(DEEMED TO BE UNIVERSITY)

PROGRAMMES' CURRICULUM & SYLLABUS

APPLICABLE FOR M.TECH STUDENTS ADMITTED IN A.Y. 2018-19

BIO TECHNOLOGY

COURSE STRUCTURE
FIRST YEAR (FIRST SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 BT 5101	Mathematics and Biostatistics	3	2	0	4
2	18 BT 5102	Biochemical Engineering	3	0	2	4
3	18 BT 5103	Molecular Biology and	3	0	2	4
4	18 BT 5104	Applied Bioinformatics	3	0	2	4
5		Elective- I	3	0	0	3
6		Elective- II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total Credits				**24**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 BT 5205	Plant and Animal Biotechnology	3	0	2	4
2	18 BT 5206	Immuno technology	3	0	2	4
3	18 BT 5207	Bioreactor modeling and Simulation	3	2	0	4
4	18 BT 5208	Downstream Processing	3	0	2	4
5		Elective-III	3	0	0	3
6		Elective-IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total Credits				**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36
		Total Credits				**84**

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 BT 51A1	Protein Engineering	3	0	0	3
2	18 BT 51A2	Enzyme Technology	3	0	0	3
3	18 BT 51A3	Medical Biotechnology	3	0	0	3
4	18 BT 51A4	Stem cell technology	3	0	0	3
5	18 BT 51A5	Molecular Modeling and Drug Design	3	0	0	3
Elective-2						
6	18 BT 51B1	Food Technology	3	0	0	3
7	18 BT 51B2	Transport phenomenon in bioprocess	3	0	0	3
8	18 BT 51B3	Bio mining	3	0	0	3
9	18 BT 51B4	Bioprocess validation and cGMP	3	0	0	3
Elective-3						
10	18 BT 52C1	Perl programming and Bioperl	3	0	0	3
11	18 BT 52C2	Bioprocess Technology	3	0	0	3
12	18 BT 52C3	Environmental Biotechnology	3	0	0	3
13	18 BT 52C4	Nano Technology	3	0	0	3
14	18 BT 52C5	IPR and Patent Laws	3	0	0	3
Elective-4						
15	18 BT 52D1	Regulatory affairs & Clinical trials	3	0	0	3
16	18 BT 52D2	Bioprocess economics and plant design	3	0	0	3
17	18 BT 52D3	Genomics and Proteomics	3	0	0	3
18	18 BT 52D4	Bio catalysis and enzyme	3	0	0	3

MATHEMATICS & BIOSTATISTICS

SYLLABUS

Numerical Methods Solutions of algebraic & transcendental equations - Bisection Method, New-Raphson Method, Solution of linear simultaneous equations, Simpson's rule, Trapezoidal rule.

LINEAR-DIFFERENTIAL EQUATION

1st order differential equations, solutions of 1st order, variable separable, homogeneous equation linear and enact equations. Linear differential equations of higher order with constant co efficient. Rules for finding complementary function and particular integral.

Presentation of data & Measures of central tendency-Frequency distribution, graphical presentation of data by histogram, frequency curve and cumulative frequency curves. Mean, medium, mode, and their simple properties (without derivation), range, mean deviation, standard deviation and coefficient of variation.

Correlation, Regression and Tests of significance -Simple correlation and regression coefficients and their relations. Limits of correlationcoefficient, effect of change of origin and scale on correlation coefficient, Linear regression and equations of line of regression, association and independence of attributes. Paired and unpaired t-test for correlation and regression coefficient. T- test for comparison of variances of two populations. Chi-square test- independence of attributes, goodness of fit, and homogeneity of sample.

Experimental designs- Principles of experimental design, completely randomized design, randomized block design and Latin square design. Analysis of variance (ANOVA) and its use in the analysis of RBD. F-test.

TEXTBOOKS :

1. Norman T.J. Bailey, Statistical methods in biology (3rd edition), Cambridge University Press (1995).
2. Bernard Rosner, Fundamentals of Biostatistics, 5th edition, Thomson Brooks/ Cole, 2000.
3. Higher engineering mathematics by B.S Grawel.

REFERENCE BOOKS :

1. S.C.Gupta and V.K. Kapoor – Fundamentals of Mathematical Statistics, 9th Extensively revised edition, Sultan Chand & Sons, 1999.
2. Advanced Engineering Mathematics, Michael D.Greenberg, Pearson Education.
3. Advanced Engineering Mathematics by Ervin Kreyszic.
4. Higher engineering mathematics by Bird john

BIOCHEMICAL ENGINEERING

SYLLABUS

INTRODUCTION TO BIOCHEMICAL REACTIONS

Types of reactions (Simple stepwise and Parallel) and their applications in fermentations, reaction rates, kinetics of homogenous reactions, molecularity and order of reaction and temperature dependency of reaction rate.

DESIGN AND OPERATION OF BIOREACTORS

Mass transfer aspect, Bioreactor types and design, Continuous stirred tank bioreactors, fed batch bioreactors, airlift bioreactors, Fluidised bed bioreactor, Bioreactors for plant and animal cell, scale up of bioreactor using constant p/v and constant KLa

Mass Transfer in Bioprocess Operation : Mass transfer by diffusion, Theories of Diffusional mass transfer film theory, Penetration theory, Surface renewal theory Mass transfer by convection, Gas-liquid mass transfer, correlation for mass transfer coefficient, measurement of KLa, O2 transfer, methodology in fermenters, specific oxygen uptake rate, critical oxygen concentration, maximum cell concentration.

Heterogeneous reactor systems : Classification of reaction systems, (homogenous, heterogeneous), mass transfer consideration in heterogeneous systems, Intra particle diffusion and reaction rates, Effectiveness factor and Thiele modules, observed Thiele modules, criterion for mass transfers limitations.

Non-ideal flow in bioreactors: Reasons for non-ideality, RTD studies (F-Curve, C-Curve for ideal and non-ideal CSTR and plug flow reactors), mean and variance of residence time, conversion using tracer information, modeling of non-ideal flow behavior by dispersion model.

TEXTBOOKS :

1. Introduction to Biochemical Engineering by D.G.Rao
2. Biochemical Engineering fundamentals by Bailey and Oliss

REFERENCE BOOKS :

1. Bioprocess Engineering Principles by Pauline and Doran

MOLECULAR BIOLOGY & R-DNA TECHNOLOGY

SYLLABUS

Scope: Recombinant DNA technology is fundamental to molecular biotechnology that is comprised of different scientific disciplines i.e. molecular biology, microbiology, biochemistry, immunology etc. The subject generates a wide range of consumer products (i.e. crops, drugs, vaccines, diagnostics, and livestock). Recombinant DNA technology uses prokaryotic and eukaryotic organisms and is the manipulation of DNA to generate clones, examine gene regulation, and express proteins. The course includes current technical procedures for recombinant DNA technology and its applications.

DNA STRUCTURE & REPLICATION

Structure of DNA:-Watson & Crick's model, Types of DNA, Denaturation and renaturation Kinetics, Replication of DNA- Semi conservative, bi-directional replication. DNA damage and repair: Types of DNA damages- deamination, alkylation, pyrimidine dimmers; Repair mechanisms-Excision, mismatch and SOS repair, Recombination: Homologous and non homologous; rec gene and its role in DNA repair.

TRANSCRIPTION AND TRANSLATION

Structure of Promoters-RNA Polymerases of Prokaryotic and Eukaryotic Organism; Transcription- Initiation, Elongation and Termination; Prokaryotic & Eukaryotic transcription; Post Transcriptional Processing of Eukaryotic RNA. Translation in prokaryotic and Eukaryotes: initiation of translation, elongation of polypeptide chain, termination of translation. Post-translational modifications.

Regulation of Gene Expression : Regulation of Gene expression in bacteria-Operon concept, lac, trp, ara operons. Control of gene expression by sigma factor and post transcriptional control. Absolute control by antisense RNA's; enhancers, upstream controlling elements, structural Motifs of transcription factors: helix turn, zinc finger motifs, leucine zippers and homeotic genes.

ENZYMES AND VECTORS IN CLONING

Restriction Enzymes; DNA ligase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern, Colony hybridization & FISH, Plasmids; Phagemids; Cosmids; Shuttle vectors, Artificial chromosome vectors (YACs; BACs); Expression vectors: Baculovirus and pichia vectors system; Plant based vectors: Ti and Ri vectors, Construction of cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Yeast two hybrid system; Phage display.

PCR, SEQUENCING & RNA TECHNOLOGIES

Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR; PCR Applications Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; Introduction

to siRNA; siRNA technology; Micro RNA; Principle and application of gene silencing; Gene knockouts and Gene Therapy; knockout mice; Disease model; Transgenics; Differential gene expression and protein array.

TEXTBOOK :

1. Fundamentals of Molecular Biology by Avinash & Kakoli Upadhyay; Himalaya

REFERENCE BOOK :

1. Current protocols in Molecular biology; Wiley Publishers.

APPLIED BIOINFORMATICS

SYLLABUS
SCOPE

The Course aims to prepare the students for understanding biological data at molecular level from both informational and biological perspective and impart conceptual, computational and practical skills to acquire, analyze, process or use the data to address significant problems in the field of Bioinformatics, of both pure and applied nature.

COMPARATIVE GENOMICS

Genetic mapping, Physical mapping, SNPs, ESTs, GSS, Gene prediction methods, Gene prediction tools, Gene annotation, Molecular Predictions with DNA sequence, Human Genome Project.

PROTEIN STRUCTURE PREDICTION AND EVALUATION METHODS

Structure of Protein – PDB, MMDB; Ramachandran Plots; Structure visualization – Rasmol; Methods of Structure prediction – Homology modeling - SPDBV, Threading, Ab-initio method; Structure Evaluation – DSSP, ProCheck, Verify 3D; Structure comparison.

PROTEIN IDENTIFICATION AND INTERACTIONS

Proteomics approaches for protein analysis; Protein identification Programs – Mascot, GFS; Comparative Proteomics methods; Protein interactions; Protein Interaction dbs – GRID, MINT; Network Mapping; Biological Pathway dbs – EcoCyc, KEGG; Pathway prediction; Metabolic pathway reconstruction.

GENE EXPRESSION ANALYSIS

Introduction; Serial Analysis of Gene Expression; Microarray, Types of Microarrays, Microarray Fabrication, Microarray hybridization and detection, Microarray Image Processing and analysis, Expression ratios, Transformations of the Expression ratio, Data Normalization.

SYSTEM BIOLOGY

Foundations of System Biology- Objectives of System Biology-Strategies relating to In Silico Modeling of biological processes- Metabolic Networks- Signal Transduction pathways, Gene Expression patterns – Applications of System Biology Markup Language (SBML), E-cell, V-cell simulations and Applications

TEXTBOOKS :

1. G. Gibson and SV Muse, A Primer of Genome Science, Second Edition - Sinauer Associates, Inc.
2. CW Sensen, Essentials of genomics and Bioinformatics, Wiley-VCH publication.

REFERENCE BOOK :

1. Speed T. (ed.) Statistical analysis of gene expression microarray data (CRC, 2003)

IMMUNO TECHNOLOGY

SYLLABUS

Immune system overview, innate and acquired immune system. Components of immune system.Phagocytosis; Inflammation, opsonization. Primary and secondary lymphoid organs. Complement. B cell, T cell ontogeny. Characteristics of antigen, T cell dependent and independent antigens and Super antigens. Types and applications of Hapten and Adjuvant.

IMMUNE RESPONSE

Generation of immune response - Primary and Secondary immune responses. Structure, functions of antibody and BCR.. Generation of Antibody diversity. TCR structure, TCR. MHC I and II gene, polymorphism. T helper, T cytotoxic cells. MHC peptide interaction. Antigen presentation, secondary signaling.

IMMUNOLOGICAL DISORDERS

Immunological disorders; Hypersensitivity and autoimmune diseases. Immune response to viral and bacterial lymphatic infection. Kinetics of immune response. Techniques in humoral and cellular immunology.

IMMUNOTECHNOLOGY

Animal models and transgenic animals and their use in immunology. Experimental immunology. Hybridoma technology. Chimeric antibodies, phage display, antibody engineering; Large scale manufacture of antibodies. Manufacturing of immunodiagnostics.

DISEASE DIAGNOSIS AND VACCINES

Concept of vaccination & Vaccine development. Strategies for development of

vaccines against dreadful diseases – malaria, tuberculosis, HIV. Diagnostic tools and Kit development technology.

TEXTBOOKS :

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.

REFERENCE BOOKS :

1. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
2. Paul.W.E, Fundamental of Immunology, 4th edition, Lippencott Raven.

BIOREACTOR MODELING AND SIMULATION

SYLLABUS

FUNDAMENTALS OF MODELING

Different approaches towards modeling, (Empirical and Modeling approach), applications and advantages of modeling and simulations, general flow diagrams for model building, simulation tools (Berkeley-Madonna, Mat Lab- Simu Link)

ENZYMES AND GROWTH KINETIC MODELS

Michaelis-Menten equation, graphical determination of Km and Vmax, Double Michaelis Menten kinetic model, inhibition models (Competitive, Non-Competitive, Uncompetitive, Deactivation Kinetics models) Monad growth kinetics model, equation for inhibition of growth, Product inhibition, , Teisser equation for growth, Contoin equation, Moses equation for growth models.

MODELING OF BATCH CULTURES

Unstructured growth models, structural kinetic model, metabolic models for batch cultures.

PRODUCT FORMATION KINETICS

Product formation kinetic models, unstructured models, chemically structured models, genetically structured models.

CASE STUDIES OF SIMULATIONS

Programme for simulation of Batch fermentation, continuous fermentation, steady state and fed batch fermentation.

TEXTBOOKS :

1. Biological reaction Engineering- J.J.Dunn, E.Heinzle, J.Ingham, J.E.Presno-sil

2. Biochemical Engineering fundamentals- James.E.Bailey and David.F.Ollis, TMH Edition
3. Franks.R.G.E (1973), Modeling and simulation in chemical Engineering, Wiley, NY

REFERENCE BOOKS :

1.Modeling and simulation in Biochemical Engineering. Adv, Biochemical Engineering, 3, 127-165
2. Hanm, B, Ruth. B (1997) Modeling dynamic biological systems, Springer-Verlag, NY.

DOWN STREAM PROCESSING

SYLLABUS

DOWN STREAM PROCESSING IN BIOTECHNOLOGY

Overview of bioseparations, Characterization of Biomolecules, characterization of Bioprocess, characterization of fermentation broth: Morphology of cells, structure of the cell wall, product concentrations, Biomass density, Rheological Behavior of fermentation broth.

PRIMARY SEPARATION AND RECOVERY PROCESSES

Recovery of intracellular products: Cell disruption methods-physical methods (osmotic shock, grinding with abrasives, solid shear, liquid shear) – chemical methods (alkali, detergents)- enzymatic methods. Removal of suspended solids: Foam separation, filtration. Filtration equipment, centrifugation, tubular bowl centrifuge, disk. Bowl centrifuge, basket centrifuge, scale up of centrifuges.

PRODUCT ENRICHMENT OPERATIONS

Membrane based separations – Classification & characteristics of membrane separation, merits of the process. Micro filtration, ultra filtration, Reverse osmosis, dialysis & electro dialysis. Selection of membrane, operational requirements of membrane. Retention coefficient, concentration factor, permeate yield & solid yield in membrane separation processes. Membrane modules: Plate & Frame, hollow fiber, spiral wound, shell & tube, cross flow micro filtration. Aqueous two-phase extraction process: Applications of aqueous two-phase extraction, reversed micelles extraction principle, micellar structures, critical micelle concentration. Protein solubilization, limitation of reversed micelles. Precipitations of proteins with salts and organic solvents, kinetics of protein aggregation.

PRODUCT PURIFICATION

Chromatographic Separations: Classification of chromatographic techniques, column chromatography, elusion frontal displacement techniques, partition

coefficient, retention time and volume, capacity factor, column efficiency, design and scale up of chromatography. Principles & practices of Gel Filtration, Ion Exchange and Affinity chromatography.

ALTERNATIVE SEPARATION METHODS AND PRODUCT POLISHING

Super critical extraction: principles of SCE, Flow scheme of a simple SCE system. Formulation strategies: Importance of formulation, formulation of beakers yeast, Enzymes, formulation of pharmaceutical products. Polishing: Crystallization, Principles of crystallization and equipment. Principles of drying and lyophilization, Freeze dryer.

TEXTBOOKS :

1. Butterworth and Heinmann. Product recovery in bioprocess Technology -Biotol series,
2. B.Siva Sankar. Bioseperations

REFERENCE BOOKS :

1. Harvey Blanch. Biochemical Engineering
2. Christie J.Geankoplis., Transport processes and Unit operations

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ELECTIVES PROTEIN ENGINEERING

SYLLABUS

PROTEIN ENGINEERING

Methods of protein isolation, purification, detection, quantitation and characterization. Study of protein structure and organization. Solid phase peptide synthesis, use of peptides in biology, examples of engineered proteins, protein design with examples.

STRUCTURE & FUNCTIONAL RELATIONSHIP OF PROTEINS

Structural characteristics of DNA binding proteins, prokaryotic and Eukaryotic transcription factors, DNA polymerases, Bacteriorhodopsin, epidermal growth factors, insulin and PDGF receptors and their interaction effectors, protein phosphorylation, Immunoglobulins, nucleotide binding proteins, serine proteases, Ribonuclease, Lysozyme.

PROTEIN FOLDING

Chaperons in protein folding, types of chaperons. Non-covalent forces in protein folding, Structural Dynamics of proteins, Protein folding models, Denaturation of proteins, Protein degradation and turn over; ATP dependent proteolysis, intracellular digestion of proteins in Lysosomes.

PROTEIN TARGETING

Introduction, Methods in targeting, translocation and transport. Signal sequences, Signal Recognition Particle, Protein export in bacteria, Protein modification and targeting. Protein targeting in Bacterial system. Protein targeting in Endoplasmic Reticulum, Mitochondria and Chloroplast.

PROTEIN TECHNIQUES

Solution properties of proteins, Protein fragmentation, Peptide sequence determination, Protein hydration, Conformational stability of proteins, Recombinant protein, Fusion proteins, Modification of proteins, Protein labeling, Peptide mapping.

TEXTBOOKS :

1. L. Stryer by Biochemistry, 5th edition Freeman – Toppan publications.
2. TM Devlin, TextBooks : of Biochemistry with clinical correlations, 6th edition with human molecular genetics. John Wiley and Sons, Inc.

REFERENCE BOOKS :

1. Moody P C E and A J Wilkinson. Protein Engineering. IRL Press.
2. Creighton T E, Proteins. Freeman W H. Second edition 1993.

ENZYME TECHNOLOGY

SYLLABUS

INTRODUCTION TO ENZYME TECHNOLOGY

Source of enzymes; Production, isolation and purification of enzymes; Characterization in terms of pH,temperature, ionic strength, substrate and product tolerance, effects of metal ions etc.; Various production methods for commercial enzymes; Large scale production of enzymes. Production of recombinant proteins (Insulin, Interleukin, Interferon); Important commercial enzymes; Amylases; Proteases; Lipases; Cellulases.

ENZYME KINETICS

Michaelis-Menten equation, alterations and significance. General mechanisms of enzyme regulation, Types of inhibition; Irreversible inhibition (proteases), Reversible (glutamine synthase & phosphorylase), competitive inhibition, Non & Un-competitive, mixed inhibition, and substrate & product.inhibition; Allosteric enzymes, qualitative description of concerted & sequential models for allosteric enzymes. Allo-steric regulation of enzymes; Deactivation kinetics. Feed back inhibition and feed forward stimulation. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate transcarbamoylase. Protein-ligand binding measurement, analysis of binding

isotherms, Hill and Scatchard plots.

ENZYME ENGINEERING

Enzymes as biological catalysts; Active site, Functional group, Enzyme substrate complex, Cofactors; Acidbase catalysis, covalent catalysis, proximity, orientation effect. Strain & distortion theory. Chemical modification of active site groups. Random and rational approach of protein engineering; Directed evolution and its applications in the field of biocatalysis; Various approaches of creating variant enzyme molecules; Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin, lysozyme, carboxypeptidase and alcohol dehydrogenase.

ENZYME IMMOBILIZATION AND APPLICATIONS

Introduction to enzyme immobilization; various immobilization methods; physical and chemical techniques for enzyme immobilization – adsorption; Matrix entrapment, encapsulation; Cross-linking; Covalent binding; Medical and analytical applications of immobilized enzymes; Design of enzyme electrode & their application in clinical diagnostics. Role of enzymes in recombinant DNA technology; Enzymes for diagnostic and analytical purposes. Use of enzymes in analysis-types of sensing-gadgetry and methods. Case studies on application – chiral conversion, esterification.

MASS TRANSFER EFFECTS IN IMMOBILIZED SYSTEMS

Analysis of Film and Pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Calculations of diffusional resistances and Thiele's modulus; Multi step immobilized enzyme systems; Solutions of numerical problems; Application and future of immobilized enzyme technology. Concentration gradients and Reaction rates in solid catalysts; Internal mass transfer and reaction; Steady state Shell Mass balance; Formulation of dimensionless groups and calculation of Effectiveness factors

TEXTBOOKS :

1. Nelson and Cox, Principles of Biochemistry, 4th Edition, W. H. Freeman, 2004.
2. J. Rehm and G. Reed, Enzyme Technology, Vol. 7a, VCH-Verlag.
3. Trevor Palmer: ENZYMES – Biochemistry, Biotechnology, Clinical chemistry. Horwood Publishing Ltd. Affiliated East – West Press Pvt. Ltd. New Delhi.

REFERENCE BOOKS :

1. Biotol Series (This series has many volumes pertaining to different subjects including white, red, blue and green biotechnology).

MEDICAL BIOTECHNOLOGY

SYLLABUS

INTRODUCTION TO MEDICAL TECHNOLOGY

Introduction and applications of medical Biotechnology. Artificial organs – methods and production principles. Artificial pancreas, Liver and Heart. Therapeutic proteins: Production of interferons, cytokinins, insulin etc.

MEDICAL DIAGNOSIS

Immunodiagnostic techniques: monoclonal antibodies production as diagnostic reagents; Diagnosis by ELISA and Western blot. DNA sequencing and diagnosis. PCR and Array based techniques in diagnosis; Present methods for diagnosis of Specific diseases like Tuberculosis, Malaria and AIDS; ethics in Molecular Diagnosis

GENE TRANSFER TECHNOLOGY

Gene therapy; Intracellular barriers to gene delivery; Overview of inherited and acquired diseases for gene therapy, Retro and adeno virus mediated gene transfer. Liposome and nanoparticles mediated gene delivery Cellular therapy.

STEM CELL TECHNOLOGY

Stem cells; definition, properties and potency of stem cells; Sources; embryonic and adult stem cells; Concept of tissue engineering; Role of scaffolds; Role of growth factors; Role of adult and embryonic stem cells. Clinical applications; Ethical issues.

HYBRIDOMA TECHNOLOGY

Hybridoma techniques and monoclonal antibody production. Production, purification, characterization and applications of monoclonal antibodies. Antibody engineering – chimeric antibody, diabody.

TEXTBOOKS :

1. F.C. Hay, O.M.R. Westwood, Practical Immunology, 4th Edition-, Blackwell Publishing, 2002
2. Pratibha Nallari, V. Venugopal Rao; Medical Biotechnology, oxford University press, 2010.

REFERENCE BOOKS :

1. James W. Goding , Monoclonal antibodies; Principles and Practice , 3rd Edition , Academic Press 1996.
2. George Patrinos and Wilhelm Ansorage, Molecular Diagnostics, 1st Edition , Academic Press, 2005.

STEM CELL TECHNOLOGY

SYLLABUS

INTRODUCTION

What are stem cells, types, origin and nature of stem cells? Characteristic features, pluripotent stem cells and its types, Molecular basis of pluripotency. Cell surface markers of stem cells. Embryonic stem cells, factors requirements for maintain stem cells. Differences between human and mouse stem cells. Development of epithelial stem cell concept. Stem cell niches.

STEM CELL CHARACTERIZATION

Cell cycle regulation in stem cell. Mechanism of stem cell renewal, Changes of phenotypic characters, Characterization of human embryonic stem cells, Isolation and maintenance of Stem cell. Genetic manipulation of Embryonic Stem cell, homologous recombination of stem cells. Surface antigenic markers, lineage marking, Genomic reprogramming. Microarray analysis of stem cells & differentiation. Zebra fish and Stem cell research.

TISSUE ENGINEERING

Neural stem cells and applications in neurodegenerative diseases, Treatment of heart diseases, diabetes, burns & skin ulcers, muscular dystrophy, regeneration of epidermis, orthopedic applications. Embryonic applications in tissue engineering. Novel sources of multipotent stem cells. Adult stem cells, Stem cell gene therapy.

BIOPHARMING

What is biopharming? Applications of stem cell technology in animal biotechnology. Production of artificial organs using stem cell technology. Artificial pancreas, kidney, heart, liver etc.

REGULATIONS AND ETHICS

Ethics of human cell research-immortal cells and moral selves, Ethical considerations, stem cell based therapies. FDA products and preclinical regulatory considerations. Patent advocacy, Science policies, ethics in stem cell research, primordial germ cells and germ cell development epigenetics and reprogramming in stem cell biology, norms in clean room.

TEXTBOOKS :

1. Rober Lanza, Essentials of Stem cell biology, Elsevier academic press, 2009
2. Joseph D. Bronzino Tissue engineering and artificial organs, Biomedical engineering hand TextBook :. volume -2, 3rd edition, CRC press, Taylor & Francis publications, 2006

REFERENCE BOOKS :

1. Daniel R. Marshak, Stem Cell Biology, Johns Hopkins University and Cambrex Corp.; Richard L. Gardner, University of Oxford; David Gottlieb, Washington University, St. Louis, 2001.

MOLECULAR MODELING AND DRUG DESIGN

SYLLABUS

EMPIRICAL FORCE FIELDS AND MOLECULAR MECHANISMS

Models, Approximations and Reality, Force Field concepts and Mathematical Expressions, Molecular Mechanical and Quantum Mechanical Force Fields, Parameterization, Generation of Potential energy surfaces. Bond Stretching, Angle bending, Torsional I terms, Out of plane, Bonding Motions, Electrostatic interactions, Vander Walls interactions, Effective pair potentials, Hydrogen Bonding, Simulation of liquid water.

