2MA209: MATHEMATICS – III **L T P C**
3 1 - 4

Fourier Series - Periodic functions, Dirichlet's conditions, Fourier series, Euler's formulae, Fourier expansion of periodic functions with period 2π, Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods, half range Fourier series, Harmonic analysis.

Laplace Transforms : Motivation, Definition, Linearity property, Laplace transforms of elementary functions, Shifting theorem Inverse Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transforms in solving ordinary differential equations, Laplace transforms of periodic, Unit step and Impulse functions.

Ordinary Differential Equations : Linear differential equations of higher order with constant coefficients, complimentary function, particular integral, method of variation of parameters, Higher order linear differential equations with variables coefficients (Cauchy's and Legendre forms), Simultaneous linear differential equations, Models for the real world problems and their solutions in particular, Modelling of electric circuits, Deflection of beams, Free oscillations, Forced oscillations, Resonance.

Partial Differential Equations : Formation of Partial differential equations, Directly integrable equations, Models of Engineering problems leading to first order partial differential equations. Langrange's equation. Applications to the Wave equation, one-dimensional heat and Laplace equation. Telegraphic and telephone equation.

Numerical Methods – Motivation, Errors, Truncation error, Rounded off error, Absolute error, Relative error and Percentage error, Solution of algebraic and transcendental equations by Newton-Raphson, Bisection, False position, iteration methods, Convergence of these methods.

Text Books:

1. Higher Engineering Mathematics (Third Edition) Vol-II, By Dr. K.R. Kachot. Publisher: Mahajan Pub. House, Ahmedabad.
2. Advanced Engineering Mathematics (Fifth Edition), Erwin Kreyszig. Publisher: John Wiley – 1999

Reference Books:

1. Higher Engineering Mathematics, By Dr. B.S. Grewal. Publisher: Khanna, New Delhi.
2. Elementry Differential Equations, By W.E.Boyce and R.Diprima Publisher: John Wiley – 2005
3. Numerical Methods for Engineers with Programming and Software Applications.By S.C. Chapra and R.P. Canale, Publisher: McGraw-Hill, Newyork – 1998
4. Fourier Series & Boundary Value Problems R.V. Churchill & J.W. Brown, Publisher: McGraw-Hill – 2006

2HM203: ENGINEERING ECONOMICS & BUSINESS MANAGEMENT **L T P C**
2 1 - 3

Basic Economic Concepts: Definition, Micro and Macroeconomics. Concept of Utility. National Income concepts. Concepts and types of economic planning. Factors of Production.

Market Demand Analysis: Demand Function and Law of Demand, factor-influencing demand. Demand forecasting, Cost Concepts, Concepts of Costs and Revenues, Break Even Analysis

Management: Concept, importance & nature. Functions and Skills

Management: Taylor's Scientific Management Theory. Fayol's Administrative Theory Planning, Decision Making, Organising, Coordination, Directing, Motivation, Controlling.
Human Resource Management: Functions of Human Resource Management,Recruitment, Selection, Training & Development., Discipline. Performance Appraisal. Grievance handling Industrial Relation. Communication. Leadership

Text /Reference Books:
1. R.D. Agrawal- Organizations and Management
2. J. Massie- Essentials of Management
3. O.P. Khanna- Industrial Economics and Management
4. Arun Monnapa & Saiydden Mirza- Personnel Management
5. K.K. Dewett- Modern Economic Theory
6. H.L. Ahuja- Advanced Economic Theory

2EE222 NETWORK ANALYSIS **L T P C**
3 1 - 4

Development of the Circuit Concept: Conventions for describing networks Network Equations Kirchoff's Law, The number of Network Equations, Source Transformations, Examples of the Formulations of Networks, Loop variable Analysis Node Variable Analysis, Determinants: Minors and the Gaus Method, Duality, State Variable Analysis
Initial Conditions: Initial conditions in elements, procedure for evaluating initial conditions.
The Laplace Transformation: Introduction, The Laplace Transformation, Some Basic Theorems for the Laplace Transformation, Examples of the Solution of Problems with the Laplace Transformation Partial Fraction Expansion, Heaviside's Expansion Theorem Examples of Solution by the Laplace Transformation,
Transforms Of Other Signal Waveforms: The Shifted unit step function, The ramp and Impulse functions, Waveform Synthesis The initial and final value of f (t) from F (s),
Network Theorems: Thevenin, Norton, Superposition, Maximum power transfer, Reciprocity, Millman, Tellegen etc.
Network Functions: Poles and Zeros Terminal Pairs or port Network Functions for the One Port and two Port, The Calculation of Network Functions Ladder Network General Networks, Poles and Zeros of Network Functions, Restrictions on Pole and Zero locations for Transfer functions
Two Port Parameters: Relationship of Two-port Variables, Short-circuit Admittance parameters, The open Circuit Impedance Parameters, Transmission parameters, The Hybrid parameters, relationships between parameters Sets, Parallel Connections of Two-port networks
Sinusoidal Steady -state Analysis: The Sinusoidal Steady State, The Sinusoidal and $e^{+- jwt,}$ Solution using $e^{+- jwt}$ Solution using $\mathbf{e}^{+- \mathbf{jwt}}$ or Im $e^{+- \mathbf{jwt}}$**,** Phasors and Phasor diagrams,
Network Synthesis: Properties of positive real function, necessary and sufficient conditions, basic Synthesis procedure, synthesis of L-C, R-L and R-C driving point functions.

Tutorials: It will consist of minimum of ten tutorial assignments.

Text / Reference Books:
1. M.E. Vanvalkenburg- Network Analyses, (PHI)
2. G.K.Mithal- Network analysis, Khanna publications

2EC202 ELECTRONICS DEVICES AND CIRCUITS – I L T P C
3 1 2 5

Semiconductor Diode Characteristics: Open-circuited PN junction, P-N junction as a rectifier, Current components in a PN junction diode, volt-ampere characteristics, Photo-diode, Temperature Dependence of diode characteristic, Transition capacitance (CT), Diffusion capacitance, diode resistance, charge control description of a diode, Rectifiers, full wave circuits, C, LC, II filters.

Clipping And Comparator Circuits: Clipping (limiting) circuits, Diode clipper, transistor clipper, Clipping at two independent levels, emitter coupled clipper.

Clamping And Switching Circuits: Clamping operation, clamping circuit taking source and diode resistance into account, Clamping theorem, Practical clamping, effect of diode characteristics on clamping voltage, Transistor as a switch, switch with inductive and capacitive load

Transistor Characteristics and biasing: Transistor Characteristics And Transistors Biasing And Thermal Stabilization: Junction Transistor, Transistor action, transistor currents component, transistor as a amplifier, transistor configurations- CB, CC, CE, CE cutoff, and saturation regions, Maximum voltage rating, DC operating point, Bias stabilization, Stabilization techniques, Bias compensation, Thermal runaway, Phototransistor

BJT As Small Signal Low Frequency Amplifier: Transistor as an amplifier, general characteristics of an amplifier, Hybrid model, Determination of h-parameters from characteristics. Analysis of amplifier circuit using h-parameters. Common emitter circuit, common collector or emitter follower circuit, Common base circuit, Analysis of common emitter amplifier with collector to base bias, Comparison of transistor amplifier configurations, linear analysis of a transistor, Miller's theorem and it's dual, Cascading transistor amplifiers, simplified CE and CC hybrid model.

Transistor At High Frequencies: Hybrid II CE transistor, Hybrid II Conductance, Hybrid II capacitance. Validity at Hybrid II Model, Variation of Hybrid II parameters, CE short-circuit current gain, current gain with resistive load, Single stage CE transistor amplifier response, Gain- bandwidth product, Emitter Follower at high frequency.

Multistage Amplifiers: Classification of amplifiers, Distortion in amplifiers, Frequency response of an amplifier, step response of an amplifier, Bandpass of cascaded stages, Two stage RC amplifier, Low frequency response of an RC-coupled stage. Effect of an emitter bypass capacitor on Low frequency response.High frequency response of two cascaded CE transistor stages, Multistage CE amplifier cascade at high frequencies

Negative Resistance Devices: Tunnel diode, UJT, Negative resistance characteristic, basic circuit principles, monostable, bistable and astable operations, Voltage controlled switching circuits, Tunnel-diode monostable circuit and astable circuit, Tunnel-diode comparator, Tunnel-diode monostable circuit. Tunnel diode transistor hybrid circuit, applications of UJT

Tutorials: It will consist of minimum of ten tutorial assignments.

Practical / Term-work: Practical /term-work will consists minimum ten experiments based on above topics.

Textbooks:

1. Millman and Halkias- Integrated Electronics, MGH
2. Boylestead & Nashelsky- Electronics Devices and Circuits Theory, PHI
3. Allen Motershead- Electronics Devices and circuits

2IC221 LINEAR CONTROL SYSTEMS **L T P C**
3 - 2 4

Introduction to Control Systems: Introduction to control systems, Classification of control systems, The Open-loop control systems & Closed-loop control systems, Comparison of Open-loop control systems & Closed-loop control systems, Servomechanism, Examples with applications in engineering field.

Mathematical Modeling of Dynamic Systems: Introduction, Differential equations of physical systems, Mechanical systems: Translational elements, Rotational Elements, Electrical systems, Transfer Functions of mechanical systems & electrical systems with examples. Analogous system: Analogous in force (torque)-voltage analogy & force (torque)-current analogy, problems on Analogy, Gear trains: Design and applications.

