B.E. Elex and Tc Syllabus_2021-22

B.E. II YEAR

MA 25014 : MATHEMATICS – III

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	1	-	70	30	-	-	100	4	-	4

COURSE OBJECTIVE

To introduce the concepts of partial differential equations, calculus of finite differences, numerical methods, Fourier series, Laplace and Fourier transform.

COURSE OUTCOMES

The outcomes of this course are:

- Identify real phenomena as models of partial derivative equations. Solve real problems by identifying them appropriately from the perspective of partial derivative equations.
- Demonstrate their understanding of the Dirichlet conditions by using them to evaluate infinite series. Calculate the Fourier transform of elementary functions from the definition.
- Select and combine the necessary Laplace transform techniques to solve second- order ordinary differential equations involving the Dirac delta (or unit impulse).
- To understand the concept of solving differentiation and integration using approximation methods.
- Able to solve algebraic and differential equations using numerical method.

COURSE CONTENTS

Unit-1 Partial Differential Equations : Formation of Partial Differential Equations, Partial Differential Equations of first order and first degree i.e., Pp+Qq=R, Linear Homogeneous Partial Differential Equations of nth order with constant coefficient, Separation of Variables, Applications to Vibration of String and Transmission Line Equation.

Unit-2 Fourier Series and Fourier Transform: Definition and Derivations, Odd and Even functions, Half-Range Series, Change of Scale. Fourier Integral, Numerical Harmonic Analysis. Fourier Transforms: Sine and Cosine Transform, Applications of Fourier Transforms to solution of Partial Differential Equations.

Unit-3 Laplace Transform : Definition, Laplace Transform of elementary and periodic functions, properties of Laplace Transform and Transforms of derivatives, Inverse Laplace Transform and its properties, Convolution Theorem, Applications of Laplace Transform to solution of linear differential equations with constant and variable coefficients, Simultaneous differential equations.

Unit-4 Calculus of Finite Differences: Difference table, Operators E and Δ, Newton's forwardand backward interpolation formula, Lagrange's interpolation formula, Differentiation and Integration, Difference Equations with constant coefficients.

Unit-5 Numerical Methods: Solution of Algebraic and Transcendental equations using Bisection method, Regular-Falsi method and Newton Raphson method. Numerical solution of simultaneous equations: Gauss Elimination method, Gauss Seidel method. Numerical
solution of ordinary differential equations: Taylor's, Picard's and Runge- Kutta method.

Text Books

1. Ramana B V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. Balagurusamy E., Numerical Methods, Tata McGraw-Hill Publishing Company Ltd. , New Delhi, 1999.

Reference books

1. Kreyszig Erwin, Advanced Engineering Mathematics, 8th edition, John Willy and sons Publications, 1999.
2. Jain, R.K. and S.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, New-Delhi, 2006.
3. Vedamurthy V.N. and Iyengar S.N., Numerical Methods, Vikas Publishing, 2008.
4. Das H. K, Higher Engineering Mathematics, S. Chand New Delhi, 2011.

Assessment

1. Internal Assessment for continuous evaluation, mid-term tests, tutorials, class performance, etc. (30%)
2. End semester Theory Exam (70%)

EC25016 ELECTRONIC DEVICES

PREREQUISITE:- Mathematics-I, Physics

COURSE OUTCOMES:-
Student should be able to:
1. Relate Semiconductor physics with various types of diode.
2. Design and analyze diode based electronics circuits and subsystem.
3. Analyze BJT based electronic circuits.
4. Design various applications based on BJT.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Introduction to semiconductor Physics: Bohr's atomic structure, E-K diagrams, Periodic Lattice, energy bands in Intrinsic and Extrinsic semiconductor carrier transport, drift and diffusion current, mobility and resistivity, Generation& recombination of carrier, Poisson &continuity equation, Ct & Cd, Switching time, Hall effect.

Unit 2. P-N junction diode and its characteristics, small signal switching models, Avalanche and Zener breakdown & its applications ,ordinary diode circuits and applications, Special diodes.

Unit 3. Charge transport in BJT, Minority carrier distribution and terminal currents, base width modulation, Ebers Moll model, I-V characteristics for CB, CE and CC configurations. Concept of load line, Transistor Biasing technique & its stability, Biasing compensation, Thermal runaway.

Unit 4. Construction & Operation of MOSFET & JFET, I-V characteristics, Channel length modulation, MOS Capacitance, C-V characteristics.

Unit 5. Integrated circuit fabrication process: Oxidation, diffusion, ion implantation, photography, etching, chemical vapor deposition, sputtering, twin tube CMOS process.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

Course Outcome: Student should be able to
1. Understand the operation of various diodes and plot its I-V characteristics.
2. Implement various diode circuits such as voltage regulator, rectifier with and without , filter, etc.

3. Understand the operation of BJT, its testing and characterization in CE, CB, CC configuration.
4. Understand the characteristics of biasing circuits for BJT.

List of Experiments:

1. To measure the V-I characteristics of Diode and verify its regions of operation.
2. To characterize Zener diode.
3. To Determine the Deflection Sensitivity of a CRO.
4. Application of Zener diode as a Voltage Regulator.
5. Comparison of Different Types of Rectifiers.
6. Comparison of Different Types of Filters.
7. To measure the regulation characteristics of Full wave Rectifier using LC and π Filter.
8. Testing of Transistor and its lead identification.
9. Characterization of transistor in CE Configuration.
10. To characterize BJT in CB Configuration.
11. Characterization of BJT in CC-(Common Collector) Configuration.
12. Characterization of fixed Bias Circuit with and without Emitter Resistor.

ASSESMENT

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Milliman & Halkias, Integrated Electronics, 2nd ed., 1997 McGraw Hill Pub.
2. Boylestad R., Electronic Devices and Circuit Theory, 7th ed., 2004 PHI.
3. Sedra & Smith, Microelectronic circuits.5th ed., 2004 Oxford university press.

REFERENCE BOOKS RECOMMENDED:-

1. Ben G. Streetman, Solid State Electronics Devices, 5th ed., 2000, PHI.
2. Bhargava, Gupta & kulshreshtha, Basic Electronics and Linear Circuits, 2nd ed., 1990, Tata McGraw Hill Education
3 R .S. Sedha, "A Text book of applied electronics", 2nd ed., 2000, S. Chand

New (Revised)

EC 25017 SIGNALS AND SYSTEMS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Represent mathematically and analyze different types of signals and systems
2. Analyze continuous and discrete systems in time and frequency domain using different transforms.
3. Define various properties of LTI systems and determine the response of an arbitrary excitation.
4. Understand Sampling and reconstruction of a signal and applications of signals and systems in communication system

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1: Signals and Systems:

Introduction to signals and systems and their applications in engineering and science. Type of signals: periodic and aperiodic signals, continuous and discrete-time signals, continuous and discrete amplitude signals, energy and power signals, even and odd signals, deterministic and random signals. Elementary continuous-time and discrete-time signals: unit impulse, unit step, ramp, exponential, signum and sync functions. Operations on signals, Types of systems, continuous-time and discrete-time systems, systems with and without memory, system properties: linearity, time-invariance, causality, stability, invertibility and inverse systems.

UNIT 2: Linear Time-Invariant (LTI) systems:

Discrete-time LTI systems: The convolution sum, Continuous-time LTI systems: The convolution integral, impulse response and step response of LTI systems, properties of LTI systems: causality, stability and invertibility. System representation through linear constant coefficient differential and difference equations (LCCDE).

UNIT 3: Fourier analysis of signals and systems:

Fourier series representation of periodic signals: Trigonometric and exponential forms, properties of Fourier series, **Continuous-time and Discrete-Time** Fourier transform representation of signals and their properties, Fourier transforms of standard signals, aperiodic and periodic signal transmission through LTI systems, Parseval's theorem, the impulse response and frequency response of LTI systems and their relationship, **Magnitude and Phase response, Time and frequency domain aspects of systems**, filtering.

UNIT 4: Laplace and Z transform:

Laplace transform, the region of convergence of Laplace transform, transfer function,

poles and zeros of a continuous-time system, properties of Laplace transform, inverse Laplace transform, analysis and characterization of LTI systems using Laplace transform: Transfer function of LTI systems, **system behavior**, causality, stability and Unilateral Laplace Transform.

Z-transform, ROC of Z-transform, properties of Z-transform, inverse Z-transform, analysis and characterization of LTI systems using Z-transform: system function of discrete time LTI systems, **system behavior**, causality, stability, Unilateral Z Transform.

UNIT 5: Sampling and applications of signals and systems:

The sampling theorem, Time-domain and frequency-domain analysis of sampled signals, aliasing. Reconstruction of signals from its samples: **ideal interpolator, zero-order hold, first-order hold.** Discrete time processing of analog signals. Applications of signals and systems.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Signals and Systems : Alan. V. Oppenheim, Allan S. Willsky and S. HAmid Nawab, 2nd Edition, Prentice Hall.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Signals and Systems: Tarun Rawat, Oxford Higher education.

REFERENCE BOOKS RECOMMENDED:

1. Signals and Systems: Hwei P Hsu, Schaum's Outline Series, 2nd Edition, Tata Mc-Graw Hill Education Private Limited.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.

EE 25004: NETWORK THEORY & ANALYSIS

PREREQUISITE: - Engg. Mathematics, Physics

COURSE OUTCOMES:-

Student should be able to:

1. Understand the sources and components used in electrical networks.
2. Analyze the electrical networks.
3. Design the two port network.
4. Analyze the electrical networks using various theorems
5. Enhance the mathematical knowledge of circuit analysis and to solve engg. problems.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Lumped circuits and Kirchoff's Laws, Circuit elements, physical components v/s circuit elements, Power and energy, Passivity. Network Topology, Loop and Nodal equations, State equations.

Unit 2. First and State Second order networks, zero state, zero input, transient and steady state response. Solution of network equations using Laplace transform, Network functions, their pole zero description.

Unit 3. Two port networks, various two port network parameters and their interrelationships.

Unit 4. Sinusoidal steady state analysis, frequency response, resonance, complex power, power factor improvement, maximum power transfer theorem, locus diagram. Superposition, Reciprocity, Thevenin's and Norton's theorem.

Unit 5. Magnetically coupled circuit, analysis of circuits with controlled sources. Analysis of balanced and unbalanced polyphase circuits. Fourier analysis of periodic waveforms, frequency spectrum, Power and energy of complex waveforms.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments

1. To determine the equivalent networks by application of Thevenin's Theorem.
2. To determine the equivalent networks by application of Norton's Theorem.
3. Study of Transient in RC circuits.
4. Study of series and parallel resonance phenomena.
5. To verify the voltage and current relations in star and delta connected systems.
6. To verify open circuit parameter and short circuit parameter for two port network.
7. Verification of superposition theorem.
8. Verification of reciprocity theorem.
9. Verification of maximum power transfer theorem.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Van Valkenberg ,Network Analysis,3rd ed.,2006, PHI
2. Desoer and Kuh ,Basic circuit theory, 2nd ed., 2009, MGH
3. Scott ,elements of Linear circuits Vol.I and II, 2nd ed., 2000, Addison-Wesley Pub

REFERENCE BOOKS RECOMMENDED:-

1. William Hyat, Engineering Network Analysis, 8th ed., 2012, Tata MGH

EC 25018: DIGITAL SYSTEM DESIGN

PREREQUISITE: - Engineering Physics, Electronic Devices

COURSE OUTCOMES:-

Student should be able to:

1. Understand the digital circuits through basic logic gates.
2. Analyze and design computational digital circuit which can perform logical and arithmetic operation.
3. Analyze and design finite state machine and data storage elements.
4. Analyze and design digital integrated circuits.
5. Analyze and design converters which facilitate the conversion of real world analog signals to digital and vice versa.

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
L	P	T	L	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
4	2	-	3	1	-	CW	END SEM	SW	END SEM	
						30	70	40	60	200

THEORY:

UNIT 1: Introduction to digital logic: Logic Simplification and Combinational Logic Design: logic gates and their presentation using diode & transistor, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, SOP & POS implication, NAND-NOR implementation, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT 2 : Combinational Logic: MSI device like comparators, Multiplexers, Encoder, Decoder, Half adder and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder.

UNIT 3: Sequential Logic Design: Building blocks like S-R, D and T, JK and Master-Slave JK FF and their conversion, Edge triggered FF, Ripple and Synchronous counters, Shift registers.

UNIT 4: Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate HTL, TTL, IIL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like PLA, PAL, FPGA. Logic implementation using Programmable Devices.

UNIT 5: Applications of digital circuits: Introduction to A/D & D/A conversion & their types, sample and hold circuits, Voltage to Frequency & Frequency to Voltage conversion. Multivibrators: Bistable, Monostable, Astable, Schmitt trigger, IC555, IC565 & their applications.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

PRACTICALS:

Course Outcome:

Students will be able to:

1. Understand various logic gates.
2. Implement different Boolean functions from universal gates

3. Implement various combinational circuits using Digital IC's.
4. Implement various sequential circuits using Digital IC's.