COMPUTER SIMULATION METHODS

Time averages, Ensemble averages, Free energy methods, Thermo dynamic Perturbation Methods, Thermodynamic Integration Methods. Calculation of thermodynamics properties. Phase space; Practical aspects of computer simulation; Boundaries monitoring Equilibrium; Long range process; Analyzing results of simulation and estimation errors.

MOLECULAR DYNAMICS SIMULATION METHODS

Molecular Dynamics using simple modules; Molecular Dynamics with continuous potentials; Running Molecular Dynamics Simulation; Constant Dynamics; Time dependent properties; Molecular Dynamics at constant temperature and pressure. Monte Carlo Simulation Methods Metropolis methods; Monte Carlo simulation of molecules; Monte Carlo simulation of Polymers; Calculating Chemical potentials; Monte Carlo simulation and molecular dynamics.

MOLECULAR MODELING IN DRUG DISCOVERY

Molecular modeling in drug discovery-Deriving and using 3D Pharma cores, Molecular docking Structure Based methods to identify lead components-Denovo ligand design. QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronic; Topology; Quantum Chemical based Descriptors

TEXTBOOKS :

1. Molecular Modeling Principles and Applications- AR Leach, Longman, 1996.

2. Molecular Dynamics Simulation-Elementary Methods- John Wiley and Sons, 1997.

REFERENCE BOOKS :

1. Current Protocols in Protein Science, Wiley Publishers, 2005; Deuflhard P., et al.
2. Computational molecular dynamics - Challenges, methods, ideas.(Springer,1999)

FOOD TECHNOLOGY

SYLLABUS

FOOD ASSOCIATED MICROBES

History of microorganisms in food, historical developments. Biotechnology in relation to the food industry, nutritive value of food, types of microorganism's associated with food, its sources, types and behavior in foods. Role and significance of microorganisms in food. Intrinsic and extrinsic parameters of foods that affect microbial growth.

FOOD PROCESSING

Bioprocessing of meat, fisheries, vegetables, diary product, enzymes and chemicals used in food processing, biochemical engineering for flavour and food productions. Emerging processing and preservation technologies for milk and dairy products.

FOOD PRESERVATION

Food preservation using irradiation, Characteristics of Radiations of interest in food preservation. Principles underlying the destruction of Microorganisms by irradiation, processing of foods for irradiation. Application of radiation, Radappertization, Radicidation, and Radurization of foods. Legal status of food irradiation. Effect of irradiation of food constituents.

STORAGE OF FOODS

Stability of food preservation with low temperatures, high temperatures, drying. Indicator and food borne pathogens. Food borne illness, quality control, HFCS (High Fructose Corn Syrup) and mycoproteins. Air sampling, metabolically injured organisms, enumeration and detection of foodborne organisms.

FOOD MICROBIOLOGY

Utilization of microorganisms in food industries, genetic manipulations. Thermophiles and Radiation-resistant microorganisms, characteristics and growth of thermophilic microorganisms, Nature of Radiation resistance in microorganisms. Rheology of food production.

TEXTBOOKS :

1. Lidsay, Willis Biotechnology, Challenges for the flavour and food industries, Elsevier Applied Science. 1988.
2. Food Science and Food Biotechnology by F.F.G. Lopez & G.V. B. Canovas (2003), CRC Press, Florida, USA.

REFERENCE BOOKS :

1. George J.B. Basic Food Microbilogy, CBS Publishers & Distributors, 1987.
2. Roger, A., Gordan B., and John T. Food Biotechnology, 1989.

TRANSPORT PHENOMENON IN BIOPROCESS

INTRODUCTION TO TRANSPORT PHENOMENA

Three levels of transport process, conservation laws, Basic laws governing momentum, heat and mass transport, pressure and temperature dependence on viscosity, thermal conductivity and mass diffusivity, Molecular theories of viscosity, thermal conductivity and mass diffusivity under different condition, Introduction to convective transport process

SHELL BALANCES FOR MOMENTUM, MASS AND ENERGY

Flow of a falling film, flow through a circular tube, flow through annulus, heat conduction with electrical, nuclear and chemical heat, heat conduction in a fin, diffusion through a stagnant gas film, diffusion with homogeneous and heterogeneous chemical reaction, diffusion and reaction in a porous catalyst, Forced convective momentum, heat and mass transport process

TRANSPORT PROCESS UNDER TURBULENT CONDITIONS

Equations of change for isothermal and non-isothermal conditions, unsteady state momentum, heat and mass transport process, Velocity distribution in turbulent flow, time smoothed equation of change, turbulent flow in ducts, unsteady state heat conduction, temperature distribution for turbulent flow in tubes, jets and at large Prandtl number, concentration distribution in turbulent flow

INTERPHASE TRANSPORT PROCESS

Definition of friction factors, friction factors for flow in tubes and pressure drop calculations, heat transfer coefficients, heat transfer coefficient for free and forced convection, analytical calculations of heat transfer, mass transfer coefficient, mass transfer coefficient in single and two phase system, mass transfer with chemical reactions

MACROSCOPIC BALANCES AND OTHER MECHANISMS OF TRANSPORT

Macroscopic balances for steady and unsteady state balances in momentum, heat and mass transport. Heat transfer by radiation, radiation between nonblack bodies at different temperatures, mass transport during centrifugation of proteins, diffusion of salts in aqueous solution, mass transport across permeable membranes, mass transport in porous media

TEXTBOOKS :

1. R. B. Bird. W.E. Stewart and E.N. Lightfoor, Transport Phenomenoa Wiley II edition, India.

REFERENCE BOOKS :

1. D.G.Rao, Introduction to Biochemical Engineering, Tata Mc Hill (2005).
2. Paul M. Doran, Bioprocess Engineering Principles Academic press (1995).
3. J E Bailey and D F Ollis, “Biochemical Engineering fundamentals “2nd edition Mc Graw-Hill (1986).
4. S Aiba, A E Humphrey and N Millis, “Biochemical Engineering” Prentice-Hall (1978).

5. Michaeln L shuler and F Kargi,Bio process Engineering : Basic concepts" 2nd ed., Prentice Hall of India (2003).

BIOMINING

SYLLABUS

INTRODUCTION TO DATA MINING

Introduction to Data mining- methods- selection & sampling- Preprocessing and cleaning-Transformation & reduction- Data mining methods- Evaluation-visualization

TEXT MINING

Overview on text mining- Natural Language Processing -Text summarization –tools- Applications of Data Mining

INTRODUCTION TO GENETIC ALGORITHMS

Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithmsin Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation issues

NEURAL NETWORK

Neural Model and Network Architectures, Perceptron Learning, Supervised HebbianLearning, Backpropagation, Associative Learning, Competitive Networks, Hopfield-Network, Computing with Neural Nets and Applications of Neural Network

INTRODUCTION TO FUZZY SETS

Introduction to Fuzzy Sets, Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures,Applications of Fuzzy Set Theory to different branches of Science and Engineering

TEXTBOOKS :

1. Mitchell, M., 1998, an Introduction to Genetic Algorithms, Prentice-Hall.
2. Lau C., (Ed), 1992, Neural Networks, IEEE Press.

REFERENCE BOOKS :

1. Freeman, J. and Skapura, D., 1991 Neural Networks: Algorithms, Applications and Programming Techniques, Addison-Wesley.
2. Klir, G.J. and Folger, T.A., 1988, Fuzzy Sets, Uncertainty, and Information, PHI.

BIOPROCESS VALIDATION & CGMP

SYLLABUS

BIOPROCESS VALIDATIONS

Validations – Methods of validation. Prerequisites, process design & testing process characterization, Process optimization, Validation options, Prospective process validation, retrospective validations, Concurrent validations, Revalidation, Organizing Revalidation studies, Analytical method validations, Cleaning validation, Prevalidation verification, Documentation, Control of cleaning materials & ancillary tools, Frequency of cleaning, Development of validation protocol.

QUALITY ASSURANCE

Quality Assurance, Quality control, Quality management, Responsibilities of quality management in laboratories, Development of quality records, Deviations of quality product process, Good laboratory practices, Responsibilities in GLP, Computational processes in GLP.

STANDARD OPERATING PROCEDURES

Standard operating procedures, SOP of immunological industries, SOP of tissue culture, Deviations of SOP, Revision occurrence in SOP, Authorized control of SOP, Guidelines and regulation of FDA and ICH for GLP.

GOOD MANUFACTURING PRACTICES

Quality control of a product, Good manufacturing practices, cGMP, GMP of industries, Sanitation & Hygiene, Control of finished products, Maintenance of materials in laboratories, Zero contamination, Documentation of GMP, Compliance of GMP.

CLINICAL PRACTICES OF GMP

Clinical practices in laboratories, Clinical practices in vaccine production, Clean room, Class A, B (USFDA), Bacterial counts in clean room, Waste disposal in laboratories, Health & hygiene of persons involved in clinical laboratories. ICH guidelines for clinical laboratories.

TEXTBOOKS :

1. P. P. Sharma,How to Practice GMP's
2. ICH Guidelines – USFDA Hand TextBook :

REFERENCE BOOK :

1. J. Seiler,Good Laboratory Practices

PERL PROGRAMMING AND BIOPERL

SYLLABUS

AN INTRODUCTION TO PERL & VARIABLES AND DATA TYPES

The Perl Interpreter - Perl Variables-Scalar Values-Variable Definition-Special Variables

ARRAYS AND HASHES

Arrays-Array Manipulation -Push and Pop, Shift and Unshift –Splice-Other Useful Array Functions- List and Scalar Context -Hashes -Maintaining a Hash

CONTROL STRUCTURES & STRING MANIPULATION

Comparisons Choices- If - Boolean Operators- Else-Loops-For Loops -Foreach Loops 52. Indeterminate Loops -While -Repeat Until -Loop Exits -Last - Next and Continue -Array-Based Character Manipulation-Regular Expressions–Match-Substitute - Translate

INPUT AND OUTPUT

Program Parameters -File I/O -Filehandles- Working with Files -Built-in File Handles -File Safety - The Input Operator–Binary- Interprocess Communications–Processes- Process Pipes-Creating Processes - Monitoring Processes

BIOPERL

Sequences -SeqFeature –Annotation-Sequence - Example Bioperl Programs

TEXTBOOKS :

1. Beginning Perl for Bioinformatics, James Tisdall, O'Reilly Publishers
2. Jamison D., Perl Programming for Biologists, Wiley publishers

REFERENCE BOOK :

1. Introduction to computers, Peter Norton, Tata Mc Graw Hill publishers

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BIOPROCESS TECHNOLOGY

SYLLABUS

INTRODUCTION

Isolation and screening of industrially important microbes. Strain improvement – mutation and recombination. Substrates for industrial fermentation.

FERMENTATION TECHNOLOGY

Concepts of basic modes of fermentation - Batch, Fed batch and Continuous fermentation. Bioreactor designs, Media formulation. Air and media sterilization, Aeration & agitation in bioprocess.

BIOPROCESS CONTROL AND MONITORING

Bioprocess control and monitoring variables such as temperature, pH, agitation, pressure, online measurement, on / off control, PID control, computers in bioprocess control system.

DOWNSTREAM PROCESSING

Downstream processing–Filtration, Centrifugation, cell disruption, chromatography, Liquid–liquid extraction, membrane process, drying crystallization, broth processing. Effluent treatment–disposal, treatment process, by-products. Fermentation economics, Bioprocess for the production of amino acids, organic acids, nucleotides, nucleosides and related compounds,

BIOPRODUCTS

Bioprocess for the production of enzymes, vitamins, antibiotics and SCP. Immobilization of enzymes and microbial cells.

TEXTBOOKS :

1. Industrial Microbiology & Biotechnology by Arnold L. demain & Julian E. Davis. (2004) ASM Press.
2. Fermentation Microbiology & Biotechnology by Emt.el-Mansi & CFA. Bryce (2004). Taylor & Francis Ltd.

REFERENCE BOOKS :

1. Principles of fermentation technology by P.F. Stanbury, A. Whitaker & S.J. Hall(1997). Oxford.
2. The Bacterial Vol. III by Gungalus, I.C. and stainer. RY. (Eds.) Academic press. New York.
3. Bacterial physiology and metabolism by Sala Teh JR - Academic press, New York..
4. Chemical Engineering by J.M. Coulson and J.F. Richardson (1984) Pergamon Press.

ENVIRONMENTAL BIOTECHNOLOGY

SYLLABUS

ENVIRONMENTAL POLLUTION

Types, Environmental pollution (water, soil, air), Noise & Thermal pollution, sources, and control. Reduction of environmental impact of industrial effluents, chemical herbicides and fertilizers. Biotechnology for hazardous waste management, persistent organic pollutants, Xenobiotics, biological detoxification of pH. Removal of oil spills. Environmental monitoring. Bioremediation – solid & liquid waste treatment.

WATER POLLUTION

Water Quality modeling for streams. Water pollution and its control, wastewater treatment – Biological processes for Industrial and domestic effluents treatments, Aerobic and non-aerobic Biological treatment. Role of Biotechnology in water purification systems. (Primary, secondary and tertiary treatments)

AIR POLLUTION

Source of air, water and solid wastes. Micrometeorology and dispersion of pollutants in Environment. Centrifugal collectors, Electrostatics, precipitator, bag filters and wet scrubbers. Design and efficiencies. Combustion generated pollution mine drainages, vehicle emission control. Case studies – Bio techniques for Air pollution control.

MICROBE-METAL INTERACTION

Heavy metal pollution and impact on environment Bioleaching Microbial systems for heavy metal accumulation, Biosorption, molecular mechanism of heavy metal tolerance, role of microbes insynthesis of nanoparticles.

ENVIRONMENT & ENERGY

Renewable sources of energy – Biogas, waste material, energy crops, cellulose. Bio-fuels & Biodiesel using microorganisms. Global Environmental problems. Ozone depletion, UV-B, Green house effect. National policy on environment.

TEXTBOOKS :

1. T. Srinivas, Environmental Biotechnology, New-Age Publications, New Delhi (2008)
2. Bru E. Rittmann and Perry L.Mc Carty, Environmental Biotechnology: Principles and Applications, Mc Graw Hill Company (2001).

REFERENCE BOOK :

1. Howard S. Peavy, Donal R. Rowe and George Tchobanoglous, Environmental Engineering, Mc Graw Hill Company (1985).

NANO TECHNOLOGY

SYLLABUS

INTRODUCTION TO NANOTECHNOLOGY:

Definition of nanoscale with reference to physics and bio-systems. Crystal Structure, Unit Cells, Bravais Lattices, Crystallographic Directions, Crystallographic Planes, Miller Indices, Bragg's Law, Single Crystal and Powder X-ray Diffraction. Types of Material -Different types of materials: Metals, Semiconductors, Composite materials, Ceramics, Alloys, Polymers and Bio Polymer composites. Imperfections in solids -Imperfections of crystal structure:

point defects, Grain boundaries, phase boundaries, Screw & Edge Dislocations.

NANO MATERIALS AND SYNTHESIS:

Nano material Synthesis: Top-Down Approach. Physical methods - Inert gas condensation, aerosol method, Arc discharge, RF-plasma technique, laser ablation, Spray Pyrolysis, Ball Milling. Bottom-up approach - Chemical Methods - Metal nanocrystals by reduction, Solvothermal synthesis, Photochemical synthesis, Electrochemical synthesis, Sonochemical routes, Solvated metal atom dispersion, Sol- gel technique.

CHARACTERIZATION OF NANO MATERIALS BY SPECTROSCOPIC TECHNIQUES :

Introduction to microscope, optical microscope, Optical absorption spectrometer, UV-Vis-NIR spectrometer, x-ray Diffraction, Scanning electron microscopy, scanning probe microscopy, scanning tunneling microscope and transmission electron microscopy.

MECHANICAL & OPTICAL PROPERTIES:

Mechanical properties of nano materials, structural properties of nano materials, melting of nano materials, electrical conductivity, optical properties of nano structured metals and semiconductors.

CARBON NANO TUBES:

Introduction to carbon nano tubes, types of carbon nanotubes, synthesis, growth mechanism, Nanolithography, lithography using photons, lithography using paticle beams, scnaning probe lithography, soft lithography. Nano sensors, Carbon nano tube applications

TEXTBOOKS :

1. Carl.C.Koch, “Nanostructured materials, processing, properties and applications, NFL publications,2007.
2. Hari Singh Nalwa – Handbook of nanostructured materials and nanotechnology: Synthesis and processing, ASP,2004.
3. Stephen Elliott & S. R. Elliott The Physics and Chemistry of Solids, John Wiley & Sons, 1998.

REFERENCE BOOKS :

1. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, 2004
2. Van Vlack, Elements materials science, Addison-Wesley, 1964
3. Zhong Lin Wang, “Characterization of Nanophase Materials”, Wiley-VCH, 2001
4. T.J.Chung, P.M. Anderson, M.K.Wu and S.Hsieh, “Nanomechanics of materials and structures, Springer, 2006.
5. Jackie Ying. Ed “Nanostructured Materials”, Academic Press, 2001. A small edited volume with some good articles on some specialized topics such as adsorption in nanoporous materials
6. R. Haynes, “Optical Microscopy of Materials, International TextBooks : Company, Glascow, 1984.

7. John J. Bozzola and Lonnie D. Russel, “Electron Microscopy”, Jones and Bartlett Publishers Inc., USA, 1999.
8. YIP-WAH-CHUNG, “Practical Guide to Surface Science & Spectroscopy”, Academic Press, 2001.
9. Christopher Hammond, “The Basics of Crystallography, II edition, Oxford Univ. Press, (2001).
10. D. P. Woodruff and T. A. Delchar, “Modern Techniques of Surface Science”, Cambridge Solid State Science Series, 1994.

INTELLECTUAL PROPERTY RIGHTS AND PATENT LAWS

SYLLABUS

INTELLECTUAL PROPERTY RIGHTS

Patents and intellectual property rights (IPR): Definition, History of intellectual property; Types of intellectual property rights, copy rights, trade marks, geographical indication, Industrial design rights, patents. Sources of patent information, patent application procedures.

PRINCIPLES, SCOPE AND FUNCTIONS OF GATT&WTO

GATT- Historical perspective, objectives and fundamental principles, impact on developing countries. WTO-Objectives, scope, functions, structure, status, membership and withdrawal, dispute settlement, impact on globalization, India-tasks and challenges.

REGULATORY AFFAIRS

Indian contest-requirements and guidelines of GMP, understanding of Drugs and cosmetic act 1940 and rules 1945 with reference schedule M,U & Y. Related quality systems-objectives and guidelines of USFDA,WHO & ICH; Introduction to ISO series.

DOCUMENTATION AND PROTOCOLS

Documentation: Types related to pharmaceuticals industry, protocols, harmonizing formulation development for global fillings, NDA, ANDA, CTD, Dealing with post approval changes-SUPAC, handling and maintenance including electronic documentation.

CASE STUDIES ON PATENTS:

Case Studies on patents (Basumati rice, turmeric, Neem, etc.)

TEXTBOOK :

1. S. H. Willing, Good manufacturing practices for Pharmaceuticals

REFERENCE BOOK :

1. P. Das & Gokul Das, Protection of Industrial property Rights.

REGULATORY AFFAIRS AND CLINICAL TRIALS

SYLLABUS

BASICS AND FEATURES OF CLINICAL TRAILS

What is clinical trial - Need, Types and phases of clinical trials, Benefits and Risks in clinical trials: Team involved in a clinical trial: Features and essential components of clinical trials: Good clinical trial practices:

PATENT REQUIREMENT AND CLINICAL TRAIL STATISTIC

Stages in patent recruitment: Recruitment evidence. Challenges in patent recruitment, Research methodology, Primary and secondary outcomes: Subgroup analysis, Checklists

DESIGN OF EXPERIMENTS AND ROLE OF IT IN CLINICAL TRAILS

Design configuration, Multicenter trails, Types of comparison: Group sequential designs, Sample size, Data capture and processing: Role of IT in clinical trials: Clinical trial team

CLINICAL TRAIL REGULATORY AFFAIRS

The history of clinical testing and its regulation, Clinical trial regulation, Good clinical trail guidance-The Indian scenario, Essential standards for performing clinical trials, Good clinical practice, Institutional ethics committee, General ethical principles, Specific ethical principles, The guidelines for drug trails, Phase wise guidelines for clinical trials, Guidelines for vaccine trails, Essential documents.

CLINICAL TRAIL BUSINESS ENVIRONMENT

Basic components of clinical trials budgets, Clinical trial Industry, Economic challenges faced by Pharmaceutical companies, India as a place for conducting clinical trials. Indian/USA/EU ethics approval system.

TEXTBOOKS :

1. Good Clinical practices,Central Drugs Standard Control organization,Govt. of India
2. Drugs and cosmetics Act 1940.

REFERENCE BOOKS :

1. International Clinical Trail, Volume 1 & 2 Dominique P.brunier and Nahler, Interpham press, Denver, Colorado.
2. Code of Federal Regulation by USFDA-Download.

BIOPROCESS ECONOMICS AND PLANT DESIGN

SYLLABUS

ECONOMIC EVALUATION

Capital cost of a project. Interest calculations, nominal and effective interest rates. Basic concepts in tax and depreciation. Measures of economic performance, rate of return, payout time. Cash flow diagrams; Cost accounting-balance sheet and profit loss account. Break even and minimum cost analysis.

BIOPROCESS ECONOMICS

Introduction, elements of total production cost, outline of the total capital investment, equipment sizing, capital cost estimates large-scale equipment and utilities. Manufacturing cost estimates-Operating costs-Raw materials, utilities, fixed costs and overhead costs, case studies of antibiotics, recombinant products, single cell protein.

INTRODUCTION TO PROCESS DESIGN

Schematic representation of unit operations, design information and flow diagrams, material and energy balances, formulation of the design problem, the Hierarchy of chemical process design and integration, optimization, Health and safety Hazards, Environment protection, plant location and lay out.

BASIC CONSIDERATIONS IN EQUIPMENT DESIGN

General design procedure, equipment classification, materials of construction-Mechanical propertiesstrength, elasticity, ductility, resilience, toughness, hardness, creep, fatigue. Metals-ferrous metals, types of iron & steels, Nonferrous metals and Non-metals. Corrosion: Forms of corrosion and their presentation. Choice of materials. Design conventions.

BASIC DESIGN PROBLEMS

Design examples on continuous fermentation, aeration and agitation. Design calculation of filter for air sterilization. Design of batch and continuous sterilizers. Design calculations for immobilized enzyme kinetics. Practical considerations in designing of Bioreactor/Fermentor construction. Introduction to different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries. Design exercise on trickle flow fermenter. Problems associated with design equations.

TEXTBOOKS :

1. Peters & Timmerhaus, Plant design and Economics for Chemical Engineers
2. M V Joshi & V V Mahajani, Process equipment design
3. Robin smith, Chemical process design and integration

REFERENCE BOOKS :

1. Harvey W Blanch, Biochemical Engineering
2. S.K. Hazra and choudary, Material Science & Processes

BIOPROCESS ECONOMICS AND PLANT DESIGN

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2. S.K. Hazra and choudary, Material Science & Processes

ENZYME MECHANISMS

SYLLABUS

BIOCATALYSIS

Current Status, Advantages & disadvantages, Comparison with other Catalysts, Biocatalysts as a technology, Green Chemistry.

CHARACTERIZATION OF A BIOCATALYST

Enzyme Kinetics, Basis of Enzyme Action, Theories of Enzyme Catalysis, Efficiency, Stability, Selectivity of Enzymes, Screening of New Enzyme Activity

Biocatalytic Asymmetric Synthesis: Basic of stereochemistry; Enantiomerically pure amino acids, Hydroxy esters with carbonyl reductase, Alcohols with ADH, Penicillin G, Ephedrine, Chiral drugs, Anticholesterol drugs, Anti-infectives, Anti-AIDS drugs, Cardiovascular drugs, Applications of Lipases and Esterases in the Pharma industry, Steroids UNIT-IV

BIOCATALYSIS IN NON-CONVENTIONAL MEDIA

Enzymes in organic solvents, Advantages of Biocatalysis in organic media, Role of water in Enzyme reactions in Organic solvents, Substrate as solvent, Ionic liquids and Supercritical Solvents for enzymatic reactions .

INDUSTRIAL ENZYMES

Enzymes in the food industry, Cell-wall degrading enzymes, Lipases, Proteases, Amylases, Xylanases, Enzymes in brewing, Fat splitting, Enzymes in the paper and pulp industry, Enzymes in the textile industry, Enzymes for preservation, The future of enzyme applications

TEXTBOOK :

1. Biocatalysis Fundamentals & Applications by Andreas Sebastian Bommarius , Bettina R. Riebel, VCH. 2. Biotransformations in Organic Chemistry by Kurt Faber, Springer Berlin.

REFERENCE BOOK:

1. Enzymes by palmer, 2. Enzymes in Industry by Wolfgang Aehle, Wiley-VCH.

CIVIL

Structural Engineering

COURSE STRUCTURE

FIRST YEAR (FIRST SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5101	Applied Mathematics	3	2	0	4
2	18CE5102	Theory of Elasticity	3	2	0	4
3	18CE5103	Structural Dynamics	3	0	2	4
4	18CE5104	Advanced Prestressed Concrete	3	0	2	4
5		Elective – I				
6		Elective – II	3	0	0	3
7	18CE5149	Seminar	0	0	4	2
		Total Credits:				**24**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5205	Finite Element Analysis	3	0	2	4
2	18CE5206	Bridge Engineering	3	2	0	4
3	18CE5207	Earthquake Resistant Design of Structures	3	0	2	4
4	18CE5208	Theory of Plates and Shells	3	2	0	4
5		Elective – III				
6		Elective – IV				
7	18IE5250	Term Paper	0	0	4	2
		Total Credits:				**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18IE6050	DISSERTATION	0	0	72	36
		Total Credits:				**36**

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18CE51A1	Repair and Rehabilitation of structures	3	0	0	3
2	18CE51A2	Design of Offshore structures	3	0	0	3
Elective-2						
1	18CE51B1	Geotechnical Earthquake Engineering	3	0	0	3
2	18CE51B2	Stability of Structures	3	0	0	3
Elective-3						
1	18CE52C1	Industrial Structures	3	0	0	3
2	18CE52C2	Design of Tall Structures	3	0	0	3
3	18CE52C3	Optimization of Structures	3	0	0	3
Elective-4						
1	18CE52D1	Advanced Design of structures	3	0	0	3
2	18CE52D2	Fracture Mechanics	3	0	0	3
3	18CE52D3	Green Buildings	3	0	0	3

APPLIED MATHEMATICS

SYLLABUS

ONE DIMENSIONAL WAVE AND HEAT EQUATIONS

Laplace transform methods for one-dimensional wave equation – Displacements in a long string – longitudinal vibration of an elastic bar – Fourier transform methods for one-dimensional heat conduction problems in infinite and semi-infinite rods.