Block diagram Technique and Signal Flow Graphs: Block diagram of a close loop system, Rules of block diagram reduction techniques, Various terms of Signal, flow Graphs, Construction of signal flow graphs, Mason's gain formula, Use of Mason's gain formula to determine the T.F. Problems.

Feedback Characteristics Of Control Systems: Feedback and non-feedback system, Reduction of parameter variations by use of feedback, Control of the effects of disturbance signals by use of feedback, Regenerative feedback, Problems.

Control Systems And Components: Comparison between ordinary motor and servomotor, T.F. of servo motors: 1) Field controlled D.C. servo Motor, 2) Armature controlled D.C. servomotor, 3) Two phase A.C. servomotor. Introduction to stepper motors & its applications. Problems.

Time Response Analysis & Design Specifications: Introduction, Standard test signal, Time response of first order control system, Time response of a second order control system, Response of second order system to the unit-step, Time response specifications, Derivation of specifications of second order system, Steady state error and error constants, Types of feedback control systems,

Concept Of Stability And Algebraic Criterion: Concept of stability, absolute stability, absolute stability and relative stability, Necessary condition for stability, Hurwitz stability criterion, Routh stability criterion , Special cases of Routh Stability Criterion, Application of Ruoth Criterion to linear feedback control system, Relative stability analysis, Nyquist stability criterion, Problems.

The Root Locus Technique**:** The concepts of Root locus, Rules for constructions of Root locus Problems.

The Frequency Response Analysis: Introduction frequency response, Frequency domain specifications, Correlation between time and frequency response, Contraction of Polar plots, Contraction of Bode plots, Experimental determinations of transfer functions, Determination of Gain margin and Phase margin gain for find stability in frequency domain, Problems.

State Variable Analysis Of Control System: Introduction, Concepts of state, state variables, state vectors, state space, State space equations, correlation between T.F.& state space equations, Space models, Problems.

Practical/ Term-work: Practical /term-work will consists minimum ten experiments based on above topics.

Text / Reference Books:

1. I.J. Nagrath & M. Gopal- Control System Engineering, New Age international
2. K. Ogata- Modern Control Engineering, PHI
3. B.C.Kuo- Automatic Control Systems
4. Raven- Automatic control Engineering
5. B.S.Manke- Linear Control Systems
6. S.N.Verma- Automatic Control Systems

2EC203 SIGNALS AND SYSTEMS **L T P C**
4 - - 4

Introduction of Signals and Systems: Signal and System, Overview of Specific Systems, Classification of Signals, Basic Operations on Signals, Elementary Signals, Systems viewed as Interconnections of Operations, Properties of Systems,Time-Domain Representations for Linear Time- Invariant Systems: Introduction, Convolution, Impulse Response Representation for LTI Systems, Properties of the Impulse Response Representation for LTI Systems, Differential and Difference Equation Representations for LTI Systems, Block Diagram Representations, State- Variable Descriptions for LTI Systems,Fourier **Representations for Signals:** Introduction, Continuous-Time Periodic Signals, Continuous-Time Nonperiodic Signals, Discrete-Time Periodic Signals, Discrete-Time Nonperiodic Signals, and Properties of Fourier Representations.

Applications of Fourier Representations**:** Introduction Frequency Response of LTI Systems, Fourier Transform Representations for Periodic Signals Convolution and Modulation with Mixed Signal Classes, Fourier Transform Representation for Discrete-Time Signals, Sampling, Reconstruction of Continuous-Time Signals from Samples, Fourier Series Representations for Finite-duration Nonperiodic Signals.

Filtering and Signal Distortion: Time Response, Frequency Response, Linear Distortion and Equalization, Ideal Low-Pass Filters, Band-Pass Transmission, Phase Delay and Group Delay, Nonlinear Distortion

Spectral Density And Correlation, Energy: Spectral Density, Correlation of Energy Signals, Power Spectral Density, Correlation of Power Signal, Spectral Characteristics of Periodic Signals, Spectral Characteristics of Random Signals And Noise, Noise Equivalent Bandwidth.

Text /Reference Books:

1. Simon Haykin- Signals and Systems, (John Wiley)
2. Simon Haykin- Analog and Digital Communications, (John Willey)
3. Bruce Carlson- Signals and Systems.
4. Oppenheim & Wilsky- Signals & Systems, (PHI)

2EC204 ELECTRONICS WORKSHOP **L T P C**
- - 2 1

Symbols of electronic components & component identification Drawing of symbols in sketchbook.

Study of various electronics components: Types, characteristics and applications,Testing of various components, Study and use of Laboratory equipments such as Multimeter, Function

generator, Power supply, CRO etc.,Soldering & desoldering practice, Study of PCB, PCB fabrication,Exercises based on fabrication & testing of small electronics circuits (or a mini project)

2SP201: CAREER ORIENTATION-I [0 1 0 0]

The objective of the supplementary course of Career Orientation – I is to sensitize each student about one's own potential, and this in turn will enable one to be self driven so as to improve one's performance and achieve one's life goals.

The topics covered are: Self start, dedication, confidence, motivation, discipline, study, progress, evaluation, appreciation, criticism, improvement, reliance, control, respect, satisfaction, awareness, fulfillment and realization, inwardly directed towards oneself.

Basically the course is an in-depth exposure of a booklet on "Gateways to Self Realization" by Shri G. Narayana. The methodology is of self learning in which the students go through the book (in depth) and make presentations before their class, carry out given exercises and interesting activities; keeping the content in focus

2MA204 ADVANCED MATHEMATICS **L T P C**
3 - - 3

Vector Calculas: Reorientation, Differentiation of Vectors, Scalars and vector fields, Gradient of a scalar function, Directional derivative, Divergence and Curl of a vector function and their physical meanings, Line, Surface and Volume integrals, Green's theorem, Gauss and Stoke's theorems (Without proof), Irrotational, Solenoidal and conservative vector fields.
Functions Of Complex Variables: Reorientation, Analytical function, Cauchy – Riermann equation (Cartesian and Polar forms), Harmonic functions, Conformal mappings, Complex integration, Cauchy's theorem and integral formula, Singularities, Taylor's and Laurent's Series theorem, Evaluation of integrals using residues.
Fourier Integrals And Transforms: Fourier integral theorem (only statement), Fourier Sine and Cosine integrals, Complex form of Fourier integral, Fourier Sine and Cosine transforms, Inverse Laplace transforms by residues, Solution of boundary value problems using Fourier transforms. Application to transverse vibration of a string and transmission lines.
Z-Transforms: Definition, Z – Transforms of some basic sequences, unit impulse and unit step sequences, inverse Z – transforms.
Introduction To Mathematical Development – Wavelets: Mathematical development of wavelets and their Applications. The idea behind wavelets, The Harr wavelets, wavelet expansion.

Text Books:
1. Dr. K.R. Kachot: Higher Engineering Mathematics Vol. III (Second Edition), Mahajan Publishing House, Ahmedabad.
2. Erwin Kreyszig: Advanced Engineering Mathematics (Fifth Edition),Publishers: John Wiley – 1999

Reference Books:
1. Dr. B.S. Grewal: Higher Engineering Mathematics,Publisher: Khanna Publishers, New Delhi.
2. Peter V. O'Neil: Advanced Engineering Mathematics (Fifth Edition),Publishers: Thomson – Books/Cole, Singapore.
3. Complex variables – Introduction & Application – By M.J. Ablowitz & A.S. Fokas Publisher: Cambridge University Press - 1998
4. Integral Transforms – By M.D. Raisinghania, Publishers: S.Chand, New Delhi

2EC201 DIGITAL CIRCUITS **L T P C**
3 - 2 4

Introduction to logic devices (PLD,FPEA)
Number System**:** Decimal, Binary, Octal, Hexadecimal number system, Conversion of numbers from one number system to other, complement method of subtraction, 9's and 10's compliment method, 1's and 2's complement method, Floating point numbers.
Binary Codes: Weighted and Non-weighted code, Self complementing course, cyclic course, 8421 BCD code, XS-3 code, Gray code, Binary to Gray conversion, Gray to Binary conversion, Parity bit and its importance in error detecting.
Logic Gates: AND, OR, NOR, NOT, NAND, X-OR, Inhibit circuits,
Boolean Algebra**:** Axioms and laws of Boolean algebra, D'morgans theorem, Duality, Reduction of boolean expression, converting AND/OR/INVERT logic to NAND/NOR logic Simplification of Boolean expression using Karnaugh Map and Quine- Mcclusky Methods

Expansion of a boolean expression to SOP and POS form, Minimization of POS and SOP expressions for 2 to 6 variables, Don't care conditions, Combinational logic, Quine- Mcclusky methods.

Combinational Circuits: The Half-adder, The Full-adder, The Half-subtractor, The Full-Subtractor, Parallel Binary Adders, The Look-Ahead Carry Adder, IC Parallel Adders, Two's Complement Addition And Subtraction Using Parallel Adders, Serial Adders, BCD adder, Binary Multipliers, Code converters, Parity bit Generators/Checkers, Comparators, IC comparators, Decoders, BCD to 7-

Segment Decoders, Display devices, Encoders, Keyboard Encoders, Priority Encoders, Multiplexers, Applications of Multiplexer, Demultiplexers

Flip-Flops and Timing Circuits: S-R Flip-flop, JK Flip-flop, D Flip-flop, T Flip-flop, Edge – Triggered Flip-flop, Master-slave Flip-flop, and Applications of Flip-flops.