LIST OF EXPERIMENTS

1. To study Logic gates.
2. To verify properties of NAND & NOR gates as universal building block.
3. Simplification & implementation of a Boolean functions.
4. Implementation of basic Boolean arithmetic logic circuits.
5. Implementation of even & odd parity generator & checker. Testing of transistor
6. Conversion from binary to gray and gray to binary code.
7. To verify 2 bit magnitude comparator for all possible conditions
8. Connection of various logical functions using 8 TO 1 multiplexer.
9. Construction of a 4- bit ripple counter & study of its operation. Imp
10. Design and implementation of various types of flip-flops using JK Flip-Flop.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition ,2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

HU 22005/24005/25005/27005: ECONOMICS FOR ENGINEERS

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	Th	Pr	THEORY		PRACTICAL		TOTAL MARKS
					CW	END SEM	SW	END SEM	
3	-	-	3	-	30	70	-	-	100

PRE-REQUISITES: NIL

COURSE OBJECTIVES:-

i. To develop the optimizing skills of technology-use in engineering problems
ii. To articulate economic analytical skills so as to contextualize the solutions of engineering problems.
iii. To explore the potential of students in economic perspective of engineering professional goals.
iv. To make sense of need of entrepreneurship and understand the financial reports of a business.

COURSE OUTCOMES: after completion of course, the students will be able to:

CO-1: Explain economic cyclic flow and Estimate the demand and demand elasticity for a product.
CO-2: Plan the production; choose appropriate production technology (combination of production factors); and estimate feasible range of production.
CO-3: Analyze the production-cost-profit relation and select the suitable project for investment
CO-4: Estimate price and the equilibrium for a firm/organization in different competitive market situations.
CO-5: Review, summarize and compare the financial statements of an accounting entity and able to apply financial ratio technique for financial analysis.
CO-6: identify the problems, see the opportunity, and ideate the solution to the problems

COURSE CONTENT:

UNIT 1.Nature and scope of economics, Economic cyclic flow, Central Economic problems, macro and micro economics, concept, determinants and law of demand and supply, Elasticity of demand, Equilibrium price, consumer surplus and equilibrium.

UNIT 2. Production, cost and Revenue: Production function, laws of return to variable proportion, Laws of return to scale, cost concepts, cost functions and their inter relation, Revenue Concepts and functions, break- even analysis, Time value of money and Investment analysis- NPV, IRR, ARR and payback period method.

UNIT 3. Pricing and Market: Price determination and firm's equilibrium under perfect competition and monopoly, price-output determination under monopolistic competition, kinked demand curve, collusive and non-collusive oligopoly.

UNIT 4. Entrepreneur, entrepreneurship and start-up, characteristics of an entrepreneur, forms of business organization, phases of startup, small medium and large scale enterprise, problems, opportunities, Design Thinking and Ideation. Business model.

UNIT 5. Accountancy: Accountancy and bookkeeping, GAAP, Assets, Liabilities and Capital, types of accounts, Journal, Ledger, Trial Balance and Financial Statements, Financial Ratio Analysis.

ASSESSMENT: Through End-Sem. Theory Exam, Theory sessionals, Mid-Sem Tests, and Assignments

Books & Reference Recommendation:

1. JhingalM.l., Economics of development and Planning, Vrinda Publication (40th Ed./latest).
2. Ahuja H. L., Advance economic theory, S Chand Publication, (21st Ed./Latest)
3. Riggs, Bedworth and Randhawa, Engineering Economics, Tata McGraw-Hill, (4th Ed./latest)
4. Principles of accountancy, Nirmal Jain,
5. Entrepreneurship by Rajeev Roy, 2nd edition
6. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of

India, New Delhi, 2004.
7. Introduction to the Constitution of India, D.D. Basu

MA 22563 / MA 25563 / MA 27563/MA 2E74: MATHEMATICS-IV

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	TU	T	P	TU	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
4	--	1	3	--	1	30	70	--	--	100

COURSE OBJECTIVE

To introduce the concepts of complex variable, statistics, stochastic process, Markov chain, reliability and graph theory.

COURSE OUTCOMES

On completion of this course, students are able

- To solve Engineering problems using complex variable techniques and line integrals of a complex valued function.
- To apply the concept of probability to find the physical significance of various distribution phenomena.
- Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability.
- Understand the concepts of reliability and maintainability.
- To apply principals and concepts of graph theory in practical situation.

COURSE CONTENTS

Unit-1 Functions of Complex Variables: Analytic function, Cauchy-Riemann Equations and Harmonic Functions, Conjugate Functions and their Applications, Complex Integrals, Cauchy's Integral Theorem and Integral Formula, Singularities, Poles, Residues, Residue Theorem, Contour Integration for simple cases, Conformal mapping and its Application to two-dimensional problems in electric field.

Unit-2 Statistics: Modern view of Probability theory, Random Variables, Distribution Function and Density Function, Random Variables of Discrete and Continuous type, Functions of two random variables, Bivariate Probability with Conditional and Marginal Probability Distribution.

Unit-3 Stochastic Process and Markov Chain: General Concepts and Definition of Stochastic Processes, Mean, Auto-correlation and Auto-Covariance, Classification of Stochastic Process and Some Problems. Probability Vectors, Stochastic Matrix, Fixed Point of a Matrix, Definition of Markov Chain, Transition Matrix and Graph, Some Theorems and Applications.

Unit-4 Reliability: Basic concepts, Failure law, Bath Tub Curve, Evaluation of Reliability of a Component from Test Data, System Reliability, Components in Series and Parallel, Redundancy, Non-Series Parallel System.

Unit-5 Graph Theory and Combinatorial Optimization: Graphs – Definitions and Basic Properties, Isomorphism, Euler Circuits and Hamiltonian Cycle, Digraphs, Trees- Properties, Spanning Trees, Planer graphs, Shortest Path Problem, Dijkstra Algorithm, Spanning Tree-Kruskal and Prim Algorithm.

Text Books

1. Ramana B V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company
   Ltd., New Delhi, 2006.
2. Das H. K, Higher Engineering Mathematics, S. Chand New Delhi, 2011.
3. Baisnab A, and Jas M, Elements of Probability and Statistics, Tata McGraw Hill Book
   Company, New Delhi, 1993.

.

Reference books

1. Jain, R.K. and Iyengar S.K, Advanced Engineering Mathematics, Narosa Publishing
   House, New-Delhi , 2006 .
2. Veerarajan T, Statistics, Probability and Random Process, 2nd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi 2003.
3. Balagurusamy E., Reliability Engineering, Tata McGraw-Hill Education Pvt. Ltd., New
   Delhi, 2012.
4. Goodaire E.G. and Michael M. Permenter, Discrete Mathematics with Graph Theory.

Assessment

1. Internal Assessment for continuous evaluation, mid-term tests, tutorials, class performance, etc. (30%)
2. End semester Theory Exam (70%)

New

EC25564: ELECTROMAGNETIC WAVES

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:
(1) Understand characteristics and wave propagation on HF transmission lines
(2) Carry out impedance transformations on Transmission Lines.
(3) Characterize Uniform Plane Wave.
(4) Calculate reflection and transmission of waves at media interface
(5) Analyze wave propagation on metallic waveguides in modal form

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1: Electromagnetic and Maxwell's Equations:
Basics of vector calculus. Basic Laws of Electrostatics, Gauss's theorem for electrostatics. Equivalence theorem, method of images. Basic laws of magneto statics, Ampere's Law, Duality, Uniqueness and reciprocity theorem. Development of Maxwell's equations.

UNIT 2: Uniform Plane Waves:
Wave equation and solution, wave polarization, wave propagation in different mediums, phase and group velocities, power flow and pointing vector, surface currents and power loss in a conductor.

UNIT 3: Plane Wave at Media Interface:
Boundary conditions, plane waves in arbitrary direction, reflection and refraction at dielectric interface and total internal reflection, Brewster's angle, Standing waves, conducting surface, skin depth.

UNIT 4: Transmission Lines:
Transmission Lines, Equations of voltage and current on Transmission lines, propagation count and characteristics impedance, reflection coefficient and VSWR, Impedance transformation on lossless and low loss transmission lines, power transfer on Transmission lines, Smith chart, admittance Smith chart, applications of Transmission lines.

UNIT 5: Waveguides:
Wave propagation in parallel plate waveguides, analysis of wave guides general approach, rectangular waveguides, TE & TM modes, surface currents on the waveguide walls, Attenuation in waveguide. Field visualization using simulation software.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT / REFERENCE BOOKS:
1. R.K Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India.
2. Principles of Electromagnetics Matthew N.O Sadiku., 6th edition.
3. David Cheng, Field & wave Electromagnetics.
4. Microwave Engineering , Pozar ,4th edition.

EC 25565: ANALOG CIRCUITS

PREREQUISITE: - Network Theory, Electronic Devices and Engineering mathematics

COURSE OUTCOMES:-

Student should be able to:

1. Analyze and design BJT and FET based amplifier for required frequency specifications.
2. Analyze and design power efficient amplifiers.
3. Improve amplifier performance by varying various parameters and design various frequency generators.
4. Analyze and design amplifiers for various linear and non linear mathematical operations using Linear integrated circuits.
5. Analyze and design various wave form generators and active filters using linear integrated circuits.

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
4	2	-	3	1	-	CW	END SEM	SW	END SEM	
						30	70	40	60	200

THEORY:

Unit 1. Review of BJT & MOSFET biasing, small signal analysis: low frequency model of BJT & MOSFET & its analysis for different configuration, Multistage amplifier.

Unit 2. High frequency analysis: High frequency model of transistor, Frequency response of amplifier, cascading of amplifier & its effect on gain & Bandwidth, Step response of amplifier. Power amplifier, compensation symmetry, configuration, RF circuit, tuned circuit

Unit 3. Feedback Amplifiers : General feedback theory, characteristics of negative feedback amplifiers, Effect of negative feedback on input and output resistance of amplifiers, analysis of feedback amplifiers. Oscillators: Principle of oscillation, calculation of frequency of oscillation & conditions for sustained oscillations, LC Oscillators - Colpitt's, Hartely and Crystal Oscillators, RC Oscillators: Phase shift & Wien bridge oscillators, Frequency stability criteria and controlled oscillators.Voltage.

Unit 4. Operational Amplifiers: Differential amplifier, its modification & transfer characteristics, Internal Architecture of op-amp, offset error in voltages & currents & their temperature drift, Op-amp parameters such as CMRR, slew rate & their measurements, Frequency response of op-amp, study of op-amp ICs like 741, 324, 308 etc. Temperature compensation techniques, current mirror in op-amp. Linear analog systems using op-amp such as - V to I and I to V converters, integrator, differentiator, Two stage and three stage instrumentation amplifiers.

Unit 5. Non-linear Applications and Active Filters using Operational Amplifiers: Non-Linear analog systems: Zero crossing detectors, Square wave & triangular wave generators, Comparators, Schmitt trigger, Voltage to frequency & frequency to voltage converters, Small signal rectifiers, Sample & hold circuit, Logarithmic amplifier. Active Filters**:** Introduction to active filters: active networks using OP-AMP, approximation to ideal low pass filter, Active filters: LP, HP, BP, BS, & their design guidelines.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

Students will be able to:-

1. Understand single & double stage amplifier, and find its gain and bandwidth.
2. Understand various oscillator circuits and find its frequency of oscillation.

3. Implement various op-amp. based circuits.
4. Implement various active filters.

List of Experiments:

1. To observe the characteristics of single stage R-C coupled amplifier
2. Verify the characteristics double stage R-C coupled amplifier
3. Measurement of input impedance and output impedance of single stage R.C coupled amplifier stage.
4. Study of frequency response of a single stage JFET amplifier
5. Study of double stage R-C coupled amplifier (with feedback).
6. Study of R-C phase shift oscillator
7. Study of Wien bridge oscillator
8. Study of OP-Amp as:
   a) Inverting Amplifier
   b) Non inverting Amplifier.
   c) Summing Amplifier
9. Study of integrator circuit & differentiator circuit using Op Amp
10. Study of class-C amplifier.
11. Study of Active low-pass filter of first order.
12. To study of active high-pass filter

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Sedra & Smith L., Electronics Circuits, 5th ed., 2004, McGraw Hill.
2. Gayakwad R.A., Op AMP & Linear Integrated Circuits. 4th ed., 2007, PHI.
3. Van Valkenburg M.E., Analog Filter Design, 2nd ed., 2001, Holt Rinehart & Winston.

REFERENCE BOOKS RECOMMENDED:-

1. Milliman & Halkias, Integrated Electronics, 2nd ed., 1997, McGraw Hill.
2. Robert Boylsted, Electronic Devices & Circuits, 2nd ed., 2000, PHI.
3. Millman and Grable, Microelectronics, 2nd ed., 1987, TMH.

EC 25566: Probability and Stochastic Processes

Prerequisite: A basic course on Calculus and Linear Algebra, Signals and systems

Course Outcomes: At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
4	-	-	-	-	-	CW	END SEM	SW	END SEM	
						30	70			100

Unit 1: Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.

Unit 2: Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions.

Unit 3: Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable.

Unit 4: Random sequences and modes of convergence; Markov, Chebyshev and Chernoff bounds; Limit theorems; Strong and weak laws of large numbers, central limit theorem.