ELLIPTIC EQUATION

Laplace equation – Properties of harmonic functions – Solution of Laplace's equation by means of Fourier transforms in a half plane, in an infinite strip and in a semi-infinite strip – Solution of Poisson equation by Fourier transform method.

CALCULUS OF VARIATIONS

Concept of variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives – Functionals dependent on functions of several independent variables – Variational problems with moving boundaries –Direct methods – Ritz and Kantorovich methods.

EIGEN VALUE PROBLEMS

Methods of solutions: Faddeev – Leverrier Method, Power Method with deflation – Approximate Methods: Rayleigh – Ritz Method

NUMERICAL INTEGRATION

Gaussian Quadrature – One and Two Dimensions – Gauss Hermite Quadrature – Monte Carlo Method – Multiple Integration by using mapping function

TEXTBOOKS :

1. Introduction to Partial Differential Equations by K. Sankara Rao, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
2. Numerical Methods in Science and Engineering A Practical Approach by S. Rajasekaran, A. H. Wheeler and Company Private Limited, 1986.
3. Calculus of Variations with Applications by A.S. Gupta, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4. Integral Transforms for Engineers by L.C. Andrews and B. K. Shivamoggi, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

THEORY OF ELASTICITY

SYLLABUS

TWO-DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES

Plane stress; Plane strain; Differential equations of equilibrium; Boundary conditions; Compatibility equations; Stress function; Governing differential equation; Solution by Polynomials; End effects – Saint-Venant's Principle; Determination of displacements; Bending of a cantilever loaded at the end; Bending of a beam by uniform load

TWO-DIMENSIONAL PROBLEMS IN POLAR COORDINATES

General equations in polar coordinates; Stress distribution symmetrical about an axis; Effect of circular holes on stress distribution in plates; Concentrated force at a point of a straight boundary; Concentrated force acting on a beam; Stresses in a circular disc, general solutions of the two-dimensional problem in polar coordinates, applications of the general solutions in polar coordinates.

STRAIN ENERGY METHODS

Total strain energy; Principle of virtual work; Griffith's theory of rupture; Castigliano's theorem; Principle of least work (Stationary potential energy), applications of the principle of least work rectangular plates, shear lag

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS

Stress at a point – components of stress; Principal stresses; Stress ellipsoid and stress director surface; Determination of principal stresses; Stress invariants; Determination of maximum shear stresses; Octahedral shear stress; strain at a point – Components of strain; differential equations of equilibrium, the principle of superposition

TORSION

Torsion of straight bars – Saint Venant's theory; Elliptic cross section; Membrane analogy; Torsion of a bar of narrow rectangular cross-section; Torsion of rolled profile sections; Torsion of thin tubes

TEXTBOOK :

1. Theory of Elasticity by Timoshenko, S. and Goodier J.N., McGraw Hill Text-Book : Co., Newyork, 1988.

REFERENCE BOOKS :

1. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.
2. Hearn , E.J. "Mechanics of Materials", Vol.2, Pergamon Press, Oxford, 1985
3. Irving H.Shames and James, M.Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India Pvt. Ltd., New Delhi -2002.

STRUCTURAL DYNAMICS

SYLLABUS

EQUATION OF MOTIONS, PROBLEM STATEMENT, SOLUTION METHODS OF SINGLE DEGREE OF FREEDOM SYSTEMS (SDOF):

Basic concepts of structural dynamics; single degree of freedom system, force displacement relationship, damping force, equation of motion, mass-spring-damper system, methods of solution of differential equation.

Free Vibration (SDOF):

Undamped free vibration, viscously damped free vibration, energy in free vibration.

Response to Harmonic and Periodic Excitations (SDOF):

Harmonic vibration of undamped systems, Harmonic vibration with viscous damping, response to vibration generator, natural frequency and damping from harmonic test, force transmission and vibration isolation, vibration measuring instruments, energy dissipated in viscous damping. Response to periodic force.

Response to Arbitrary, Step And Pulse Excitations (SDOF) : Response to unit impuse, response to arbitrary force, step force, ramp force, response to pulse excitations, solution methods, effects of viscous damping.

NUMERICAL EVALUATION OF DYNAMIC RESPONSE (SDOF) :

Time stepping methods, methods based on interpolation of excitation, central difference method, Newmark's method, stability and computational error, analysis of nonlinear response by Newmark's method. Earthquake Response to Linear Systems (SDOF)

Earthquake excitation, equation of motion, response quantities, response history, response spectrum concept, deformation, pseudo-velocity and pseudo acceleration response spectra, peak structural response from the response spectrum, response spectrum characteristics, elastic design spectrum, comparison and distinction between design and response spectra.

GENERALISED SINGLE DEGREE OF FREEDOM SYSTEMS

Generalised SDOF systems, rigid body assemblages, systems with distributed mass and elasticity, lumped mass system-shear building, natural vibration frequency by Rayleigh's method.

MULTI -DEGREE OF FREEDOM SYSTEMS (MDOF)

Equation of motions: simple system-two storey shear building, general approach for linear systems, static condensation, symmetric plan systems: ground motion. Multiple support excitation, methods of solving the equation of motions.

FREE VIBRATION (MDOF): NATURAL FREQUENCIES AND MODES

systems without damping, modal and spectral matrices, orthogonality of modes, normalization of modes. Solution of undamped free vibration systems, solution methods for eigenvalue problem.

TEXTBOOKS :

1. Dynamics of structures by Anil K Chopra; Prentice-Hall of India Limited, New Delhi.3rd edition 2006.
2. Dynamics of Structures by R.W. Clough and P.E. Penzien, McGraw-Hill. 1st edition 1975

REFERENCE BOOKS :

1. Structural Dynamics for Structural Engineers by G. C. Hart & K. Wang; John Wiley & Sons. 1st Edition 1991
2. Structural Dynamics by Mario Paz, CBS Publishers.1st edition 1991.

ADVANCED PRESTRESSED CONCRETE

SYLLABUS

INTRODUCTION, PRESTRESSING SYSTEMS AND MATERIAL PROPERTIES

Basic concepts of pre-stressing; Historical development; Advantages and Types of Pre-stressing, Pre-tensioning Systems and Devices, Post-tensioning Systems and Devices, Need for High strength steel and High strength concrete; Losses of Prestress: Nature of losses of pre-stress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

Analysis of Prestressed Member

ANALYSIS OF MEMBERS UNDER AXIAL LOAD

Analysis at Transfer, Analysis at Service, Analysis for Ultimate Strength, Analysis of Member under Flexure: Analysis at Transfer and at Service, Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, design loads and strength, Calculation of Crack Width, Variation of Stress in Steel, Analysis of a Rectangular Section, Analysis of a Flanged Section.

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS

Importance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members. Long term deflection of cracked member; Transmission of Pre-Stress: Transmission of Pre-stressing force by bond; Transmission length; Bond stresses; Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre –tensioned and post – tensioned grouted beams, stress distribution in end block, Anchorage zone reinforcements; Shear And Torsion Resistance Of Prestressed Concrete Member: Shear and Principal stresses; Ultimate shear resistance of pre-stressed concrete members; Design of shear reinforcement, pre-stressed concrete members in torsion,

Design of reinforcements for torsion, shear and bending.

DESIGN OF PRE-STRESSED MEMBERS:

Design of sections for flexure, Design of Sections for Axial Tension, Design of Sections for compression and bending, design of pre-stressed section for shear and torsion, design of pre-stressed member for bond. Dimensioning of flexural member, design for pre-tensioning member, design of post-tensioning members.

COMPOSITE CONSTRUCTION OF PRESTRESSED CONCRETE:

Composite structural member, types of composite construction, analysis of stresses, differential shrinkages, deflection of composite member, flexural strength of composite sections, shear strength of composite section; Design of Continuous Prestressed Concrete Member:Advantages of continuous members, ultimate load analysis of continuous pre-stressed member, design of continuous pre-stressed concrete beams.

TEXTBOOKS : (SUPPLEMENTED WITH IS: 1343)

1. Prestressed Concrete by N. Krishna Raju; Tata Mc Graw - Hill Publishing Company Limited, New Delhi.3rd edition, 1995.
2. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns; John Wiley & Sons, 3rd edition, 1981.REFERENCE Books :
3. Prestressed concrete by N. Rajagopalan; Narosa Publishing House.2nd edition, 2005.
4. Design of Prestressed Concrete by A. Nilson; John Willey & Sons.2nd edition, 1987.

REHABILITATION OF STRUCTURES

SYLLABUS

Introduction

Deterioration of structures with aging; Need for rehabilitation

Distress in concrete /steel structures. Types of damages; Sources or causes for damages; effects of damages; Case studies

DAMAGE ASSESSMENT AND EVALUATION MODELS

Damage testing methods; Non-destructive testing methods

REHABILITATION METHODS

Grouting; Detailing; Imbalance of structural stability; Case studies

METHODS OF REPAIR

Shortcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling

SEISMIC RETROFITTING OF REINFORCED CONCRETE BUILDINGS

Introduction; Considerations in retrofitting of structures; Source of weakness in RC frame building – Structural damage due to discontinuous load path; Structural damage due to lack of deformation; Quality of workmanship and materials; Classification of retrofitting techniques; Retrofitting strategies for RC buildings – Structural level (global) retrofit methods; Member level (local) retrofit methods; Comparative analysis of methods of retrofitting

TEXTBOOKS :

1. Diagnosis and treatment of structures in distress by R.N. Raikar, Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
2. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.
3. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.

DESIGN OF OFFSHORE STRUCTURES

SYLLABUS

WAVE THEORIES

Wave generation process, small and finite amplitude wave theories.

FORCES OF OFFSHORE STRUCTURES:

Wind forces, wave forces on vertical, inclined cylinders, structures - current forces and use of Morison equation.

OFFSHORE SOIL AND STRUCTURE MODELLING:

Different types of offshore structures, foundation modeling, structural modeling.

ANALYSIS OF OFFSHORE STRUCTURES:

Static method of analysis, foundation analysis and dynamics of offshore structures.

DESIGN OF OFFSHORE STRUCTURES:

Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

TEXTBOOK :

1. Dawson.T.H., “Offshore Structural Engineering”, Prentice Hall Inc Englewood Cliffs, N.J. 1983

REFERENCE BOOKS :

1. Chakrabarti, S.K. “Hydrodynamics of Offshore Structures”, Computational Mechanics ,Publications, 1987.
2. Brebia, C.A and Walker, S., “Dynamic Analysis of Offshore Structures”, New Butterworths, U.K. 1979.
3. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex, 2000.
4. Reddy, D.V. and Arockiasamy, M., “Offshore Structures”, Vol.1 and Vol.2, Krieger ,Publishing Company, Florida, 1991.

GEOTECHNICAL EARTHQUAKE ENGINEERING

SYLLABUS

SEISMOLOGY AND EARTHQUAKES

Introduction, Seismic Hazards, seismic waves, internal structure of earth, Continental drift and plate tectonics, faults, elastics rebound theory, geometric notations, location of earthquakes, size of earthquakes.

STRONG GROUND MOTION

Strong ground motion measurement, ground motion parameters, estimation of ground motion parameters.

SEISMIC HAZARD ANALYSIS

Identification and Evaluation of Earthquake Sources, deterministic seismic hazard analysis, probabilistic seismic hazard analysis.

WAVE PROPAGATION

Waves in unbounded media, waves in a semi – infinite body, waves in a layered media, attenuation of stress waves.

DYNAMIC SOIL PROPERTIES

Measurement of dynamic soil properties using field and laboratory tests (overview), stress strain behavior of cyclically loaded soils, strength of cyclically loaded soils.

GROUND RESPONSE ANALYSIS

One – Dimensional Ground Response Analysis – Linear and Non-Linear Approaches.

LOCAL SITE EFFECTS:

Effect of local site conditions on ground motion, design parameters, development

of design parameters.

LIQUEFACTION

Flow liquefaction, cyclic mobility, evaluation of liquefaction hazards, liquefaction susceptibility, initiation of liquefaction, effects of liquefaction.

Soil Improvement for Remediation of Seismic Hazards: Densification techniques, Reinforcement Techniques, Grouting and Mixing techniques, Drainage techniques.

TEXTBOOK :

1. Geotechnical Earthquake Engineering by Steven L. Kramer, prentice Hall, 1st Edition, 1996.

REFERENCE BOOK :

1. Geotechnical Earthquake Engineering Handbook by Robert W. Day, Mc-Graw-Hill.2nd Edition, 2010.

STABILITY OF STRUCTURES

SYLLABUS

BUCKLING OF COLUMNS

Introduction; Methods of finding critical loads; Critical loads for straight columns with different end conditions and loading; Inelastic buckling of axially loaded columns; Energy methods; Prismatic and non-prismatic columns under discrete and distributed loading; General Principles of elastic 0stability of framed structures.

BUCKLING OF THIN WALLED MEMBERS OF OPEN CROSS SECTION

Torsion of thin-walled bars; warping; Non-uniform torsion; Torsional buckling under axial loading; Combined bending and torsion buckling.

LATERAL BUCKLING OF BEAMS

Beams under pure bending; Cantilever and simply supported beams of rectangular and I- sections; Beams under transverse loading; Energy methods; Solution of simple problems.

BUCKLING OF RECTANGULAR PLATES

Plates simply supported on all edges and subjected to constant compression in one or two directions; Plates simply supported along two opposite sides perpendicular to the direction of compression and having various edge conditions along the other two sides.

BUCKLING OF SHELLS

Introduction to buckling of axially compressed cylindrical shells.

MATHEMATICAL TREATMENT OF STABILITY PROBLEMS

Discrete/Discontinuous systems; Eigen value problem; Converting continuous systems to discrete systems using the finite element method – Buckling of a column with sudden change in cross-section

TEXTBOOK :

Theory of elastic stability by Timoshenko & Gere, McGraw Hill, 1961.

REFERENCE BOOKS :

1. Background to buckling by Allen and Bulson, McGraw-Hill, 1980.
2. Elastic stability of structural elements by N.G.R.Iyengar, Macmillan India Ltd., 2007.

FINITE ELEMENT ANALYSIS

SYLLABUS

BASIC PRINCIPLES:

Equilibrium equations; Strain-displacement relations; linear constitutive relations; Principle virtual work; Principle of stationary potential energy

ELEMENT PROPERTIES

Different types of elements; Displacement models; Relation between nodal degrees of freedom and generalized coordinates; Convergence requirements; Compatibility requirement; Geometric invariance; Natural coordinate systems; Shape functions; Element strains and stresses; Element stiffness matrix; Element nodal load vector. Isoparametric elements – Definition, Two-dimensional isoparametric elements – Jacobian transformation, Numerical integration

DIRECT STIFFNESS METHOD AND SOLUTION TECHNIQUE

Assemblage of elements–Obtaining Global stiffness matrix and Global load vector; Governing equilibrium equation for static problems; Storage of Global stiffness matrix in banded and skyline form; Incorporation of boundary conditions; Solution to resulting simultaneous equations by Gauss elimination method

PLANE-STRESS AND PLANE-STRAIN ANALYSIS

Solving plane stress and plane-strain problems using constant strain triangle and four nodded Isoparametric element

ANALYSIS OF PLATE BENDING

Basic theory of plate bending; Shear deformation plates; Plate bending analysis using four noded Isoparametric elements

TEXTBOOK :

1. Introduction to Finite Elements in Engineering by R.T. Chandrupatla and A.D. Belegundu, Prentice Hall of India, 1997.

REFERENCE BOOKS :

1. Finite Element Analysis by Abel and Desai, New Age Publishers, 2007.
2. Finite Element Analysis: Theory and Programming by C. S. Krishnamoorthy, Tata McGraw- Hill, 1995
3. Finite Element Procedures in Engineering Analysis by K. J. Bathe, Prentice Hall Inc.,1996.
4. The Finite Element Method by O.C. Zienkiewicz, and R.L.Taylor, McGraw – Hill, 1987.

BRIDGE ENGINEERING

SYLLABUS

I.R.C. SPECIFICATIONS FOR ROAD BRIDGES

Different types of bridges; I.R.C. specifications for road bridges; Design Of R.C Slab Culvert: Loads considered for design, Design of R.C. slab culvert.

DESIGN OF T – BEAM BRIDGE

Pigeaud's method for computation of slab moments; courbon's method for computation of moments in girders; Design of simply supported T-beam Bridge.

DESIGN OF SUB STRUCTURE FOR BRIDGES

Pier and abutment caps; Materials for piers and abutments' Design of pier; Design of abutment; Backfill behind abutment; approach slab.

DESIGN OF BEARINGS FOR BRIDGES

Importance of bearings; bearings for slab bridge; bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing; Foundations For Bridges: Scour at abutments and piers; Grip length; Types of foundations; Design of well foundation.

CABLE SUPPORTED BRIDGE

Different types of cable supported bridge, difference between suspension bridge and cable stayed bridge. Different components and factors considered for design of a) suspension bridge, b) cable stayed bridge.

TEXTBOOKS :

1. Essentials of Bridge Engineering by Johnson Victor; Oxford & IBH publishing Co. Pvt. Ltd.2007
2. Cable supported bridges, concepts and design by N J Gimsing. John Willey and Sons, 2nd edition

REFERENCE BOOK :

1. Design of Bridge Structures by T. R Jagadeesh, M.A Jayaram, Prentice Hall of India Pvt. Ltd. 2nd edition.

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

SYLLABUS

SEISMIC-RESISTANT BUILDING ARCHITECTURE

Introduction; Lateral load resisting systems- moment resisting frame, building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements

DESIGN FORCES FOR BUILDINGS

Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS 1893(Part 1) – Equivalent static method, Model analysis using response spectrum

DUCTILITY CONSIDERATIONS IN EARTHQUAKE RESISTANT DESIGN OF RCC BUILDINGS

Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920

EARTHQUAKE RESISTANT DESIGN OF A LONG TWO-STOREY, TWO-BAY RCC BUILDING

Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of an exterior joint as per IS13920.

BASE ISOLATION OF STRUCTURES

Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; seismic-isolation design principle; Feasibility of seismic isolation; Seismic-isolation configurations

TEXTBOOKS :

1. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.
2. Seismic design of reinforced concrete and masonry buildings by T. Paulay and M.J.N. Priestley, John Wiley & Sons, 1991.
3. The seismic design handbook, Edited by F. Naeim, Kluwer Academic publishers, 2001.

THEORY OF PLATES AND SHELLS

SYLLABUS

INTRODUCTION:

Assumptions in the theory of thin plates – Pure bending of Plates – Relations between bending moments and curvature - Cases of pure bending of rectangular plates, Cylindrical bending - immovable simply supported edges – Synclastic bending and Anticlastic bending – Strain energy in pure bending of plates in Cartesian and polar co-ordinates – Limitations.

LATERALLY LOADED CIRCULAR PLATES:

Differential equation of equilibrium – Uniformly loaded circular plates with simply supported and fixed boundary conditions – Annular plate with uniform moment and shear force along the boundaries.

LATERALLY LOADED RECTANGULAR PLATES:

Differential equation of plates – Boundary conditions – Navier solution for simply supported plates subjected to uniformly distributed load and point load – Levy's method of solution for plates having two opposite edges simply supported with various symmetrical boundary conditions along the other two edges loaded with u. d. l. – Simply supported plates with moments distributed along the edges - Approximate Methods.

Effect of transverse shear deformation - plates of variable thickness – Anisotropic plates-thick plates- orthotropic plates and grids - Large Deflection theory.

DEFORMATION OF SHELLS WITHOUT BENDING:

Definitions and notation, shells in the form of a surface of revolution, displacements, unsymmetrical loading, spherical shell supported at isolated

points, membrane theory of cylindrical shells, the use of stress function in calculating membrane forces of shells.

General Theory of Cylindrical Shells: A circular cylindrical shell loaded symmetrically with respect to its axis, symmetrical deformation, pressure vessels, cylindrical tanks, thermal stresses, in extensional deformation, general case of deformation, cylindrical shells with supported edges, approximate investigation of the bending of cylindrical shells, the use of a strain and stress function, stress analysis of cylindrical roof shells.

TEXTBOOK :

1. S.P Timoshenko and S.W Krieger, Theory of Plates and Shells, McGraw Hill, 1989.

REFERENCE BOOKS :

1. R. Szilard, Theory and Analysis of Plates – Classical Numerical Methods', Prentice Hall inc, 1974.
2. P.L Gould, Analysis of Shells and Plates, Springer-Verlag, New York, 1988.

INDUSTRIAL STRUCTURES

SYLLABUS

PLANNING AND FUNCTIONAL REQUIREMENTS

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety – Protection against noise and vibration - Guidelines of Factories Act.

INDUSTRIAL BUILDINGS

Roofs for Industrial Buildings - Steel and RCC - Gantry Girders - Design of Corbels and Nibs – Machine foundations.

POWER PLANT STRUCTURES

Types of power plants – Design of Turbo generator foundation – containment structures.

POWER TRANSMISSION STRUCTURES

Transmission Line Towers - Substation Structures - Tower Foundations - Testing Towers.

AUXILIARY STRUCTURES

Chimneys and Cooling Towers – Bunkers and Silos – Pipe supporting structures.

TEXTBOOKS:

1. Manohar S.N, "Tall Chimneys - Design and Construction", Tata McGraw Hill,

1985
2. Santha kumar A.R. and Murthy S.S., “Transmission Line Structures”, Tata McGraw Hill, 1992.
3. Srinivasulu P and Vaidyanathan.C, “Handbook of Machine Foundations”, Tata McGraw Hill, 1976.
4. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, “Industrial Buildings: A Design Manual”, Birkhauser Publishers, 2004.
5. Proceedings of Advanced course on “Industrial Structures”, Structural Engineering Research Centre, Chennai, 1982.

TALL STRUCTURES

SYLLABUS

INTRODUCTION

Why Tall Buildings, Factors affecting growth, Height and structural form

The Tall Building Structure: Design process, Philosophy, scope and content;

Design Criteria: Design philosophy, Loading, Sequential loading, Strength and Stability, Stiffness and drift limitations, Human Comfort criteria, Creep, Shrinkage and temperature effects, Fire, Foundation settlement and soil structure interaction.

LOADING ON TALL STRUCTURES: GRAVITY LOADING:

Methods of live load reduction, Impact gravity loading, Construction loading, Wind loading: -Simple static loading, Dynamic loading, Earthquake loading: -Equivalent lateral force procedure, Model analysis procedure, Combination of loading: -Working stress design, Limit Sate design;

STRUCTURAL FORM: STRUCTURAL FORM

Braced frame structures, Rigid Frame structures, In filled-Frame structures, Flat plate- Flat slab structures, Shear wall structures, Wall frame structures, Framed tube structures, Suspended structures, Floor systems :-(Reinforced concrete):-One-way slabs on beams or walls, One-way pan joints and Beams, One-way slab on beams and girders, Two-way Flat plate, Two way flat slab, Waffle flat slabs, Two-way slab and beam, Floor systems :- (Steel framing):-Onaway beam system, Two-way beam system, Three way beam system, Composite Steel-Concrete floor system

DIA GRID CONSTRUCTION PRACTICES

Modeling for Analysis : Approaches to analysis:-Preliminary analyses, Intermediate and final analysis, Assumptions:- Materials, Participating components, Floor slabs, Negligible stiffnesses, Negligible deformations,

Cracking, High-Rise Behavior, Modeling for Approximate analyses:- Approximate Representation Bents, Approximate modeling of slabs, Modeling for continuum analyses, Modeling for Accurate analyses:-Plane frames, Plane shear walls, Three dimensional frame and wall structures, P-Delta effects, The assembled model;

BRACED FRAMES

Types of bracings, Behavior of bracings, Behavior of bracing bents, Methods of analysis: -member force analysis, Drift analysis, worked example for calculating drift by approximate methods, use large scale bracing.

RIGID-FRAME STRUCTURES

Rigid frame behavior, Approximate determination of member forces caused by Gravity loading:- Girder forces-Code recommended values, two cycle moment distribution, and Column forces, Approximate Analysis of member forces caused by horizontal loading:-Allocation of loading between bents, member force analysis by portal frame method, Approximate method by cantilever method, Approximate analysis of rigid frames with setbacks, Approximate analysis for drift:- Components of drift, correction of excessive drift, Effective shear rigidity (GA), Flat plate structures:-Analogues rigid frame, Worked examples, Computer analysis of rigid frames, Reduction of rigid frames for analysis:-Lumped girder frame, single-bay substitute frame;

SHEAR WALL STRUCTURES:

Behavior of shear wall structures, Analysis of proportionate wall systems: - Proportionate Non twisting structures, Proportionate twisting structures, Non Proportionate structures: -No proportionate Non twisting structures, Non proportionate twisting structures, Behavior of nonproportionate structures, Effects of discontinuities at base, Stress analysis of shear wall: - Membrane finite element analysis, Analogous frame analysis

TUBULAR STRUCTURES:

Structural behavior of tabular structures: -Framed- tube structures, Bundled Tube structures, Braced-Tube structures, General three-dimensional structural analysis, Simplified Analytical models for symmetrical Tubular structures: -Reduction of three-dimensional frame tube to an equivalent plane frame, Bundled-Tube structures, Diagonally braced frame tube structures;

DYNAMIC ANALYSIS:

Dynamic Response to Wind Loading:-Sensitivity of structures wind forces, Dynamic structural response due to wind forces, Along wind response, Cross wind response, worked examples, Dynamic response to Earthquake motions:- Response of Tall buildings to ground accelerations, response spectrum analysis, Empirical relations for fundamental natural frequency, Structural damping ratios, Comfort criteria: Human response to building motions:- Human perception of building motion, Perception thresholds, Use of comfort criteria in design

TEXTBOOK :

1. Tall Building Structures Analysis and Design by Bryan Stafford Smith & Alex Coull; A Wiley-Interscience Publications, Newyork,1991

REFERENCE BOOKS :

1. Tall Building Structures on Elastic Subgrade and Research of Semi-Analytical. Method [D] by Gong Yaoqing. Beijing: Tsinghua University, 2006
2. ETABS, Three-Dimensional Analysis of Building Systems. Computers and Structures inc., Berkeley, California, 1989.