Shift Registers: Serial-in Serial-out Shift register, Serial-in Parallel-out Shift register, Parallel-in Serial-out Shift register, Parallel-in Parallel-out Shift register, Bi-directional shift register, Universal shift register, Dynamic shift register, Applications of shift registers.

Counters: Asynchronous counter, Design of Asynchronous counter, Effect of Propagation Delay in Ripple counter, Decoding of Ripple counters, Integrated circuit Ripple counters, Synchronous counters, Design of Synchronous counter.

Logic Families: Digital IC specification terminology, Logic families, TTL, Open collector gate, TTL subfamilies, IIL, ECL, MOS, CMOS, Dynamic MOS Logic

Memories: Memory types and terminology, Read Only memory, Semiconductor RAMs, Non-volatile RAMs, Sequential memories, Programmable logic Devices, Magnetic memories, Optical Disk memory, Charge coupled devices.

Analog To Digital And Digital To Analog Converters**:** Digital to Analog Conversion, R-2R ladder type DAC, Weighted resistor type DAC, Switched current source type DAC, Switched capacitor type DAC, Analog to Digital Conversion, Counter type A/D converter, Tracking type A/D converter, Flash-type A/D converter, Dual slope type A/D converter, Successive approximation type ADC.

Introduction to programmable logic devices : PLD, FPGA

Practical / Term-work: Practical /term-work will consists minimum ten experiments based on above topics.

Text / Reference Books:

1. M. Morris Mano- Digital logic and computer Design, PHI
2. A. Anand Kumar- Fundamentals of Digital Circuits, PHI
3. R.P.Jain- Digital Electronics, TMH
4. B. Somanathan Nair- Digital Electronics and Logic Design, PHI

2EC205 ELECTRONICS DEVICES AND CIRCUITS – II L T P C
3 1 2 5

Feedback Amplifier: Feedback concept, transfer gain with feedback, general characteristics of negative-feedback amplifiers, input resistance, output resistances, method of analysis of a feedback amplifier, Current-shunt feedback, voltage-shunt feedback, current-series feedback, voltage-series feedback

Oscillators: Sinusoidal oscillator, Phase shift oscillators, Resonant-circuit, General form of oscillators, Wien bridge oscillators, Crystals oscillator

Power Amplifier: Class a, second harmonics distortion; higher order harmonics generation, transformer-coupled audio power amplifiers, efficiency, and Push-Pull amplifier, Class B, Class AB

Power Supply: Regulated power supply – series voltage regulator design, Short circuit and overload protections, Voltage regulator ICs. -Linear & SMPS
Tuned Amplifier: Basic principle, Single tuned, double tuned and staggers tuned amplifiers
Field Effect Transistor: Construction of JFET, operation of JFET, JFET characteristics, pinch-off voltage, JFET volt-ampere characteristics, FET small signal, MOSFET, FET as a VVR FET biasing, Fixed bias circuit, Voltage divider biasing circuit, self bias circuit, biasing for depletion type MOSFET, JFET as an amplifier, JFET low frequency small signal model, Common source circuit, Common drain circuit
MOSFET: Fundamental of MOS Diode, MOSFET, Effect of Gate & Drain voltage on Mobility, Channel Length Modulations, MOSFET Break drown & Punch –Through, Subthreshold Current, MOSFET Scaling, Nonuniform Doping in the Channel, Threshold voltage of Short-channel MOSFETs, Small Signal Analysis, SOI MOSFET, Buried Channel MOSFET.
Basic MOS Device Physics: General Considerations, MOS I/V Characteristics, Second order effects, Mos Device Models.
Single Stage Amplifier: Basic Concepts, Common –Source Stage, source Follower, Common Gate Stage, Cascode Stage, Choice of device models.
CMOS Processing Technology: Wafer Processing, Photolithography, Oxidation, Ion Implantation, Deposition and Etching, Device Fabrication, Interconnects, Latch-ups.

Tutorials: It will consist of minimum of Ten tutorials assignments.

Practical / Term-work: Practical /term-work will consist of minimum ten experiments based on above topics.

Text Books:
1. Millman & Halkias -Integrated Electronics, McGraw Hill
2. Behzad Razavi-Design of Analog CMOS Integrated Circuits

2EE224 ELECTRICAL MACHINES AND MATERIALS L T P C
4 - 2 5

Conducting Materials: Properties of conducting materials, types of conducting materials-copper, aluminum and silver, material used for special purpose like fuse, filaments, circuit breaker contacts, thermocouple materials, bimetals, soldering materials, materials used for instrumentation system.
Insulating and Dielectric Materials: General property of insulating materials, polarization, dielectric constant, permittivity, surface resistivity and volume resistivity, dielectric strengths, puncture, flashover, types of insulating materials, classification of insulating material according to operating temperature, piezoelectric materials, ceramics: properties and application.
Semiconductor Materials: Introduction to semiconductor physics, properties of semiconductor materials, silicon and germanium, intrinsic and extrinsic semiconductor, doping, hall effect, diffusion drift phenomenon, special semiconductors.
Magnetic Materials: Classification of magnetic material (Diamagnetic ferromagnetic, ferrite, paramagnetic material), soft and hard magnetic material, characteristics of magnetic material, properties of magnetic material (magnetization, permeability, coercivity, retentivity), B-H curve, Hysteresis phenomenon, iron loss, types, methods for reducing iron loss.
Superconductors: Concepts of super conducting materials, types of super conducting materials, application of super conducting materials in electrical machines, power cables, electromagnets, future prospects.

DC Generator: Construction, types and EMF equation of DC generators, types of winding: Lap and Wave, commutation, methods of improving commutation, internal and external characteristics of DC generator.
DC Motors: Principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motors, speed control of DC shunt and series motors, DC shunt motors starter.
Transformer: Principle of operation, EMF equation, voltage ratio and turn ratio, Construction of single phase transformer, phasor diagram of transformer on No load and On load, exact and approximate equivalent circuit of transformer, voltage regulation, loses and efficiency of transformer, condition of maximum efficiency, auto transformer, parallel operation of transformers.
3-Phase Induction Motor**:** Construction, production of rotating field, principle of operation, speed and slip, rotor current, relation between rotor copper loss and rotor input, torque of an induction motor, condition of maximum torque, torque slip curve, losses and efficiency, starters for 3-phase induction motor, speed control of induction motor.
Single Phase Induction Motor: Production of magnetic field, starting of single-phase induction motor by capacitor and shaded pole motors.

Practical / Term-work: Practical /term-work will consists minimum ten experiments based on above topics.

Text / Reference Books:
1. G. K. Chhalotra -Electrical Engineering Materials, Khanna Publication
2. C. S. Indulkar -Electrical Materials, S. Chand
3. A. J. Dekker -Electrical Engineering Materials, PHI
4. Van. Vlack -Elements of Material Science
5. P. L. Kapoor -Electrical Engineering Materials
6. M. G. Say -Performance & Design of Alternating Current Machines
7. D.C. Machines and Transformers By, B. Murugesh Kumar
8. P. K. Mukharjee & S. Chakravarthi -Electrical Machines
9. B. L. Theraja -Electrical Technology – Vol II

2EC206 COMMUNICATION SYSTEMS **L T P C**
3 1 2 5

Random Processes - Introduction, Mathematical Definition of a Random Process, Stationary Processes, Mean, Correlation, and Covariance Functions,
Ergodic Processes, Transmission of a Random Process Through a Linear Time Invariant Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise, Representation of Narrowband Noise in Terms of In-phase and Quadrature Components, Representation of Narrowband Noise in Terms of Envelop and Phase Components, Sine Wave Plus Narrowband Noise.
Continuous Wave Modulation – Introduction, Amplitude Modulation, Linear Modulation Schemes, Frequency Translation, Frequency-Division Multiplexing, Angle Modulation, Frequency Modulation, Nonlinear Effects in FM systems, Superheterodyne Receiver, Noise in CW Modulation Systems, Noise in Linear Receivers using Coherent Detection, Noise in AM Receivers using Envelope Detection, Noise in FM Receivers.
Pulse Modulation – Introduction, Sampling Process, Pulse-Amplitude Modulation, Other forms of Pulse Modulation, Bandwidth – Noise Trade-off,
Quantization Process, Pulse-Code Modulation, Noise Considerations in PCM Systems, Time-Division Multiplexing, Digital Multiplexers, Virtues, Limitations and Modifications of PCM, Delta Modulation, Linear Prediction, Differential Pulse-Code Modulation, Adaptive

Differential Pulse-Code Modulation. **Baseband Pulse Transmission** - Introduction, Matched Filter, Error Rate Due to Noise, Intersymbol Interference, Nyquist's Criterion for Distortionless Baseband Binary Transmission, Correlative-Level Coding, Baseband M-ary PAM Transmission, Digital Subscriber Lines, Optimum Linear Receiver. Adaptive Equalization.

