Schmitt trigger. Blocking oscillators
III	**HIGH FREQUENCY AMPLIFIERS** - Hybrid Pi model, Conductances and capacitances of hybrid Pi model, high frequency analysis of CE amplifier, gain bandwidth product, unity gain frequency f_T, Emitter follower at high frequencies.
IV	**TUNED AMPLIFIER -** Band Pass Amplifier, Parallel resonant Circuits, Band Width of Parallel resonant circuit. Analysis of Single Tuned Amplifier, Primary & Secondary Tuned Amplifier with BJT & FET, Double Tuned Transformer Coupled Amplifier. Stagger Tuned Amplifier. Pulse Response of such Amplifier, class C tuned amplifiers, Shunt Peaked Circuits for Increased Bandwidth.
V	**POWER AMPLIFIERS - C**lassification, Power transistors & power MOSFET (DMOS, VMOS). Output power, power dissipation and efficiency analysis of Class A, class B, class AB, class C, class D and class E amplifiers as output stages. Pushpull amplifiers with and without transformers, Complementary symmetry & quasi complimentary symmetry amplifiers

Text/References:

1. M. H. Rashid, Microelectronic Circuits Analysis and Design, Cengage Learning
2. Millman, Integrated Electronics, TMH.
3. A. S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford University Press.
4. Fundamentals of Analog Circuits 2e, Floyd, Pearson
5. David A. BELL, Electronic Devices and Circuits, Oxford University Press.
6. Electronic Devices and Circuits–II, R.Tiwari, Genius publications
7. Salivahnan, Electronics Devices and Circuits, TMH.

4EC1A RANDOM VARIABLES & STOCHASTIC PROCESSES

Class: IV Sem. B.Tech.		**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 1**		**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**
Units	**Contents of the subject**	
I	**PROBABILITY** - Introduction, definitions, set theory, probability space, conditional probability, combined experiments.	
II	**RANDOM VARIABLES -** Introduction, Distribution and density functions, Discrete and continuous random variables, Specific distributions: Normal (Gaussian), Exponential, Rayleigh, Uniform, Bernoulli, Binominal, Poisson, discrete Uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions.	
III	**MULTIPLE RANDOM VARIABLES** - Two random variables: bivariate distributions, Pne function of two random variables, Two functions of two random variables, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables: multiple functions of multiple random variables, jointly Gaussian random variables, sums of random variable, Central limit theorem.	
IV	**STOCHASTIC PROCESSES** - Definitions, Random process concept, Statistics of stochastic processes: mean, autocorrelation, autocovariance. Stationary processes, strict and wide sense stationary, Random processes and Linear Systems.	
V	**STOCHASTIC PROCESSES IN FREQUENCY DOMAIN** - Power spectrum of stochastic processes, Transmission over LTI systems, Gaussian and White processes, Properties of power spectral density	

Text/References:

1. Probability, Random Variables And Stochastic Processes, Papoulis, TMH
2. Devore – Probability and statistics for engineering and sciences, Cengage learning
3. Mendenhall – Introduction to probability and statistics, Cengage learning
4. Probability, Random Variables And Random Signal Principles, Peebles, TMH
5. Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson
6. Probability and Random Processes with Application to Signal Processing, 3/e, Stark, Pearson
7. Random Variables & Stochastic Processes, Gaur and Srivastava, Genius publications
8. Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley
9. An Introduction to Probability Theory & Its App., Feller, Wiley
10. Stochastic Processes, 2ed, Ross, Wiley

4EC3A ELECTRONIC MEASUREMENT & INSTRUMENTATION

Class: IV Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	**Contents of the subject**
I	**THEORY OF ERRORS -** Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors, Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.
II	**ELECTRONIC INSTRUMENTS -** Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Component Measuring Instruments: Q meter, Vector Impedance meter, RF Power & Voltage Measurements, Introduction to shielding & grounding. .
III	**OSCILLOSCOPES** - CRT Construction, Basic CRO circuits, CRO Probes, Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes.
IV	**SIGNAL GENERATION AND SIGNAL ANALYSIS -** Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis - Measurement Technique, Wave Analyzers, Frequency - selective wave analyser, Heterodyne wave analyser, Harmonic distortion analyser, and Spectrum analyser.
V	**TRANSDUCERS** - Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers:- RTD, Thermocouples, Thermistors, LVDT, Strain Gauges, Bourdon Tubes, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

Text/References:

1. Electronic Instrumentation, H S Kalsi, TMH
2. Electronic Measurements & Instrumentation, Bernard Oliver, TMH
3. Instrumentation Measurement & Analysis, B.C.Nakra,K.K. Chaudhry, TMH
4. Electronic Measurements and Instrumentation, Gupta & Soni, Genius pub.
5. Electronic Measurements & Instrumentation, Bernard Oliver, John Cage, TMH
6. Electronic Measurements and Instrumentation, Lal Kishore, Pearson
7. Elements of Electronic Instrumentation And Measurement, Carr, Pearson
8. Electronic Instrument and Measurment, Bell, Oxford
9. Instrumentation for Engineering Measurements, 2ed, Dally, Wiley
10. Introduction To Measurements and Instrumetation, Arun K. Ghosh, PHI