Unit 5: Random process and classification Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Autocorrelation, Power spectral density.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Text/Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers
5. S.Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

EC 25567: ANALOG AND DIGITAL COMMUNICATION

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

(i) Compare different Continuous Wave modulation schemes.
(ii) Study the behavior of Communication systems in presence of noise.
(iii) Investigate Pulse modulation schemes and multiplexing schemes.
(iv) Analyze different digital modulation and demodulation schemes.
(v) Evaluate error performance of digital communication systems.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

Unit 1: Amplitude Modulation: Review of Fourier transform, its properties, probability, random variable and random process and power spectral density. Need of modulation, Generation and detection of AM, DSB-SC, SSB-SC and VSB signals. Frequency division multiplexing, Sources of noise, Gaussian and white noise, Quadrature components of noise, Noise in amplitude modulation systems.

Unit 2: Angle Modulation: Instantaneous frequency, Phase and Frequency modulation, Narrowband FM, Wideband FM, bandwidth of angle modulated signals, Generation and detection of angle modulated signals. Stereophonic FM broadcasting. Pre-emphasis and De-emphasis filters. TRF receivers, Superheterodyne radio receiver, Noise in Frequency

modulation systems. Threshold effect in angle modulation.

Unit 3: Pulse modulation: Sampling process. Sampling of bandpass signals, Quantization, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation (DPCM). Delta modulation (DM), Adaptive Delta modulation (ADM), Line codes and their PSD, Noise considerations in PCM, Time Division multiplexing.

Unit 4: Baseband Pulse Transmission and Signal space analysis: Inter symbol Interference and Nyquist criterion, Equalization Techniques, Eye patterns, Geometric representation of signals, Optimum detection of signals in noise, Optimum receivers using coherent detection for AWGN channels, Probability of Error.

Unit 5: Pass band Digital Modulation and Trade-offs: Phase Shift Keying (PSK), Frequency Shift Keying (FSK), Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK), their generation, detection, PSD and Probability of Error evaluations. Comparison of Digital Modulation schemes using a single carrier.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

REFERENCE BOOKS RECOMMENDED:

1. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
2. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
3. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

List of Experiments

1. Fourier Synthesis of periodic waveforms.
2. Generation of AM and Double Side band suppressed carrier waveform and multiplexing and demultiplexing FDM signal.
3. Demodulation and detection of AM and DSB-SC using Envelope Detector and Synchronous Detection.
4. Modulation and demodulation of Frequency Modulated waveform,.
5. To generate sampled signal of a band limited sinusoidal signal & its reconstruction, and to observe the two channels Time Division Multiplexing in analog domain & digital domain.
6. Generation & detection of TDM-PCM signal.
7. Analysis of different methods of data transmission to regenerate the data at receiver or repeater.
8. Verification of DM output for various amplitudes and frequencies of input signal and for various clock frequencies.
9. Study of Adaptive Delta Modulation and Demodulation
10. Generation and detection of BPSK and QPSK signal
11. Generation and detection of ASK and FSK signal.
12. Study of QAM modulation and demodulation

ASSESMENT: Viva, Simulation Assignment, Quiz, End semester exam

EC 25568 ELECTRONICS WORKSHOP

Prerequisite: - Engineering physics

Course outcomes:- Student should be able to:

1. Identify various types of electronic components and subsystems and apply them in various Electronic circuits.
2. Analyze electronics circuits and systems, diagnose faults and their rectification
3. Design, fabrication and testing of different types of electronics subsystem using analog and digital ICS.
4. Develop skills of writing a structured technical document and its presentation.

Subject Code	Subject Name	eriods / Week			Maximum Marks				Credits		
					Theory		Practical				
		L	T	P	End Sem	CW	End Sem	SW	Th	Pr	Total
	Electronics Workshop	-	-	4	-	-	60	40	-	2	2

Practical:

Unit 1. Various types of resistors, capacitors, inductors, their ratings, characteristics & application of single / multistrand wires, coaxial & flat cables, BNC, TNC & N - type connectors, PCB edge connectors, octal & panel connector, relays & band switches, SPST, SPDT, DPDT & push button switches, types of batteries, selections, testing, identification practice for all components, circuit diagrams using components & practicing symbols, cost of various commercially available components.

Unit 2. Thermal resistance, heat sink & its design. Selection of solder, Soldering wire & fluxes, Techniques of soldering, Soldering practice, Soldering defects and their causes.

Unit 3. Design, fabrication & testing of following types of sub systems using discrete components & integrated circuits:

(a) Analog System : series and shunt regulator, multi stage amplifiers, oscillators including VCOs, impedance matching networks, attenuators, popular analog ICs for sub-systems

(b) Digital Circuit: Drivers for increasing fan-out, TTL-CMOS & vice-versa interfacing, applications of 555 IC, counters, 7-segment display, issues involved in product - design, interfacing 7-segment display panels, opto-coupler for isolation etc., popular digital ICs for sub- systems.

Unit 4. Circuit assembly using bread board, Types of PCB & their selection, techniques of making PCB for projects, layout of components, precaution, electrical wiring diagrams, elements of grounding & shielding, PCB layout practice, Mass manufacturing of PCBs, SMD and Through hole components.

Unit 5. Fabrication of small electronic circuit such as power supply, Oscillators etc.
Trouble-shooting: AC & DC Point testing, connection failure, continuity, short circuit and open circuit, component and its pin identification, component failure and its identification, data manual referencing for equivalent component. Technical report writing.

Assessment:- Hardware project, quiz, internal and external viva

Text Books Recommended:

1. Harper, Handbook of Electronic Components. 2nd ed., 1997
2. Goyal and Khetan, A Monograph of Electronic Design,2nded., 1983 Khanna Publ.
3. Mottershed Allen, Electronics devices & circuits,2nd ed., 2006 PHI

HU

HOURS PER WEEK			CREDITS		MAXIMUM MARKS				
L	T	P	Th	Pr	THEORY		PRACTICAL		TOTAL MARKS
					CW	END SEM	SW	END SEM	
-	2	-	2	-	100	-	-	-	100

22881/24881/25881/27881: Values, Humanities and Professional Ethics

PRE-REQUISITES: NIL COURSE OBJECTIVES:-

- **(i)** To make students understand of his/her social responsibility as an engineer.
- **(ii)** To create an awareness on Engineering Ethics, Indian constitution and Human Values
- **(iii)** To make students capable of doing self-exploration and recapitulation
- **(iv)** To make students aware of the global problems

COURSE OUTCOMES: After completion of course, the students will be able to:

CO-1**:** Explain and elaborate the social institutions and Constitution of India through which the society and nation is governed.
CO -2: Describe the kinds of values and ethics and their importance
CO - 3: Contextualize the professional attitude and approaches as per needs of society and values.
CO -4: Explain and illustrate the process of Social, Political and Technological changes incontext to global changes

COURSE CONTENT:

1. Role of Humanities in Engineering education, Morals, Values and Ethics,social institutions and association, social stratification in India, social change, Universal and Situational values, coexistence of self and body and their needs and activities.

2. Constitution of India - Preamble, Rights and Duties. Directive Principles, Parliamentary and presidential democracy, The Problem of hierarchy of values and their choice, the views of Mahatma Gandhi on concept Indian nation and democracy.

3. Ethical and decision making capability and its development: Meaning of Ethical dilemma, Concept of personal and group Ethics: Balance between -rights and duties,The Problem of Sustenance of value in the process of Social, Political and Technological changes.

4. Engineering Ethics: engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger variety of moral issued - types of inquiry - moral dilemmas – moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy Models of Professional Roles.

5. Global Issues: Multinational corporations - Environmental ethics - computer ethics - weapons development – engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership.

ASSESSMENT:

Only Sessional Work (100 marks) on the basis of internal viva (30) Attendance (20), Quizes/Tests (30) and Presentations (20) will be awarded against the assessment done throughout the session.

Books for references

1. Little, William: An Introduction of Ethics (allied Publisher, Indian Reprint1955)
2. William, K Frankena : Ethics (Prentice Hall of India,1988)
3. Gaur R. R., Sangal R. and Bagaria G. P., Haman Values and Professional Ethics, Excel Books, New Delhi, 2010
4. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.
5. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
6. Introduction to the Constitution of India, D.D. Basu

EC 35008: MICROPROCESSORS AND MICROCONTROLLERS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand the basic architecture of 8 bit Microprocessor and interpret its operation using assembly language programming and interfacing.
2. To understand 16 bit Microprocessor's (8086) internal logic design.
3. To understand the internal architecture of 8051 Microcontroller and demonstrate its internal operation using assembly language programming.
4. Apply the architectural knowledge for the real time problem solving using interfacing concepts.
5. Understand various Microprocessors based systems and memory system design.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

UNIT 1: 8085 Architecture: Registers. I/O devices, memory bus structures. Instruction-sets, addressing modes, Assembly language programming and their timing and execution. Interfacing with memory and I/O devices. Internal Interrupt system & its expansion.

UNIT 2: Introduction to 16 bits microprocessors, Architecture of 8086 microprocessor, instruction sets, addressing modes, assembly language and interrupt handling.

UNIT 3: Architecture of 8051 microcontroller, SFR's, instruction sets, assembly language programming, timers and counters, serial communication in 8051.

UNIT 4: Interfacing of 8051: A/D, D/A converter, external memory, LCD, Keyboard and stepper motor.

UNIT 5: Introduction to peripheral interface ICs such as PID 8155, PPI 8255 and their interfacing with microprocessors and microcontrollers. Real time applications design.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

PRACTICALS:

S.No.	List of Programs
1)	Write an assembly language program for the addition of two 16 bit numbers. (Use consecutive memory location technique for data and result storage)
2)	Write an assembly language program for the multiplication of two 8 bit numbers. (Use consecutive memory location technique for data and result storage)
3)	Write an assembly language program for the division of two 8 bit numbers. (Use consecutive

memory location technique for data and result storage)

4) Write an assembly language program for multiplication of a 16 bit hex number with 8 bit hex number.

5) Write an assembly language program to find largest number out of the ten 8 bit numbers.

6) Write an assembly language program with subroutine to find out positive, negative and zero in a given series of ten hex data stored at 3000H location.

7) Write an assembly language program to find out square root of a number by subtracting odd integer.

8) Write an assembly language program to XOR data without using XRA instruction.

9) Write an assembly language program with subroutine technique to assembly and disassembly a given 8 bit words. (Hint: Data 98H can be disassembled as 09H and 08H)

10) Write an assembly language program to add a series of five hex numbers in BCD.

11) Write an assembly language programs to add, subtract, multiply & divide two 8 bit nos. stored in register R0 & R1 of register bank 0 of 8051 microcontroller, store the results of various operations in different registers of register bank 2.

12) Write an assembly language programs convert given 8 bit binary no. in accumulator to 3 digits BCD, store 100 R2, 10 digit in R1 & 1s digit in R0 of register bank 1.

13) Write an assembly language programs to find smallest no. in a given array. Array is stored at location starting from address 3000H.

14) Write an assembly language programs to implement a Boolean logic Y=(A+B).C Use bit addressable area of internal RAM .A,B & C are Boolean variables

15) Write an assembly language programs to generate a square wave of 8O% duty cycle on bit 3 of port 1.

16) Write an assembly language programs to swap lower & upper nibble of any 8 bit data stored in a register without using SWAP instruction.

17) Write an assembly language programs to find square root of a no. using subtraction of successive odd integers.

18) Write an assembly language programs to calculate value of function $f(x) = x^2 + x + 1$. Where x is an 8 bit binary number.

19) Write an assembly language programs assuming that INT 1 pin of 8051 is connected to a switch that is normally high. Whenever it goes low it should turns on an LED connected to P1.3 which is normally off. It should stay ON for few seconds and then go down.

20) Write an assembly language program to display a string of characters on LCD.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam

TEXT BOOKS RECOMMENDED:

1. Gaonkar, Introduction to Microprocessor. 2nd ed., 2004, Prentice Hall.
2. Sridhar and Ghosh, Computer Organizations and Architecture, 2nd ed., 2003,PHI.
3. Mazidi,8051 Microcontroller and Embedded Systems, 2nd ed. 1998, Pearson Edu.
4. Ayala, The 8051 Microcontroller, 2nd ed. 2001, Penram Publ.

REFERENCE BOOKS RECOMMENDED:

1. Rey Bhurchandi, Advanced Microprocessor Architecture, 2nd ed. 2001, TMH.
2. Bray, The Intel Microprocessors: Architecture, Programming and Interfacing, 2nd ed., 2003 PHI.

Revised Syllabus with Lab

EC 35009: ANTENNA & WAVE PROPAGATION

COURSE OUTCOMES:-

At the end of this course students will demonstrate the ability to:

1. Learn basic concepts of antenna and radiation
2. Learn various performance space parameters of antenna.
3. Learn various types of antenna array.
4. Learn various practical antennas in the broad frequency range.
5. Understand atmospheric structure and its impact on radio wave propagation.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

Theory:

Unit 1: **Antenna Fundamentals**: Retarded Potential, Radiation Equation. Radiation Mechanism of Antennas. Radiation Integral and Auxiliary Potential Functions. Radiation from Linear Wire Antennas i.e. Infinitesimal Dipole, Small Dipole, Finite Length Dipole and Half Wave Dipole.