Signal Space Analysis - Introduction, Geometric Representation of Signals,
Conversion of the Continuous AWGN Channel into a Vector Channel, Likelihood Functions, Coherent Detection of Signals in Noise : Maximum Likelihood Decoding, Correlation Receiver, Probability of Error.

Text / Reference Books:

1. Simon Haykins -Communication system, Wiley
2. Roddy and Coolen -Electronic Communication, PHI
3. Taub and Schilling -Principles of Communication Systems , Tata Mcgrawhill
4. Bruce Carlson -Communication Systems, Tata Mcgrawhill

2EC207 ELECTRONIC CIRCUIT DESIGN LABORATORY **L T P C**
- - 2 1

The students will carryout mini circuit design project based upon following guidelines

1. The project should be strictly hardware based.
2. The project can be carried out individually or in a group.
3. The project work involves fabrication, testing and calibration (if required) work of some electronic circuit.
4. The project should be defended by adequate documentation & presentation.
5. A teacher can assign fabrication of trainer kits to the students.

2EC208 COMPUTER APPLICATION PACKAGES FOR ELECTRONICS DESIGN **L T P C**
- - 2 1

Laboratory exercises based on

1. Circuit simulation package like Pspice, Circuit maker, Electronic workbench or equivalent
2. PCB design and Schematic drawing package like ORCAD, CADSTAR, or equivalent.
3. Exercises on MATLAB.

Note: Student may be given exposure to any latest available software tools related to circuit simulation, schematic layout & PCB design.

2SP202- CAREER ORIENTATION-II **[1 0 0 0]**

The objective of this course is to continue previous course and enhance efforts for individual development. The course also aims to provide information on different topics related to their career planning and preparation. Topics include:-

-Goal Setting
-Stress Management
-Emotional Intelligence
-Career Prospects
-Industry Expectation
-Communication skills (Practical sessions)
  a. Presentation skills
  b. Interview Techniques

c. Group discussions
d. Non-verbal communications

-Overview of different tests for competitive exams
-Ethics for engineers
-Interpersonal relations
-Team works

Methodology of learning will be based on lecture-cum-interaction, workshops, expert lectures from industry people, assignments etc.

Syllabus for B.Tech Semester V (EC)

2EC301: ELECTROMAGNETIC THEORY **L T P C**
3 1 - 4

Vector Analysis: Scalars & Vectors, dot and cross products, co-ordinate systems and conversions.
Coulomb's law and electrical field intensity: Coulomb's law, field due to different charge distributions.Electric flux density,
Gauss's law and divergence: Concept of electric flux density, Gauss's law and its applications, differential volume element, divergence, Maxwell's first eqn. and divergence theorem.
Energy and potential: Energy expanded in moving a point charge in electrical field, line integral, definition of potential difference and potential, potential field of a point charge and system of charges, potential gradient, dipole, energy density in electrostatic field.
Conductors, dielectrics and capacitance: Definition of currents and current density, continuity eqn., metallic conductors and their properties, semiconductors, dielectric materials, characteristics, boundary conditions, capacitance of a parallel plate capacitor.
Poisson's and Laplace eqn.: Poisson's and Laplace eqn., Uniqueness theorem, examples of solution of Laplace and Poisson's eqns.
Steady magnetic field: Biot-Savart's law, Ampere's circuital law, concept of flux density, scalar and vector magnetic potential.
Magnetic forces, materials and inductance: Force on a moving charge, force on a differential current element, force and torque on a close circuit, magnetization and permeability, magnetic boundary conditions.
Time varying field and Maxwell's eqns.:Faraday's law, displacement current, Maxwell's eqns. in point and integral forms.
The uniform plane waves: Wave motion in free space, perfect dielectric, dielectric, pointing vector, power consideration, propagation in good conductor, phenomena of skin effect, reflection of uniform plane waves, Standing Wave Ratio.

Tutorials:
This shall consist of solution of about 20 examples based on the above topics

Text / Reference Books:
William Hayt- Engineering Electromagnetic, Vth edition McGraw Hill
J.D.Kraus- Electromagnetics, McGraw Hill

2EC302: INTEGRATED CIRCUITS AND APPLICATIONS **L T P C**
3 - 2 4

Operational Amplifier and its characteristics: Differential Amplifier, Block Diagram Representation of Op-Amp., Schematic Symbol, Dual Power Supply for Op-Amp., Ideal Op-Amp., Equivalent Circuit, Integrated Circuits, Op-Amp. with Negative Feedback.

Practical Op-Amp and Various Parameters: Measurement of Input Offset Voltage, Input Offset Current, Input Bias Current, Differential Input Resistance, Output resistance, Input Capacitance, Offset Voltage Adjustment Range, Input Voltage Range, Output Offset Voltage Swing, CMRR, Slew rate, PSRR, Gain Bandwidth Products, Transient Response, Power Consumption etc.

Applications of Operational Amplifier: Linear Applications:- AC/DC Amplifier, Inverting and Non-Inverting Amplifier, AC Amplifiers with single supply voltage, The Peaking Amplifier, Summing, Scaling and Averaging Amplifier, Instrumentation Amplifier, Differential input and Differential output amplifier, Integrator, Differentiator, Voltage to Current Converter with floating and grounded load, Current to Voltage Converter, Voltage Follower.

Non Linear Applications:-Comparator, Zero Crossing Detector, Schmitt Trigger, Voltage Limiters, Clipper and Clampers, Absolute Value output circuit, Peak Detector, Sample and Hold Circuit, Precision Rectifier – Half/Full Wave, Square, Triangular and Saw tooth Wave Generator, Log/ Antilog Amplifier,

Active Filters: Classification of filters, Magnitude and frequency Scaling, Magnitude and attenuation characteristics of ideal and practical filters., design Parameter Q & ω_0, Biquad (Universal) filter design, Butter worth Low pass and Highpass filters-1^{st} and 2^{nd} order circuits design, Butterworth pole location, Sallen & Key circuit, Butterworth Bandpass Filters-Frequency Transformation, Deliyannis- Friend circuit , Chebyshev filter characteristics, Band reject filters.

Other Specialized ICs:

555 Timer and its Applications: Block Diagram, Monostable and Astable Multivibrator, Applications as Frequency Divider, Square Wave Generator, Free Running Ramp Generator etc.

Phase Locked Loop and its Applications: Block Diagram and Operation, Applications as Frequency Multiplier, Frequency Shift Keying

Design of Power Supply: Simple OP-AMP Voltage regulator, three terminal Voltage

Regulators, Fixed and Adjustable Voltage Regulators (78XX,LM317), Heat Sink, Dual

Power supply (LM320, LM317), Basic Switching Regulator and its characteristics

Power Amplifiers: Monolithic Power Amplifiers (LM380)

Function Generator: IC XR 2206,8038

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:
Ramakant A. Gayakwad- Op-Amp and Linear Integrated Circuits, 4th Edition (PHI)
Van Valkenburg- Analog filter design, Oxford Publication

2EC303:MICROPROCESSOR & COMPUTER ARCHITECTURE **L T P C**
3 - 2 4

Organization of a Computer: Von Neumann and Harvard, architecture;
Instruction Set Architecture: RISC and CISCprocessors;
Computer Arithmetic: fixed point and floating point, arithmetic;
Design of ALU: hardware algorithms for addition, multiplication and division of fixed point and floating point, numbers;
Processor design: Data Path and Control Design, Microprogramming, Exception Processing, Pipelining; Memory, Organization: memory hierarchy, cache organization, Virtual Memory; System Design: bus structure, bus transactions;
Input-output Systems: programmed I/O, DMA and interrupt, driven I/O. Illustrations with examples of CISC processors from Intel and RISC processors like MIPS and ARM, Basics of 8086 microprocessor.

Laboratory Work:
Practical work will be based on the Specific processor like INTEL 8086/Pentium processor. Its assembly language programming, Interfacing of Memory and peripheral I/O systems etc.

Text / Reference Books:
J. Hayes, Computer Architecture and Organization, (McGraw-Hill, 3rd ed. 1998),
D. Patterson and J. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Third Edition, Morgan Kaufman

2EC304:MODERN MEASUREMENT & INSTRUMENTATION **L T P C**
3 - 2 4

Measurement errors and Standards: Definitions, Accuracy and precision, significant figures, Types of error, statistical analysis, probability of errors, limiting errors, Time and frequency standards, Electrical standards
Electromechanical indicating instruments: Suspension galvanometer, torque and deflection of the galvanometer, permanent magnet moving coil mechanism, DC ammeter, DC voltmeters, Voltmeter Sensitivity. Series type ohmmeter, shunt

type ohmmeter, Multimeter or VOM, calibration of DC instruments, Alternating –current indicating instruments, thermo instruments, electrodynamometers in power measurements, watt hour meter, power factor meters, instrument transformers.

Bridge measurements: Wheatstone bridge, kelvin bridge, AC bridge and their applications, Maxwell bridge, Hay's bridge, unbalance conditions, wein bridge.Anderson's bridge, De sautys bridge, schering bridge,

Electronics instrument for measuring basic parameters: True RMS responding voltmeter, digital frequency meter, circuit for measurement of frequency, simplified composied ckt of digital frequency meter, high frequency measurements, period measurement, ratio and multiple ratio measurements, time interval measurements

Cathode Ray Oscilloscope: Introduction, oscilloscope block diagram, Cathode Ray Tube, CRT ckts, Vertical deflection system, delay line , multiple trace, Horizontal deflection system, oscilloscope scope and transduces, oscilloscope techniques, special oscilloscope.