OPTIMIZATION OF STRUCTURES

SYLLABUS

Basics of engineering analysis and design, need for optimal design, formulation of optimal design problems, basic difficulties associated with solution of optimal problems, Classical optimization methods, necessary and sufficient optimality criteria for unconstrained and constrained problems, Kuhn-Tucker conditions, Global optimality and convex analysis, Linear optimal problems, Simplex method, Introduction to Karmarkar's algorithm. Numerical methods for nonlinear unconstrained and constrained problems, sensitivity analysis, Linear post optimal analysis, sensitivity analysis of discrete and distributed systems. Introduction to variational methods of sensitivity analysis, shape sensitivity, Introduction to integer programming, dynamic programming, stochastic programming and geometric programming, Introduction to genetic algorithm and simulated annealing.

TEXTBOOKS :

1. S.S. Rao, Optimization, Theory and Applications, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1991.
2. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and examples, Prentice Hall India Pvt. Ltd, 1998.

REFERENCE BOOKS :

1. J.S. Arora, Introduction to Optimum Design, McGraw-Hill TextBook : Company, New York, 1989.
2. A.J. Morris (Editor), Foundations of Structural Optimization - A Unified Approach; John Wiley and Sons, Chichester, 1982.
3. R.T. Hafta and Z. Gurdal, Elements of Structural Optimization, 3rd Ed., Kluwer academic publishers, 1996.

ADVANCED DESIGN OF STRUCTURES

SYLLABUS

INTRODUCTION

Analysis and design of portal frames, Design example for hinged and fixed frame.

REINFORCED CONCRETE DEEP BEAMS

Introduction to Deep Beams Parameters influencing design; IS Code provisions; design of simply supported and continuous beam

ELEVATED WATER TANKS

Introduction, Analysis & Design of INTZ Tanks including staging

and continuous deep beams.

EARTHQUAKE RESISTANT DESIGN

Concept of Earthquake resistant design, provisions of seismic Code IS 1893 (Part-I), Response spectrum, Design spectrum, Design of buildings, Reinforcement detailing, Provisions of IS 13920

INTRODUCTION TO PLASTIC ANALYSIS

stress strain relationship of Mild steel, Elastic design versus Ultimate load design, Plastic bending of beams, Shape factor, Load factor, Plastic analysis, Procedure for plastic analysis, Design consideration

TEXTBOOK :

1. Advanced Reinforced Concrete Design, by N.Krishna Raju, CBS publishers, 2009.

REFERENCE BOOKS :

1. Advanced Reinforced Concrete Design by Varghese, Pentice Hall India, 1st edition 2004.
2. Advanced Reinforced Concrete Design (vol-II) by S. S. Bhavikatti, New age international, 2nd edition, 2009.
3. Design of steel structures by L.S Negi Tata Mc Graw Hill publishing company Limited, 2nd edition, 1997
4. Earthquake Resistant Design of structures by Pankaj Agarwal and Manish Shrikande PHI Learning Private Limited. 2006.

FRACTURE MECHANICS

SYLLABUS

INTRODUCTION

Significance of fracture mechanics, Griffith energy balance approach, Irwin's modification to the Griffith theory, Stress intensity approach, Crack tip plasticity, Fracture toughness, sub-critical crack growth, Influence of material behaviour, I, II & III modes, Mixed mode problems.

LINEAR ELASTIC FRACTURE MECHANICS (LEFM):

Elastic stress field approach, Mode I elastic stress field equations, Expressions for stresses and strains in the crack tip region, Finite specimen width, Superposition of stress intensity factors (SIF), SIF solutions for well-known problems such as centre cracked plate, single edge notched plate and embedded elliptical cracks.

Crack Tip Plasticity: Irwin plastic zone size, Dugdale approach, Shape of plastic zone, State of stress in the crack tip region, Influence of stress state on fracture behaviour.

ENERGY BALANCE APPROACH

Griffith energy balance approach, Relations for practical use, Determination of SIF from compliance, Slow stable crack growth and R-curve concept,

DESCRIPTION OF CRACK RESISTANCE. LEFM TESTING

Plane strain and plane stress fracture toughness testing, Determination of R-curves, Effects of yield strength and specimen thickness on fracture toughness, Practical use of fracture toughness and R-curve data.

ELASTIC PLASTIC FRACTURE MECHANICS (EPFM)

Development of EPFM, J-integral, Crack opening displacement (COD) approach, COD design curve, Relation between J and COD, Tearing modulus concept, Standard JIc test and COD test.

FATIGUE CRACK GROWTH

Description of fatigue crack growth using stress intensity factor, Effects of stress ratio and crack tip plasticity – crack closure, Prediction of fatigue crack growth under constant amplitude and variable amplitude loading, Fatigue crack growth from notches – the short crack problem.

PRACTICAL PROBLEMS

Through cracks emanating from holes, Corner cracks at holes, Cracks approaching holes, fracture toughness of weldments, Service failure analysis, applications in pressure vessels, pipelines and stiffened sheet structures.

TEXTBOOK :

1. Ewalds, H.L. & Wanhill, R.J.H., Fracture Mechanics – Edward Arnold Edition

REFERENCE BOOKS :

1. Broek, D. Elementary Engineering Fracture Mechanics, Sijthoff & Noordhoff Int. Pub., 1988.
2. Broek, D. The Practical Use of Fracture Mechanics, Kluwer Academic Pub., 1990.
3. Hellan, D. Introduction to Fracture Mechanics, McGraw Hill TextBook : Company, 1985.
4. Kumar, P. Elements of Fracture Mechanics, Wheeler Publishing, 1998.
5. Simha, K.R.Y. Fracture Mechanics for Modern Engineering Design, University Press,1996.

GREEN BUILDINGS

SYLLABUS

INTRODUCTION

What is Green Building, why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, what are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

GREEN BUILDING CONCEPTS AND PRACTICES

Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

GREEN BUILDING OPPORTUNITIES AND BENEFITS

Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

GREEN BUILDING DESIGN

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

AIR CONDITIONING

Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement.

MATERIAL CONSERVATION

Handling of non-process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture;

INDOOR ENVIRONMENT QUALITY AND OCCUPATIONAL HEALTH

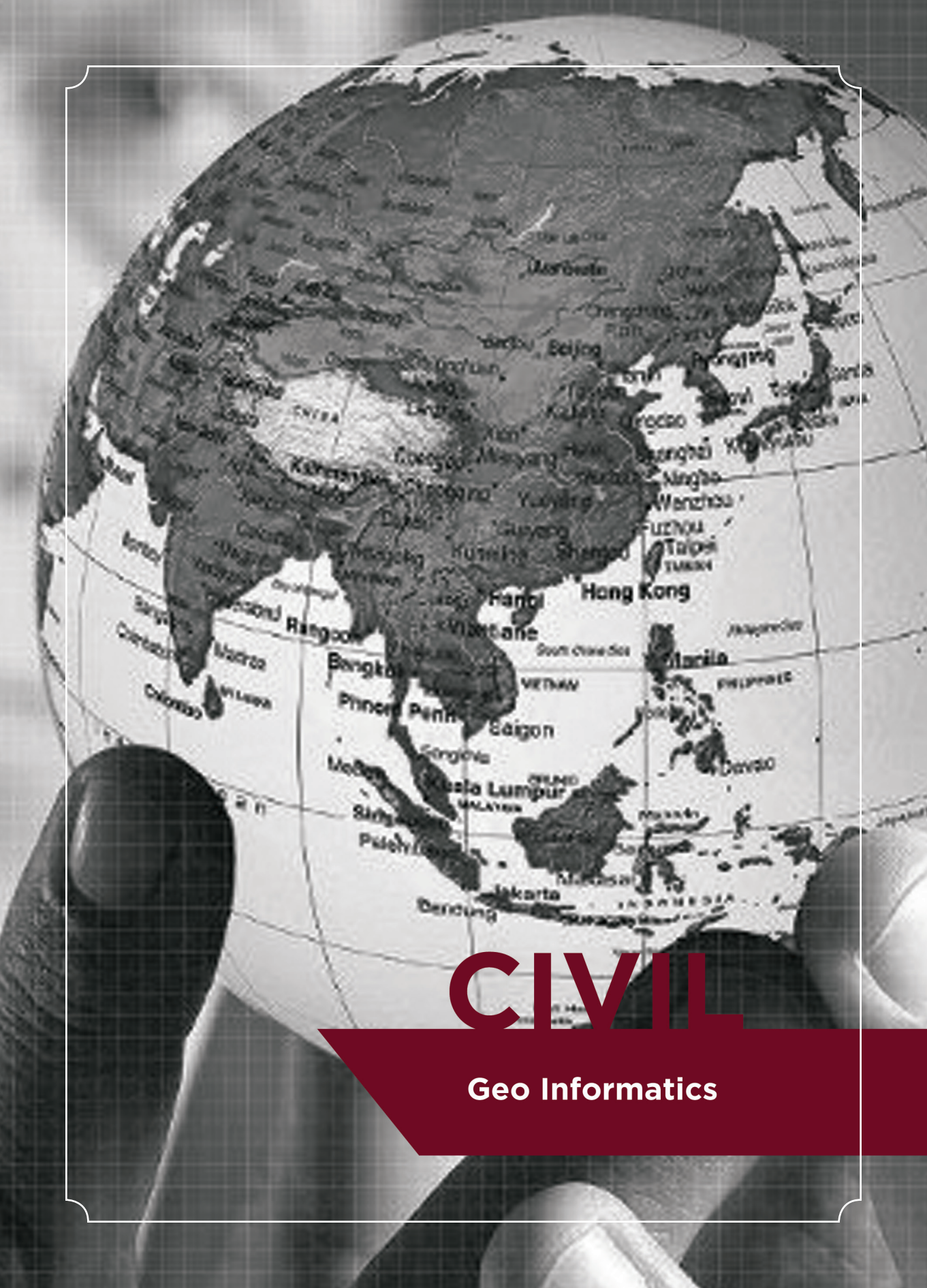
Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

TEXTBOOKS :

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009.
2. Green Building Hand TextBook : by Tomwoolley and Samkimings, 2009.

REFERENCE BOOKS :

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009



CIVIL

Geo Informatics

FIRST YEAR (FIRST SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5109	Fundamentals of Geospatial Technology	3	0	2	4
2	18CE5110	Geographical Information System	3	0	2	4
3	18CE5111	Advanced Computer Programming and Statistics	3	2	0	4
4	18CE5112	Photogrammetry	3	2	0	4
5		Elective-I	3	0	0	3
6		Elective -II	3	0	0	3
7	18IE5149	Seminar	0	0	4	2
		Total Credits				**24**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5213	Digital Image Processing	3	0	2	4
2	18CE5214	GIS Data Analysis & Modelling	3	0	2	4
3	18CE5215	Geodesy and GPS	3	2	0	4
4	18CE5216	Geospatial Applications	3	2	0	4
5		Elective- III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18IE5250	Term Paper	0	0	4	2
		Total Credits				**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18IE6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18CE51E1	Principles of Earth & Environment Sciences	3	0	0	3
2	18CE51E2	Geoinformatics for Water Resource Management	3	0	0	3
3	18CE51E3	Data base Management system(DBMS)	3	0	0	3
4	18CE51E4	Topographical Surveying	3	0	0	3
Elective-2						
1	18CE51F1	Advanced Surveying and cartography	3	0	0	3
2	18CE51F2	Environmental Geoinformatics	3	0	0	3
3	18CE51F3	Structural Analysis using Geomatics	3	0	0	3
4	18CE51F4	Geospatial Technology for Transport Engineering	3	0	0	3
Elective-3						
1	18CE52G1	Statistics and Adjustment Computations	3	0	0	3
2	18CE52G2	Cadastral survey' and information system	3	0	0	3
3	18CE52G3	Engineering Survey Methodology and Instrumentation	3	0	0	3
4	18CE52G4	Geospatial Technology for Natural Resources				
		& Disaster Management	3	0	0	3
Elective-4						
1	18CE52H1	Coordinate systems and Map Projections	3	0	0	3
2	18CE52H2	Principles of Geomatics	3	0	0	3
3	18CE52H3	Geospatial Technology for Rural Development	3	0	0	3
4	18CE52H4	Urban Water Management using Geomatics	3	0	0	3

FUNDAMENTALS OF GEOSPATIAL TECHNOLOGY

SYLLABUS

INTRODUCTION

Definition, History of Remote Sensing. Basic components of Remote sensing, Electromagnetic Remote sensing process, Passive and active remote sensing. Electromagnetic Spectrum, Energy source and its characteristics, Nature of EMR, Blackbody radiation principles, radiation quantities and terminology

PHYSICS OF REMOTE SENSING

EMR Interaction with Earth Surface Materials -Spectral signature concepts – Spectral reflectance & emittance – Typical spectral reflective characteristics of water – vegetation, soil, minerals/rock, man-made structures. Atmospheric properties, solar radiant energy characteristics with atmosphere Atmospheric Scattering, Particulate scattering & absorption, Rayleigh's & Mie's theories. Sunlight & skylight & its spectral composition, Atmospheric Windows.

REMOTE SENSING PLATFORMS AND SENSORS

Introduction; Satellite system parameters; instrumental and viewing parameters, sensor parameters: Spatial, Spectral and Radiometric resolutions, Imaging sensor systems: Multi spectral imaging sensor systems, Thermal sensing systems, microwave image systems. Earth resources satellites: Landsat, SPOT, IRS, AEM and other recent satellites. Meteorological satellitesNOAA, GOES, NIMBUS, Meteosat series, Oceansat, IKONOS satellites.

VISUAL IMAGE INTERPRETATION

Introduction, Types of pictorial data products; Image interpretation strategy, Levels of interpretation keys; Process of image interpretation; Basic elements of image interpretation. Overview on visual image interpretation equipment. Key elements of visual image interpretation, Topography, Drainage Pattern and Texture, Erosion, Image tone, Vegetation and land use; Concept of converging evidence. Temporal aspects of image interpretation.

IMAGE ANALYSIS

Visual image analysis for land use / land cover mapping, geological and soil mapping, Agriculture applications for forestry applications, water resources applications, Urban and regional planning, Environmental assessment. Principles of land form identification and evaluation: Sedimentary, Igneous and Metamorphic rock terrain.

TEXTBOOKS :

1. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987.
2. Remote Sensing by JAMES B. CAMPBELL Published by Taylor & Francis Ltd.
3. M. Anji Reddy, Text TextBook : of Remote sensing and GIS by, BSP Publications, Hyderabad, 2001.

GEOGRAPHICAL INFORMATION SYSTEM

SYLLABUS

INTRODUCTION

Introduction, Definitions of GIS and related terminology, The Evaluation of GIS, Components of GIS, Geospatial data, Spatial data infrastructure, Introduction, Map as a model, Spatial elements and terminology, Classification of maps, Map scale, Spatial referencing system, Computers in map production, Trends in computer construction, General software's in map production.

FUNDAMENTALS OF GIS

A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels of measurement. Introduction; Stages of GIS data modeling; Graphic representation of Spatial Data, Raster data representation, Vector data representation, Spatial data models; Raster GIS models: Types of raster GIS models, Compact raster data models; Vector GIS models, Spaghetti model, Topological model, Shape file, Compact vector data models; Comparison of Raster and Vector Models.

GIS DATA MANAGEMENT

Introduction, Database management systems: Functions of DBMS, Components of DBMS; GIS data file management: Simple list, Ordered sequential files, Indexed files, Building GIS worlds; Database models: Hierarchical database models, Network systems, Relational database models, Standard query language (SQL), Storage of GIS data, The hybrid data model, The integrated data model; Object based data models: Entity-Relationship-Attribute model, Organizational strategy of DBMS in GIS.

DATA INPUT, DATA EDITING AND DATA QUALITY

Introduction, The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing; GPS for GIS data capture Data editing, Detecting and correcting errors, Data reduction and generalization, Edge matching and Rubber sheeting

DATA QUALITY

Components of data quality. Accuracy, Precision and resolution, Consistency, Completeness, Sources of error in GIS; Modeling errors, point data error models, Line and area data error models, Models for dot and pixel counting; Error evaluation by graphical methods.

GIS APPLICATIONS

Remote sensing and GIS Linkage, GIS software, Topography as an environmental factor, locational factor, topographic elements, topographic structures and topographic connections. Case studies

TEXTBOOKS :

1. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
2. Text TextBook : of Remote sensing and GIS by M. Anji Reddy, BSP Publications, Hyderabad.
3. Geographical Information Systems by Demmeers

ADVANCED COMPUTER PROGRAMMING AND STASTICS

SYLLABUS

COMPUTER BASICS

Problem solving using computers- flowcharts-algorithms-CPU-Input and output units-. computer memory- Basic concepts of Object Oriented Languages, Basic structure of C++ programming- tokes-keywords-data types: basic data types-derived data types-user defined data types- constants-variables-arrays-one, two and multi-dimensional arrays-structure-union-enumerated data types.

Arithmetic operators- relational operators-increment and decrement operators-bit wise operators-arithmetic expression-precedence of operators-Evaluation of expression- type compatibility-expression and implicit conversion-manipulators-control structures: decision making and branching-decision making and looping-Function declaration and definition- argument passing-return values. Class and objects-member functions- array of objects-object as a argument-function overloading- friend function-operator overloading-this pointer-static data member-static member function

CONSTRUCTORS

Default constructor-parameterized-copy constructor-dynamic constructor-destructors-Inheritance-single inheritance-multiple inheritance-multilevel inheritance-pointers virtual functions and polymorphism Introduction to statistics :population-sample –primary data and secondary data - graphical and diagrammatic representation of data- Measure of central tendency-Mean, median and mode-measure of dispersion-range-standard deviation -raw and central moments-skewness and kurtosis(definition only)-Concept of probability –classical and relative frequency definition of probability-addition and multiplication laws of probability(without proofs) and examples.

CONCEPT OF RANDOM VARIABLES

Probability mass function-probability density function-probability distribution function (definitions only)- Binomial, Poisson and Normal distribution (definitions and statements of properties and examples). Principles of least square-fitting of

straight line-parsons coefficient of correlation and concept of linear regression.

Concept of testing of hypothesis critical region-two type errors-level of significance of large sample tests for single mean and difference of means. single proposition and difference proportion- chi square test for goodness of fit and chi square test of means and f-test for equality of variances-arithmetic, Geometric and harmonic mean.

TEXT BOOKS:

1. Fundamentals of Computers by V Raja Raman
2. Object Oriented Programming with C++ by E. Balagurusawmy
3. Statistical methods S.P.Gupta. S Chand Publications.

PHOTOGRAMMETRY

SYLLABUS

INTRODUCTION

Definition of photogrammetry, History of photogrammetry, Types of photographs, Organisation of Aerial photography, Geometry of vertical photograph, Scale of vertical aerial photograph, Displacement of image position due to height, Displacement of image position due to tilt. Introduction, Types of aerial cameras, Classification single lens frame camera, Components of frame aerial camera, Fudicial marks, Principle point, Camera mounts, Camera controls, Automatic data recording, Camera calibration, Elements of interior orientation.

STEREO PHOTOGRAMMETRY

Depth perception, Monoscopic depth perception, stereoscopic depth perception, Experiment for stereoscopic viewing, Stereoscopic viewing of overlapping aerial photographs, Stereoscope, pocket stereoscope, Mirror stereoscope, Procedure for use of stereoscopes, Steps for viewing stereo pair of aerial photographs, Y parallax, Vertical exaggeration in stereo viewing. Definition of parallax, stereoscopic parallax, Methods of parallax measurement (monoscopic), Principle of floating mark, Stereoscopic methods of parallax measurement, parallax equations, Elevation by parallax differences, Approximate equation for elevation, Measurement of parallax differences, Parallax corrections, Parallax correction graph, Computation of flight height and air base, Error evaluation.

Flight Planning: Need for flight planning, Items for flight planning, Purpose of photography, Photo scale, Flying height, End lap and side lap, Base-height (B-H) ratio, Neat model, Flight map, Flight planning template.

CONTROL FOR AERIAL PHOTOGRAPHY

Definition, Classification (Horizontal, Vertical), Nature and characteristics of control points, Location and numbering, bridging of strip, Bridging of blocks, Ground control provision, Post-pointing and pre-pointing.

Orientation Procedures for Stereo Plotting Instruments: Introduction, Basic concept, Interior orientation, Relative orientation, Absolute orientation.

AERIAL TRIANGULATION

Introduction, Purpose of aerial triangulation, Principle of Aerial Triangulation, Classification of Aerial triangulation based on methods, Preparation for aerial triangulation, Independent Model Triangulation (IMT), Aerial Triangulation (Analytical method), Blocks of photos, Bundles adjustment.

TEXTBOOKS :

1. Paul, R.Wolf Elements of Phogrammetry,McGrew-Hill,International Book-Company,Japan, 1993.
2. Geoinformatics for Environmental Management by M. Anji Reddy, BS Publications
3. Remote sensing and image interpretation by Lillesand and Kiefer, John wiley and sons.
4. Elements of Photogrammetry by K.K.Rampal.

PRINCIPLES OF EARTH & ENVIRONMENT SCIENCES

SYLLABUS

FUNDAMENTALS OF EARTH SCIENCES

Introduction, Origin of the Earth; Age of the Earth; Internal constitution of the Earth; surface-features of the globe; Concepts of petrology - Igneous, sedimentary and metamorphic rocks.

Groundwater Hydrology: Geologic formations as aquifers, Types of aquifers, Ground water basins, ground water quality aspects, concepts of basin management, Floods –Estimation and control, Reservoir, Surface investigation of ground water.

FUNDAMENTALS OF GEOMORPHOLOGY

Definition of Geomorphology, geomorphological agents, weathering, Soil process, fluvial, eolian, coastal and other land forms, Stream deposition. Hydro Chemistry: Physical, Chemical and Microbial nature of Water. Water Pollution-Surface and Ground water pollution- Point and Non-point sources.

ECOSYSTEMS

Structure and function, Abiotic and Biotic components. Biochemical aspects of toxic chemicals in the environment-Air, Water: Pesticides in water.

Scope of ecology in environmental management: Physical, chemical and environmental factors and their relation to organisms. Climatic factors: Interaction of ecological factors - light – temperature. Precipitation-Humidity-Wind.

EDAPHIC FACTORS (SOIL SCIENCE)

Composition of soil-formation of soil-Factors affecting soil formation-soil profile-Soil classification – Soil Complex – components and properties-soil erosion – soil conservation. Structure and Function of Ecosystem: Energy flow - Food chains - producers-herbivores – carnivores – decomposers – food webs – Ecological pyramids. Major Ecosystems: Pond, Marine, Grassland, Forest, Desert and Cropland ecosystems – Productivity of different ecosystems.

TEXTBOOKS :

1. A textbook of Geology, P.K. Mukerjee, 12th Edition, 1995.
2. TextBooks : of Engineering and general geology by Parbin Singh 7th Edition 2004
3. Ground water hydrology, Danid Keithtodd, 2nd Edition, 1995.
4. Hydrology, HM Raghunath, 1986.
5. Principles of Geomorphology, William D Thonbury, 2nd Edition 2002.
6. Ecology & Environment, P.D.Sharma, Ashish Publications, 1994.
7. Introduction to Ecology, Paul Colinvaux, 1973. Wiley International Edition.
8. Fundamentals of Ecology, E.P. Odum, 1971. W.B. Saunders & Co.

GEOINFORMATICS FOR WATER RESOURCES MANAGEMENT

SYLLABUS

FUNDAMENTALS

Internal Constitution of the Earth. Basic Concepts of Geologic Structures Governing Occurrence and Movement of Ground Water, Ground Water in Igneous, Metamorphic and Sedimentary Rocks, Hydrogeological Methods of Exploration. Watershed Management: Objectives of Planning Watershed Projects, Guidelines for Project Preparation, Watershed Delineation, Codification, Resources Surveys, Hydrological, Soil, Vegetative and Land Use Surveys, Socio-Economic Surveys, Water and Soil Conservation Works, People's Participation and Constraints, Participatory Rural Appraisal in Watershed Programme, Community Mobilization & Participatory Management, Peoples Institutions, Capacity Building.

RAIN WATER-HARVESTING METHODS:

Methods of Rainwater Harvesting from Roof Tops, Purification Techniques for Direct use, Harvesting of Surface Runoff, Climatic Changes, Its Effects on Water Resource

WETLANDS

Introduction, Definition, Classification, Delineation, Identification Methods, Importance of Wetlands, Human Impacts, Wetland Protection, Mitigation. Wetland Management: Designed Ecosystem, Water and Treated Wastewater Recycling and Reuse, Soil Filters, Constructed Wetlands.es & Water Supplies.

Introduction, concept of watershed, need for watershed management, concept of sustainable development, Hydrology of small watersheds, Principles of soil erosion, causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds Control of soil erosion, methods of soil conservation – structural and non-structural measures.

Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures, Artificial recharge of groundwater in small watersheds, methods of artificial recharge, Reclamation of saline soils, Micro farming, biomass management on the farm.

TEXTBOOK :

1. Hydrogeology by Davis and Dewiest
2. Soil and Water Conservation Engineering by Schwarb, Fengmin, John Wiley, 2002.
3. Applied Hydrology by Ven Te Chow, Maidenment & Mays, Mc Graw Hill, 1987.
4. Water Resources Engineering by L.W.Mays, Wiley, 2004.