Unit 2: **Antenna Performance Parameters**: Radiation pattern i.e. Isotropic, Directional, and Omnidirectional Patterns, Radiation Intensity and Power density, Gain & Directivity, Effective area and Aperture, Band width and beam width, Antenna impedance, Antenna Efficiency, Polarization. Friis Transmission Equation and reciprocity. Antenna Radar Cross Section and SAR.

Unit 3: **Antenna array and Fundamentals:** Linear, planar and circular**.** End fire & broad side arrays, Two and multielement arrays, Technique of multiplication of patterns, Binomial and Dolph Chebycsheff arrays, Phased array, Smart antennas and Beam forming techniques. Antenna Synthesis and techniques.

Unit 4: **Types of Antennas and Analysis**: Linear wire antenna and dipole, MF & HF antennas, Tower antenna, VHF & UHF antenna, GSM antennas, Loop Antenna, Rhombic antenna, Aperture antennas, Broad band antennas, Equiangular and Conical equiangular spiral antenna, Frequency independent antennas, Log periodic antenna, Reflector and Horn antennas, Micro strip antennas, measurement and Design approach.

Unit 5: **Radio Wave Progation:** Ground wave propagation, reflection from earth's surface, Space wave and sky wave propagation, Tropospheric wave and tropospheric scattering, Duct propagation. Ionosphere propagation, Structure of ionosphere and atmosphere, various parameters like Critical frequency, Maximum usable frequency, Least usable frequency, & Virtual heights etc.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

PRACTICALS:

The list of the experiments is as follows:

1. Familiarization and study of Advanced antenna measurement system and RF anechoic chamber

2. Familiarization and calibration study of vector Network Analyzer (MSP2202).

3. Design and simulation of Microstrip patch antenna (Virtual lab)

4. Characterization of Circular polarization in MSA (Virtual lab)

5. Measurement of Radiation parameters of Microstrip antenna through VNA and anechoic chamber

6. Measurement of Co-polarization and cross polarization of arbitrary test antenna using RF anechoic chamber and measurement system

7. Measurement of insertion losses and cable losses using Vector network analyzer

8. Calculation and generation of radiation pattern of RMSA (Microstrip) in azimuth & elevation plane.

9. Calculation and generation of radiation pattern of YAGI antenna (Microstrip) in azimuth & elevation plane.

10. Calculation and generation of radiation pattern of annular ring antenna (Microstrip) in azimuth & elevation plane.

11. Measure the variation of field strength/inverse square, power flow of arbitrary test antenna in RF anechoic chamber.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Antenna Theory**:** Analysis and Design, 2nd ed., 2000, Wiley Publication.
2. Kraus J.D., Antennas, 2nd ed., 2000, McGraw Hill.
3. Prasad K. D., Antenna & Wave Propagation, 2nd ed., 2001, Khanna Publication.

REFERENCE BOOKS RECOMMENDED:-

1. Collin R.E., Antennas & Wave Propagation, 3rd ed., 2001, McGraw Hill.
2. Chatterjee Rajeshwari, Antenna theory and practice, 2nd ed. 1998, New Age Publ.
3. Jordan & Ballman, Electromagnetic Wave & Radiation System, 2nd ed., 2006, PHI.

EC 35010 : VLSI DESIGN

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand the basic VLSI design flow.
2. Write and simulate HDL code for basic combinational and sequential circuits. & understand the basics of synchronous finite state machines.
3. Analyze the static & dynamic characteristics of cmos inverter.
4. Design combinational & sequential logic circuits
5. Understand the basics of memory design and working of programing logic devies such as CPLD and FPGA.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

Theory:-

Unit 1: Issues and Challenges in Digital IC Design: general overview of design hierarchy, layers of abstraction, integration density and Moore's law, VLSI design styles; MOSFET fabrication: basic steps of fabrication, CMOS p-well and n-well processes, layout design rules; Gajeski's Chart, PLD based design flow, synthesis, simulation, placement and routing, floor planning, verification, back annotation etc.

Unit 2: Finite state machine design: state machines, Mealy and Moore machines, state diagram, state table reduction techniques for state tables, transition tables, design of sequential circuits using FSM. Introduction to HDLs, their features, HDL based design, features of Verilog/VHDL and programming methodologies, various modelling styles in Verilog/VHDL, Digital designing with HDL, test benches, Verilog/VHDL coding for FSM.

Unit 3: Review of the basics of CMOS, operation of NMOS, PMOS, CMOS, MOS Capacitance; CMOS Inverter: MOS Device Model with Sub-micron Effects, VTC Parameters (DC Characteristics), CMOS Propagation Delay, Parasitic Capacitance Estimation, Layout of an Inverter, Switching, Short-Circuit and Leakage Components of Energy and Power; Interconnects: Resistance, Capacitance Estimation, delays, Buffer Chains, Low Swing Drivers, Power Distribution.

Unit 4: Combinational Logic Design: Static CMOS Construction; Performance Optimization of Digital Circuits by Logical Effort; Sizing; Ratioed Logic, Pass Transistor, Transmission Gate Logic, DCVSL, Dynamic Logic Design Considerations, noise considerations in dynamic design Power Dissipation in CMOS Logic, Domino and NORA designs; Sequential Circuits Design: Classification, Parameters, Static Latches and Register, Race Condition, Dynamic Latches and Registers, Two Phase vs. Single Phase clock designs; Design of arithmetic building blocks like adders and multipliers.

Unit 5: Semiconductor memories: non-volatile and volatile memory devices, flash memories, SRAM Cell Design, Differential Sense Amplifiers, DRAM Design. Programmable logic devices: PLA, PAL, PROM etc., programming strategies, circuit implementation, CPLD and FPGA architecture, case study of Intel FPGAs, their features and programming.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

PRACTICALS:

Unit 1(L): SPICE (Open-source) and experiments based on it **(Week-1, Week-2, Week-3)**
Unit 2(L): MAGIC (Open-source) and experiments based on it **(Week-4, Week-5, Week-6)**
Unit 3(L): Introduction to HDLs, their features, HDL based design, features of Verilog/VHDL and programming methodologies, various modelling styles in Verilog/VHDL, Digital designing with HDL, test benches. **(Week-7, Week-8, Week-9, Week-10)**

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2/e, Prentice Hall of India, 2003.
2. N. Weste and D. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3/e,Pearson Education India, 2007.
3. S. Brown & Z. Vranesic- Fundamentals of Digital Logic with VHDL
4. Samir Palnitkar, Verilog (Lab)

REFERENCE BOOKS RECOMMENDED:

1. Weste & Eshraghain – principles of CMOS VLSI Design
2. D.L.Perry- VHDL Programming by Example
3. J. Bhasker- VHDL Primer
4. Sung Mo Kang- CMOS Digital Integrated Circuits, TMH

EC 35011: DATA COMMUNICATION

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Analyze and design efficient source codes so as to transmit the information at a rate below the capacity of channel.
2. Analyze and design channel codes so as to have minimum probability of error.
3. Analyze and able to explain data communication systems and its components.
4. Analyze and able to understand communication systems using different digital data transmission and access techniques.
5. Able to understand different digital switching techniques and protocols for data transmission.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

Unit 1. Information Theory:
Concept of amount of information, Entropy of discrete ensembles, Shannon's source coding theorem, Encoding of discrete sources, Mutual information, Channel coding theorem, Calculation of channel capacity of discrete memoryless channels, Shannon's channel's capacity of AWGN channel, Shannon's limit, Modulation-coding trade-offs.

Unit 2. Error Control Coding:
Asynchronous and synchronous transmission, Types of error, Error detection, Error correction, Hamming distance, Hamming weight, Parity-check codes, Repetition code, Cyclic Redundancy Check (CRC), Error control using forward error correction (FEC), Linear block codes, Cyclic codes, Hamming codes, Convolutional codes.

Unit 3. Data transmission and Signal Encoding:
Networks for data communication (LAN, MAN, WAN), Network models: OSI reference model and TCP/IP model, Transmission terminology, Transmission impairments, Data rate limits, Performance parameters, digital signal encoding, Modes of digital data flow (simplex, duplex, full duplex), Transmission modes and media, Scrambling, Discrete Multi-tone Technique (DMT). ADSL and Cable TV networks for data transmission.

Unit 4. Multiplexing, Synchronization, Spread Spectrum and Multiple Access:
Review of FDM, TDM, WDM, Synchronous and Statistical, Synchronization, Digital transmission system hierarchy and their frame structure DS0, DS1, T1, E1 etc. Spread Spectrum: Frequency hop spread spectrum (FHSS), Direct sequence spread spectrum (DSSS), Multiple Access Techniques.

Unit 5: Telecommunication switching and Networks:
Necessity of switching, Introduction to digital switching, Circuit switching, Packet switching, Telephone Network, Dial-up modems, Traffic engineering: Network traffic and load parameters, Erlang formulae, An overview of ISDN architecture and protocol and Voice over Internet Protocol (VoIP), Introduction to ITU and IEEE standards.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Simon Haykin, “Communication Systems”, John Wiley Publications, 4th edition, 2000.
2. Bernard Sklar, “Digital Communications Fundamentals and Applications”, 2nd edition, 2001.
3. Behrouz A. Forouzan, “Data Communications and Networking”, Tata Mc Graw Hill, 4th edition, 2007.

REFERENCE BOOKS RECOMMENDED:

1. Martin.S Roden, “Digital and Data Communication Systems”, Prentice Hall Publications, 1982.
2. John C. Bellamy, “Digital Telephony”, John Wiley Publications, 3rd edition, 2000.
3. N. Abramson, Information and Coding, McGraw Hill, 1963.

PEC 1

CO 35251: DATA STRUCTURES & OPERATING SYSTEMS

COURSE OUTCOMES: -

At the end of this course students will demonstrate the ability to:

1. Identify linear versus nonlinear data structures, Understand common data structures and be able to implement them, choose appropriate data structures for problem solving and show how data structures map onto physical memory.
2. Compare different implementations of the same data structure, Manipulate data structures with basic operations.
3. The general structure and purpose of an operating system, the concepts of process, address space, and file, process deadlock, deadlock avoidance and recovery, Compare and contrast various CPU scheduling algorithms.
4. Understand different memory management techniques and be able to describe the advantages and disadvantages of each, Storage systems– disks

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Data Structure: stack, queue, list, tree, definition of complexity.

Unit 2. Sorting: Theory of sorting, searching, various techniques and their comparison, matrix manipulation, sets and string.

Unit 3. Operating System: Evolution, different types, features of operating system. CPU Scheduling: Types of scheduler, process and processor scheduling, multiprogramming. Input /Output: Asynchronous operation, speed gap, programmed I/O, Interrupt driven I/O.

Unit 4. Memory: Hierarchy, management technique, partitioning, swapping, paging, segmentation, page segmented memory, comparison of techniques, virtual memory, and demand paging and replacement policies.

Unit 5. File System: User and System view of file system, disk organization, disk allocation method: contiguous, linked and Indexed, file protection, system calls, disk scheduling. Deadlock avoidance and deadlock recovery. Case Studies: Linux, Unix, MS-DOS, Window NT.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments:

Lab Assignment # 01

1. Write a program to implement singly linked list in following way: Note: Your output menu should be following-

**********Menu**********

1. Insertion

2. Deletion
3. Traversing
4. Searching

Enter your choice: 1

Where do you want to insert:

1. At beginning
2. At a specified position
3. At end

One node inserted!!!

**********Menu**********

1. Insertion
2. Deletion
3. Traversing
4. Searching

2. Write a program to reverse a singly linked list.
3. Write a program to implement doubly linked list.
4. Write a program to merge two singly linked list in sorted order.

Lab Assignment # 02

1. Write programs to implement stack by following ways:
   a) Using Array
   b) Using Linked List.
2. Write a program to implement Queue.
3. Write a program to implement binary search tree and perform following operations on that:
   a) Traversal (inorder,preorder,postorder)
   b) Sort the data of tree in ascending order.
4. Write a program to sort the array elements in following way:

   The sorting technique always maintains a sorted sublist in the lower positions of the list. Begin by assuming that a list with one item (position 0) is already sorted. On each pass, one for each item 1 through $n-1$, the current item is checked against those in the already sorted sublist. As we look back into the already sorted sublist, we shift those items that are greater to the right. When we reach a smaller item or the end of the sublist, the current item can be inserted. (**Hint:** It works the way we sort playing cards in our hands.)

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Galvin and Silberschatz, Operating Systems and concepts, Addison Wesley.
2. Tanenbaum, Operating Systems, PHI
3. Kruze, Data Structures and Program Design, Prentice Hall

REFERENCE BOOKS RECOMMENDED:-

4. William Stallings, Operating systems, PHI
5. Bach A. S., Design of UNIX operating system, PHI.R
6. Tenanbaum, Data structures using C, Pearson Edu.