Instrument for generation and analysis of waveforms: Introduction, The sine wave generator, frequency synthesized signal generator, frequency divider generator, signal generator modulation, sweep frequency generator, pulse and square wave generator, function generator, wave analyzers, harmonic distortion analyzer, spectrum analyzer

Display devices and recorders: Digital display methods, digital display units, segmental displays, dot matrices, rear projection display, light emitting diode, liquid crystal diodes, segmental gas discharge displays, decade counting assembly's, display systems, decimal decoders BCD to 7-segment converter, BCD to dot matrix converter, Resolution in digital meters, sensitivity of digital meters, accuracy specification of digital multimeters. Recorders, recording requirements, analog recorders like graphic oscillgraphic, strip chart recorder , types of strip chart recorder, galvanometer type recorders, null type recorders, potentiometric recorders, single point recorders, multi point recorders, XY recorders ultra violets recorders

Data conditioning and acquisition systems: Signal conditioning system,generalized Data Acquuition system,Objectives ofDAS, single channel and multi channel DAS

Transducers: Electrical transducers -selection consideration, resistive strain guage, Temperature transducers: platinum type, thermister, inductive, LVDT, capacitive, Load cell, Piezoelectric, Photoelectric transducer,Computer Aided measurements

Laboratory Work:

This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:

Albert D. Helfrick And William D. Cooper- Modern electronics Instrumentation And Measurement Techniques, PHI

A.K.Sawhney - A course in Electrical and electronics measurement and Instrumentation, Dhanpatrai & Sons

Kalsi - Electrical and Electronic Measurement and Instrument, TMH

2EC305: DIGITAL COMMUNICATION **L T P C**
3 - 2 4

Passband Digital Transmission : Introduction, Passband Transmission Model, Coherent Phase-shift keying, Hybrid Amplitude / Phase Modulation Schemes, Coherent Frequncy – shift keying, Detection of signals with Unknown phase, Noncoherent Binary Frequency shift keying, Differential phase-shift Keying,
Comparison of Digital Modulation Schemes using a Single Carrier, Voiceband Modems, Multichannel Modulation

Spread-Spectrum Modulation : Introduction, Pseudo-Noise Sequences, A Notion of spread Spectrum, Direct-Sequence Spread Spectrum with Coherent Binary Phase-shift Keying , Signal-Space Dimensionality and processing Gain, Probability of Error, Frequency – Hop Spread Spectrum

Multiuser Radio Communications : Introduction, Multiple-Access Techniques, Satellite Communications, Radio Link Analysis, Wireless Communications, Statistical Characterization of Multipath Channels, Binary signaling over a Rayleigh Fading Channel, TDMA & CDMA Wireless Communication System, Source Coding of Speech for Wireless Communication, Adaptive Antenna Arrays for Wireless Communication.

Information Theory : Introduction, Ucertainty, Information and Entropy,
Source – Coding Theorem, Data Compression, Discrete Memoryless Channels,Mutual **Information, Channel Capacity, Channel:** Coding Theorem,
Differential Entropy and Mutual Information for Continuous Ensembles,
Information Capacity theorem, Implications of the Information Capacity Theorem,
Information Capacity of Colored Noise Channel, Rate Distortion Theory, Data Compression.

Error-Control Coding - Introduction, Discrete-Memoryless Channels,
Linear Block Codes, Cyclic Codes, Convolutional Codes, Maximum Likelihood Decoding of Convolutional Codes, Trellis-Coded Modulation, Turbo Codes, Computer Experiment: Turbo Decoding, Low-Density Parity-Check Codes, Irregular Codes.

Text / Reference Books:

Simon Haykin – Communication Systems

J.G. Proakias- Digital Communication, TMH

B.P.Lathi- Digital and Analog Communication System, Oxford press

Bernard Sklar: Digital Communication

2EC402: DIGITAL SIGNAL PROCESSING **L T P C**
3 - 2 4

Discrete-Time Signals and Systems:
Introduction, Discrete-Time Signals, Discrete-Time Systems, LTI Systems, Properties of LTI Systems, Linear Constant Co-efficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Discrete-Time random signals.
The Z- Transform
Sampling of Continuous-Time Signals:
Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples.
Transform Analysis of Linear Time-Invariant System:
Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, Minimum/Maximum phase systems, Linear system with generalized.
Structures for Discrete Time Systems:
Block Diagram representation of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, Transposed forms Basic Structures for FIR Systems, Overview of finite-precision Numerical effects, Effects of Co-efficient quantization, Effect of round off noise in digital filters, Zero input limit cycles in Fixed-point realizations of IIR filters, Lattice structures.
Filter Design Techniques:
Design of Discrete-Time IIR filters from Continuous-Time filters, Design of FIR filters by windowing Optimum approximations of FIR filters, FIR equiv. ripple approximations.
Discrete-Fourier Transform: Representation of Periodic sequences: The discrete Fourier Series, Properties of discrete Fourier Series, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT.
Computation of Discrete-Fourier Transform:
Efficient Computation of DFT, Goertzel Algorithm, Decimation-in-Time FFT Algorithms, Decimation-in-Frequency FFT Algorithm, Discrete Cosine Transform, Applications of DSP.
Fundamentals of Architecture of DSP Processor

Laboratory work will be based on topics covered under the above syllabus.

Text / Reference Books:

1. "Discrete Time Signal Processing:, Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
2. "Digital Signal Processing: A Practical Approach", Ifetchor, Pearson Education India

3. "Digital Signal Processing: A Computer Based approach", Sanjit Mitra, McGrawHill.
4. "Digital Signal Processing: Principles, Algorithm & Application", Proakis, Manolakis, PHI, 2003, 3rd Edition.
5. MATLAB user's guide.

2EC307: SEMINAR **L T P C**

- - 2 1

A students is required to select an advanced topic relevant to field of study. Student should submit report based on his study and is required to make presentation for evaluation.

2EC310: POWER ELECTRONICS

L T P C
3 - 2 4

Power Semiconductor devices: Basic structure, IV characteristics, switching characteristics and operation of devices like power diode, Bipolar Junction Transistor, Power MOSFET, Thyristors, Gate Turn off thyristor, Insulated Gate Bipolar Transistor, MCT, SIT, SITH etc. Series and parallel connections of the devices, Snubber circuits, Gate and Base drive.

Power Electronic Circuits: Line frequency single phase diode rectifiers, Single Phase controlled rectifiers and Inverters, DC-DC switch mode converter, step up(Boost) and step down (Buck) converter, switch mode DC-AC Inverter, Basic concept of Pulse Width Modulation, Resonant Converter, zero voltage and/or zero current switching, Load resonant converter, resonant switch converter.

Power Supply Application: Switching DC power supply, Over view of Switching power supplies, DC-DC converter with Electrical Isolation, control of SMPS, Power supply protection, Power Conditioners, Power Line disturbances and Uninterruptible Power supply (UPS), various block of UPS.

Motor Drive Applications: Introduction, AC and DC motor characteristics, criteria for selecting drive components, permanent Magnet DC motor, Separately excited DC motor drive, reluctant motor, servo motor, stepper motor, speed control of AC motor,

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:
Ned Mohan, Tore M. Undeland, William P. Robbins – Power electronics converter, applications and design, John Wiley and Sons, Inc.
Muhammad H. Rashid - Power Electronics Circuits, Devices and Applications, PHI and Pearson Education, Third Edition.

2EC311: ANTENNA THEORY

L T P C
3 - 2 4

Basic antenna concepts: Various definitions, antenna parameters, transmission formula, sources of radiation, comparison between antennas & transmission lines.

Point sources: Power patterns of various sources, radiation intensity, directivity, beam width, sources with pattern of arbitrary shape, gain, field & phase patterns.
Arrays of point sources: Arrays of 2 isotropic point sources, non-isotropic point sources, principles of pattern multiplication, linear arrays of non-isotropic point sources of equal amplitude & spacing, broad side, end fire arrays, radiation pattern determination of linear arrays, schelkunoff theorems for linear arrays, dolph Tchebysheff distribution for linear arrays.
Electric dipole and thin layer antennas: Short electric dipole radiation of short dipole, various field components radiation patterns, radiation resistance of linear antenna, radiation resistance of half wave dipole, quarter wave dipole.
Loop Antenna: EMF equation of loop antenna, directivity, Small loop short magnetic dipole, comparison of far field of small loop and short dipole loop antennas, field pattern of circular loop antenna & its radiation resistance.
Helical antenna: Helical geometry, transmission radiation modes.
Arrays of dipoles & apertures: Horizontal antennas and vertical antennal above a ground plane, arrays with parasitic elements, 3G (freq. scanning arrays retro arrays, adaptive arrays & smart antennas), long wire antennas, location methods of feeding antennas, folded dipole antennas.
Reflector antennas & feed systems: Plane sheet reflectors & diffraction, corner reflectors, Parabola, paraboloid reflector, aperature distribution & efficiencies, off axis operation of parabolic reflectors, cassegrain feed of other reflector antennas.
Slot horn & complementary antennas: Slot antenna, its pattern, principle & complementary antennas, horn antennas.
Lens antennas: Dielectric lens, reflector lens antennas, millimeter wave measurement
Antennas for special applications:
Sleeve, microstrip antennas, antennas design consideration for satellite Communication.
Antennas measurement: Measurement of pattern gain, 3db Beam width, Side lobe and back lobe measurement phase polarization, impedance, Antenna noise measurement.
Radio wave propagation: Modes of propagation, Definitions, Multi hop propagation.