REFERENCE BOOKS :

1. Watershed Management for Indian conditions by E.M. Tademan, Omega Scientific Publishers, 2002.
2. Watershed Hydrology by Peter.S.Black, Prentice Hall, 1991.
3. Manual on Water Supply and Treatment, 3rd Edition- Revised & Updated, May, 1999Published by CPHEEO, Ministry of Urban Development, GOI, New Delhi.
4. Analysis of flow in water distribution Networks by P.R. Bhave, Technomic Publishing, Co., USA, 1991.
5. Geiger, W.F., Marsalek, J. Zudima and Rawls, G. J. (1987 “Manual on Drainage in Urban Areas”, 2 Volumes, UNESCO, Paris.
6. Storm water Management by Wanelista and Edelin, Wiley publications, 1993.

DATA BASE MANAGEMENT SYSTEMS

SYLLABUS

INTRODUCTION

Databases and Application development, Components, Advantages of the DBMS, System approach, Leading commercial databases, Brief history of DBMS, Application development

DATABASE DESIGN

Designing Databases, Class diagrams, Data types (Domains), Events, Large projects, Application design. DATA NORMALIZATION: Tables, Classes and Keys, Sample database, Normal Forms, Data Rules and Integrity, converting a class diagram to normalized Tables, View Integration, Data Dictionary

DATA QUERIES

Three Tasks of a Query Language, Query basics, Computations, Subtotals and GROUP BY, Multiple tables. ADVANCED QUERIES AND SUBQUERIES: NOT IN, OUTER JOINTS, SQL SELECT, SQL Data Definition Commands, SQL Data Manipulation Commands, Quality: Testing Queries

FORMS, REPORTS AND APPLICATIONS

Effective Design of Reports and Forms, Form Layout, Creating Forms, Direct manipulation of Graphical objects, Reports, Application Features.

Data Base Integrity and Transactions: Procedural languages, Data triggers, Transactions, Multiple users and concurrent Access ACID Transactions, Key generation, Database cursors.

DATA BASE ADMINISTRATION

Introduction, Data administrator, Data Base administrator, Data Base Structure, Meta data, Backup and recovery, Security

TEXTBOOKS :

1. Data Base Management Systems by Gerald V.Post, Tata Mcgraw-hill edition
2. Data Base Management Systems by Ramakrishnan and Gehrke Tata Mcgraw-hill.
3. DataBase Systems Concepts by Silberschatz , Tata Mcgraw-hill edition.

TOPOGRAPHICAL SURVEYING

SYLLABUS

FUNDAMENTALS OF SURVEYING

Historical development of surveying, principles of surveying, types of surveying, classification of surveys & maps, Plan Vs Map, Accuracy Vs Precision, sources and kinds of error; Principle, use and adjustment of surveying instruments – Chain, Compass, Plane table, Level & Tachometer; Chains- types, errors in chaining, chain triangulation, basic problems in chain surveying; Compass- types, designation of bearings, Plane table- instruments used for plane table survey, working with plane table, methods of plane tabling; Leveling – definition, leveling instruments, methods of leveling; Tacheometric surveying – principle, methods to determine horizontal distance, uses of tachymetric surveying; azimuth, bearing, relationship between bearings & azimuths.

ADVANCED SURVEYING

Electronic Distance Measurement (EDM) – principle, instrument characteristics, accessories, operation, EDM without reflecting prisms; Total Station – types, instrument description, field techniques, motorized total stations; field procedures for total stations in topographic surveys.

TOPOGRAPHICAL SURVEYING

Definition, uses of topographical maps, relief, methods of representing relief, contour and contour interval, characteristics of a contour, procedure in topographic surveying, Methods of locating contours, Interpolation of contours, DAM Surveys

PROJECT PLANNING

Definition & Terms, Systems of Co-ordinates, constitution of a survey party, duties of an Officer-in-charge, Duties of camp Officers; planning, execution and completion of a topographical survey, Quality Vs Quantity; Case studies.

TEXTBOOKS :

1. TextBook : of Plane Surveying By David Clark Part I and Part II
2. TextBook : of Surveying By Punmia Part I and Part II

REFERENCE BOOKS :

1. Surveying and Leveling – Agor
2. Principles of Cartography – K.S.Singh
3. Estimation & Costing – N.D.Chakraborti

ADVANCED SURVEYING AND CARTOGRAPHY

SYLLABUS

TOPOGRAPHICAL SURVEYING

Introduction to topographical mapping, scale of topographical maps, Indian topographical series and their numbering system, topographical survey methods. Precise level and Precise levelling

ELECTRONIC SURVEYING:

Basic principles, classifications, applications, comparison with conventional surveying. electromagnetic wave theory - electromagnetic distance measuring system - principle of working and EDM instruments, application of Lasers in distance measurement.

GEODESY AND ASTRONOMY

Introduction to Geodesy, Earth and its size and shape, coordinate systems, earth and its motions-annual, spin, precession, nutation, polar motion. Earth and its gravity field – anamoly, gravity potential, geoid and deflection to vertical. Celestial sphere, meridians and vertical circles, astronomical coordinate systems, astronomical triangle, determination of azimuth

CARTOGRAPHY

Definition, scope and content the spheroid, map scale, co-ordinate system, methods of mapping, relief maps, thematic maps, map projections, classification, principles of construction of common projections, cylindrical, conical, azimutal, and globular projections, properties and uses and choice of projections, plane co-ordinates, UTM system, projection used in Survey of India topographical sheets, map reproduction.

GLOBAL POSITIONING SYSTEM

Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS: Surveying and mapping, remote sensing, GIS.

TEXTBOOKS :

1. Gopi, “Advanced surveying: Total station, GIS and Remote Sensing”, Pearson Education ,
2. India, 2007.
3. Hoffman.B, H.Lichtenegga and J.Collins, “Global Positioning System - Theory and Practice”, Springer - Verlag Publishers, 2001.
4. Borden D. Dent, Jeffrey Troguson, Thomas W. Hodler, “Cartography: Thematic map Design”, McGraw-Hill Higher Education, 2008.
5. Wolfgang Torge, “Geodesy”, Berlin: de Gruyter, 2001.

ENVIRONMENTAL GEOINFORMATICS

SYLLABUS

FOREST RESOURCES MANAGEMENT

Geomatics in forestry, forest cover mapping and change detection, forest inventory and stock mapping, dynamics of forest ecosystem and forest canopy, forest damage assessment, parameters of forest inventory, development of working plan, forest management information system (FMIS), forest fire forecasting and risk area mapping, biodiversity characterization, wildlife habitat mapping.

WATERSHED MANAGEMENT

Introduction and concepts of watershed, role of remote sensing and GIS database for watershed management, objectives of watershed management, Watershed characteristics, research approach, thematic mapping for a model watershed, watershed management for sustainable development.

WATER QUALITY MAPPING AND MODELING

Geoinformatics for water resources development and management, ground water exploration and targeting using RS and GIS, water quality management case studies – groundwater and surface water quality mapping and salt water intrusion modeling.

SOLID WASTE MANAGEMENT

Introduction, types and classification of solid waste, impacts of solid waste, physical and chemical characteristics of solid waste, factors affecting solid waste generation rates, collection and transportation systems, solid waste sampling techniques, types, merits and demerits of solid waste disposal methods, hierarchy of solid waste management, disposal site identification.

NATURAL DISASTER MANAGEMENT

Introduction, types of landslides, common features of landslides, causes of landslides and related phenomena, landslide analysis, remote sensing for landslide mapping, hazard mapping of landslides.

URBAN PLANNING AND MANAGEMENT

Introduction, geoinformatics in urban planning, issues in urban planning, urban growth management, urban sprawl assessment, urban land use and infrastructure, urban transport network identification and mapping, urban city guide map change detection and updation, pipeline alignment studies, Land evaluation and suitability studies, Land use/Land cover mapping and planning.

TEXTBOOKS :

1. Geoinformatics for Environmental Management by Anji Reddy, M.
2. Introduction to Environmental Remote Sensing by Barrett, E.C.
3. Remote Sensing and Tropical Land Management by Eden, M.J., Parry I.T.
4. Remote Sensing and Image Interpretation by Lillesand and Kiefer.
5. Remote Sensing in Hydrology by Engman
6. Advances in Environmental Remote Sensing by F. Mark Danson.
7. Remote Sensing in Geology by Siegal.
8. Remote Sensing in Soil Science by Mulders M.A.
9. Principles odd GIS for Land Resources Assessment by Burrough P.A.

STRUCTURAL ANALYSIS USING GEOMATICS

SYLLABUS

REMOTE SENSING

Electromagnetic spectrum, electromagnetic radiation-atmospheric interaction, interaction with matter, resolutions, platforms, IRS, LANDSAT, etc. Geographical information system: Components and structure, databases and structures, data types, data models, spatial data analysis techniques.

STRUCTURAL ANALYSIS

Attitude of beds, Structural mapping- lineaments, folds, faults, joints and unconformities, Structural analysis using aerial and satellite data.

Lithology: Igneous, sedimentary and metamorphic rocks, Lithological mapping using aerial photos and satellite imagery. Elements of interpretation - Digital analysis for litho logical discrimination.

GEOMORPHOLOGY

Geomorphological mapping using aerial photos and satellite imagery, Landforms like denudational, structural - fluvial, marine, aeolian, glacial and volcanic landforms. Flood and drought studies – flood frequency analysis, flood plane zoning, estimation of flood for different frequencies, flood forecasting, drought assessment and monitoring.

EXPLORATION TECHNIQUES

Mineral Resources, Groundwater, Engineering Geology, Hydro geomorphological mapping, Landslide studies.

TEXTBOOKS :

1. Ravi P. Gupta - Remote Sensing Geology - Springer Verlag Publications, 2005.
2. Floyd F. Sabins: Remote sensing: Principles and Interpretation, W.H. Freeman and Company, 2007.
3. Verstappean H.T, Remote Sensing in Geomorphology,Elsevier Scientific Publications,1977.
4. Druary, S.A - Image Interpretation in Geology - Allen and Unwin Ltd,2004.
5. Lintz J and Simonett David.S, - Remote Sensing of Environment - Addission Wesley Reading,1976.

GEOSPATIAL TECHNOLOGY FOR TRANSPORT ENGINEERING

SYLLABUS

GIS – T DATA MODELS

Data Domains and Data Modelling in GIS – T; Data Modelling Techniques; Data Modeling and Design Issues; Graph Theory and Network Analysis; Network representation of a Transportation System; Linear referencing methods and systems; Transportation Data Models for ITS and related Applications.

TRANSPORTATION DATA SOURCES AND INTEGRATION

Basic Mapping Concepts; Transportation Data Capture and Data Products; Transportation Data Integration; Spatial Data Quality; Spatial and Network aggregation.

SHORTEST PATHS AND ROUTING

Fundamental Network Properties; Fundamental Properties of Algorithms; Shortest Path Algorithms; Routing Vehicles with in Networks.

NETWORK FLOWS AND FACILITY LOCATION

Flow through Uncongested Networks; Flow through Congested Network; Facility location within Networks; Spatial Aggregation in Network Routing and location problems.

GIS BASED SPATIAL ANALYSIS AND MODELING

GIS and spatial Analysis; Urban sprawl; GIS Analytical functions; Coupling Transportation Analysis and Modelling with GIS; Customizing GIS; Supporting Advanced Transportation Analysis in GIS.

TRANSPORTATION PLANNING

Transportation Analysis Zone Design; Travel demand Analysis; Landuse – Transportation Modelling; Route Planning; Decision support.

INTELLIGENT TRANSPORTATION SYSTEMS

ITS Applications; ITS Architectures and Geographic Information; Integrating GIS and ITS. Transportation, Environment and Hazards: Mapping sensitive Environmental features; GIS and Transportation related Air Quality; Accidents and Safety Analysis; Transportation of hazardous Materials.

TEXTBOOKS :

1. Miller HJ and Shaw SL, Geographic Information Systems for Transportation: Principles and Applications, Oxford University Press,2001.
2. Implementation of GIS in State DOTs, NCHRP Report No:180.
3. Simlowitz HJ. GIS Support Transportation System Planning. International GIS Sources TextBook :.
4. Scholton HJ and Stillwell JCH, Geographical Information Systems for Urban and Regional Planning, Kluwer Acedemic Publishers,2010.
5. Hill JC, GIS in Transportation, Transportation Research Part C & 2000.

DIGITAL IMAGE PROCESSING

SYLLABUS

DIGITAL COMPUTERS AND IMAGE PROCESSING: INTRODUCTION:

Information Systems – Encoding and decoding, modulation Satellite data – acquisition, storage and retrieval – generation of data products digital data formats. Computer basics: Hardware and Software, Networks, Image Display Subsystem, Color Display System, Hard copy System , Data Format for Digital Satellite Imagery, Image file Format and Data Compression

PRE PROCESSING OF REMOTE SENSING DATA

Introduction, Cosmetic Operations- Missing Scan Lines, De –stripping Methods, Geometric Corrections and Registration. Coordinate Transformations, Atmospheric Correction Methods, Illuminations and View Angle Effects, Sensor Calibration and Terrain Effects and radiometric correction methods

IMAGE ENHANCEMENT TECHNIQUES

Introduction, Human Visual Systems, Contrast Enhancement- Linear Contrast Stretch, Histogram Equalization, Guassian Stretch, Pseudo Color Enhancement- Density Slicing, Pseudo Color Transform.

IMAGE TRANSFORMS

Introduction, Arithmetic Operations- Image Addition, Subtraction, Multiplication and Division. Empirically Based Image Transforms- Perpendicular Vegetation Index, Tasselled Cap Transformations, NDVI. Principal Component Analysis

IMAGE FILTERING TECHNIQUES:

Introduction, Low Pass Filters- Moving Average Filters, Median Filters, Adaptive Filters, High Pass Filters- Image Subtraction Method, Derivative Based Method, Frequency Domain Filters, Filtering for Edge Enhancement

IMAGE CLASSIFICATION

Introduction, Geometrical Basis of Classification, Unsupervised classification, Supervised Classification Training Samples, Statistical Parameters and Classifiers Image Classification Accuracy Assessment: Image classification accuracy assessment, Performance analysis, Various Band Data for Land use, Land Cover Classification System with Case Studies. Image Classification and GIS, Integration and Linkage. Software: ERDAS, Geomatica, ENVI and e-Cognition

IMAGE PROCESSING LAB

Geo-coding of Images/Toposheets, Geo-referencing of Images, Subset & Mosaic of images/Toposheets, Data fusion (Data merging),Image Enhancement, Point operators, Spatial domain operators, Edge detection, Supervised classification of data, Unsupervised classification of data GIS – Creating of layered thematic information and GIS Analysis, TIN – 3D viewing Basic understanding of the TNT MIPS, ERDAS, GEOMEDIA, ENVI Software packages.

TEXTBOOKS :

1. John, R. Jensen, Introductory Digital Image Processing – Prentice Hall, New Jersey, 1986.

2. Robert, A. Schowengergt. Techniques for image processing and classification in Remote Sensing, 1983.
3. Hord, R.M. Digital Image Processing, Academic Press Pub. 1982.
4. Paul. M. Mather- Computer Proctessing of RS Images, Wiley

GIS DATA ANALYSIS & MODELLING

SYLLABUS

FUNDAMENTALS OF GIS

Map – scale, projection and symbolism. GIS - Introduction, definition and terminology, categories, components, fundamental operations, functional elements. Data structures, data models, GIS data, acquisition, input, storage, output generation. Data preprocessing, database management, integrated analysis of spatial and attribute data.

GIS SPATIAL ANALYSIS

Introduction, defining spatial objects - point, line and area objects based on their attributes, higher level point, line and area objects. Measurement: Measuring length of linear objects, measuring polygons, measuring shape, measuring distance. Classification – Principles, Neighborhood functions, Polygonal neighborhoods, Buffers.

STATISTICAL SURFACES

Surface mapping, sampling the statistical surface, Digital Elevation Model (DEM). Interpolation- linear and non-linear, uses and problems. Terrain reclassification – steepness of slope, aspect, shape or form. Discrete surfaces - dot distribution maps, choropleth maps.

SPATIAL ARRANGEMENT

Spatial Arrangement -Point patterns, Theissen Polygons, Area patterns, Linear patterns, Directionality of Linear and Areal objects, Connectivity of Linear objects, Routing and allocation.

OVERLAY ANALYSIS

Cartographic overlay, point-in-polygon and line-in-polygon operations, Polygon overlay, automating point-in-polygon and line-in-polygon procedures in Raster, Automating Polygon overlay in Raster, Automating vector overlay, types of overlay.

DATA MODELLING

The state of GIS for Environmental Problem Solving, A Perspective on the State of Environmental Simulation Modeling, GIS and Environmental Modeling,

The Role of Software Venders in Integrating GIS and Environmental Modeling, Cartographic Modeling, Scope of GIS and relationship to environmental modeling, data models and data quality.

INTEGRATED MODELLING USING GIS

Hydrological Modeling - water quality modeling, watershed management and modeling, saltwater intrusion models. Land-surface-subsurface Process Modeling - pipeline alignment studies, solid and hazardous waste disposal site selection, zoning atlas for industrial siting, environmental information system development. Ecosystem modeling, risk and hazard modelling.

GIS DATA ANALYSIS AND MODELLING LAB

Spatial data analysis using ArcView, Map Composition and Output Generation using Arc View GIS software, Alignment survey by handheld GPS, Processing of GPS survey data with GIS software, Plot by Total Station Survey in field, Data conversion from AutoCAD into ArcGIS, Open source GIS. Integration of Spatial and Non-Spatial Data, Datum and Projection, Layout Preparation in Arc View

TEXTBOOKS :

1. Fundamentals of GIS by MICHAEL N DEMERS. Published By john Wiley & Sons Inc.
2. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert

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GEODESY AND GPS

SYLLABUS

INTRODUCTION

Definition of Geodesy, Classification of Geodesy, Geometric Geodesy, - Physical Geodesy, Physical surface of earth, The Geoid, The Ellipsoid. ELLIPSOID OF REVOLUTION: Mathematical properties, The Ellipse, Basic properties of ellipse, Flattening, Eccentricity, Relationship between eccentricity and flattening, Principal parameters of ellipsoid, Parameters of commonly used ellipsoid, Use of ellipsoid as regional datum. Coordinate system of rotational ellipsoid-Ellipsoid geographic co-ordinates, Spatial ellipsoidal coordinate system.

COMPUTATION OR THE ELLIPSOID

Need for mathematical surface, Reduction of baseline to mathematical surface, Reduction of baseline to reference ellipsoid, Effect or height of a point observed on the azimuth of a line, Convergence of meridians, Forward and backward Azimuths, Plane curves and geodesic line, Calculation of coordinates.

GRAVITY

Expressions for gravity and potential, Geoid undulations and deflections of vertical, Measurement of gravity on earth, Reduction of gravity values.

Satellite Geodesy: Introduction, Artificial satellite, Satellite orbit, Celestial coordinate system, Geodetic position from known orbit, Coordinate transformation in equatorial plane, Range observation from three satellite positions.

MAP PROJECTION

Geometry of map projections, Evolution of map projection, Development of projection surfaces, Characteristics of map projections, Equidistant projections with one standard parallel, Equidistant projections with two standard parallel, Equal area projections with straight meridians, Projections with all parallels standard, Conformal projections with straight meridians.

GLOBAL POSITIONING SYSTEM (GPS)

Introduction, Background, the space segment, The control segment, The user segment, The performance of GPS, Factors influencing GPS accuracy, GPS positioning. GPS signal characteristics, signal structure, signal coverage, signal propagation, Differencing of GPS data, single differenced data.

GPS MATHEMATICAL MODEL AND GPS APPLICATION

GPS mathematical model, Pseudo range mathematical model, Preparation for data processing, Baseline data computation coordinate change and satellite positions GPS receivers, Fundamentals of GPS application for various results. Making sense of GPS Techniques, GPS project planning, Possible applications like high resolution contour data.

TEXTBOOKS :

1. Manual of Geospatial Science & Technology edited by John D. Bossler (Taylor & Francis)
2. Essentials of GPS by NK Agarwal, Spatial Network Pvt Ltd, Hyderabad.

GEOSPATIAL APPLICATIONS

SYLLABUS

INTERPRETATION

Fundamentals of interpretation, Land use/Land cover mapping, Geological and soil mapping, agriculture, water resources, Rangeland and Wildlife Ecology applications, Interpretation for terrain evaluation – Soil characteristics, Land use suitability. Plant Sciences: Introduction, Manual interpretation, Structure of

the Leaf, Spectral Behavior of the Living Leaf, vegetation Indices, Applications of Vegetation Indices, Phenology, Advanced very High-Resolution Radiometer (AVHRR), Separating Soil Reflectance from Vegetation Reflectance, Tasseled Cap Transformation.

EARTH SCIENCES

Introduction, Photogeology, Lineaments, Geobotany, Direct Multispectral Observation of Rocks and Minerals, Mineral targeting, Photoclinometry, Band Ratios, Soil and Landscape Mapping, Integrated Terrain Units.

HYDROSPHERIC SCIENCES

Introduction, Spectral Characteristics of Water Bodies, spectral Changes as Water Depth increases, Location and Extent of Water Bodies, Roughness of the water Surface, Bathymetry, Chromaticity diagram, Drainage basin Hydrology, Evapotranspiration, manual interpretation irrigation and command area development, ground water mapping, watershed delineation.

LAND USE AND LAND COVER

Introduction, Significance of Land Use and Land Cover Information, Applications of Remote Sensing, Land Use classification, mapping land use change, broad – scale land cover studies.

GLOBAL REMOTE SENSING

Introduction, Biogeochemical Cycles, Advanced Very High-Resolution Radiometer (AVHRR), Earth Observing System, EOS Instruments, EOS Bus, EOS Data and Information system, Long –Term Environment Research Sites, Global Land Information System, Global Data Base.

TEXT BOOKS :

1. Introduction to Remote Sensing by JAMES B. CAMPBELL. Published by Taylor & Francis Ltd.
2. Remote Sensing and Image Interpretation by THOMASLILLESAND AND RALPH W KEIFER published by John Wiley & Sons

STATISTICS AND ADJUSTMENT COMPUTATIONS

SYLLABUS

INTRODUCTION

Introduction, Direct and Indirect Measurement, Measurement Error Sources, Definitions, Precision versus Accuracy, Redundant Measurements in Surveying

and Their Adjustment, Advantages of Least squares Adjustments.

Measurements and Their Analysis: Introduction, Sample Versus Population, Range and Median, Graphical Representation of Data.

NUMERICAL METHODS OF DESCRIBING DATA

Measures of Central Tendency, Additional Definitions, Alternative Formula for Determining Variance, Numerical Examples, Derivation of the Sample Variance (Bissell's Correction), STATS AND SYS-STAT Program

RANDOM ERROR THEORY

Introduction, Theory of Probability, Properties of the Normal Distribution Function, Probability of the Standard Error, Uses of Percent Errors

Confidence Intervals And Statistical Testing: Introduction, Distributions used in Sampling Theory, Confidence Interval for the Mean: t Statistic, Testing the Validity of the Confidence Interval, Selecting a Sample Size, Confidence Interval for a Population Variance , Confidence Interval for the Ratio of Two Population Variances. Hypothesis Testing: Test of Hypothesis for the Population Mean, Test of Hypothesis for the Population Variance: 2 , Test of Hypothesis for the Ratio of Two Population Variances.

ERROR PROPAGATION IN TRAVERSE SURVEYS

Introduction, Derivation of Estimated Error in Latitude and Departure, Derivation of Estimated Standard Errors in Course Azimuth, Computing and Analyzing Polygon Traverse Misclosure Errors, Computing and Analyzing Link Traverse Misclosure Errors

ERROR PROPAGATION IN ELEVATION DETERMINATION

Introduction, Systematic Errors in Differential Leveling, Random Errors In Differential Leveling, Error Propagation in Trigonometric Leveling

TEXT BOOK :

1. Adjustment Computations (Statistics and Least Squares in Surveying and GIS) - Paul R.Wolf & Charles D. Ghilani.

ADASTRAL SYRVEY AND INFORMATION SYSTEM

SYLLABUS

Definitions, Technical and legal requirements, status of cadastral surveys in India, Land registration system, Records of rights, Resettlement operations, Relocation of parcels, Village and Distract boundaries.

Cadastral survey specifications, Application of Photogrammetry to Cadastral

surveys, Drawing and reproduction of cadastral maps, Consolidation of Land holdings.

Projections and coordinate systems for cadastral surveys, Grids, Rectangular and Curvillinear grid, Indian grid, Cassini, Lambert conformal Conic, Policonic, Transverse Mercator and UTM projections, Conversion of coordinates from one projection to another, Linear affined and conformal transformation of coordinates.

Land registration systems in India, Computerization of Land records, Cadastral survey practices in developing and developed countries.

Concepts of LIS, Applications of Digital mapping and Digitial photogrammetry to LIS and Cadastral survey mapping.

TEXTBOOKS :

1. Plane Surveying by David Clark, Part- I and Part-II
2. Surveying by Punmia Part- I and Part-II

ENGINEERING SURVEY METHODOLOGY AND INSTRUMENTATION

SYLLABUS

Fundamentals of engineering drawing, Interpretation of isometric and section drawings. Plotting of cross sections.

Accuracy and Precision of instruments. Specifications and procedures for medium and large-scale surveys for engineering, irrigation, hydel, command area development, urban development, pipe line, power and transmission lines, town planning etc. Standards of Accuracy.

Techniques of depth sounding and ranging. Bathymetric contours. Tides and tide gauges.

Setting out of circular, transition, and vertical curves. Transferring alignment of railways, roads, pipe lines, conveyor belts, canals etc. from plan to ground.

Computation of areas and volumes. Planimeter and pantograph. Volume determination from Digital Elevation Models. Setting out of tunnels and shafts. Survey in underground and open-cast mines. Transfer of points and azimuth through vertical shafts (Correlation). Gyro-theodolite and photo- theodolite; uses in mines.

Electronic theodolites and levels, Precise leveling, Deformation measurements, Precise targeting. Subsidence surveys, crustal movements. Electronic Total Stations, GPS Receivers and their applications to Engineering Surveys.