4EC4A ELECTROMAGNETIC FIELD THEORY

Class: IV Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 1**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	**Contents of the subject**
I	**INTRODUCTION -** Vector Algebra, different Coordinate system, Relation in rectangular, cylindrical, spherical and general curvilinear coordinates system. Line, Surface and volume integral, Concept and physical interpretation of gradient, Divergence and curl. Divergence, Stoke's and Green's theorems.
II	**ELECTROSTATICS -** Electric field intensity & flux density (**D**). Electric field due to various charge configurations. Gauss's law, divergence of electric flux and maxwell's first equation, The potential functions and gradient of electric potential.Maxwell curl equation for static electric field. Poisson's and Laplace's equation and their solution. Divergence of current density (**J**) and Continuity equation for current. Duality of **J** and **D**, Capacitance and electrostatics energy. Field determination by method of images, Boundary conditions, Field mapping and concept of field cells.
III	**MAGNETOSTATICS -** Bio-Savart's law, Ampere's circuital law Magnetic field intensity **H**, flux density **B** & magnetization **M**, their interrelation. Curl of **H.** Magnetic scalar and vector potential, Faraday's Law, self & mutual inductance, Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field maping and concept of field cells.
IV	**TIME VARYING FIELDS -** Displacement currents, displacement vector and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, Depth of penetration-skin effect, Sinusoidal time variations, Reflection & Refraction of Uniform Plane Wave, standing wave ratio. Pointing vector and power considerations.
V	**RADIATION, EMI AND EMC -** Retarded Potentials and concepts of radiation, Radiation from a small current element. Radiation Resistance**:** Introduction to Electromagnetic Interference and Electromagnetic compatibility, EMI error in equipments, EMI standard, EMI coupling modes, Methods of eliminating interference, shielding, grounding, conducted EMI, EMI testing: emission testing, susceptibility testing.

Text/References:

1. Kshetrimeyum – Electromagnetic field theory, Cengage learning

2. Hayt, Engineering Electromagnetics, TMH
3. Jordan Balmain, Electromagnetic Field Theory and Radiations, PHI
4. Sadiku, Electromagnetic Field Theory, Oxford
5. Kaduskar ,Principles of Electromagnetics, Wiley
6. Reitz ,Foundations of Electromagnetic Theory, Pearson
7. Seavganokar, Electromagnetic Waves, TMH
8. Rao, Electromagnetic Field Theory and Transmission Lines, Wiley
9. Mahapatra, Principles of Electromagnetics, TMH
10. David K. Chang, Electromagnetic Field Theory, Pearson

4EC 5A OPTIMIZATION TECHNIQUES

Class: IV Sem. B.Tech.		**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3**		**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**
Units	**Contents of the subject**	
I	**INTRODUCTION -** Historical development, engineering application of optimization, Formulation of design problems as a mathematical programming problem, Classification of optimization problems	
II	**LINEAR PROGRAMMING -** Simplex methods, Revised simplex method, Duality in linear programming, post optimality analysis.	
III	**APPLICATIONS OF LINEAR PROGRAMMING -** Transportation and assignment problems.	
IV	**NON-LINEAR PROGRAMMING -** Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and Indirect methods.	
V	**DYNAMIC PROGRAMMING -** Introduction, multi-decision processes, computational procedure	

Text/References:

1. Albright - Data analysis, optimization and simulation modeling, Cengage learning
2. Hiller and Lieberman, Introduction to Operation Research (Seventh Edition),TMH
3. Prasad – Operations Research, Cengage learning
4. Ravindren Philips and Solberg, Operation Research Principles and Practice (Second Edition), Wiley
5. Anderson – An introduction to management science, quantitative approaches to decision making, Cengage learning

4EC6A Mathematics-IV

Class: IV Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Lectures: 3 Tutorial: 1**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Mid-term (20) & End-term (80)]**

Units	Contents of the subject
I	**NUMERICAL ANALYSIS -** Finite differences – Forward, Backward and Central differences. Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula
II	**NUMERICAL ANALYSIS- Integration**-Trapezoidal rule, Simpson's one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard's mathod, Euler's and modified Euler's methods, Miline's method and Runga-Kutta fourth order method, Differentiation.
III	**SPECIAL FUNCTIONS –** Bessel's functions of first and second kind, simple recurrence relations, orthogonal property of Bessel's, Transformation, Generating functions, Legendre's function of first kind. Simple recurrence relations, Orthogonal property, Generating function.
IV	**STATISTICS AND PROBABILITY -** Elementary theory of probability, Baye's theorem with simple applications, Expected value, theoretical probability distributions-Binomial, Poisson and Normal distributions. Lines of regression, co-relation and rank correlation.
V	**CALCULUS OF VARIATIONS -** Functional, strong and weak variations simple variation problems, the Euler's equation.