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:
J.D.Krauss - Antennas, McGraw Hill
K.D. Prasad - Antennas & WavePropagation, Satyaprakash Publications
Jordan & Balmain - Electromagnetic wave & radiating systems, PHI Publication

2EC312:FIBER OPTIC COMMUNICATION **L T P C**
3 - 2 4

Overview of Optical fiber Communications: Electromagnetic spectrum Evolution of fiber optic system, Elements of an optical fiber transmission link
Optical fibers: Structures, Wave guiding and fabrication: Optical laws and definitions, optical fiber modes and configurations, Mode theory, single mode and graded index fibers, fiber materials, fabrication and mechanical properties, fiber optic cables.
Signal Degradation in Optical fibers: Attenuation, signal distortion in optical waveguide, pulse broadening in graded index fiber, mode coupling
Optical Sources: Light emitting diode (LEDs)-structures, materials, Figure of merits, characteristics & Modulation
Laser Diodes -Modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, temperature effects, Light source linearity.
Power Launching and Coupling: Source-to fiber power launching, Lensing schemes, fiber-to-fiber joints, LED coupling to single mode fibers, fiber splicing, and connectors.
Photo detectors: Principles of operation, types, characteristics, figure of merits of detectors photodiode materials.
Optical Receiver Operation: Receiver operation, Specification, Preamplifier types
Transmission Systems: Point–to-point link, system requirements and design of link, Multi-channel Transmission Techniques.
WDM Concepts and Components:
Principles of WDM, DWDM, Passive Optical Components, Tunable sources and Filters.
Advances in Optical Fiber Systems: Telecommunications & broadband application, SONET/SDH, EDFA, Optical switching
Fiber Optical Measurements: Measurement of Attenuation, Dispersion, NA, OTDR, EYE pattern Technique.

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.
Text / Reference Books:
Gerd Keiser - Optical Fiber Communication, 3rd Edition, Mc Graw Hill
John M. Senior - Optical Fiber Communication, PHI

2EC313: DIGITAL SYSTEM DESIGN **L T P C**
3 - 2 4

MSI & LSI circuits and their Applications: Introduction, Examples of Useful Digital Circuits, Arithmetic Circuit, Comparators, Multiplexers, Code

Converters, Wired Logic, Practical Aspects of Wired Logic and Bus Oriented Structures.

Sequential Machines: Types of sequential Machines: Mealy and Moore Machine, Counter Design Using Sequential Machines, State Reduction, Multimode Counters, Sequence Detectors, Timing and Triggering Consideration, Clock Skew.

System Controllers: Use of MSI Decoders and MSI Multiplexers in system Controllers, ROM, PROM, PLA in System Controllers, Concepts of a Programmable System Controller, RTL Description of Simple Machine, Design From RTL description.

Hardware Description Languages (HDL), HDL based design; Introduction to data path and control path synthesis;

Asynchronous Finite state machine: Asynchronous Analysis, Design of Asynchronous Machines, Cycles and Races, Hazards, Essential Hazards

Considerations of technology; testability and fault-tolerance in design.: Architecture of FPGA and CPLD & its Programming

Laboratory Work:

This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:

William I. Fletcher - An Engineering Approach To Digital Design, PHI
C. Roth, Digital System Design Using VHDL, Thomson Publication

2EC3E8 Elective-I

2EC318: VLSI DESIGN **L T P C**

3 - 2 4

Fabrication of MOSFET: Introduction, Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.

MOS Transistor: The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure &Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling & small-geometry effects, MOSFET capacitances.

MOS inverter Static characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement & Depletion type MOSFET load), CMOS Inverter.

MOS inverters Switching characteristics and Interconnect Effects: Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.

Combinational MOS Logic circuits: Introduction, MOS logic circuits with Depletion NMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs).

Sequential MOS Logic circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, Clocked latch & Flip-flop circuit, CMOS D-latch & Edge-triggered flip-flop.

Dynamic Logic Circuits: Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.

Low Power VLSI Design:

VLSI Design Flow, VLSI Design Consideration, Hierachy, Concepts of Regularity, Modularity and Locality,VLSI Design Approaches, Methodologies and Classifications, VLSI Design Qualities

Laboratory Work:

This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:

Mo kang, Yusuf Leblebici- CMOS Digital Integrated circuits – Analysis and Design by Sung, TATA McGraw-Hill Pub. Company Ltd. Third Edition

Pucknell & Eshraghian - Basic VLSI Design, PHI, 3rd Ed.

2EC328: MULTIMEDIA SYSTEMS

L	T	P	C
3	-	2	4

Introduction: Multimedia systems, Issues in multimedia systems

Media types: Text, Images, Video, Audio and its representation,Animation

Compression: Loosy compression, Lossless compression, Entropy coding

Text Compression: LZ, LZW, Arithmetic coding

Image Compression: GIF, Transform Coding: DCT, KLT, Principal Component analysis, JPEG, JPEG 2000 standards

Video compression: MPEG 1, MPEG 2, MPEG 4 and MPEG 7 Standard

3-D model compression Speech and Audio Compression

Media Synchronization: Stream management, System Decoder model, DMIF (Delivery Multimedia Integration Framework), Synchronization elementary streams and layers

Multimedia System Design: Hardware: Processor architecture, Bus structure,digital I/O, Analog I/O, Video camera, I/O devices, BUS : USB ,Firewire

Software: Operating System: Scheduling algorithms (EDF, RMS) Resource management, Management of I /O System

Network Communication: Communication Networking, Delivery modalities, Integrated network, Issues related to Transfer of data: Audio, Video, Image, Speech and text, Properties of multimedia servers, Internet protocol architecture: RTP, RTSP,RTCP, SIP,SAP

Multimedia Content Management & Retrieval: Stored media access, Media filtering, Content based query, Query based example, CBIR (Content Based Image Retrieval) Video Retrieval, MPEG-7 standard

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:
Halsall- Multimedia Communications & Networking, Pearson Edu. Asia
Steiner- Multimedia Computing, Pearson Edu .Asia

2EC338: TELECOMMUNICATION TRANSMISSION AND SWITCHING **L T P C 3 - 2 4**

Introduction: Evolution of Telecommunications, Basic of switching System, Telecommunication transmission, digital Transmission, Four wire circuits, FDM, TDM, PDH, SDH.
Evolution of Switching System: Stronger, Rotary Dial Telephone, Signaling Tones, Step-by- Step Switching, Crossbar Switching: Principal of Common Control, Touch Tone Dial Telephone, Principals of Crossbar Switching, Digital Switching.
Electronic Space Division: SPC, Distributed SPC, Software Stored Program Control, Centralized Architecture, Application Software, Enhanced Services, Two-Stage Networks, Three-Stage Networks, n-Stage Networks.
Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Grade of Service, Non blocking Networks, synchronization.
Control of Switching System: Call processing function, Common Control, stored Program Control
Signaling Techniques: In channel Signaling, Common Channel Signaling, Signaling Sytem-6 (SS6), Signaling System-7 (SS7).
Traffic Engineering: Network Traffic Load and Parameters Grade of Service and Blocking Probability, Modeling switching Systems, Incoming Traffic and Service Time Characterizations, Blocking Models and Loss Estimates, Delay Systems, Traffic Measurement, Lost call System, Queuing System.
Telecom Networks: Introduction, Analog Networks, Integrated Digital Networks, Integrated services Digital Networks, Cellular radio Networks, Intelligent Networks, Private Networks, Numbering, National Schemes, International Numbering, Numbering Plan for the ISDN era, Public Data Networks, Charging, Routing, General, Automatic alternative routing, Numbering, Network Management, IN, VPN, B-ISDN

Laboratory Work:
This shall consist of about 10 Practicals based on the above syllabus.

Text / Reference Books:

Viswanathan- Telecommunication Switching Systems and Networks (Published By PHI)

J.E.Flood - Telecommunication Switching Traffic and Network (Pearson Education)

INSTITUTE ELECTIVE - I

2EC314: MICROCONTROLLER LAB

L	T	P	C
-	-	2	1

Micro controller Lab includes the study of 8 bit/16 bit microcontroller. Micro controller hardware for doing exercises in assembly language programming and hardware interfacing. Laboratory assignments typically address hardware issues such as parallel and serial ports, interrupts, and timers. Some assignments deal with controlling attached devices, such as stepper motors, LED displays etc.

Text / Reference Books:

K. J. Ayala- The 8051 Micro controller – Architecture Programming & Application, Penram International.

MAZIDI &MAZIDI - 51 Micro controller and Embedded System, PearsonEdu.Asia

Syllabus for B.Tech Semester VII (EC)

2EC401: DATA COMMUNICATION AND NETWORKING **L T P C**
3 - 2 4

Introduction to Data Communication and Networking: Data communication, use of Networks, Internet Protocols and standards, layering of Models, OSI model, Internet model.