TEXT BOOKS :

1. TextBook : of Plane Surveying David Clark Part I & II
2. TextBook : of Surveying Punmia Part I and Part II

GEOSPATIAL TECHNOLOGY FOR NATURAL RESOURCES & DISASTER MANAGEMENT

SYLLABUS

LAND RESOURCES

Land evaluation and suitability studies by Remote sensing and GIS. Techniques of land use / land cover map preparation. Land use / land cover mapping and planning. Municipal GIS: Geomatics in Solid and Hazardous waste disposal site selection, Environmental Information System Development for municipalities: Case studies

GEOSCIENCES

Role of Remote sensing and GIS in geological studies and case studies. Water Resources: Ground water exploration and targeting. Watershed characteristics, watershed management and Integrated approach for sustainable planning. Water quality modeling.

AGRICULTURE

Soil and altitude, Soil and aspect, Soil and slopes, Soil landscapes, Soil erosion modeling. Crop type classification, area estimates, and spectral response of different crops. Crop diseases and Assessment, Crop and Water management and monitoring. Advances in Crop monitoring.

FORESTRY

Survey and mapping of forest cover, Forest change detection, Forest damage assessment and Forests monitoring, Land evaluation for forestry.

ECOSYSTEM MODELING

Spectral response of vegetation and mapping, Ecosystem Analysis, Environmental impact analysis and monitoring, Ecosystem modeling, Wetland mapping. Spatial Models of Ecological Systems and Process.

DISASTER MANAGEMENT

Introduction and Overview- Natural and man made hazards – land slides- volcanoes- floods and famines- earth quakes- forest fires Human Induced disasters- industrial disasters- dams- constructional and others.

TEXTBOOKS :

1. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert
2. Manual of Geospatial Science and Technology Edited By John. D. Bossler, Taylor And Francis, London
3. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, New York, 1987.
4. Geographical Information Systems by David Martin
5. Remote Sensing in Geology by Siegal
6. Remote Sensing in Forest Resources by John. A. Howard, Chapman and Hall.

COORDINATE SYSTEMS AND MAP PROJECTIONS

SYLLABUS

COORDINATE SYSTEMS

Terrestrial coordinate system- Geocentric systems and Topo-centric systems, Introduction to celestial coordinate systems, Terrestrial geocentric systems, Conventional International Origin, Polar motion, Reference coordinate systems, Geodetic coordinate systems- Indian Geodetic System and WGS 84, Rectangular and curvilinear coordinate systems in two and three dimensions.

MAP PROJECTIONS

Basic problem and purpose of map projections, Classification of Map Projections, Curves/ Lines of special properties- Geodesic, Great circle, Rhumb line or Loxodrome, Distortions, Guassian fundamental quantities, Conformal mapping, Review of complex variables and differential geometry, Condition of conformality, Isometric latitude, Cauchy-Reimann equations, Scale factor, Meridian convergence, Geometry of projected curves.

Polyconic projection, Mercator's projection, Transverse Mercator and Universal Transverse Mercator projections, Lambert Conformal Conic projection, Polar Stereographic projection, Universal Polar Stereographic projection, Cassini Projection.

Transformation of coordinates from geodetic to various projections- Direct and Inverse problems, Transformation of coordinates from one projection to another, Grids- Lambert grid for India,

Design of grids and layouts for various zones/states, Comparative merits of various projections, Choice of projections, Linear and non-linear conformal and affine transformations.

TEXTBOOKS :

1. Plane Surveying by David Clark, Part-I and Part- II.
2. Surveying by Purmia, Part-I and Part- II.

REFERENCE BOOKS :

1. Map Projections used by the U. S. Geological Survey, by John P. Snyder, U. S. Government Printing office Washington, 1982.
2. Coordinate systems in Geodesy, by E. J. Krakiwsky and D. E. Wells, The Department of Surveying Engineering, The University of New Brunswick, Frederiction N. B. 1971.
3. Conformal Map Projections in Geodesy, by E. J. Krakiwsky, Department of Survey Engineering, University of New Brunswick, Frederiction N. B. 1973.
4. Map projections for Geodesists, Cartographers, and Geographers, by Peter
5. Richardus, and Ron K. Adler, North-Holland Publishing Company- Amsterdam, Oxford.

PRINCIPLES OF GEOMATICS

SYLLABUS

INTRODUCTION

Geomatics basics, data types, data acquisition sources and techniques

GEODESY AND CARTOGRAPHY

Modern surveying instruments, projection systems, heights and geoids-local and global, datums, map classification-Topographic, thematic, map reading

Global positioning systems: GPS signal, segments, GPS errors, technical characteristics, measurement techniques, other positioning systems

REMOTE SENSING

Electromagnetic spectrum, electromagnetic radiation-atmospheric interaction, interaction with matter, resolutions, platforms, IRS, LANDSAT, etc.

GEOGRAPHICAL INFORMATION SYSTEM

Components and structure, databases and structures, data types, data models, spatial data analysis techniques, applications

TEXTBOOKS :

1. Gopi, “Advanced surveying: Total station, GIS and Remote Sensing”, Pearson Education India, 2007
2. Hoffman. B, H.Lichtenegga and J.Collins, “Global Positioning System - Theory and Practice”, Springer - Verlag Publishers, 2001

3. Lillesand T.M and Kiefer R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, 2008.
4. Kang Tsung Chang., Introduction to Geographic Information Systems, Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2008.

GEOSPATIAL TECHNOLOGY FOR RURAL DEVELOPMENT

SYLLABUS

Concepts of Rural Area and Rural Development; Causes of Rural Backwardness, Need for Rural Development, Levels of Living of Rural People Poverty indicators.

Organizational Aspects of Agriculture, Alternative Occupations in Rural Areas, Assessment of Rural Energy Supply and Demand, Planning for Rural Development,

Definition and Characteristics of Village Communities – Concept and Importance of Rural Industrialization. Engineering aspects of rural infrastructure development - Education - Housing – Health - Drinking Water Supply Road Network, PURA model, Study of poverty alleviation programmes implementation.

Governance of Rural Information and Communication Technology: Opportunities and Challenges; GIS and Governance in Development in India: Trends and Strategy for Implementation; ICT Infrastructure for Rural Development: Issues and Priority for Application.

Geospatial techniques for mapping of rural resources. Spatial technologies in rural planning management administration and development.

TEXTBOOKS :

1. Jain S.C. Indigenous Resources for Rural Development, Concept Publishers, 2005.
2. N.I.R.D. Facets of Rural Development,
3. Technologies for Rural Development; http://en.wikibooks.org/wiki/ Technologies for_Rural_Development, 2010.
4. Harekrishna Misra (ed.), Governance of Rural Information and Communication Technologies, Opportunities and Challenges, Academic Foundation, 2009.

URBAN WATER MANAGEMENTUSING GEOMATICS

SYLLABUS

General introduction to urbanisation and its effect on water cycle – urban hydrological cycle – trends in urbanisation – Effect of urbanisation on hydrology.

Urban Hydrological cycle – time of concentration – importance of short duration of rainfall and runoff data – methods of estimation of time of concentration for design of urban drainage systems.

Master drainage plans – issues to be concentrated upon – typical content of an urban drainage master plan – interrelation between water resources investigation and urban planning processes – planning objectives – comprehensive planning – use of models in planning.

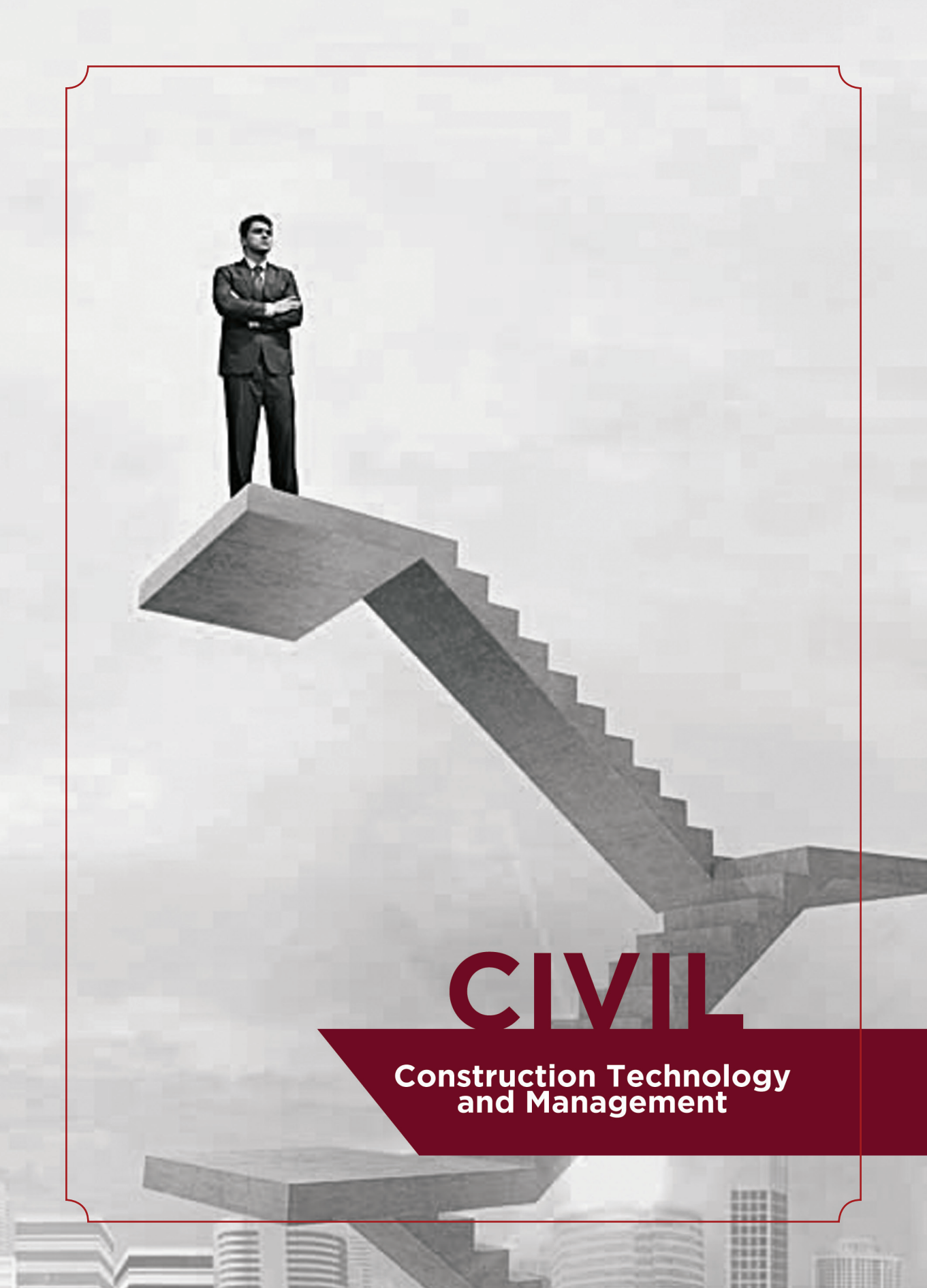
Basic approaches to urban drainage – runoff quantity and quality – wastewater and stormwater reuse – major and minor systems.

Elements of drainage systems – open channel – underground drains – appurtenances – pumping – source control. Stormwater Analysis Calculation of runoff and peak – Design of stormwater network systems.

Best Management Practices – Detention and retention facilities – Swales-constructed wetlands. Operation and maintenance of urban drainage system – interaction between stormwater management and solid waste management, Various model available for stormwater management. Legal aspects

TEXTBOOKS :

1. Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, “Manual on Drainage in Urbanised area” – 2 volumes, UNESCO, 1987.
2. Hall M J , Urban Hydrology, Elsevier Applied Science Publisher,1984.
3. Stahre P and Urbonas B , “Stormwater Detention for Drainage”, Water Quality and CSO Management, Prentice Hall, 1990.
4. Wanielista M P and Eaglin ,“Hydrology – Quantity and Quality Analysis”, Wiley and Sons, 1997.
5. Marsalek et al “Urban water cycle processes and interactions”, Publication No. 78, UNESCO, Paris(http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf), 1997.
6. Maksimovic C and J A Tejadxa-Guibert “Frontiers in Urban Water Management – Deadlock or Hope”, IWA Publishing,2001.



CIVIL

Construction Technology and Management

FIRST YEAR (FIRST SEMESTER)`

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5117	Green Buildings	3	0	2	4
2	18CE5118	Construction Materials & Concrete Technology	3	2	0	4
3	18CE5119	Construction Planning Scheduling and Control	3	0	2	4
4	18CE5120	Statistical Methods for Management	3	2	0	4
5		Elective- I	3	0	0	3
6		Elective -II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total Credits				**24**

FIRST YEAR (SECOND SEMESTER):

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18CE5221	Mechanized Construction and Machinery	3	0	2	4
2	18CE5222	Project Formulation Appraisal	3	2	0	4
3	18CE5223	Construction Laws and Regulations	3	2	0	4
4	18CE5224	Quality Management and Safety Management Systems in Construction	3	0	2	4
5		Elective-III	3	0	0	3
6		Elective-IV	3	0	0	3
7	18IE5250	Term Paper	0	0	4	2
		Total Credits				**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18IE6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18CE51I1	High Performance Buildings	3	0	0	3
2	18CE51I2	Precast Concrete Structure	3	0	0	3
3	18CE51I3	Special Concrete	3	0	0	3
4	18CE51I4	Structural Health Monitoring	3	0	0	3
Elective-2						
1	18CE51J1	Construction Personnel Management	3	0	0	3
2	18CE51J2	Building Services, Maintenance Management	3	0	0	3
3	18CE51J3	Infrastructure Valuation	3	0	0	3
4	18CE51J4	Construction Economics & Finance	3	0	0	3
Elective-3						
1	18CE52K1	Environmental Impact Assessment on built Environment	3	0	0	3
2	18CE52K2	Deep Excavations and ground water control methods	3	0	0	3
3	18CE52K3	Mass Transport Systems	3	0	0	3
4	18CE52K4	Form Work for Construction Structures	3	0	0	3
Elective-4						
1	18CE52L1	Emerging construction Technologies	3	0	0	3
2	18CE52L2	Building Envelopes	3	0	0	3
3	18CE52L3	Construction and fire safety	3	0	0	3
4	18CE52L4	Resource Management and Control in Construction	3	0	0	3

CONSTRUCTION TECHNOLOGY

SYLLABUS

Materials - Modular co-ordination, standardization and tolerances-system for prefabrication. Pre-cast concrete manufacturing techniques, Moulds – construction design, maintenance and repair. Pre-casting techniques - Planning, analysis and design considerations - Handling techniques Transportation Storage and erection of structures. Joints -Curing techniques including accelerated curing such as steam curing, hot air blowing etc., -Test on precast elements - skeletal and large panel constructions - Industrial structures. Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit. Quality control - Repairs and economical aspects on prefabrication.

FIELD VISIT

Students must visit minimum of 10 construction Sites and shall submit the reports on various construction practices which include foundation Practice, Farm Work, Rod bending, Concreting, Slab Work, Highway construction.

TEXTBOOKS :

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol.1.2&3.

REFERENCE BOOKS :

1. Richardson, J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
2. MadhavaRao. A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
3. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
4. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
5. Bruggeling, A.S.G., &Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers, Netherland, 1991.

CONSTRUCTION MATERIALS

SYLLABUS

STONES – BRICKS – CONCRETE BLOCKS

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacture of clay bricks – Tests on bricks – Compressive Strength - Water Absorption – Efflorescence –Bricks for special use – Refractory bricks – Cement and Concrete hollow blocks – Lightweight concrete blocks – Code Practices

LIME – CEMENT – AGGREGATES - MORTAR

Lime – Preparation of lime mortar – Cement. Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration - Compressive strength – Tensile strength – Soundness and consistency – Setting time – Aggregates – Natural stone aggregates – Industrial byproducts – Crushing strength – Impact strength – Flakiness – Abrasion Resistance – Grading – Sand – Bulking – Code Practices

CONCRETE

Concrete – Ingredients – Manufacture – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction – Principles of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – IS method – High Strength Concrete and HPC – Other types of Concrete – Code Practices

TIMBER AND OTHER MATERIALS

Timber – Market forms – Industrial timber- Plywood - Veneer – Thermocole – Panels of laminates – Steel – Aluminum and Other Metallic Materials - Composition – uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Code Practices

MODERN MATERIALS

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geosynthetics for Civil Engineering applications.

TEXTBOOKS :

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. 2.M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd,2003.

CONSTRUCTION PLANNING SCHEDULING AND CONTROL

SYLLABUS

UNDERSTANDING PROJECT MANAGEMENT

Project manager, organization structures, organizing and staffing the project office and team

MANAGEMENT FUNCTIONS

Directing, controlling, project authority, interpersonal influences, barriers, team building, communication, time management, conflicts

CONSTRUCTION PLANNING

Project planning, milestone schedules, WBS, Network techniques, CPM, PERT and Prima Vera, Resources leveling and smoothing.

COST CONTROL

Understanding control, operating cycles, cost account Codes, Job cost report, Projected Cost Estimates, status reporting, variance and earned value

PROJECT MANAGEMENT INFORMATION SYSTEM

MIS reporting, Daily, Weekly and monthly reporting, Actual vs. Planned cost reports, Planning & Cost control document. Quality and safety.

TEXTBOOKS :

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.

REFERENCE BOOKS :

1. Harold Kerzner Project Management CBS Publisers& Distributors 2nd Edition.
2. Frank Harris & Ronald McCaffer Modern Construction Management Blackwell science 4th Edition.
3. Roy Pilcher Principles of Construction Management McGraw Hill London.
4. Calin M. Popescu, ChotchaiCharoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
5. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
6. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
7. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985

STATISTICAL METHODS FOR MANAGEMENT

SYLLABUS

ONE DIMENSIONAL RANDOM VARIABLE

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

ESTIMATION THEORY

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

TESTING OF HYPOTHESES

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, χ^2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

DESIGN OF EXPERIMENTS

Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

QUEUEING MODELS

Poisson Process – Markovian queues – Single and Multi-Server Models – Little's formula Machine Interference Model – Steady State analysis – Self Service queue.

TEXTBOOKS :

1. D. Gross, C. M. Harris, Fundamentals of Queuing Theory, Third Edition, John Wiley and Sons, 2002.
2. Vohra, N.D. "Quantitative Techniques in Management", Tata McGraw – Hill Company Limited, 2007.

REFERENCE BOOKS :

1. D. C. Montgomery, G. C. Runger, Applied Statistics and Probability for Engineers, Third Edition, John Wiley and Sons, 2007.
2. Walpole, R.E., Myer, R.H., Myer, S.L. and Ye, K., Probability and Statistics for Engineers and Scientists, 7th edition, Pearson Education, Delhi.

MECHANIZED CONSTRUCTION AND MACHINERY

SYLLABUS

STANDARD TYPES OF EQUIPMENT

Special equipment, cost of owning and operating equipment, depreciation costs, investment and operating costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, balancing of equipment. Study of equipment with reference to available types and their types and their capacities, factors affecting their performance

EARTHMOVING EQUIPMENT -I

Tractors and attachments, dozers and rippers, scrapers, shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, rollers and compactors Drilling and blasting equipments,

EARTHMOVING EQUIPMENT -II

Bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives. Pile driving equipments, Types, pile driving hammers, single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory drivers

PUMPING EQUIPMENTS

Reciprocating, diaphragm & centrifugal pumps, well point system Stone crushing equipment: - jaw, gyratory and cone crushers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants,

PUMPING EQUIPMENTS

Portable plants Concrete manufacture, transport, placing and compacting equipment, mixers, central batching and mixing plants, pavers, transit mixers, concrete pumps shotcrete Air Compressor Equipments for moving materials, builder's hoists, forklifts, cranes, belt-conveyors, cableways, ropeways.

TEXTBOOK:

1. Construction planning, Equipments and methods. R.L.Peurify, TMH, 1996

REFERENCE BOOKS :

1. "Construction Equipment and its Planning and Applications", Mahesh Varma, Metropolitan TextBook : Co.(P) Ltd., New Delhi. India.
2. Construction Machinery and Equipment in India". (A compilation of articles Published in Civil Engineering and Construction Review) Published by Civil Engineering and Construction Review, New Delhi, 1991

PROJECT FORMULATION AND APPRAISAL

SYLLABUS

PROJECT FORMULATION

Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno- Economic Feasibility Report, Detailed Project Report – Different Project Clearances required

PROJECT COSTING

Project Cash Flows – Time Value of Money – Cost of Capital

PROJECT APPRAISAL

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various

Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in practice

PROJECT FINANCING

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios Private Sector Participation

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

REFERENCE BOOKS :

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation, Review,Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan, India Ltd., 1992.
3. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987.
4. Barcus, S.W. and Wilkinson.J.W., Hand TextBook : of Management Consulting Services, McGraw Hill, New York, 1986.

CONSTRUCTION LAWS AND REGULATIONS

SYLLABUS

CONSTRUCTION CONTRACTS

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability –Design of Contract Documents – International Contract Document – Standard Contract Document– Law of Torts.

TENDERS

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Andhra Pradesh Transparency in Tenders Act.

ARBITRATION

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence –Enforcement of Award – Costs.

LEGAL REQUIREMENTS

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land –Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law– Local Government Laws for Approval – Statutory Regulations.

LABOUR REGULATIONS

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Andhra Pradesh Factory Act – Child Labour Act - Other Labour Laws.

TEXTBOOKS :

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India,
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001.

REFERENCE BOOKS :

1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
2. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construc-tionManagement and Organisation, Printice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 1982. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) PrivateLimited, 2006.

QUALITY MANAGEMENT AND SAFETY MANAGEMENT SYSTEMS IN CONSTRUCTION

SYLLABUS

QUALITY MANAGEMENT

Introduction – Definitions and objectives – Factors influencing construction quality – Responsibilities and authority – Quality plan – Quality Management Guidelines – Quality circles.

QUALITY SYSTEMS

Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification.

QUALITY PLANNING

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures -Processes and products – Total QA / QC programme and cost implication.

QUALITY ASSURANCE AND QUALITY IMPROVEMENT TECHNIQUES

Objectives – Regularity agent, owner, design, contract and construction oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, –Stability methods and tools, optimum design – Reliability testing, Reliability coefficient and reliability prediction - Life cycle costing – Value engineering and value analysis. Quality Improvement Tools and Techniques.

SAFETY MANAGEMENT SYSTEMS

Fundamental of safety management, construction safety, safety in scaffolding and working platform, welding and handling, excavation work, concreting and cementing work. Building construction, TAC and NBC rules, High rise building. Evolution of modern safety concept-Safety policy - Safety Organization. Safety survey, safety inspection, safety sampling, Safety Audit. Concept of an accident, Reportable and non reportable accidents, unsafe act and condition principles of accident prevention, Overall accident investigation process. Risk management

REFERENCE BOOKS :

1. Hutchins.G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva TextBooks : Pvt. Ltd., 1994.
2. James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 1997.
3. John L. Ashford, The Management of Quality in Construction, E &F.N.Spon, 1989.
4. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001.
5. Kwaku.A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., 1985.
6. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longm.

HIGH PERFORMANCE BUILDINGS

SYLLABUS

INTRODUCTION

What is High Performance Building, Why to go for High Performance Building, Benefits of High Performance Buildings, High Performance Building Materials and Equipment in India, What are key Requisites for Constructing a High Performance Building, Important Sustainable features for High Performance Building,

HIGH PERFORMANCE BUILDING CONCEPTS AND PRACTICES

Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

HIGH PERFORMANCE BUILDING OPPORTUNITIES AND BENEFITS

Opportunities of High Performance Building, High Performance Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

HIGH PERFORMANCE BUILDING DESIGN AND AIR CONDITIONING

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement, Introduction to air conditioning, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement.

MATERIAL CONSERVATION AND INDOOR ENVIRONMENT QUALITY AND OCCUPATIONAL HEALTH

Handling of non-process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture, Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.

TEXTBOOKS :

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009.
2. Green Building Hand TextBook : by Tomwoolley and Samkimings,2009.

REFERENCE BOOKS :

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

PRECAST CONCRETE STRUCTURES

SYLLABUS

INTRODUCTION

Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems – Production – Transportation – Erection.

PREFABRICATED COMPONENTS

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

DESIGN PRINCIPLES

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

JOINT IN STRUCTURAL MEMBERS

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

DESIGN FOR ABNORMAL LOADS

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

REFERENCE BOOKS :

1. CBRI, Building materials and components, India, 1990
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994
3. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
4. Structural design manual, Precast concrete connection details, Society

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SPECIAL CONCRETE

SYLLABUS

CONCRETE INGREDIENTS

Composition of OPC – Manufacture – Modified Portland Cements – Hydration Process of Portland Cements – Structure of Hydrated Cement Pastes Mineral Admixtures – Slags – Pozzolanas and Fillers – Chemical Admixtures –Solutes

– Retarders – Air Entraining Agents – Water Proofing Compounds –Plasticizers and Super Plasticizers Aggregates – Properties and testing of fine and course aggregates – combining of aggregates – Substitute material for aggregates – recent advancements.

SPECIAL CONCRETES

Fibre Reinforced Concrete – Self Compacting Concrete – Polymer Concrete – High performance concrete – Sulphur concrete – pervious Concrete.

CONCRETE MIX DESIGN

Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High Performance Concrete – High strength concrete – variations in concrete strength.

MECHANICAL PROPERTIES OF CONCRETE

Interfacial Transition Zone – Fracture Strength – Compressive strength – Tensile strength - Impact strength - Bond strength.

DURABILITY OF CONCRETE

Factors affecting durability – Chemical Attack – Permeability – chloride penetration –water absorption – creep – Shrinkage.

REFERENCE BOOKS :

1. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
2. Gambhir.M.L., Concrete Technology – Tata McGraw Hill TextBook : Co. Ltd.,Delhi, 2004.
3. Neville, A.M., Properties of Concrete, Longman, 1995.
4. MethaP.K.andMontreio P.J.M., Concrete Structure Properties and Materials, Prentice Hall, 1998.
5. Gupta.B.L. and Amit Gupta, Concrete Technology, Standard Publishers Distributer, New Delhi, 2004.