PEC 1

EC 35252: ELECTRONICS MEASUREMENT

COURSE OUTCOMES:-

At the end of this course students will demonstrate the ability to:

1. Study various types of measuring instruments & their characteristics with their applications in various electronic circuits.
2. Measure signals, diagnose fault in electronics circuits & systems and its rectification.
3. Design and analyze transducer based measurement circuits.
4. Design and analyze electronic measurement circuits and subsystems.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Measurement and their methods, classification of measuring instruments, static and dynamic characteristics of instruments, accuracy, resolution, sensitivity, precision, linearity, dynamic range, etc, speed of response, fidelity, static &dynamic errors, S/N & SINAD ratio.Standards of resistance, voltage, current, frequency and time, shielding and grounding.AC and DC voltmeters. Strain Gauge and its applications.

Unit 2. Basics of Transducers, LVDT, Strain Gauge, Microphones, speakers, opto electronics and piezo electric transducers, their calibration and application, universal product code.

Unit 3. Principle & construction of CRO & its various controls, Digital storage oscilloscopes, Estimation of phase & frequency using CRO. Measurement of RF frequency, power , Impedance and VSWR.

Unit 4. Principle, construction & applications of Frequency meter & Q-meter and AC bridges. High frequency measurements, Measurements of insertion gain & phase.

Unit 5. Signal & waveform generators, Frequency synthesizers, Digital voltmeter, digital frequency counters & millimeters. Spectrum analyzer, RF impedance, voltage and power meter, optical power meter, vector analyzer, distortion analyzer, VSWR, insertion loss and return loss measurements. Measurement of RF Impedance, RF Voltage and RF Power.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of experiments

1. Introduction to CRO.
2. Measurement of unknown frequency using CRO.
3. Measurement of unknown phase shift using CRO.

4. Introduction to Digital Storage Oscilloscope (DSO)
5. Measurement of parameters from the device characteristic curves displayed by curve tracer.
6. Measurement using general purpose Digital Multimeter.
7. Study of Balanced Modulator as a phase meter.
8. Measurement of insertion gain of a two port network.
9. Measurement of linear displacement.
10. Measurement of displacement utilizing piezoresistive effect.
11. Measurement of linear displacement utilizing the principle of change in capacitance.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Shawney, Electrical & Electronic Measurement, 17th ed., 2005, Dhanpat Rai& Sons.
2. D. V. S. Murthy, Transducers and Sensors, 2nd ed., 2000, PHI.
3. Copper, Electronic Measurement, 5th ed., 2009, PHI.

REFERENCE BOOKS RECOMMENDED:-

1. Patranabis D., Sensors and Transducers, 2nd ed., 2001, S. Chand & Co.
2. Bhattacharya S. K., Electronics, Measurements and instrumentation, 2nd ed., 2001, Khanna Pub.
3. Terman & Petit, Electronic measurements, 3rd ed., 2005, Mc Graw Hill.

(III YEAR B.E.) SEMESTER 'B'

EE 35507 CONTROL SYSTEMS

PREREQUISITE: - Engineering Mathematics, Network Analysis

COURSE OUTCOME:-

Students should be able to:

1. Understand modelling of systems and their simulation.
2. Learn effect of feedback on closed loop control systems.
3. Understand frequency domain and state space analysis of a control system
4. Design and analysis of Compensation techniques**.**

PERIOD PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
						CW	END SEM	SW	END SEM	
4	2	-	3	1	-	30	70	40	60	200

THEORY:-

Unit 1. Modeling of Systems and Simulation: Modeling of thermal, hydraulic pneumatic processes, mechanical, electrical systems, impulse response, concept of transfer function, block diagram algebra, signal flow graph, Mason's formula. Control system Component: Error detectors, servomotors, servo-amplifiers, modulators demodulators, pneumatic controllers, hydraulic controller.

Unit 2. General Feedback **THEORY:** Mathematical feedback theory, return ratio, return difference effects of feedback on closed loop performance. Time domain analysis: Test signals, transient behaviour of closed loop systems such as position servo and process servo systems, derivative and rate feedback, control, steady state behaviour of position and process servomechanisms, steady errors, integral control, stability of Routh-Hurwitz Criterion.

Unit 3. Frequency domain analysis: Concept of frequency polar indices plot, bode plots, frequency domain performance, M_p and ω_p effects of adding poles and zeroes of frequency domain performance, conformal mapping, principle of argument. Nyquist criterion, transportation lag, relative stability, conditionally stable system constant M and constant N loci, root loci.

Unit 4. State space analysis: Open loop system. Description, state space, eigenvalues and eigenvectors, modal transformation, solution of state differential equation, method of feedback in state space closed loop system description in state space controllability and observability in the sense of feedback control, effect of feedback on eigenvalues, eigenvectors and on modal transformation, solution of closed loop state differential equation, and introduction of phase plane analysis.

Unit 5. Compensation techniques: Types of compensation, reasons of compensation, design of compensation using phase lead networks. Stability analysis: Concept of BIBO stability, Routh-Hurwitz criteria, Nyquist criterion, relative stability, positive definiteness and semi-definiteness of quadratic forms, Lyapunov stability criteria.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments

1. To determine the performance characteristics of an angular position error detector using potentiometers.
2. To determine the characteristics of a Synchro Transmitter Receiver pair and use as a torque synchro and angular error detector.
3. To find the transfer function of an A.C. Servomotor.
4. To find the transfer function of a D.C. Servomotor.
5. To control the angular position of an AC servo motor as a carrier control system.
6. Determination of the time response characteristics of a DC Servo angular position control system.
7. To perform closed loop Speed control of a D.C Servomotor.
8. To determine the performance characteristics of a DC motor speed control with PWM type power driver.
9. To determine the performance characteristics of a DC motor speed control with SCR type power driver.
10. Analysis of Proportional + Integrator + Derivative (PID) control actions for First and second order systems.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Kuo B.C. Automatic Control System.
2. Ogata K., Modern Control Engineering.
3. Nagrath I.J. and Gopal M., Control Systems Engineering.

REFERENCE BOOKS RECOMMENDED:-

1. Melsa J.L. and Schuttz D.G. Linear Control Systems.

EC35511: MOBILE COMMUNICATION

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand basics of cellular communication and its various standards.
2. Have knowledge of fading channel for mobile system designing.
3. Learn fundamental concepts of various speech coding and modulation techniques.
4. Develop insight of emerging 5G transmission technology.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

Unit 1: Review of cellular architecture, Frequency Re-use, Channel Assignment Strategies, Handoff Process, Factors affecting Handoff Process, Handoff Strategies, Interference and System Capacity, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Cell Splitting, Sectoring, Microcell Zone concept, Repeaters, Trunked Radio System.

Unit 2: Signal propagation: mobile cellular environment, Reflection, Diffraction, Scattering, multipath propagation and fading, Large scale path loss: Free Space Propagation loss equation, propagation path loss, Ground reflection (Two-Ray) model, Link budget design, Log-normal Shadowing, power delay profile, channel parameters (delay spread, doppler spread, coherence bandwidth, coherence time, LCR and ADF) and types of fading channel.

Unit 3: Fading mitigation techniques, Time diversity, Frequency and Space diversity, Receive diversity, Concept of diversity branches and signal paths, Performance gains, Selective combining, Maximal ratio combining, Equal gain combining, performance analysis for Rayleigh fading channels, Transmit Diversity, Equalization principle and adaptive equalization, CDMA principle and implementation.

Unit 4: Basic properties of speech: Speech coding for wireless system such as time domain and frequency domain coder, vocoders, popular speech codes in GSM. Modulation techniques for mobile communication, their generation, detection and performance of spectral and power efficiency.

Unit 5: GSM architecture and specification, Radio link features in GSM, GSM logical channels and frame structure. LTE Standard for next generation mobile systems. 5G and beyond Transmission Technologies, OFDM, MIMO and NOMA.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Rappaport T.S., Wireless Communications: Principles and Practice, 2nd ed., 2004 PHI.
2. Aditya K. Jagannatham, Principles of Modern Wireless Communications Systems Published by McGraw-Hill Education
3. Andreas F. Molisch Wireless Communications, 2nd ed., 2001, Wiley Pub.

REFERENCE BOOKS RECOMMENDED:-

1. Wilkis and Garg, Principles of GSM Technology, 2nd ed. 2004, PHI.
2. Fehar K., Wireless Digital Communication, 2nd ed. 2001, PHI.
3. Ramji Prasad and Richard Van Nee, OFDM Wireless Multimedia Communication, 2nd ed. 1998, Artech House.

EC 35513: COMPUTER NETWORKS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand the basics of computer network architecture, topology, and network model.
2. Understand the design issues of various MAC layer protocols for deployment of Ethernet/IEEE Standards.
3. Illustrate the design issues of network layer and transport layer protocols in computer networks.
4. Develop the concepts of routing algorithms and routing protocols.
5. Understand the design issues of WAN and advanced computer network architecture.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

UNIT 1: Review of concepts of layering and layered models - OSI and TCP/IP. Basic Overview of TCP/IP Protocol Stack, Circuit Switching and Packet switching, various types of networks, different LAN, MAN and WAN topologies, Network Hardware and Software Components, Transmission media, access devices like NIC, repeaters, switches, routers, protocols.

UNIT 2: Data Link Layer: Medium Access Protocols, LAN technology: Transmission medium, topology and Medium Access Control (MAC) techniques, Local Area Network types: IEEE 802.x standards – Ethernet, Fast Ethernet, Gigabit Ethernet, Switched Ethernet, Token Ring protocols, FDDI protocols

UNIT 3: Network and Transport layer: Internetworking with TCP/IP:- Internet/ IP addressing schemes & various Internet services, Network Layer: Internet protocol (IP) suite including IPV4 protocol and IPV6 protocol. Transmission Control Protocol:- basic features, transport protocols TCP and UDP, Connection Establishment and Closure, Flow Control and Congestion Control at Transport Layer

UNIT 4: Introduction to IP routing and services: Routing algorithms, various interior Gateway protocols like RIP, OSPF, and Routing among the ISPs using BGP. IP Services: Network Management with SNMP, ARP.

UNIT 5: WAN technology and Application Layer Services (HTTP, FTP, Email, and DNS), WAN technology: Introduction to label switching and MPLS, Introduction to Software defined networking. QoS design guidelines, VoIP

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments:

1. Study and Comparison of Various Network Topologies, Their Advantages, Disadvantages and Applications
2. Study of Various Networking Devices, Their Advantages, Disadvantages and Applications & Case Study of Optical Fiber.
3. To Configure a Machine on WINDOW Platform.
4. To Configure a Machine on LINUX Platform.
5. To Study how to Transfer Data From One Machine to Another Using FTP i.e. File Transfer Protocol
6. Installation of Ubuntu (Open Source LINUX) on a Machine.
7. Configuration of TELNET Service on a LINUX Machine.
8. Configuration of NFS Service on LINUX Machine
9. To Study SAMBA SERVER.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:

1. Comer, Internetworking with TCP/IP Vol. 1, PHI.
2. Stalling W., Data and Computer Communication, PHI.
3. Forouzan B., Data Communication and Networking, TMH.
4. Kurose, Ross, Computer Networking: A Top-Down Approach, Pearson, 7 th edition.

REFERENCE BOOKS RECOMMENDED:

1. Tanenbaum, Computer Networks, PHI.
2. Radia Pearlman, Interconnections, bridges, routers, switches and internetworking protocol.
3. Charles Spurgeon, Ethernet: The Definitive Guide, O'Reilly Media Publication

EC 35514: APPLIED DIGITAL SIGNAL PROCESSING

COURSE OUTCOMES:-

At the end of this course students will demonstrate the ability to:

1. Apply Fourier and z-transforms to represent and analyze LTI discrete time systems and implement DTS
2. Compute numerically the response of discrete time systems (DTS) for finite time inputs
3. Analyze and design digital IIR and FIR filterS
4. Analyze the effects of finite word length and estimate the power spectrum
5. Analyze multirate signal processing and apply DSP

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

UNIT 1: Discrete-time Sequences, Discrete-time systems attributes, Sampling and reconstruction of signals, Z-Transform, Transform analysis of LSI systems, Frequency analysis, Inverse systems, Linear phase systems, Implementation of Discrete Time Systems.

UNIT 2: Discrete Fourier Series, Discrete Fourier Transform (DFT), Linear convolution using DFT, Fast Fourier Transform (FFT) Algorithms. Linear filtering approach for computing DFT.

UNIT 3 : Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters.

UNIT 4: Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation.