Physical Layer: Transmission media (Twisted pair, Coaxial cable, Fiber optic cable), Wireless Medium as Physical Layer (Electromagnetic Spectrum, ISM Band, Lighwave Transmission), Circuit switching, Telephone network, DSL technology, Cable modem, SONET/SDH

Data Link Layer: Services to N/W layer, Framing, Bit Stuffing, Character Stuffing, Error Correction, Error control, Flow control mechanism stop & wait, Go-back-, Selective repeat. Example data link protocol HDLC, PPP.

Medium Access Layer: Channel allocation problem, Multiple Access, CSMA, CSMA/CD, CSMA/CA

Local Area Network: Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, Blue tooth, Connecting devices- Repeaters, Hub, Bridges, Switch, Router, Gateways, Virtual LAN, Broadband Wireless Networks

Example Networks: X.25, Frame Relay, ATM, ISDN

Network Layer: Packet Switching, Virtual circuits and datagram, Static and Dynamic Routing Algorithms (Optimality principle, Static Routing Algorithms, Shortest Path, Flooding, Dynamic routing Algorithms, Distance Vector, Link state routing.), IP Addressing, CIDR & NAT, IP layer protocols (ICMP, ARP, RARP, DHCP, BOOTP,), IPv6, Congestion control Algorithms (Principles, policies, Algorithms), QoS- Quality of Service (Integrated Services & Differentiated Services)

Transport layer: Elements of Transport protocols, Internet protocols - TCP & UDP.

Application Layer: DNS- Domain Name System, E-mail, FTP.

Network Security: Cryptography, Symmetric key Algorithms, DES, AES, Public key Algorithms, RSA, Digital Signatures, Firewall, IPSec

Laboratory work will be based on topics covered under the above syllabus.

Text / Reference Books:

1. A. S. Tanenbaum- Computer Networks, PHI
2. Behrouz Forouzan - Data and Communication Networking, TMH
3. Widjaja- Communication Networks,

2EC402: DIGITAL SIGNAL PROCESSING **L T P C**
3 - 2 4

Discrete-Time Signals and Systems:

Introduction, Discrete-Time Signals, Discrete-Time Systems, LTI Systems, Properties of LTI Systems, Linear Constant Co-efficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Discrete-Time random signals.

The Z- Transform

Sampling of Continuous-Time Signals:

Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples.

Transform Analysis of Linear Time-Invariant System:

Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, Minimum/Maximum phase systems, Linear system with generalized.

Structures for Discrete Time Systems:

Block Diagram representation of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, Transposed forms Basic Structures for FIR Systems, Overview of finite-precision Numerical effects, Effects of Co-efficient quantization, Effect of round off noise in digital filters, Zero input limit cycles in Fixed-point realizations of IIR filters, Lattice structures.

Filter Design Techniques:

Design of Discrete-Time IIR filters from Continuous-Time filters, Design of FIR filters by windowing Optimum approximations of FIR filters, FIR equiv. ripple approximations.

Discrete-Fourier Transform: Representation of Periodic sequences: The discrete Fourier Series, Properties of discrete Fourier Series, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT.

Computation of Discrete-Fourier Transform:

Efficient Computation of DFT, Goertzel Algorithm, Decimation-in-Time FFT Algorithms, Decimation-in-Frequency FFT Algorithm, Discrete Cosine Transform, Applications of DSP.

Fundamentals of Architecture of DSP Processor

Laboratory work will be based on topics covered under the above syllabus.

Text / Reference Books:

1. "Discrete Time Signal Processing:, Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.
2. "Digital Signal Processing: A Practical Approach", Ifetchor, Pearson Education India
3. "Digital Signal Processing: A Computer Based approach", Sanjit Mitra, McGrawHill.
4. "Digital Signal Processing: Principles, Algorithm & Application", Proakis, Manolakis, PHI, 2003, 3rd Edition.
5. MATLAB user's guide.

2EC403: MICROWAVE ENGINEERING **L T P C**
3 - 2 4

Introduction to microwaves: Microwave frequencies, advantages of microwaves, and general applications of microwaves
Basic transmission line theory: Transmission line equations & solutions, condition for distortion less line, lines terminated in load, open & short, standing wave and standing wave ratio, line impedance and admittance, impedance matching, problem solutions using smith charts
Microwave wave-guides: Rectangular wave guides (With all necessary details and derivations), Circular wave-guides, corrugated wave-guide.
Microwave components: Scattering Parameters, Wave-guide tees, magic tee, directional couples, circulars and isolators, corners, bends, twists, flanges, matched termination, coupling probes, loops
Microwave tubes and circuits: Limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multi cavity klystron, reflex klystron, traveling wave tube, Magnetron.
Semiconductor microwave devices: Varactor diodes, step-recovery diodes, parametric amplifiers, tunnel diode, Gunn diode, PIN diode, schottky barrier diodes, Microwave transistors Bipolar transistor, Hetrojunction Bipolar transistor, MESFET, High electron mobility transistor (HEMT),
Microstip & Integrated Circuits: Strip lines and micro strip lines, MIC, MMIC
Radar systems: Basic principle, radar range equation: powers and frequencies used in radar, basic pulsed radar system, moving target indication, CW Doppler radar, Factor Influencing maximum range, Pulsed system, Display Methods, Search and Tracking radar systems, Moving target indicator (MTI), CW Doppler Radar, Frequency Modulated CW radar.

Laboratory work will be based on topics covered under the above syllabus.

Text / Reference Books:

1. Siteshkumar Roy & Manojit Mitra - Microwave semiconductor devices, PHI
2. A. K. Gautam - Microwave engineering, (S. K. Kataria pub)
3. Samuel Liao - Microwave devices and circuits, PHI
4. Dennis Roddy - Microwave Technology, PHI
5. Manojit Mitra - Microwave engineering, Dhanpatrai & Co.
6. G.Kennedy - Electronic Communication systems, McGraw-Hill Book Company
7. Annapurna Das, Sisir K.Das- Microwave engineering, (TMG)

2EC3E9 ELECTIVE – II

2EC319: MODERN PROCESSOR ARCHITECTURE **L T P C**
3 - - 3

Processor Design: The Evolution of processors, Instruction set Processor design, Principles of Processor performance, Instruction level parallel processing
Pipelined processors: Pipelining fundamentals, pipelined processor design, deeply pipelined processors

Memory and I/O systems: Computer system overview, Latency and bandwidth, memory hierarchy, virtual memory systems, memory hierarchy implementation, I/O systems

Superscalar Organization: Limitations if Scalar pipelines, Superscalar pipeline overview

Superscalar Techniques: Instruction Flow techniques, Register Data Flow Techniques, memory data flow Techniques

Case studies of Superscalar Processors: The PowerPC 620, Instruction fetching, dispatching, execution and completion Intel'sP6 Microarchitecture Basics of the P6 micro architecture, pipelining, the in order front end,out of order core, retirement, memory subsystem.

Advanced Instruction Flow techniques: Static and Dynamic Branch Prediction techniques, Hybrid branch predictors, Instruction Flow issues and techniques

Advanced Register Data Flow Techniques: Value Locality with and without speculation

Executing Multiple Threads: Synchronizing Shared memory threads, introduction to multiprocessor systems, explicitly multithreaded processors, implicitly multithreaded processors, executing the same thread

Text / Reference Books:

1. John Paul Shen, Mikko H. Lipasti- Modern processor Design Fundamentals of Superscalar Processors, TMH
2. Daniel Tabak- Advanced Microprocessors, TMH

2EC349 ERROR CONTROL CODING

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Compact Coding: Introduction of Block Codes, Linear Codes, Cyclic Codes, Dual Cyclic codes. Linear –feedback shift registers for encoding and decoding of cyclic codes.

The polynomial-division register, Register for encoding, Register for error detection and correction, The Meggitt decoder.

Linear Algebra: Field, Vector Spaces, Linear codes as Vector Spaces, Dual codes.

Galios Field: Roots of equations, The Galios Field GF, Primitive field elements,Irreducible and primitive polynomials, Minimal polynomials.

Bose-Chaudhari-Hocquenghem Codes: Construction of BCH codes, Error syndrome in finite fields, Decoding of BCH codes,Reed Solomon Codes,The Berlekamp algorithm, The error evaluator polynomial.

Convolutional Codes: Convolutional code and its representation by code tree, trellis diagram and state diagram,Maximum Likelihood Decoding: Viterbi decoding algorithm.

Turbo codes: Introduction to Turbo codes and Iterative decoding with exchange of extrinsic information with MAP decoding algorithm.