STRUCTURAL HEALTH MONITORING

SYLLABUS

STATIC FIELD TESTING

Types of static tests - Simulation and loading methods - Static response measurement

DYNAMIC FIELD TESTING

Stress history data, types of dynamic field test - Dynamic response methods

Periodic and Continuous Monitoring; Hardware for Remote data acquisition systems; Remote Structural Health Monitoring: Networking of sensors – Data comparison technique; Case Studies. Structural Cracks and Reasons for various cracks, observation of structure on visual eye and also from nondestructive tests.

TEXTBOOKS :

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, John Wiley and Sons, 2006.
2. Douglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
3. J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor andFrancis Group, London, U.K, 2006.
4. Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007

CONSTRUCTION PERSONNEL MANAGEMENT

SYLLABUS

MANPOWER PLANNING

Manpower Planning process, Organizing, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

ORGANISATION

Requirement of Organisation – Organisation structure – Organisation Hierarchical charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection strategies – Placement and Training.

HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR

Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager – all aspects of decision making – Significance of human relation and organizational – Individual in organization – Motivation – personality and creativity – Group dynamics, Team working – Communication and negotiation skills.

WELFARE MEASURES

Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.

MANAGEMENT AND DEVELOPMENT METHODS

Wages and Salary, Employee benefits, Employee appraisal and assessment – Employee services – Safety and Health Management – Special Human resource problems – Productivity in human resources – Innovative approach to designing and managing organization – Managing New Technologies – Total Quality Management – Concept of quality of work life – Levels of change in the organizational Development – Requirements of organizational Development – System design and methods for automation and management of operations – Developing policies, practices and establishing process pattern – Competency up gradation and their assessment – New methods of training and development – Performance Management.

TEXTBOOKS :

1. Carleton Counter II and Jill Justice Coutler, The Complete Standard Hand-book of Construction Personnel Management, Prentice-Hall, Inc., 1989.

REFERENCE BOOKS :

1. Charles D Pringle, Justin GooderiLongenecter, Management, CE Merril Publishing Co. 1981.
2. Dwivedi R.S, Human Relations and OrganisationalBehaviour, Macmillian India Ltd.,2005.
3. Josy.J. Familaro, Handbook of Human Resources Administration, Mc-Graw-Hill International Edition, 1987.
4. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.

BUILDING SERVICES, MAINTENANCE MANAGEMENT

SYLLABUS

WATER SUPPLY AND ELECTRIC SERVICES

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom– taps – quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit

Electrical systems – Basic of electricity – single/Three phase supply – protective devices in electrical installation – Earthing for safety – Types of earthing – ISI Specifications. Electrical installations in buildings – Types of wires, wiring systems and their choice – planning electrical wiring for building – Main and distribution boards –Principles of illumination

DRAINAGE AND SOLID WASTE DISPOSAL

Principles of drainage, surface drainage, shape and sizes of drains and sewers, storm water over flow chambers, methods of laying and construction of sewers Traps – shapes, sizes, types, materials and function, Inspection chambers - sizes and construction, Ventilation of House drainage: Anti siphonage pipe, system of plumbing - single stack , one pipe system, one pipe partially ventilating system and two pipe system, grey water recycling and dual plumbing Types of fixtures and materials: sinks, shower tray, shower temple, bath tub, Jacuzzi, water closets, flushing cisterns, urinals, sinks , wash basins, bidet, etc. Design of Septic tank, Oxidation pond, Dispersion trench and soak pits. Arrangements of fixtures in a bathroom Treatment system- Root zone treatment system, Decentralized Wastewater Treatment Systems (DEWATS), Soil Bio technology, packaged Bio-Reactor System. Approaches for solid waste management, Solid wastes collection and removal from buildings. On-site processing and disposal methods, guidelines for municipal solid waste management, e-waste management. Disposal of Wastes: Sanitary land filling, Composting, Vermi-compost, Incineration, Pyrolysis

FIRE FIGHTING SERVICES, PLUMBING AND FIRE FIGHTING LAYOUT OF SIMPLE BUILDING

Classification of buildings based on occupancy, causes of fire and spread of fire, Firefighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire. Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements – planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Application of above studies in current design problems and preparing design layout and details - Plumbing layout of residential and public buildings, Firefighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

ILLUMINATION AND LIGHTING DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and color – synthesis of light – Additive and subtractive synthesis of color – Luminous flux – Candle – solid angle illumination – utilization factor –Depreciation factor –MSCP – MHCP –Laws of illumination. Classification of lighting –Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required, and minimum level of illumination required for physically handicapped and elderly in building types.

ELECTRICAL LAYOUT OF SIMPLE BUILDINGS, HEAT VENTILATION AND AIR CONDITIONING (HVAC)

Electrical layout of a simple residential, school and commercial building Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning Air cooling, Different systems of

ducting and distribution, Essentials of air-conditioning system.

REFERENCE BOOKS :

1. Charangith shah, Water supply and sanitary engineering, Galgotia publishers. Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw – Hill publishing company Limited.
2. E.R.Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York, 1968.
3. Handbook for Building Engineers in Metric systems, NBC,New Delhi, 1968.
4. Philips Lighting in Architectural Design, McGraw Hill, New York, 1964.
5. R.G.Hopkinson and J.D.Kay, the Lighting of Buildings, Faber, and Faber, London, 1969.
6. S.C.Rangwala, Water supply and sanitary engineering, Charotar publishing house.

INFRASTRUCTURE VALUATION

SYLLABUS

CONCEPTS

Introduction, History of value engineering, Value Function, Cost, Worth, Case Study Discussions. General Techniques in infrastructure Valuation: General Techniques- Brainstorming Technique, The Gordon Technique, Feasibility Ranking, The Morphological Analysis Technique, ABC Analysis, Probabilistic Approach, Make or Buy Technique, Case Study Discussions.

Special Techniques in infrastructure valuation: Special Techniques, function, cost, worth Analysis, Function Analysis System Technique, Technically oriented Fast and Customer, Oriented Fast, Weighted Evaluation Method, Equal Importance Method, Descending Order of Importance Method. Numeric Analysis, Forced Distribution technique, Quantitative Method, predetermined minimum method, Evaluation Matrix, Break even analysis, Life Cycle Cost (LCC), Case Study Discussions.

APPLICATIONS OF INFRASTRUCTURE VALUATION

Team Dynamics, Team Structure and team Building, Definition of the creative and Structured Phases of value engineering, The Workshop approach to achieving value, target setting, time management, case study discussions.

REFERENCE BOOKS :

1. Anil Kumar Mukhopadhyaya, Value Engineering Concepts, Techniques and Applications, Response TextBooks :, 2013.
2. Anil Kumar Mukhopadhyaya, Value Engineering Mastermind from Concept

to Value Engineering Certification, Response TextBooks :, 2009.
3. Lawrence D. Miles, Techniques of Value Analysis and Engineering, Mc-Graw-Hill TextBook : Company, 2009.
4. M.R.S. Murthy, Cost Analysis for Management Decisions, Tata McGraw-Hill Publishing Company Ltd., 1988.

CONSTRUCTION ECONOMICS & FINANCE

SYLLABUS

Construction accounting, Income statement. Depreciation and amortization. Engineering economics, Time value of money, discounted cash flow, NPV, ROR, PI, Bases of comparison, Incremental rate of return Benefit-cost analysis, Replacement analysis, Break even analysis. Risks and uncertainties and management decision in capital budgeting. Taxation and inflation. Work pricing, cost elements of contract, bidding and award, revision due to unforeseen causes, escalation. Turnkey activities, Project appraisal and project yield. Working capital management, financial plan and multiple source of finance. International finance, Budgeting and budgetary control, Performance budgeting. appraisal through financial statements, Practical problems and case studies.

REFERENCE BOOKS :

1. Simon A. Burtonshaw-Gunn, “Risk and Financial Management in Construction”, Gower Publishing, Ltd.,2009
2. Warneer Z, Hirsch, Urban Economics, Macmillan, New York, 1993
3. Eugene F. Brigham, Michael C. Ehrhardt, ”Financial Management Theory and Practice”, Cengage hLearning, 2010.

ENVIRONMENTAL IMPACT ASSESSMENT ON BUILT ENVIRONMENT

SYLLABUS

INTRODUCTION

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of

projects requiring, Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements. Identifying the Key Issues: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts,

GLOBAL ENVIRONMENTAL ISSUES, EIA METHODOLOGIES

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods- Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods,

INTRODUCTION

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

IDENTIFYING THE KEY ISSUES

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection: Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts,

REFERENCE BOOKS :

1. Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., 1997.
2. David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003.
3. Hosetti, B. B., Kumar Eds, A., Environmental Impact Assessment and Management, Daya Publishing House, 1998.
4. UNESCO, Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development, UNESCO/UNEP, Paris, 1987.
5. Anjaneyulu.Y., and Manickam. V., Environmental Imapact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
6. Wathern.P., Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.

DEEP EXCAVATIONS AND GROUND WATER CONTROL METHODS

SYLLABUS

DEEP EXCAVATION

Deep excavations - Standards & Codes of practice / Types & uses, Construction methodologies & detailing, Analysis methods & ground movements, Design of retaining structure, Design of temporary works, Tutorial, Monitoring systems, Maintenance / Operation / Coursework discussion

ROADS & TUNNELS

Roads & Tunnels - Standards & Codes of practice / Road geometry & drainage, Pavement design & Geotechnics / Monitoring / Maintenance of Roads, Embankments & Cuttings - Standards & Codes of practice / Types & uses / Construction methodologies & detailing, Embankments & Cuttings - Analysis methods & ground movements / Monitoring systems / Maintenance , Standards & Codes of practice / Types & uses, Construction methodologies & detailing, Analysis methods & ground movements, Design of lining, Design of temporary works, Tunnels – Tutorial, Monitoring systems, Tunnels - Maintenance / Operation / Coursework discussion

DEWATERING

Dewatering of shallow and deep open excavations. Effect of ground water movement. Methods of groundwater control. Shallow and deep well points. Horizontal drainage, vacuum dewatering by electro-osmosis, single and multiple well system, group of wells. Draw down factors, vertical sand drains, pressure relief beneath excavation, well point pumps, headers discharge lines control of surface water. Installation and operation of well point system.

GROUTING METHODS

Cement grouting, colgrout, concrete process, prepacked concrete, intrusion grout. Alluvial grouting, various types of clay grouting. Chemical grouting – grouts for injection of fine sands. Resin grouting. Polymerization technique. Field procedure, applications and limitations.

PILING & COFFER DAMS AND CAISSON

Behaviour of single pile and a group piles during driving, under loads-ultimate loads on driven and cast in Situ piles. Construction details of precast piles, prestressed piles, and steel piles, friction piles. Driven and bored piles, large diameter piles, negative and positive skin friction, multiple under reamed piles, raker piles, sand piles, Anchor piles, load on piles – Static. Vibrating loads, cyclic loading, safe bearing load, methods of pile driving by vibration above and under water through different strata, micro piles. Cofferdams – types, design and construction of single, double wall. Cofferdam. Sheet pile cofferdams, concrete wall movable cofferdam, land cofferdams, soldier construction method. Cofferdam wall by ICOS method, caissons, details, design and construction.

REFERENCE BOOKS :

1. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
2. Construction Equipment Planning and Applications – Dr. Mahesh Verma
3. Brochures Published by various agencies associated with construction.
4. Journals such as CE & CR. Construction world, International Construction Document Reports of actual major works executed.

EMERGING CONSTRUCTION TECHNOLOGIES

SYLLABUS

GFRC Facade Panels System, Prefabricated Building, Vertical ICF Wall, Mechanical Concrete, Filterpave systems, FRP Rebar, FRP Deck: Rehabilitation of a Steel Truss Bridge, Concrete Lumber, Bone-shaped Short Fiber Composite, Slurry Infiltrated Mat Concrete, Alternative Material Dowel Bars for Rigid Pavement Joints, Snap Joint Technology for Composite Structures, Superpave System,

Modular FRP Composite Bridge Deck, Composite Column Reinforcement, Rapid In situ Load Testing, Carbon Fiber Reinforced Polymer (CFRP), Polymer Concrete Pipes, Use of Composite Piping Offshore, Recycled Plastic Composite Railroad Ties. High Performance Steel (HPS), Embedded Galvanic Anodes, DIS Seismic Isolator, Hydraulic Vibratory Pile Driver, Soft Trencher, Deep Mixing Method for Ground Improvement, Mortar less Concrete Block System, Post-tensioned Steel Structure

Attachment of Steel Decking using Mechanical Fasteners and Powder Actuated or Pneumatic Tools, Seismic Isolation Bearings, Bridge Lock-up Device System, Adjustable Steelwork Connectors, Precast Hybrid Moment Resistant Frames, Precast Concrete Beam to Column System (BSF)

Low Temperature Concrete Admixture, Use of Recycled Tire Rubber in Concrete, Steel Free Concrete Bridge Deck, Rapid Repair Products, Concrete Restoration & Protection System, Precast Inverted T Beam, Conductive Concrete, Smart Concrete.

Rapid Drying Concrete, Rapid-1 Hardening Accelerator Concrete Admixture, Reactive Powder Concrete, Mellose non-dispersible Underwater Concrete, Segment Precast Floating Draw Span, Self-Placing Concrete, Shrinkage Reducing Admixture for Concrete, Corrosion Inhibitors for Reinforced Concrete, High Performance Concrete(HPC).

TEXTBOOKS :

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage,

Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol.1.2&3.

REFERENCE BOOKS :

1. Richardson,J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
2. MadhavaRao.A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
3. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
4. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
5. Bruggeling, A.S.G., &Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers, Netherland, 1991.

BUILDING ENVELOPES

SYLLABUS

BUILDING ENVELOPE SYSTEM

Building Envelope System-Performance Objectives-Physical Components-Sources of Moisture Intrusion-Results of Failure.

FOUNDATION CONSTRUCTION

Thermal and Moisture Protection-Groundwater Gutters-Crawl Spaces-Damp proofing and Waterproofing- Girders

WALL CONSTRUCTION & ROOF CONSTRUCTION

Wall Framing-Vapor Diffusion Problems-Recommendations-House Wrap and Underlayment-Window and Door Openings-Flashing and Caulking-Siding, Skylights-Moisture Penetration-Roof Valleys-Shingles and Shakes-Roof Sheathing-Repairs Flashing Window and door installation & ventilation system Installation and requirements: Windows, Doors and Skylights-Proper Flashing-Door and Window Installation Code-Attic Ventilation-Heating, Ventilation and Air Conditioning Building Envelope Best Practices: Moisture Retarding Construction, Capillary Breaks, House Wrap Installation, Window and Door Installation, Siding Installation, Roofing Best Practices

TEXTBOOKS :

1. H. Hens, 2012, Building Physics: Heat, Air and Moisture, Fundamentals and Engineering Methods with Examples and Exercises, Second Edition
2. ASHRAE, HANDBOOK - Vol. 1-4 ed. ASHRAE 2009-2012.

CONSTRUCTION AND FIRE SAFETY

SYLLABUS

Classification of fire, Portable fire extinguishers, Pumps and primers, Foam and foam making equipments, Hose and hose fittings, Water relay systems, Breathing apparatus, Small gears.

Fire protective clothing, Ladders, Ropes and lines, bends & hitches, Fire prevention, Special appliances, Firefighting Codes and standards, Electrical fire hazards, Structures under fire.

Site planning and housekeeping, Types of Scaffolds, Scaffold Erection & dismantling, Scaffold Inspection.

Safety in scaffolding – an overview, Investigation of scaffold accident, Provisions on scaffold under the building other construction workers central rules, 1998, Safety in excavations, trenching and shoring

Road work and pilling operation, Ladders, use of safety nets and fall protection systems, Concrete and concert foams and shoring, Importance of civil work in construction industry, Material handling, Important safety requirements and inspections

RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

SYLLABUS

RESOURCE PLANNING

Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.

LABOUR MANAGEMENT

SYSTEMS APPROACH, CHARACTERISTICS OF RESOURCES, UTILIZATION, MEASUREMENT OF ACTUAL RESOURCES REQUIRED, TOOLS FOR MEASUREMENT OF RESOURCES, LABOUR, CLASSES OF LABOUR, COST OF LABOUR, LABOUR SCHEDULE, OPTIMUM USE LABOUR.

MATERIALS AND EQUIPMENT

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution. Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.

TIME MANAGEMENT, RESOURCE ALLOCATION AND LEVELING

Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control. Time-cost trade off, Computer application – Resource leveling, resource list, resource allocation, Resource loading, Cumulative cost

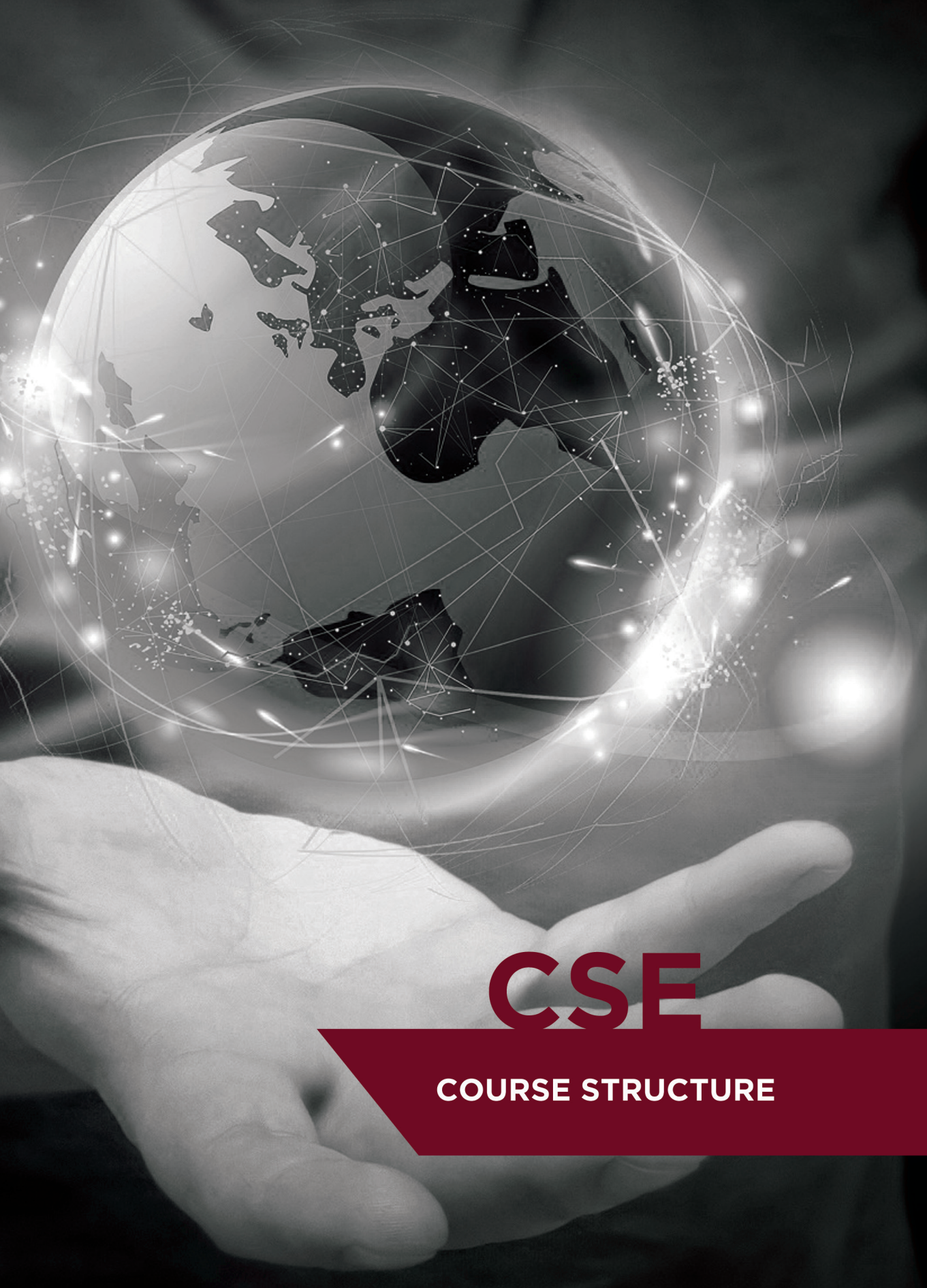
– Value Management.

TEXTBOOKS :

1. Andrew,D., Szilagg, Hand TextBook : of Engineering Management, 1982.
2. Harvey, A., Levine, Project Management using Micro Computers, Obsorne -McGraw Hill C.A.Publishing Co., Inc. 1988.Industry, Granda Publishing Ltd., 1980.

REFERENCE BOOKS :

1. James.A.,Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.
2. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1980.



CSE

COURSE STRUCTURE

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS 5101	Mathematical Foundations of Computer Science	3	2	0	4
2	18 CS 5102	Computer Organization & Architecture	3	2	0	4
3	18 CS 5103	Data Structures & Algorithms	3	0	2	4
4	18 CS5104	Distributed Database Management System	3	0	2	4
5		Elective –I	3	0	0	3
6		Elective -II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	**18**	**4**	**8**	**24**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS 5205	Operating System Design	3	2	0	4
2	18 CS 5206	Computer Networks & Security	3	2	0	4
3	18 CS 5207	Object Oriented Analysis and Design	3	0	2	4
4	18 CS 5208	Enterprise Programming	3	0	2	4
5		Elective – III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 CS 51A1	Soft Computing	3	0	0	3
2	18 CS 51A2	Machine Learning and pattern Classification	3	0	0	3
3	18 CS 51A3	Data Mining	3	0	0	3
4	18 CS 51A4	Natural Language Processing	3	0	0	3
Elective-2						
1	18 CS 51B1	Requirements Engineering	3	0	0	3
2	18 CS 51B2	Principles of Programming Languages	3	0	0	3
3	18 CS 51B3	Compiler Design	3	0	0	3
4	18 CS 51B4	Software Testing & Quality Assurance	3	0	0	3
Elective-3						
1	18 CS 52C1	Cryptography & Network Security	3	0	0	3
2	18 CS 52C2	Mobile computing	3	0	0	3
3	18 CS 52C3	High Performance Computing	3	0	0	3
4	18 CS 52C4	Network management Systems	3	0	0	3
Elective-4						
1	18 CS 52D1	Service Oriented Architecture	3	0	0	3
2	18 CS 52D2	Visual Programming	3	0	0	3
3	18 CS 52D3	Digital Image Processing	3	0	0	3
4	18 CS 52D4	Big Data Analytics	3	0	0	3

MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

SYLLABUS

Logic, Proofs, sets functions and relations, Algorithm and Integers, Induction and Recursion, Counting, Graph theory, Trees, Boolean Algebras, Automata, Grammars and Languages.

TEXTBOOKS :

1. Joe L.Mott, Abrabam Kandel & Theodore P.Bakev, 'Discrete Mathematics for Computer Scientists & Mathematics' PHI.
2. John.E.Hopcroft, R.Motwani, & Jeffery.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003

REFERENCE BOOKS :

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.
2. Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing Company Limited, New Delhi, 2007.
3. John E Hopcroft & Jeffery D Ullman' 'Introduction to Automata Theory & Languages And Computation', Narosa Publishing House
4. KLP Mishra & N.Chandrasekharan, 'Theory of Computation', PHI.
5. Discrete and Combinational Mathematics- An Applied Introduction-5th Edition – Ralph. P.Grimaldi. Pearson Education

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COMPUTER ORGANIZATION & ARCHITECTURE

SYLLABUS

Computer abstractions and technology: Assemblers, Linkers, and the SPIM Simulator: The Basics of Logic Design: Instructions: Language of the Computer: Arithmetic for Computers: A Survey of RISC Architectures desktop and server RISCs: Assessing and Understanding Performance: Mapping Control to Hardware. Large and Fast: Exploiting Memory Hierarchy,Parallel Processors from Client to Cloud 500

TEXTBOOK :

1. Computer Organization and Design, Third Edition, by David Patterson and John Hennessy Morgan Kaufmann Publishers, 2013

REFERENCE BOOKS :

1. Computer Organization and Architecture, Design for Performance 7th Edi-

tion – 2009, Stallings, Pearson Education
2. Computer organization 5th Edition Hamacher, Vranessis Zaky -2002 Mc-Graw Hill International.
3. Computer Architecture and Organization 3rd Edition John P.Hayes
4. Fundamentals of Digital Logic & Micro Computer Design, 5th Edition, M.Rafiquzzaman John Wiley
5. Digital Design Fourth Edition, M.Morris Mano, Pearson Education/PHI.

DATA STRUCTURES & ALGORITHMS

SYLLABUS

INTRODUCTION

Algorithms, Algorithms as a technology, Insertion Sort, Analyzing algorithms, Designing algorithms, asymptotic notations, standard notations, common functions, Recurrences: substitution method, master method. Sorting and order statistics: Quick sort: Description, Performance, Worst Case Analysis, Heap sort, sorting in linear time. Elementary Data Structures: – Linked lists, Stacks, Queues, Hash Tables: Direct address tables, Hash tables, Hash functions, Open addressing, Binary search trees: Quering, Insertion, Deletion, Red-Black Trees. Advanced Data Structures: B – Trees, Binomial Heaps Data Structures for Disjoint Sets: Operations, Linked-list representation, Disjoint-set forests. Advanced Design and Analysis Techniques: Greedy Algorithms: An activity-selection Problem, Elements of greedy strategy, Huffman Codes. Dynamic Programming: Matrix Chain multiplication, Optimal Binary Search Trees, Amortized Analysis: Aggregate analysis, The Accounting Method, The Potential Method.Graph Algorithms: Elementary graph algorithms: Representation of graphs, BFS, DFS, Topological Sort, Strongly connected components, Minimum Spanning Trees: The algorithms of Kruskal and Prim's. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single source shortest paths in DAG's, Dijkstra's algorithm, All-Pair Shortest paths: Shortest paths and Matrix multiplication, Floyd-Warshall algorithm. Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum Bipartite matching. String Matching: The naïve string matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm. NP-Completeness: NP-Completeness and the classes P an NP, P, NP, and NP-Complete problems

TEXTBOOK :

1. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt.Ltd./ Pearson Education

REFERENCE BOOKS :

1. Algorithm Design: Foundations,Analysis and Internet examples, M.T. Goodrich and R.Tomassia,John wiley and sons.
2. Fundamentals of Computer Algorithms,Ellis Horowitz, Satraj Sahni and S.Rajasekharam, Galgotia publications pvt. Ltd.
3. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.
4. Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.
5. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

DISTRIBUTED DATABASE MANAGEMENT SYSTEM

SYLLABUS

DATABASE FUNDAMENTALS

DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types, Data Modeling: ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. Enhanced ER data Model, EER Diagram, Specialization and Generalization, Lattice, Union, Disjoint Properties, Constraints and relationships, Other issues in designing EER diagrams ,Relational Model, Relational Algebra, Operators in relational algebra, Algorithms for ER to relational mapping. Distributed databases features – distributed database management systems – Review of databases and computer networks. Levels of distribution transparency – reference architecture – types of data fragmentation – distributed transparency for read only applications and update applications – distributed database access primitives and integrity constraints. Distributed database design – a frame work for distributed database design – the design of database fragmentation – the allocation of fragments. Translational global queries to fragment queries – equivalence transformation for queries – transforming global queries into fragment queries – distributed grouping and aggregate function evaluation – parametric queries. Query optimization – problems in query optimization – objectives in query process optimization – similar representation of queries – model for query optimization – join query – general queries. Distributed transactions and concurrency control. Frame work for transaction management – properties and goals of transaction – atomicity of distributed transactions – recovery procedures – concurrency control for distributed transactions. Foundations of distributed concurrency control – distributed deadlocks – concurrency control based on time stamps.