UNIT 5: Discrete time processing of continuous time signals, Sampling rate conversion using Discrete-time processing, Introduction to multirate signal processing. Applications of DSP.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments:

1. Introduction to MATLAB
2. Generation of Different Types of Signals
3. Generation of Sum of Sinusoidal Signals
4. Linear Convolution
5. N-POINT FFT
6. Auto Correlation & Power Density Spectrum

7. To Find Frequency Response of FIR Low Pass /High Pass Filters
8. To find frequency response of IIR low pass / High pass filters
9. Architecture and Instruction Set of DSP chip-TMS320C6713
10. CODE COMPOSER STUDIO (CCS)
11. Linear Convolution using CC Studio
12. Circular Convolution using CC Studio
13. FIR Filter Design Using TMS320C6713 DSP Processor
    [Rectanguler/Triangular/Kaiser Window]
14. IIR Filter Design Using TMS320C6713 DSP Processor
15. N-POINT Fast Fourier Transform (FFT)
16. To Compute Power Density Spectrum of A Sequence
    [Using TMS320C6713 DSP Processor]

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. D.G.Manolakis and V.K.Ingle Applied Digital Signal Processing: Theory and Practice, Cambridge University Press, 2011.
3. Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, 2015

REFERENCE BOOKS RECOMMENDED:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.
3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
4. E.C.Ifeachor and B.W.Jervis, Digital Signal Processing: A Practical Approach, Peaarson

PEC 2

EC 35661: EMBEDDED SYSTEMS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand the basic RISC computer architecture using AVR Microcontroller.
2. Understand the interfacing of ATmega 8 with Wireless Network.
3. Understand the Mixed signal controller and also able to interface the Networking module with it.
4. Understand the ARM Processor's Architecture and Basic Concept of RTOS.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

UNIT-1: **AVR Microcontrollers**: Introduction to Embedded system, embedded system architecture, Introduction to AVR ATmega 8 bit Microcontroller, their Architecture and features, memory mapping, instruction set, addressing modes, assembly language programming.

UNIT-2:AVR Microcontroller's Interfacing & Basic I/O Programming: ATmega I/O ports, timers/counters, programming to generate delay and wave form generation, Interfacing of ATmega with LoRa Module, ZigBee Module and WiFi Module.

UNIT-3: **MSP 430 Microcontroller**: Introduction to MSP 430 microcontroller, Architecture MSP430 memory organization, I/O system organization, MSP 430 instruction Set and assembly language programming.

UNIT-4: **MSP 430 Microcontroller's Interfacing**: Basic Elements of Interfacing of MSP 430, System clock, fundamental Interrupts concept, times and event counter, GPIO ports, Interfacing with USART, Modem.

UNIT-5: **ARM Microprocessor & RTOS**: Introduction to ARM Microprocessor based systems, Architecture of Cortex M3, Instruction set, Registers, Processor Data Path, Memory Address Map, System Stack Architecture, Features of ARM. Introduction of Real Time operating systems, interrupt routines in RTOs, Inter-process communication.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

TEXT BOOKS RECOMMENDED:

1. ARM Microprocessor systems, CORTEX M Architecture, programming & interface, CRC press, Muhammad tahir & kashif javed
2. AVR, Microcontroller & Embedded system, Person Edu., Mazidi
3. Introduction to Embedded systems Using microcontroller and the MSP430, Springer, Manuel, Rogelio, & isidoro.

REFERENCE BOOKS RECOMMENDED:

1. Microcontroller in Practice, Springer, L. Susnea, M. MitSecu,
2. Embedded Systems , TMH publications, Prof. Rajkamal
3. MSP 430 Microcontroller Basics, Newnes, John Davies.

PEC 2

IT 35662: INTELLEGENT SYSTEMS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

CO1 Explain the basics concepts of A.I. and problem solving through searching.

CO2 Apply fuzzy logic concept for given situation.

CO3 Design the neural network model for given real world scenario.

CO4 Describe various machine learning algorithms to solve real time problem.

CO5 Apply various machine algorithm for given dataset.

CO6 Explain concept of intelligent system and agents and significant of machine learning.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

UNIT 1: Artificial Intelligence:

Concept of Artificial Intelligence and intelligent agents. Areas of Artificial Intelligence. Problem solving and search methods, Knowledge, reasoning, and planning (KRP), Uncertainties and probabilities in KRP.

UNIT 2: Fuzzy Systems: Foundations of Fuzzy Logic. Foundations of Fuzzy Control. Types of Fuzzy Controllers. Fuzzy Logic Toolbox. Creation of Fuzzy Inference System with Fuzzy Logic Toolbox. Creation of Fuzzy Controllers.

UNIT 3: Neural Networks: Neuron Model. Perceptron Model. Modeling of Basic Logic Functions using the Perceptrons. Feedforward Neural Network with Backpropagation Error. Approximation of Functions by a Two-layer Feedforward eural Network. Character Recognition using Two-layer Feed-forwardNeuralNetwork.

UNIT 4: Machine learning: Basics, Types and Applications of ML
Supervised Learning: Introduction to Supervised Learning, Linear Methods for Regression, Support Vector Machines. Naive Bayes, Decision Tree, Ensemble methods: Bagging, boosting, Evaluating learning algorithms. Classification problems; decision boundaries; nearest neighbor methods, Logistic regression,

UNIT 5: Unsupervised Learning: Introduction to Unsupervised Learning, Cluster Analysis, Clustering K-means, hierarchical agglomeration clustering, Expectation Maximization method, Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), Reinforcement Learning.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

Text Books :-

1. Rich & Knight , "Artificial Intelligence" ,2nd Edition,Tata Mcgraw Hill.
2. Rajsekaran and Pai, "Neural Network and Fuzzy Logic", 2nd Edition,Prentice Hall of India.
3.T.Mitchell "Machine Learning," Mc-Graw Hill, 1997.

Reference Books:-

1. Russel & Norvig, "Artificial Intelligence",2nd Edition ,Pearson Education.
2. Patterson, "Introduction to AI and expert System",2nd Edition, Prentice Hall of India.
3. S.N. Sivananadan & S.N. Deepa, "Principles of Soft Computing", 1st Edition,Wiley India.
4. Ethem Alpaydin,Introduction to Machine Learning", MIT Press,2004.

5. Jacek M Zurada, “Introduction to Artificial Neural System”, JAICO Publishing.

EC 35881: ELECTRONICS DESIGN AND SIMULATION

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand various types of Microcontrollers and their Architecture.
2. Analyze various Simulation software for Microcontrollers
3. Write code and simulate various microcontroller based circuits.
4. Interface various peripheral devices with microcontroller and calculate power requirement.
5. Install Linux based OS for Microcontrollers.
6. Design a microcontroller based working hardware project.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
-	-	4	-	-	40	60	100	2	-	2

1. Study of Various Microcontroller families and their comparison. Understanding various ports of a microcontroller.

2. Various Simulation software and their limitations, Simulation of microcontroller and there programming methodology.

3. Interfacing various sensors, motors and other peripheral devices with microcontroller.

4. Power calculations. Installation of Linux OS for microcontrollers.

5. **MINOR PROJECT**: Students will submit a microcontroller based project in a group at the end of the semester.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:

1. Muhammad Ali *Mazidi*. Janice Gillispie *Mazidi*. Rolin D. McKinlay.The 8051 Microcontroller and Embedded Systems. , 2e, Pearson Education
2. Rajkamal, Embedded Systems: Architecture Programming and Design, 2e, TMH Education.

REFERENCE BOOKS RECOMMENDED:

1. Jeremy Blum, Exploring Arduino , 1e, Wiley
2. Davies, John H, MSP430 Microcontroller Basics, 1e, Elsevier
3. MUHAMMAD ALI *MAZIDI*. ROLIN D. MCKINLAY, PIC Microcontroller and Embedded Systems, 1e, Pearson Education India.
4. Simon Monk, Programming the Raspberry Pi: Getting started with Python, 2e, McGraw Hill Education

(IV YEAR B.E.) SEMESTER 'A'

New Subject

EC 45009 : WIRELESS AND MOBILE NETWORKS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand basic technologies implied in 3G and 4G mobile networks.
2. Learn device to device and millimeter wave communication in 5G networks.
3. Understand the basic concepts of wireless sensor network and its protocols
4. Learn the routing mechanism inside wireless sensor networks.
5. Understand the technology and standards of Mobile IP, Bluetooth, ZigBee and RFID.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

Unit 1: 3G & 4G Mobile Networks

Third Generation mobile Technology 3G –UMTS, UTRAN- Architecture, WCDMA, HSDPA, Spreading and De-Spreading, Scrambling, User Equipment (UE), CS and PS Domain Protocol Architectures, SGSN and GGSN in UMTS, 4G- LTE and LTE-Advance.

Unit 2: Emerging Mobile Networks

Millimeter-wave Communications (5G) – Beam-forming, physical layer techniques, Interference and mobility management, Massive MIMO - propagation channel models, Channel Estimation, Imperfect CSI. Pilot Contamination, Spatial Modulation (SM), Device to Device (D2D) Communication.

Unit 3: Wireless Sensor Networks: Basic and MAC Protocols

Wireless sensor Network- Architecture, Applications, Technology for sensor nodes & networks, operating environment, Medium Access Control Protocols - Low duty cycle protocols and wakeup concepts -Contention-based and contention-free protocols, Schedule-based hybrid protocols.

Unit 4 Wireless Sensor Networks: Routing Protocols

Routing And Data Gathering Protocols. Routing Challenges and Design Issues in Wireless Sensor Networks. Data centric Routing, Energy aware routing, Gradient-based routing, Rumor Routing, Hierarchical Routing, Location Based Routing.

Unit 5: Short Range wireless networks

Mobile IP, Bluetooth- Protocol stack, RFID and ZigBee technologies and their practical usage. IEEE 802.11 standards and its variants. 6LoWPAN, LoRa.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam

TEXT BOOKS RECOMMENDED:

1. Sumith Kaseara, Nishit Narang, "3G Networks Architecture, Protocols", Tata McGraw Hill
2. Afif Osseiran, Jose.F.Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks" , Cambridge University Press
3. Feng Zhao and Leonidas Guibas – *Wireless Sensor Networks, An information processing approach* - Morgan Kaufmann publication

4. Kaveh Pahlavan, Prashant Krishnamoorthy – *Principle of wireless networks- A united approach*- Pearson Education, 2002

REFERENCE BOOKS RECOMMENDED:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati- *Wireless Sensor Networks: Technology, Protocols and Applications* -Wiley publication
2. Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.
3. Vijay K. Garg – *Wireless communication and networking* – Morgan-Kaufmann series in networking- Elsevier publication

(PEC-3) Revised syllabus with Lab

EC 45207 : MICROWAVE DEVICES & CIRCUITS

COURSE OUTCOME:-

At the end of this course students will demonstrate the ability to:

1. Identify of various types of Microwave electronic components and systems.
2. Understand different modes of operation of various RF and Microwave circuits.
3. Design and analyze of high frequency circuits and systems.
4. Solving complex RF & Microwave communication network design problems.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Features and applications of microwaves, Wave propagation in striplines and microstrip lines, and Slot lines, Limitations of conventional vacuum tubes, Microwave tubes like Two cavity klystron and Reflex klystron, Magnetron, TWT, Backward wave oscillator etc.

Unit 2. Solid state microwave sources, transferred electron devices, Tunnel diode Gunn diode and oscillators, IMPATT diode, TRAPATT diode, Pin diode, Varactor diode, Schottky diode, Parametric amplifiers, Crystal diode, Frequency multipliers, Microwave BJT & FET.

Unit 3. Scattering matrix, S-parameters & its applications in Network analysis, Matching Network, Detector diodes, detector mounts, detector output indicator, slotted line, measurement of power, impedance & S-parameter, measurement of frequency & VSWR.

Unit 4. Impedance transformer, Microwave filters, Power dividers and Diodirectional couplers, E-plane Tee, H-plane tee, Matched hybrid Tee.Tensor permeability, Wave propagation in ferrite medium, Isolators, Circulators, YIG resonators, Simulation Techniques for design of Microwave Components and devices.

Unit 5. Analysis and design of Dielectric resonators; Design of RF and microwave low noise and power amplifiers & oscillators using S- parameter techniques, Mixer and converter design, diode phase shifters, attenuators, Design of hybrid and monolithic, microwave and millimeter wave integrated circuits.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

.**LIST OF EXPERIMENTS**

1. **To determine the characteristics and electronic tuning range of Klystron tube amplifier.**
2. **To determine the frequency & wavelength in a rectangular waveguide working on TE10 mode E.M. propagation .**
3. **To determine the Standing Wave Ratio and Reflection Coefficient in a Rectangular waveguide system with different loads .**
4. **To determine an unknown Impedance in a slotted line section using Smith chart.**
5. **To measure V-I characteristics of Gunn Diode at microwave frequencies .**
6. **To measure the following parameters in a multi-hole directional coupler**

7. **Main-line and auxiliary-line VSWR.**
8. **The coupling factor and directivity.**
9. **To determine the S-Matrix of Magic Tee.**
10. **To determine the characteristics of Isolator and Circulators at different microwave frequencies.**
11. **Design study of microwave amplifier using microwave office (Virtual experiment)**
12. **To design microwave filter sing electromagnetic software (Virtual experiment)**

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:

1. Liao S., Microwave Devices & Circuits''., 2nd ed. 2001,PHI.
2. Gupta K.C., Microwave Engg., 3rd ed.2004,Wiley Easter Pub.
3. Watson, Solid State Microwave Devices, 5th ed.2008,Wiley.
4. David M. Pozar, Microwave Engineering, 3rd edition, 2011 Willey India.