Text/References:

1. Advanced Engg. Mathematics, Irvin Kreyszig, Wiley
2. Datta – Mathematical methods of science & engineering, Cengage learning
3. **O'neil – Advanced Engineering mathematics, Cengage learning**
4. Applied Statics & Probability, Montgomery, Wiley
5. Engineering Mathematics, T Veerarajan, TMH
6. Mathematical Techniques, Jordan, Oxford
7. Engineering Mathematics IV, K.C. Sarangi and others, Genius publications
8. Advance Engineering Mathematics, Potter, Oxford
9. Advanced Engineering Mathematics, 2/e, Greenberg

4EC7A Computer Programming Lab-II

Class: IV Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs.: 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Sessional/Mid-term (60) & End-term (40)]**

S. No.	List of Experiments
1	**Programs in C++** Write a program to perform the complex arithmetic.
2	Write a program to perform the rational number arithmetic..
3	Write a program to perform the matrix operations. (Transpose, addition, subtraction, multiplication, test if a matrix is symmetric/ lower triangular/ upper triangular)
4	Implement Morse code to text conversion and vice-versa.
5	To calculate Greatest Common Divisor of given numbers.
6	To implement tower of Hanoi problem.
7	**Program in Java** To implement spell checker using dictionary.
8	To implement a color selector from a given set of colors.
9	To implement a shape selector from a given set of shapes.
10	To implement a calculator with its functionality.
11	By mapping keys to pens of different colors, implement turtle graphics.
12	To implement a graph and display BFS/DFS order of nodes.

4EC8A ANALOG ELECTRONICS LAB (Common to EC & EIC)

Class: IV Sem. B.Tech.	Evaluation
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs.: 3**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Sessional/Mid-term (60) & End-term (40)]**

S. No.	List of Experiments
1	Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1kHz with and without negative feedback.
2	Study of series and shunt voltage regulators and measurement of line and load regulation and ripple factor.
3	Plot and study the characteristics of small signal amplifier using FET.
4	Study of push pull amplifier. Measure variation of output power & distortion with load.
5	Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency
6	Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.
7	Study the following oscillators and observe the effect of variation of C on oscillator frequency: (a) Hartley (b) Colpitts
8	Design Fabrication and Testing of k-derived filters (LP/HP).
9	Study of a Digital Storage CRO and store a transient on it.
10	To plot the characteristics of UJT and UJT as relaxation.
11	To plot the characteristics of MOSFET and CMOS.

4EC9A MEASUREMENT & INSTRUMENTATION LAB

Class: IV Sem. B.Tech.	**Evaluation**
Branch: Electronics & Comm. Engg. **Schedule per Week** **Practical Hrs : 2**	**Examination Time = Three (3) Hours** **Maximum Marks = 100** **[Sessional/Mid-term (60) & End-term (40)]**

S. No.	**List of Experiments**
1	Measure earth resistance using fall of potential method.
2	Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
3	Measure unknown inductance capacitance resistance using following bridges (a) Anderson Bridge (b) Maxwell Bridge
4	To measure unknown frequency & capacitance using Wein's bridge.
5	. Measurement of the distance with the help of ultrasonic transmitter & receiver.
6	Measurement of displacement with the help of LVDT
7	Draw the characteristics of the following temperature transducers: (a) RTD (Pt-100) (b) Thermistors.
8	Draw the characteristics between temperature & voltage of a K type thermocouple.
9	Calibrate an ammeter using D.C. slide wire potentiometer.
10	Measurement of strain/ force with the help of strain gauge load cell.
11	. Study the working of Q-meter and measure Q of coils.
12	Calibrate a single-phase energy meter (Analog and Digital) by phantom loading at different power factor by: (i) Phase shifting transformer (ii) Auto transformer

4EC10A HUMANITIES & SOCIAL SCIENCES

Branch: Electronics & Comm.Engg. **Schedule per Week** **Practical Hrs : 2**	**Examination Time = Three (4) Hours** **Maximum Marks = 50** **[Sessional/Mid-term (30) & End-term (20)]**

S. No.	
1	India- Brief History of Indian Constitution- Framing, Features, Fundamental Rights, Duties.
2	Society- Social groups- Concept & Types, Socialization- Concept & Theory, Social Control- Concept, Social Problem in Contemporary India, Status & Role.
3	Microeconomics- Demand, Supply and Their elasticity's, Cardinal and Ordinal approach to consumption, Consumer Surplus, Laws of returns, Returns to scale, cost analysis
4	Macroeconomics- National Income, Money & Banking, Monetary & Fiscal policies, Unemployment, Inflation, Characteristics of Indian Economy.
5	Introduction to Industrial Psychology – Definitions & Scope Major influences on industrial Psychology- Scientific anagement and human relations schools Hawthorne Experiments Individual in Workplace: Motivation and Job satisfaction, Stress management, Organizational culture, Leadership & group dynamics.

Text book:

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Kaur – Micro ECON, Cengage learning
3. McEachern/Indra – Macro ECON, Cengage Learning