Text / Reference Books:
Introduction to Error /Control Codes by Salvatore Gravano
Error Correcting Codes by Todd. K. Moon

2EC359 ADVANCE COMMUNICATION SYSTEMS **L T P C**
3 - - 3

Satellite Communication systems:

- Orbital Mechanics- Kepler's laws, Orbits, Orbital effects, Orbital perturbations
- Satellite sub systems- AOCS, TTC&M, Antennas, Transponders,
- Earth station technolgoy
- Link calculation
- Satellite systems- GEO systems, non-GEO communication systems
- Satellite Applications- Global Positioning System, Very Small Aperture Terminal system, Direct to Home Satellite Systems

Cellular Communication Systems:

- 2G TDMA standard GSM- standards, architecture, radio aspects, security, call flow,
- 2G CDMA standard IS-95- Service aspects, key features, radio aspects, forward and reverse channel processing, challenges
- 3G mobile systems- IMT 2000 vision, radio aspects, UMTS, network aspects, CDMA 2000, W-CDMA

Mobile Data Communication Systems:

- Circuit switched data services- HSCSD
- Packet switched data services- GPRS, CDPD, EDGE

Radar Systems:

- The Radar Equation, Detection of Signal in Noise, Integration of Radar Pulses, Transmit Power, Pulse Repetition frequency, system losses, Antenna Parameters and Radar Equation consideration
- MTI and Pulse Doppler Radar, Doppler Filter Banks, Digital MTI Processing Detector, Pulse Doppler Radar,
- Tracking Radar, Monopulse Tracking, Conical Scale and Sequential Lobbing, Comparison of Trackers, Automatic tracking with Surveillance Radar

Recent Advances:

- Ultra wideband systems (UWB)
- Push To Talk (PTT) technology
- Mobile IP

Textbooks:

1. Introduction to wireless & Mobile systems- D.P.Agarwal, Qing-An zeng- Thomson P
2. Wireless communications, principles and practices, Theodore S. Rappaport Pearson Education.
3. Radar Systems by Skolnik

2EC4E4 ELECTIVE-III

2EC414 EMBEDDED SYSTEMS **L T P C**
3 - 2 4

Introduction
Characteristics of Embedding Computing Applications; Concept of Real time Systems; Challenges in Embedded System Design; Common design metrics; Components of embedded systems; Examples of embedded systems; Hardware and Software Systems development tools

Embedded System Architecture
Bus Protocols and Organization-PCI, ISA, EISA, Vesa; CISC and RISC processor; Harvard and Von Neumann Architecture; Superscalar and VLIW architectures; Introduction to ARM Processor and PIC microcontroller; I/0 Sub-system- Busy-wait I/0, DMA, Interrupt driven I/0, Power saving strategies

Designing Embedded Computing Platform
Memory Devices and their Characteristics- EEPROM, Flash Memory, DRAM; I/O Devices- Watchdog Timers, Interrupt Controllers, DMA Controllers

Operating System
Basic Features of an Operating System; Processes and Threads; Process management; Memory management; Context Switching- Cooperative Multi-tasking, Pre-emptive Multi-tasking; Scheduling-Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling; Inter-process Communication- Signals, Shared Memory Communication, Message-Based Communication; Device Drivers-Introduction, function, architecture, types, implementations; Evaluating Operating System Performance-Response time Calculation, Interrupt latency; Resource access protocols-Priority inheritance protocol, Priority ceiling protocol; Power Optimization Strategies for Processes; Introduction to Network OS and Mobile OS; Example Real Time OS Vx-works, RT-Linux

Networks for embedded systems
Distributed embedded architecture, I2C, CAN Bus; I/O Device Interfacing Protocols- GPIB, FIREWIRE, USB, IRDA

Embedded System Development
UML as Design tool- UML notation, Requirement Analysis and Use case Modeling, Static Modeling, Object and Class Structuring, Dynamic Modeling; Architectural Design- Hardware-Software Partitioning, Hardware-Software Integration; Design examples; Fault-tolerance Techniques; Reliability Evaluation Techniques

Laboratory work will be based on topics covered under the above syllabus.

Textbooks:

1. Computers as components Principles of embedded computing system design by Wayne Wolf (Morgan Kaufmann).
2. Rajkamal - Embedded systems Architecture, Programming and Design, (TMH).

2EC424 IMAGE PROCESSING **L T P C**
3 - 2 4

Introduction: Introduction to Digital Image Processing, Examples of Fields that Use Digital Image Processing, Types of Imaging, Other Imaging Modalities, Components of an Image Processing

Digital Image Fundamentals: Elements of Visual Perception, Structure of the Human Eye, Image Formation in the Eye, Brightness Adaptation and Discrimination, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Acquisition Using a Single Sensor, Image Acquisition Using Sensor Strips, Image Acquisition Using Sensor Arrays, A Simple Image Formation Model, Image Sampling and Quantization, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-Level Resolution, Aliasing and Moiré Patterns, Zooming and Shrinking Digital Images Some Basic Relationships Between Pixels Neighbors of a Pixel, Adjacency, Connectivity, Regions, and Boundaries Distance Measures Image Operations on a Pixel Basis Linear and Nonlinear Operations

Image Enhancement in the Spatial Domain: Background Some Basic Gray Level Transformations, Image Negatives, Log Transformations, Power-Law Transformations, Piecewise-Linear Transformation Functions, Histogram Processing, Histogram Equalization, Histogram Matching (Specification), Local Enhancement, Use of Histogram Statistics for Image Enhancement Using Arithmetic/Logic Operations, Image Subtraction, Image Averaging Basics of Spatial Filtering, Smoothing Spatial Filters, Smoothing Linear Filters, Order-Statistics Filters, Sharpening Spatial Filters ,Foundation ,Use of Second Derivatives for Enhancement–The Laplacian ,Use of First Derivatives for Enhancement—The Gradient Combining Spatial Enhancement Methods,

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, The One-Dimensional Fourier Transform and its Inverse, The Two-Dimensional DFT and Its Inverse Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and frequency Domains, Smoothing Frequency-Domain Filters, Ideal Low pass Filters, Butterworth Low pass Filters, Gaussian Low pass Filters, Additional Examples of Low pass Filtering, Sharpening Frequency Domain Filters, Ideal High pass Filters, Butterworth High pass Filters, Gaussian High pass Filters, The Laplacian in the Frequency Domain, Unsharp Masking, High-Boost Filtering, and High-Frequency Emphasis Filtering ,Homomorphic Filtering ,Implementation: Some Additional Properties of the 2-D Fourier Transform

Computing the Inverse Fourier Transform Using a Forward Transform Algorithm, More on Periodicity: the Need for Padding The Convolution and Correlation Theorems Summary of Properties of the 2-D Fourier Transform The Fast Fourier Transform Some Comments on Filter Design

Image Restoration:

Color Image Processing: Color Fundamentals Color Models Pseudocolor Image Processing Basics of Full-Color Image Processing Color Transformations Smoothing and Sharpening Color Segmentation Segmentation in HSI Color Space Segmentation in RGB Vector Space Color Edge Detection Noise in Color Images Color Image Compression

Morphological Image Processing: Some Basic Concepts from Set Theory Logic Operations Involving Binary Images Dilation and Erosion Dilation Erosion

Opening and Closing The Hit-or-Miss Transformation Some Basic Morphological Algorithms Extensions to Gray-Scale Images

Image Segmentation: Detection of Discontinuities, Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, The Use of Motion in Segmentation, Spatial Techniques, Frequency Domain Techniques

Laboratory work will be based on topics covered under the above syllabus.

Text / Reference Books:

1. R. C. Gonzalez, R. E. Woods- "Digital Image Processing", Addison-Wesley.
2. A. K. Jain - "Fundamentals of digital Image Processing", Prentice-Hall.
3. K. R. Castleman - "Digital Image Processing".

2EC444 WIRELESS COMMUNICATION **L T P C**
3 - 2 4

- Overview of wireless Communication:
  History, Technical issues, brief of current wireless systems, wireless spectrum

- Mobile Radio propagation: Large scale Pathloss :
  Radio wave propagation environment, free space path loss, Three basic mechanism, Reflection, Diffrection, Scattering, empirical path loss models,

- Mobile radio propagation: Small scale fading and multipath
  Small scale Multipath propagation, impulse response of a Multipath channel, Parameters, types of small scale fading, Rayliegh and rician distribution, Statistical models for Multipath fading channels

- Modulation Techniques: Constant envelope modulation-MSK, GMSK; Combined and linear modulation techniques-MPSK, QAM, MFSH, OFDM; Spread spectrum modulation, performance in fading and Multipath channels

- Equalization, Diversity: Fundamentals of equalization, generic adaptive equalization, survey of equalization techniques, linear equalizers, non-linear equalization, Algorithms for adaptive equalization, Diversity Techniques, Maximal ratio combining, Space diversity, polarization diversity, frequency diversity, Time diversity, RAKE receiver

- Multiple Access Techniques: FDMA, TDMA, SSMA- DSSS, FHMA; SDMA, Hybrid Techniques

- Cellular Concept- frequency reuse, co-channel interference, adjacent channel interference, hand off mechanism, cell splitting, sectoring,, channel assignment

Textbooks:

1. Wireless communications, principles and practices, Theodore S. Rappaport Pearson Education.
2. Wireless Communication by Andrea Goldsmith – Cambridge University Press

2EC405 MINOR PROJECT **L T P C**

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* In addition to regular timetable, intensive 6 weeks during summer.

Minor project involving analysis, design, and implementation and testing of substantial hardware, software or any combination in the field of study. A project report will be prepared and submitted for a viva - voce examination.

2EC406: MAJOR PROJECT **L T P C**
- - 14 -

Major Project involving analysis, design, and implementation and testing of substantial hardware, software or any combination in the field of study. A project report will be prepared and submitted for a viva - voce examination.

2EC407: COMPREHENSIVE VIVA/VOCE **L T P C**
- - - 2

Each student will prepare for the subjects studied in the previous semesters and present it. The comprehensive presentation consists of the fundamentals of the subjects, their relevance in further study and in industry.