REFERENCE BOOKS RECOMMENDED:

1. Gandhi, Microwave Engineering & Application, 2nd ed.2005,McMillan Int. Ed.
2. Reich, Microwave Principles, 5th ed.2009,CBS Publ.
3. Collin, Foundations for microwave engineering, 4th ed. 2001,Wiley Publ

(PEC-3) (Revised Syllabus)

EC45208 : OPTICAL COMMUNICATIONS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand Optical Fiber Communication System and its parameters.
2. Analyze transmission characteristics of optical fiber and their effects.
3. Understand the construction and operation of various optical sources and detectors.
4. Design and study performance analysis of optical receivers
5. Brief introduction of optical fiber networks and amplifiers

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Overview of optical fiber communications system: elements of an optical fibre transmission link, Wave propagation in optical fiber, analysis of optical waveguide using ray theory, wave model, Optical fibers : Structure & wave guiding fundamentals, basic optical laws, optical fibre modes & configuration mode, different types of optical fibers, Physical and electrical characteristics of fiber.

Unit 2. Signal degradation in Optical Fiber due to dispersion and attenuation: signal distortion in optical wave guides, pulse broadening in graded index and step index wave guides, mode coupling, Fabrication of fibers, overview of fibre materials and measurement techniques like OTDR.

Unit 3. Optical sources and detectors: LEDs, LASER diodes, basic principle, various structures-semiconductor lasers, distributed feedback lasers Photo-detectors - pin-diodes, APDs, Physical principles of photo diodes, photo detector noise-NEP, detector response time, Avalanche multiplication noise, photo diode materials.

Unit 4. Optical receivers Direct detection and coherent receivers, noise in detection process, System design, power budgeting, rise time budgeting; fibre to fibre joints, and splicing techniques, Optical fibre connectors, Introduction to optical amplifiers (EDFA, SOA), optical switches

Unit 5. Optical networks: Basic networks- SONET/ SDH, WDM network : Broadcast – and – select Networks, wavelength routed networks, DWDM, Passive Optical Access Networks, Introduction to elastic optical network and LiFi.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments

1. To familiarize with the optical communication kit and its specifications and interfaces.
2. To establish data link communication employing intensity modulation and demodulation.
3. To generate frequency and pulse width modulation and demodulation in optical communication.
4. To measure various losses in optical communication
5. To measure the effect of bending on attenuation in optical fiber.
6. To measure the optical parameters.
7. To characterize LED as optical source.
8. To characterize Laser Diode.
9. To establish PC to PC communication using RS232 interface via optical fiber link.
10. Preparation of fiber optic cable termination.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Senior J.M., Optical Fibre Communications: Principles & Practice, 2nd ed. 2001, PHI.
2. Agrawal Govind P., Fibre Optic Communication Systems, 5th ed. 2001, John Wiley & Sons, students ed.
3. Black Uyless, Optical Networks and 3rd Genration Transport Systems, 3rd ed. 1998, Pearson.

REFERENCE BOOKS RECOMMENDED:-

1. Keiser G, Optical Fibre Communication, 5th ed. 2006, McGraw Hill.
2. Mynbanv and Scheiner, Fibre Optic Communication Technology, 2n^{d} ed 2010, Pearson Edu.
3. Djfar K Mynbaev & Scheiner, Fibre Optic Communication Technology, 5th ed. 2005, Pearson

CO 45251: DATA SCIENCE

changes in this are expected.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

PRE-REQUISITE: NIL

COURSE OUTCOMES: After Completing the course student should be able to:

1. Comprehend the IT-interestingness of data and understand the attributes of data. 2. Preprocess the given data and visualize it for a given application or data exploration/ mining task.
3. Apply techniques of supervised and unsupervised machine learning for various data applications.
4. Implement web search methods by page ranking and can implement models of information retrieval by applying different techniques of text mining.

COURSE CONTENTS: THEORY:

UNIT 1. Understanding Data: Data Wrangling and Exploratory Analysis, Data Transformation & Cleaning, Feature Extraction, Data Visualization. Introduction to contemporary tools and programming languages like R, Python etc. for data analysis.

UNIT 2. Statistical & Probabilistic analysis of Data: Multiple hypothesis testing, Parameter Estimation methods, Confidence intervals, Bayesian statistics and Data Distributions.

UNIT 3. Introduction to machine learning: Supervised & unsupervised learning: Classification & Clustering Algorithms like Decision Tree based classification and KMeans clustering, Dimensionality reduction: PCA & SVD, Correlation & Regression analysis, Training & Testing data: Overfitting & Under fitting.

UNIT 4. Introduction to Information Retrieval: Boolean Model, Vector model, Probabilistic Model , Text based search: Tokenization , Tf-IDF, stop words and ngrams , synonyms and parts of speech tagging

UNIT 5. Introduction to Web Search & Big Data: Crawling and Indexes, Search Engine architectures, Link Analysis and ranking algorithms such as HITS and Page Rank Hadoop File system & Map Reduce Paradigm.

TEXT BOOKS RECOMMENDED:

1. Field Cady, “The Data Science Handbook” , 1/e , 2018, Publisher: Wiley
2. Sinan Ozdemir, “Principles of Data Science “, 1/e, 2016, Packt Publishing Limited

REFERENCE BOOKS:

1. Peter Bruce, “Practical Statistics for Data Scientists: 50 Essential Concepts”,

Shroff/O'Reilly; First edition (2017)

2. Pang-Ning Tan, “Introduction to Data Mining”, Pearson Edu., 2007

3. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education, 2004

THEORY ASSESSMENT:

1. Internal Assessment for continuous evaluation, mid-term tests, Tutorials, Quizzes, Class Performance, etc. (30%)

2. End semester Theory Exam (70%)

PEC-4

EI 45252: VLSI TECHNOLOGY

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1: To describe crystal growth and wafer preparation methods.

2: To discuss layering in terms of chip fabrication.

3: Illustration of various patterning methods.

4: Gain knowledge about layout design rules, stick diagrams etc.

5: Illustration of subsystem design and memories.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

THEORY:

Unit 1. Crystal Growth and wafer preparation: Wafer terminology, different crystalline orientations, CZ method, CMOS IC Design flow, Crystal Defects, Fabrication process of FETs, MOSFETs, and BIMOS etc.

Unit 2. Layering: Epitaxial growth methods, oxidation, Kinetics of oxidation, thin film fabrication, Metallization, Physical Vapor Deposition and Sputtering.

Unit 3. Patterning: Lithography, Optical Lithography, Electron Lithography, X- Ray Lithography, Ion Lithography. Photo masking steps, Resists. Doping: Diffusion; Diffusion models, Ion Implantation; Implantation Equipment, Channeling.

Unit 4. VLSI process techniques and Integration: Floor planning, layout, Design rules, stick diagrams, Test generation, Logic Simulation, Introduction to EDA tools. Contamination control: Clean rooms, HEPA, ULPA Filters and Class numbers.

Unit 5. Subsystem Design: Data-paths; adder, Shift resisters, ALU, Memory; NVRWM, Flash memories, 6-Transistor RAMs. Latch up in CMOS circuits.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. S.K. Gandhi, VLSI Fabrication Principles, Wiley.
2. S.M. Sze, VLSI Technology, II edition, McGraw Hill.
3. P. Van Zandt, Microchip Fabrication, A practical Guide to Semiconductor Processing, Third edition, McGraw Hill.

REFERENCE BOOKS RECOMMENDED:

1. James D Plummer, Silicon VLSI Technology Fundamentals Practice & Modeling Pearson Education Limited
2. Singh R.K., VLSI Technology Design & Basics of Microelectronics, S. Kataria & Sons

PEC-4

BM 45253 : DIGITAL IMAGE PROCESSING

COURSE OUTCOMES:

1: Study of fundamentals of image processing and image perception.
2: Introduction to image enhancement spatial domain techniques.
3: Introduction to image restoration: noise degradation model.
4: Introduction to different image transforms.
5: Concepts of image analysis, feature extraction etc.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

Unit. 1 Fundamentals of Image Processing and Image Perception

Two-dimensional systems - linear systems and shift invariance. Fourier transform - Z - transform - Block matrices, Toeplitz and Kronecker product. Luminance, brightness and contrast. Color representation, color matching and reproduction, color vision model. Image sampling and quantization. Two dimensional sampling theory, reconstructions of images from its samples. Image acquisition.

Unit. 2 Image Enhancement Spatial Domain Techniques

Image negative, contrast stretching, gray level and bit plane slicing, power law transformation, histogram equalization and histogram specification, local enhancement techniques, image subtraction, averaging and logical operations. Spatial filtering: low pass, high pass and derivative filters, median filtering. Frequency domain filters: low pass, high pass and butterworth filters.

Unit. 3 Image Restoration

Noise degradation model, estimation of degradation model. Restoration in presence of noise- spatial filtering, frequency domain filtering, inverse filter and least mean square error(wiener) filtering.

Unit. 4 Image Transforms

2-D FFT and its properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, K L transform

Unit. 5 Image Analysis Feature extraction, spatial features, amplitude and histogram features, transform features, edge detection: gradient, Compass Laplace, Sobel, Prewitt operators, stochastic gradients. Line and spot detection. Boundary extraction: connectivity and contour following.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Gonzalez Rafel C, Wintz Paul , *Digital Image Processing*, Addison Wesley, 1987.
2. Jain Anil K,*Fundamentals of Digital Image Processing* , Prentice Hall, 1996.
3. B. Chanda, D. Majumder,*Digital Image Processing and Analysis*, PHI, 2011.

REFERENCE BOOKS RECOMMENDED:

1. Pratt William K , *Digital Image Processing*, John Wiley and Sons, 2006

EC 45301: INTERNET OF THINGS (IoT)

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand IoT architecture and IoT decision framework.
2. Configure Raspberry Pi, understand sensors, actuators & get started with Python on Raspberry Pi.
3. Understand various IoT networking protocols used to develop communication solutions.
4. Able to design architecture for an end-to-end solution and perform data analytics.
5. Understand IoT challenges, business solutions, research scope and current development.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1:

Introduction: Definition, Characteristics of IoT, IoT Conceptual framework, IoT Architectural view, Physical design of IoT, Logical design of IoT, Application of IoT.

UNIT 2:

Machine-to-machine (M2M), SDN (software defined networking) and NFV (network function virtualization) for IoT, data storage in IoT, IoT Cloud Based Services.

UNIT 3:

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, SOAP, REST, HTTP Restful and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IoT, Media Access control.

UNIT 4:

Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Actuator, Sensor data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Network Technology.

UNIT 5:

IoT Design methodology: Specification -Requirement, process, model, service, functional & Operational view.IoT Privacy and security solutions, Raspberry Pi & arduino devices. IoT Case studies: smart city streetlights control & monitoring.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. V. Madisetti and A. Bahga, "Internet of things (A-Hand-on-Approach)", Universal Press.
2. Rajkamal, "Internet of Things", Tata McGraw Hill publication.
3. A. Pajankar and A. Kakkar, "Raspberry Pi by Example", Packet Publishing Ltd, Birmingham, UK.

REFERENCE BOOKS RECOMMENDED:

1. F. Dacosta “Rethinking the Internet of things: A Scalable Approach to Connecting Everything”, Apress publications.
2. D. Norris, “The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black”, McGraw-Hill Education, New Delhi.
3. P. Raj and A.C. Raman, “The Internet of Things”, CRC Press (T&F Group), New York

EC 45302 : ADVANCED DIGITAL SIGNAL PROCESSING

COURSE OUTCOMES:

At the end of the course, the student should be able to:

1. Analyze and apply the concepts of random processes in practical applications
2. Analyze and apply linear estimation and prediction techniques for a given random process
3. Analyze, mathematically model, modify and enhance speech and music signals.
4. Analyze and apply appropriate adaptive algorithm for processing non-stationary signals
5. Analyze and apply wavelet transforms for signal and image processing based applications

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1 : Discrete-Time Random Signals
Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, Response of LTI systems to random processes Power Spectral Density, Some useful random process models.

UNIT 2: Linear Estimation and Prediction
Estimation of mean, variance and covariance, Estimation theory, Spectrum estimation, Optimum Linear filters, Optimal FIR (Wiener) filter, Extraction of signal from noise, Forward and Backward Linear prediction and all-pole signal modeling.

UNIT 3: Speech and Audio Processing
Audio Signal Characteristics, Production model, Hearing and Auditory model, Acoustic characteristic of speech, Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model. Audio signal acquisition, Representation and Modeling, Enhancement of audio signals: Spectral Subtraction, Weiner based filtering, Neural nets.

UNIT 4: Adaptive Filtering:
Concept of adaptive filtering, Method of Steepest descent, LMS adaptive filters: Structure and operation of LMS algorithm, Statistical LMS theory, Other LMS based algorithms, RLS algorithm.

UNIT 5: Introduction to Wavelets:
Piecewise constant approximation - the Haar wavelet, Building up the concept of dyadic Multiresolution Analysis (MRA), Relating dyadic MRA to filter banks, review of discrete signal processing, Elements of multirate systems and two-band filter bank design for dyadic wavelets, The Uncertainty Principle and its implications: the problem and the challenge that Nature imposes, The importance of the Gaussian function.
ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Simon Haykin, Adaptive Filter Theory, Fourth Edition, Pearson Education India, 2002.

2. Vikram Gadre and Aditya Abhyankar**,** Multiresolution and Multirate Signal Processing: Introduction, Principles and Applications, McGraw Hill Education; First edition, July 2017.
3. Sen, Soumya, Dutta, Anjan, Dey, Nilanjan, Audio Processing and Speech Recognition,1st edition, 2019, Springer.
4. D.G.Manolakis and V.K.Ingle Applied Digital Signal Processing: Theory and Practice, Cambridge University Press, 2011.

REFERENCES BOOKS RECOMMENDED:

1. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.
2. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
3. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.
4. Gold, B.; Morgan, N.; Ellis, D. Speech and audio signal processing: processing and perception of speech and music. 2nd rev. ed. Wiley-Blackwell, 2011

IP45010 : INDUSTRIAL ENGINEERING AND MANAGEMENT

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

PRE- REQUISITE: NIL

COURSE OBJECTIVES:

This course aims to develop the productivity improvement skills among students with the applications of methods and tools of Industrial Engineering and Management.

COURSE OUTCOMES:

CO-1: To understand and apply the concepts of work study for productivity improvement.

CO-2: To comprehend the basic fundamentals of management and organization.

CO-3: To grasp and apply the concepts of personnel management and identify the problems associated with human resource.

CO-4: To identify and solve the problems related to quality management and apply the quantitative decision making in managerial decision making.

COURSE CONTENTS:

Theory:

Unit-1. Productivity, Method Study- Fundamentals, Procedure, Principles of Motion Economy and Therbligs. Work Measurement techniques, Time Study- Fundamentals, Procedure, Equipments, Rating, Allowances and Time standards.

Unit-2. Principles and Functions of Management, Organization- Principles, Types and Structures, Formal and Informal Organization, Span of Control, Delegation, Centralization and Decentralization.

Unit-3. Personnel Management Functions, Communication, Motivation and Leadership Theories, Recruitment, Selection, Training, Performance appraisal, Job Evaluation, and Wage Incentive Schemes.

Unit-4. Quality Control, Economics of Quality Control, Quality Assurance and TQM Fundamentals, Process Capability Studies, Control Charts for Variables and Attributes, Acceptance Sampling Plans and Economics of Acceptance Sampling.

Unit-5. Quantitative Techniques for Decision Making: Introduction to Operations Research, Models, Linear Programming, Transportation and Assignment Models and Applications,Network Techniques and applications.

COURSE ASSESSMENT: Students will be assessed as following:
Theory paper:

(1) End Semester Exam: 70% weightage,
(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage,assignment: 16.5% weightage, regularity 16.5% weightage)

Books & References Recommended :

1. Mahajan M.Industrial Engg. and Production Management, Dhanpat Rai, New Delhi.
2. International Labour Organisation (I. L.O.), Work Study, Geneva.
3. Terry and Franklin, Principles of Management, Irwin.
4. Barnes R.M., Time and Motion Study, Wiley, New York.
5. Grant E.L., Statistical Quality Control. McGraw-Hill, New York.
6. Vohra ND, Quantitative Techniques in Management, TMH, New Delhi.

EE 45203/4503: INDUSTRIAL AND POWER ELECTRONICS

PREREQUISITE: Basic and Analog Electronics, Basic Electrical Engineering

COURSE OUTCOMES:-

At the end of this course students will demonstrate the ability to:

1. To provide students a deep insight in to the operational behaviour of practical power switching devices with respect to their static and dynamic characteristics
2. To learn the working principle of classified topologies of Thyristor based AC/DC, AC/AC, DC/DC and DC/AC converters.
3. To design and analyze the operation of above converters considering their applications.
4. To understand design of firing circuits for Thyristor based line commutated converters.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	2	70	30	40	60	200	3	1	4

THEORY:

Unit 1. Static power devices: Thyristor family, two transistor analogy of SCR, construction, characteristics, parameters, turn on and turn off methods, firing circuits, isolation and amplifier circuits, synchronization circuits.

Unit 2. Converters: AC to DC converters, single phase rectifier circuits with different load, various quadrant operation, basic principle and power circuits of dual converter and cyclo converter.

Unit 3. DC to DC converter: Basic principle of chopper circuits, various chopper circuits and their working, step up chopper, performance analysis.

Unit 4. Inverters: CSI and VSI inverters, single phase inverters, principle of operation, voltage and frequency control techniques.

Unit 5. Industrial Application of Power Electronics, SMPS, UPS, AC and DC drives, Power Supplies.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

PRACTICALS:

List of Experiments

1. Verification of steady state characteristics of different static switches.
2. Phase control of TRIAC using DIAC and RC circuit in light dimming circuit.
3. Firing pulse generation using UJT based relaxation oscillator.
4. Firing pulse generation for SCR using TCA 785 IC.
5. Performance evaluation of single phase uncontrolled converter for R, RL load.
6. Performance evaluation of single phase controlled converter for R, RL load.
7. Performance Analysis of step down chopper

8. Performance evaluation of current commutation circuit for SCR
9. Performance evaluation of voltage commutation circuit for SCR.
10. Effect of duty cycle on the output voltage of buck-boost converter.

ASSESMENT:

Internal viva, Continuous evaluation of experiments, Journal write-up, and Additional experiments conducted, Quiz, End semester exam.

TEXT BOOKS RECOMMENDED:-

1. Semiconductor Power Electronics, C.M. Pauddar, Jain Brothers
2. Power Electronics, M.H. Rashid,Pearson Education Limited
3. Power Electronics, Ned Mohan,John Wiley & Sons Inc Sea Pvt. Ltd.

REFERENCE BOOKS RECOMMENDED:-

1. Power Electronics, P.C. Sen, Tata Mcgraw Hill Publishing Co Ltd

PEC-5

EC - 45602-: OPTICAL NETWORKS

HRS. PER WEEK			CREDITS			MAXIMUM MARKS				
T	P	Tu	T	P	Tu	THEORY		PRACTICAL		TOTAL MARKS
3	-	-	3	-	-	CW	END SEM	SW	END SEM	
						30	70	-	-	100

PRE-REQUISITES:- Computer networks, Optical Communication.

COURSE OUTCOME:-

Students should be able to:

1. Understand of second generation of Digital transport
2. Analyze the architecture of third generation of Digital transport.
3. Understand the operation of WDM
4. Design of optical network consisting of routers and access networks

Unit 1: SONET/SDH: Review of SONET/SDH, Frame structure, Functional Components, SONET Problem Detection.

Unit 2: Optical Transport Network: Architecture**,** Current Digital Transport Hierarchy, New Optical transport and Digital Transport Hierarchy, The OTN Layered Model, Generic Framing Procedure (GFP)

Unit 3: WDM networks: Operation, Dense Wave Division Multiplexing (DWDM), Elements of WDM networks, Amplifiers, WADM Input and Output Ports, WDM Cross-connects

Unit 4: Optical Routers: Switching in Optical Internets, Optical Switching Technologies, An Optical Router, Micro Electro Mechanical Systems (MEMS), Optical cross connects

Unit 5: Optical access networks: Architecture, Hybrid fiber coax (HFC), Enhanced HFC, Passive optical networks; Optical burst switching, Optical CDMA: Basic concept and applications.

Text Books:

1. Ramaswami and Sivrajan, *Optical Networks: A Practical Perspective*, Pearson.
2. Uyless Black, *Optical Networks and 3rd Genration Transport Systems*, Pearson
3. Senior J.M., *Optical Fibre Communications: Principles & Practice*, PHI.

References Books:

1. Biswanath Mukherjee **,** *Springer Handbook of Optical Networks***,** Springer

OEC 2

EC 45759: SATELLITE AND RADAR COMMUNICATION SYSTEMS

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. Understand basic concepts of Satellite communication and its sub systems.
2. Understand design strategies of Satellite links and multiple access techniques
3. Understand basic concepts of GPS and its applications.
4. Understand basic concept of Small satellites and its applications.
5. Understand basic concept of RADAR and its applications.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

Theory :

Unit 1. Basics of Satellite Subsystems: Geo-stationary and other Satellite orbits and its location from earth, Satellite Communication Subsystems, Transponders.

Unit 2. Satellite Channel and link design: Major Frequency allocation, Design of Downlink & Uplink, Earth Station, Multiple access Techniques including DAMA, SCPC.

Unit 3. Satellite Navigation & Global Positioning Systems: Introduction to GPS Positioning principles, GPS receivers and codes, Satellite Signal Acquisition, GPS Signal Level & timing accuracy, differential GPS, VSAT.

Unit 4. **Design of small satellites:** Small satellite power budget, applications of small satellites, small satellite bus, power subsystems, structural subsystems, satellite launch vehicle."

Unit 5. Radar Systems: Historical review of Radar, Range equation and its analysis, Different Display Systems like PPI, E- Scope etc. CW & FM Radar: MTI and Pulse-Doppler radar, Radar Scanning & tracking, Application of Radar such as Navigation Systems etc, and their applications.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Timothy Pratt & Charles Bostain, Satellite Communication, 2nd ed. 2001, Wiley.
2. I.J.Bahal and P. Bhatia, Micro strip Antenna, 3rd ed. 2004, New ed, Artech house Inc.
3. Tapan & Sarkar, Smart Antenna. IEEE Press/ CRC Press. 4th ed. 2003.

REFERENCE BOOKS RECOMMENDED :

1. Manual of Satellite Communication, 3rd ed.,2008,Tata McGraw Hill.
2. M.I. Skolnik, Introduction to Radar System,3rd ed.,2001,TMH.
3. D. Roddy, Satellite Communication, 4th ed.2001

EC--: GAME THEORY IN WIRELESS COMMUNICATION

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. To Introduce different concepts of game theory
2. To understand application of Game theory in engineering.
3. To have necessary background of Game theory to design wireless systems.
4. To study various Games and to identify their suitability in wireless comm.

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1: Introduction to game theory. Prisoner's dilemma, Nash Equilibrium, Co-operative and Non co-operative games, zero-sum & nonzero-sum games. Types of strategies, Saddle point (Equilibrium) point, rules of determining a saddle point. Optimal strategies.

UNIT 2: Non-cooperative Game Theory, Game in Normal form, Analysing Games: Pareto optimality, Maxmin and Minmax strategies.

UNIT 3: Stochastic games, Bayesian games, Computing equilibria,concept of Shapely value

UNIT 4: Coalition Game Theory and algorithmic game theory, basic concepts and analysis. Transferable Utility, Analyzing Coalitional Games.

UNIT 5: Aplication in Wireless Networks: Resource Allocations, Routing in Sensor and Ad-Hoc Networks ,CDMA Power Control , Radio Spectrum Arbitrary Distribution.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOK RECOMMENDED :

1. Zhu Han, Game Theory in Wireless and Communication Networks: Theory, Models, and Applications,1edition.

OEC 2 (New Subject)

EC-45-- : INTRODUCTION TO CRYPTOGRAPHY

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to:

1. To understand the need of information security and classification of possible security attacks
2. To conceptualize basic network security model, associated transformation and related terminology.
3. Design of symmetric key systems for data confidentiality and their comparison
4. Design of an asymmetric key system, its application in digital signature and comparison with symmetric key systems
5. Various practical applications of cryptographic techniques for data security

Hours / Week			Maximum Marks				Total Marks	Credits		
			Theory		Practical					
L	T	P	End Sem	CW	SW	End Sem		Th	Pr	Total
3	-	-	70	30	-	-	100	3	-	3

UNIT 1: Need for information security, possible security violations (attacks) and their classification, Basic principles of cryptography, Typical mechanisms, network security model and associated terminology.

UNIT 2: Kerckhoff principle of network security, Classification of transformation techniques, Substitution techniques (Caeser, mono-alphabetic, poly-alphabetic, Playfair), transposition techniques (railfence, multiple stages), their comparison on the basis of cryptanalysis, introduction to product cipher.

UNIT 3: Asymmetric key system and its features, RSA algorithm, applications of asymmetric key system, elements of key generation and its management, comparison of asymmetric and symmetric key system.

UNIT 4: Digital signature as data authentication, digital envelope, hash functions and their properties, Secure Hash Function (SHA), Message Digest (MD5) and their comparison.

UNIT 5: Modes of operations (Electronic code book and counter mode) and their applications, security options in social media sites (whatsapp, gmail) and their signifance, IT act section 43 of India, Introduction to General Data Protection Regulations (GDPR), block chain and PGP.

ASSESMENT: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

TEXT BOOKS RECOMMENDED:

1. Kahate A., "Cryptography and network security", Tata MGH publ., second ed.
2. Stallings W., "Cryptography and network security:, Pearson edu. Publ., Second ed.
3. Bose R., "Information theory, coding and cryptography", Tata MGH publ., second ed.

REFERENCE BOOKS RECOMMENDED:

1. Simon Singh, "The code book", Ted Smart Publ.
2. Kaufman C. And Perlman R., "Network security", Pearson Edu. Publ.
3. Zimmerman P., "An introduction to cryptography", PGP corporation
4. Various URLs including www.[iacr.org (International Organization of Cryptographic Research), pgpi.org., nist.org/aes, epic.org, crypto.org, privacy.org, prism-break.org, certin.org, multi factor/two-step authentication/verification]