TEXTBOOKS :

1. Elmasri and Navathe, 'Fundamentals of Database Systems', 2008, 4th edition, Pearson Education. '
2. Seri and Pelagatti, "Distributed databases principles and systems" ,McGraw Hill, 12th Edition.

REFERENCE BOOKS :

1. Raghuramakrishnan – "Database management system", 3/e, McGraw Hill.
2. Valduriez, Sridhar, Principles of Distributed Database Systems, 2/e, OZSU, , Pearson, 2001
3. Korth, Silberschatz, Sudershan Database System Concepts, 5/e, , TMH
4. P O' Neil, E O'Neil Data Base Principles, Programming, and Performance, 2/e, , Elsevier

SOFT COMPUTING

SYLLABUS

INTELLIGENT SYSTEMS AND SOFT COMPUTING

Intelligence systems, Knowledge-based systems, knowledge representation and processing, soft computing. Fundamentals of Fuzzy Logic Systems: Fuzzy sets, Fuzzy logic operations, generalized operations, Fuzziness and fuzzy resolution, relations, composition and interface, considerations of fuzzy decision- making. Fuzzy logic control: Basics of fuzzy control, Fuzzy control architecture, Properties of fuzzy control, robustness and stability. Fundamentals of artificial neural networks: Learning and acquisition of knowledge, features of artificial neural networks, fundamentals of connectionist modeling. Major classes of neural networks: The multi-layer perceptrons, radial basis function networks, Kohonen's self-organizing network, The Hopfield network, industrial and commercial application of ANN. Dynamic neural networks and their applications to control and chaos prediction:Training algorithms, fields of applications of RNN, dynamic neural networks for identification and control, neural network–based control approaches, dynamic neural networks for chaos time series, Artifical neural networks for chaos predictions. Neuro Fuzzy Systems: Architecture of Neuro fuzzy systems, construction of Neuro fuzzy systems. Evolutionary computing: Over view of Evolutionary computing, Genetic algorithms and optimization, the schema theorem: the fundamental algorithm of Genetic algorithms, operations, integration of Genetic algorithms with neural networks, integration of Genetic algorithms with fuzzy logic. Known issues in Genetic algorithms, population-based incremental learning, ES applications, Swarm Intelligence, Artificial Immune systems, simulated annealing, Rule Mining with Soft Computing.

TEXTBOOKS :

1.Fakhreddine O. Karry, Clarence De Silva, ,Soft Computing and Intelligent

systems Design Theory, Tools and Applications", Pearson, 2009
2. Introduction to Evolutionary Algorithms by Xinjie Yu • Mitsuo Gen, Springer

REFERENCE BOOKS :

1. Data Mining Multimedia, Soft Computing, and Bioinformatics by Sushmita Mitra, Tinku acharya, Wiley edition
2. S N Sivanandam, S N Deepa, "Principles of Soft Computing", Wiley India,2008
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson, 2004.
4. Timothy J Ross Fuzzy Logic with Engineering Applications , 3rd Edition, Wiley, 2010.
5. Bart Kosko, Neural Networks and Fuzzy Systems , PHI, 2004
6. Soft Computing: Methodologies and Applications (Advances in Intelligent and Soft Computing) by Frank Hoffmann, Mario Koeppen, Frank Klawonn and Rajkumar

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MACHINE LEARNING AND PATTERN CLASSIFICATION

SYLLABUS

Supervised Learning, Bayesian Decision Theory, Parametric Methods, Multivariate Methods, Dimensionality Reduction. Clustering, Nonparametric Methods, Decision Trees, Linear Discrimination, Local Models, Kernel Machines. Bayesian Estimation, Hidden Markov Models, Bayesian Decision Theory. Pattern Classifications: Maximum-Likelihood and Bayesian Parameter Estimation,Nonparametric Techniques, Linear Discriminant Functions, Multilayer Neural Networks. Stochastic Methods, Nonmetric Methods, Algorithm-Independent Machine Learning,Unsupervised Learning and Clustering.

TEXTBOOKS :

1. Ethem Alpaydin, "Introduction to Machine Learning , The MIT Press, 2010
2. Stephen Marsland, "Machine Learning an Algorithmic Perspective", CRC Press, 2009.

REFERENCE BOOKS :

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", Wiley, 2012
2. Horst Bunke, Abraham Kandel, Mark Last, "Applied Pattern Recognition" Springer, 2008.
3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003
4. M. Narasimha Murty and V. Susheela Devi, Pattern Recognition.
5. NPTEL Web Course, 2011 (http://nptel.iitm.ac.in/courses.php?disciplineId=106).

DATA MINING

SYLLABUS

INTRODUCTION

What is Data Mining?, Motivating Challenges, The Origins of Data Mining, Data Mining Tasks, Scope and Organization of the TextBook : . Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity. Exploring Datathe Iris Data Set Summary Statistics, Visualization, OLAP and Multidimensional Data Analysis. Classification: Basic Concepts, Decision Trees, and Model Evaluation: Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction, Model Over fitting, Evaluating the Performance of a Classifier, Methods for Comparing Classifiers. Classification: Alternative Techniques: Rule-Based Classifier, Nearest-Neighbor Classifiers, Bayesian Classifiers, Artificial Neural Network (ANN), Support Vector Machine (SVM), Ensemble Methods, Class Imbalance Problem, Multi class Problem. Association Analysis: Basic Concepts and Algorithms: Problem Definition, Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns, Effect of Skewed Support Distribution. Association Analysis

ADVANCED CONCEPTS

Handling Categorical Attributes, Handling Continuous Attributes, Handling a Concept Hierarchy, Sequential Patterns, and Sub graph Patterns, Infrequent Patterns. Cluster Analysis: Basic Concepts and Algorithms: Overview, K-means, Agglomerative, Hierarchical Clustering, DBSCAN, Cluster Evaluation. Anomaly Detection: Preliminaries, Statistical Approaches, Proximity-Based Outlier Detection, Density-Based Outlier Detection, Clustering-Based Techniques. Cluster Analysis: Additional Issues and Algorithms: Characteristics of Data, Clusters, and Clustering Algorithms, Prototype- Based Clustering, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms, Which Clustering Algorithm.

TEXTBOOK:

1. Introduction to Data Mining, BY Pang-Ning Tan / Michael Steinbach / Vipin Kumar, Pearson Education

REFERENCE BOOKS :

1. J. Han, M Kamber, “Data Mining: Concepts and Techniques”, second edition, Elsevier, New Delhi, 2006.
2. Dunham M, “Data Mining: Introductory and Advanced Topics”, Prentice Hall, New Delhi, 2002.
3. Hand.D, Mannila H, Smyth.P, “Principles of Data Mining”, MIT press, USA,2001.

NATURAL LANGUAGE PROCESSING

SYLLABUS

Mathematical Foundations, Linguistic Essentials, Corpus-Based Work. Words: Collocations, Statistical Inference: n-gram Models over Sparse Data, Word Sense Disambiguation, Lexical Acquisition. Grammar: Markov Models, Part-of-Speech Tagging, Probabilistic Context Free Grammars, probabilistic parsing. Applications and Techniques: Statistical Alignment and Machine Translation, Clustering, Topics in Information Retrieval, Text Categorization. A Comprehensive Mathematical Framework for the Development of Semantic Technologies, Formal Methods and Algorithms for the Design of Semantics-Oriented Linguistic Processors. Structural Discovery in Natural Language Processing: Graph Models, Small words of Natural Language, Graph Clustering, Unsupervised Language Separation. Unsupervised Part-of- Speech Tagging, Word sense Induction and Disambiguation, Graph Based Natural Language Processing.

TEXTBOOKS :

1. Christopher D Manning, Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 2003.
2. Semantics-Oriented Natural Language Processing by Vladimir A. Fomichov, Springer publications

REFERENCE BOOKS :

1. Structure Discovery in Natural Language by Chris Biemann, Springer publications
2. Graph-based Natural Language Processing and Information Retrieval by Rada Mihalcea, Dragomir Radev, Cambridge Publications
3. Lucja M Iwanska, Stuart C Shapiro, "Natural Language Processing And Knowledge Representation: Language For Knowledge And Knowledge For Language", AAAI Press 2000.
4. Anne Kao, Stephen R Poteet, "Natural Language Processing and Text Mining, Springer, 2010.
5. Daniel Jurafsky, James H Martin, "Speech and Language Procesing", Pearson, 2000
5. James Allen, "Natural Language Understanding, 2nd Edition, Pearson, 2008.

EQUIREMENTS ENGINEERING

SYLLABUS

View of Domain- Engineering, Stack Holders, Facets, Process Engineering Model. Requirement Engineering, Requirement Facets, the Requirements Engineering Models, Modeling and Models, Jacksons Description Principles, Domain- Attributes, Acquisition, Domain Analysis And Concepts Formation, Validation And Verification. Requirement -Stockholders, Acquisition, Analysis And Concept Formation, Verification And Validation, Satisfiability And Feasibility, Hardware/Software Co -Design, Software Architecture Design. Quality Assurance in Requirements Management, Planning for Requirements Management, Requirements Change Management, Requirements Tracing, Tracking and Reporting, Measurement and Metrics. Roles and Responsibilities in REM, Requirements Management through SDLC, Tools and Techniques for Requirements Engineering and Management and Pitfalls and Best Practices.

TEXTBOOKS :

1. Dines Bjorner, Software Engineering Vol-3, Do mains, Requirements, Software Design, Springer, 2005.
2. Murali Chemuturi , “Requirements Engineering and Management for Software Development Projects “,Springer, 2013.

REFERENCE BOOKS :

1. The Requirements engineering handbook by Ralph R Young, Artech House, 2004.
2. Dines Bjorner, Software Engineering Vol-2, Do mains, Requirements, Software Design, Springer, 2004.
3. Pohl, Klaus, “Requirements Engineering: Fundamentals, Principles, and Techniques”, Springer, 2010.

PRINCIPLES OF PROGRAMMING LANGUAGES

SYLLABUS

DESCRIBING SYNTAX AND SEMANTICS

Introduction, The General Problem of Describing Syntax, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meaning of Programs. Lexical and Syntax Analysis: Introduction, Lexical Analysis, The Parsing Problem, Recursive – Descent Parsing, Bottom – Up Parsing. Names, Binding, Type Checking, and Scopes: Introduction, Names, Variables, The Concept of Binding, Type Checking, Strong Typing, Type Compatibility, Scope, Scope & Lifetime, Referencing Environments, named Constants. Data Types: Introduction, Primitive Data Types, Character String Types, User – Defined Ordinal Types,

array Types, associate Arrays, Record Types, Union Types, pointer & Reference Types. Expressions and Assignment Statements: Introduction, Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational & Boolean Expressions, Short

– Circuit Evaluation, Assignment Statements, Mixed – mode Assignment. Statement-Level Control Structure: Introduction, Selection Statements, iterative Statements, Unconditional Branching, Guarded Commands. Subprograms: Introduction, Fundamentals of Subprograms, Design Issues for Subprograms, Local Referencing Environments, Parameter – Passing Methods, Parameters That Are Subprogram Names, Overloaded Subprograms, Generic Subprograms, Design Issues for Functions, user-Defined Overloaded Operators, Co routines. Implementing Subprograms: Abstract Data Types And Encapsulation Constructs: The Concept of Abstraction, Introduction to Data Abstraction, Design Issues for Abstract Data Types, Language Examples, Parameterized Abstract Data Types, Encapsulation constructs, Naming Encapsulations. Support for Object-Oriented Programming: Introduction, Object-Oriented Programming, Design Issues for Object-Oriented Languages, Support for Object-Oriented Programming in Smalltalk, Support for Object-Oriented Programming in c++, Support for Object-Oriented Programming in Java, for Object-Oriented Programming in C#, for Object- Oriented Programming in Ada 95, The Object Model of JavaScript, Implementation of Object- Oriented Constructs. Functional Programming Languages:. Logic Programming Languages: Introduction, A Brief Introduction to Predicate Calculus, Predicate Calculus & Proving Theorems, An Overview of Logic Programming, The Origins of Prolog, the Basic Elements of Prolog, The Deficiencies of Prolog, applications of Logic Programming.

TEXTBOOKS :

1. ‘Concept of Programming Languages’, Robert W, Sebesta, Seventh Edition Pearson.

REFERENCE BOOKS :

1. Programming languages - Glezzi, 3/E, john wiley
2. Programming Languages Design and Implementation- Pratt and Zelkowitz, `4th edition, PHI/Person education.
3. Programming in PROLOG – clocksin, springer.

COMPILER DESIGN

SYLLABUS

Overview of Compilation, Scanners, Parsers. Context-Sensitive Analysis, Intermediate Representations. The Procedure Abstraction, Code shape. Introduction to Optimization, Data- Flow Analysis, Scalar Optimization. Instruction Selection, Instruction Scheduling , Register Allocation.

TEXTBOOK :

1. Keith Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers, 2004.

REFERENCE BOOKS :

1. Advanced Compiler Design Implementation by Steven S. Muchnick, Morgan Kaufmann, 1997.
2. Alfred Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", 2nd edition, Pearson Education, 2012.
3. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
4. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
5. C.D Brown, J Levine, T Mason, "LEX and YACC", O'Reilly Media, 1992.
6. Henk Alblas and Albert Nymeyer, "Practice and Principles of Complier Building with C", PHI, 2001.
7. Parag Himanshu Dave, Himanshu Bhalchandra Dave, "Compilers: Principles and Practice", 1st Edition, Pearson.

SOFTWARE TESTING AND QUALITY ASSURANCE

SYLLABUS

Basic Concepts and Preliminaries, Theory of Program Testing, Unit Testing, Control Flow Testing, Data Flow Testing, Domain Testing. System Integration Testing, System Test Categories, Functional Testing, Test Generation from Fsm Models. System Test Design, System Test Planning and Automation, System Test Execution, Acceptance Testing, Test Team Organization. Organizing for Quality Management, Commercial and Governmental Standards for Use in Software Quality Assurance, Personnel Requirements to Make Software Quality Assurance Work, Training for Quality Management, The Pareto Principle Applied to Software Quality Assurance, Inspection as an Up-Front Quality Technique, Software Audit Methods. Software Safety and Its Relation to Software Quality Assurance, CMMI PPQA Relationship to SQA, SQA for Small Projects, Development Quality Assurance, Quality Management in IT, Costs of Software Quality.

TEXTBOOKS :

1. Kshirasagar Naik, Priyadarshi Tripathy Software Testing and Quality Assurance Theory and Practice John Wiley & Sons, Inc., Publication
2. G. Gordon Schulmeyer Handbook of Software Quality Assurance Fourth Edition 2008 Artech House.

REFERENCE BOOKS :

1. Ilene Burnstein Practical Software Testing Springer 2003
2. William E. Lewis Software Testing and Continuous Quality Improvement Second Edition AUERBACH PUBLICATIONS
3. Jeff Tian Software Quality Engineering Testing, Quality Assurance, and Quantifiable Improvement JOHN WILEY.

OPERATING SYSTEM DESIGN

SYLLABUS

Introduction, The Operating System Interface , Implementing Processes ,Interposes Communication, Processes, Memory ,Virtual Memory , Virtual Memory ,IO Devices , IO Systems ,File Systems , File System Organization , Resource Management, Design Techniques for Two level implementation, Interface design, Models of communication, Static versus dynamic tradeoffs, Caching, Hinting, Indirection

TEXTBOOK :

1. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, TMH,1998 edition.

REFERENCE BOOKS :

1. Silberschatz & Galvin, “Operating System Concepts”, 8thedition, John Wiley & Sons Inc,
2. William Stallings, “Operating Systems – Internals and Design Principles”, 5/e, Pearson.
3. Andrew S. Tanenbaum, “Modern Operating Systems”,2nd Edition, Pearson Edu., 2004.
4. Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004.
5. Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004.

COMPUTER NETWORKS AND SECURITY

SYLLABUS

Computer Networks and the Internet , Application Layer,. Transport Layer, The Network Layer. The LinkLayer: Links, AccessNetworks, and LANs,

Congestion Control and Resource Allocation. Introduction to Network Security: Attacks, services, Security. A model of Inter network Security, Principles of Symmetric and public key cryptography, Steganography, One time PADS., E-Mail Security: PGP, SMIME, Intruders, Intrusion Prevention and Detection: Introduction, Prevention versus Detection, Types of Intrusion Detection systems, DoS Attack Prevention/Detection, Malware Defense.

TEXTBOOKS :

1. Kurose, J. and Ross, K. ,2012. Computer Networking: A Top-Down Approach (6th edition). Addison-Wesley.

REFERENCE BOOKS :

1. Peterson, L.L. and Davie, B.S. 2012. Computer Networks -- A Systems Approach. (5th edition), Morgan Kaufmann, Elsevier.
2. Comer, D.E. (2004). Computer Networks and Internets with Internet Applications. (4th edition). Prentice Hall.
3. Comer, D.E. 1995. Internetworking with TCP/IP vol. I. (3rd edition). Prentice Hall. ,5th edition, 2006.
4. anenbaum, Computer Networks, 4th Edition, (Pearson Education / PHI).

OBJECT ORIENTED ANALYSIS AND DESIGN SYLLABUS

INTRODUCTION

software engineering and failures, software engineering concepts, software engineering development activities, manging software development, ARENA case study. Project organization and communication: introduction, an overview of projects, project organization concepts, project communication concepts, organizational activities. Requirements Elicitation:introduction,overview , concepts,activities, managing requirements Elicitation, ARENA case study. analysis: introduction,overview, concepts, activities, managing analysis, ARENA case study. System design: decomposing the system-introduction, overview, concepts, activities, managing system design, ARENA case study. Object design: reusing pattern solutions- introduction, overview, reuse concepts, reuse activities, managing reuse, ARENA case study. Object design: specifying interfaces- introduction, overview, concepts, activities, managing object design, ARENA case study,Introducing to UML, Unified Process, Requirements : The Requiements overflow, use case moeling, advanced use case modeling Analysis: The analysis workflow, Objects and classes, finding analysis classes, Relationships, inheritance and polymorphism, Analysis packages, use case realization, Activity diagrams.Design: The design workflow, design classes, refining analysis relationships, interfaces and components, use case realization - design, state machines. Implementation: The implementation workflow,

deployment, mapping models to Code: introduction, overview, concepts, activities, managing implmentation, ARENA case study. Testing: introduction, overview, concepts, activities, managing testing. Rationale managements: introduction, overview, concepts, activities, managing rationale, configuration management: introduction, overview, concepts, activities, managing configuration management.

TEXTBOOKS :

1. Bernd Bruegge Allen H.Dutoit "Object Oriented Software Engineering using UML,patterns

and Java", Third Edition,Pearson Education

2. Jim Arlow,Ila Neustadt,"UML 2 and the Unified Process- Practical Object Oriented Analysis and Design",Pearson Education,Second Edition.

REFERENCE BOOKS :

1. G. Booch, Object Oriented Analysis and Design with Applications 2/e Pearson
2. C. Larman, Applying UML and patterns, Pearson
3. R. Fairly, Software Engineering, Mc Graw Hill Publishing Co.
4. G. Booch, J.Rumbaugh, J. Jacobson, The Unified Modeling Language – User Guide Addison– Wesley
5. C.Ghezzi,M. Jazayeri and D. Mandrioli, Fundaments of Software Engineering prentice Hall of India, Ltd.
6. R.S Pressman, Software Engineering: A Practitioner's Approach, 5/e, Mc Graw Hill International Edition

ENTERPRISE PROGRAMMING

SYLLABUS

Introduction to XHTML, Cascading Style Sheets (CSS), JavaScript: Introduction to Scripting, Control Statements Part 1, Control Statements Part 2, Functions, Arrays, Objects. Dynamic HTML: Object Model and Collections, Dynamic HTML: Event Model, XML, RSS, Web Servers (IIS and Apache). Java EE Essentials, J2EE Multi-Tier Architecture, Advanced JSP topics, Java Server Faces, Working with Databases, Advanced topics in JDBC. EJB Fundamentals and Session Beans, EJB Entity Beans, Message Driven Beans, EJB Relationships, EJB QL, and JDBC. Design Patterns and EJB. J2EE Design patterns and Frameworks: Pattern Catalog- Handle-Forward pattern, Translator pattern, Distributor pattern, Broadcaster pattern, Zero sum pattern, Status Flag Pattern, Sequencer pattern, Behavior Separation pattern, Consolidator pattern, Simplicity pattern, Stealth Pattern. Web Services and JAX-WS. Java Mail API, Java Interface Definition Language and CORBA, Java Remote Method Invocation, Java Messaging Service, Java Naming and Directory Interface API.

TEXTBOOKS :

1. Beginning Java EE 5 From Novice to Professional by Kevin Mukhar, James L. Weaver, Jim Crume, Chris Zelenak, publisher: Apress, 2005 Edition.
2. J2EE: The complete reference by James Keogh, publisher: McGraw-hill Osborne Media; 1 editon.

REFERENCE BOOKS :

1. An Introduction to Network Programming with Java by Jan Graba, Publisher: Springer, 2nd edition, 2006.
2. Beginning Java EE 6 platform with GlassFish 3 From Novice to Professional by Antonio Goncalves, 2009, Apress Publisher.

CRYPTOGRAPHY AND NETWORK SECURITY

SYLLABUS

BASIC CRYPTOGRAPHIC TECHNIQUES

Encryption — Symmetric Techniques: Substitution Ciphers, Transposition Ciphers, Classical Ciphers: Usefulness and Security, The Data Encryption Standard (DES), The Advanced Encryption Standard (AES), Confidentiality Modes of Operation, Key Channel Establishment for Symmetric Cryptosystems. Encryption — Asymmetric Techniques: Insecurity of “TextBooks : Encryption Algorithms”, The Diffie-Hellman Key Exchange Protocol, The Diffie-Hellman Problem and the Discrete Logarithm Problem, The RSA Cryptosystem (TextBooks : Version), Cryptanalysis Against Public-key Cryptosystems, The RSA Problem, The Integer Factorization Problem, Insecurity of the TextBooks : RSA Encryption, The Rabin Cryptosystem (TextBooks : Version), Insecurity of the TextBooks : Rabin Encryption, The ElGamal Cryptosystem (TextBooks : Version), Insecurity of the TextBooks : ElGamal Encryption, Need for Stronger Security Notions for Public-key Cryptosystems, Combination of Asymmetric and Symmetric Cryptography, Key Channel Establishment for Public-key Cryptosystems. Authentication Protocols — Principles:. Hash and Message Digests: MD5, SHA1, HMAC. Authentication Framework for Public-Key Cryptography:Directory-Based Authentication, Non-Directory Based Public-key Authentication Framework. Formal Approaches to Security Establishment-Formal and Strong Security Definitions for Public-Key Cryptosystems: Introduction, A Formal Treatment for Security, Semantic Security — the Debut of Provable Security, Inadequacy of Semantic Security, Beyond Semantic Security. Provably Secure and Efficient Public-Key Cryptosystems: Introduction, The Optimal Asymmetric Encryption Padding, The Cramer-Shoup Public-key Cryptosystem, An Overview of Provably Secure Hybrid Cryptosystems. Formal Methods for Authentication Protocols Analysis,Zero-Knowledge Protocols: Basic Definitions, Zero-knowledge Properties Proof or Argument, Protocols with Two-sided-error, Round Efficiency, Non-interactive Zero-knowledge. Network

Security Standards:

TEXTBOOKS :

1. Modern Cryptography Theory and Practice, Wenbo Mao, Pearson Education 2008
2. Network Security: Private Communication in a Public World, Charlie Kaufman, Radia Perlman Mike Speciner, Prentice Hall 2/E.(Hash and Message Digests, Unit V)

REFERENCE BOOKS :

1. Cryptography and Network Security, William Stallings, 4/E Publisher: Prentice Hall
2. Information Security Principles & Practice, Mark Stamp, WILEY INDIA 2006.
3. Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY 2006.
6. Network Security Essentials (Applications and Standards) by William Stallings, Pearson Education.

MOBILE COMPUTING

SYLLABUS

An Overview of Wireless Systems, Teletraffic Engineering, Radio Propagation and Propagation Path-Loss Models. An Overview of Digital Communication and Transmission, Fundamentals of Cellular Communications. Multiple Access Techniques, Architecture of a Wireless Wide-Area Network (WWAN), Speech Coding and Channel Coding. Modulation Schemes, Antennas, Diversity, and Link Analysis, Spread Spectrum (SS) and CDMA Systems. Mobility Management in Wireless Networks, Security in Wireless Systems, Security in Wireless Systems.

TEXTBOOK :

1. Vijay K. Garg WIRELESS COMMUNICATIONS AND NETWORKING Morgan Kaufmann Publishers 2007.

REFERENCE BOOKS :

1. Anurag Kumar, D. Manjunath and Joy Kuri WIRELESS NETWORKING Morgan Kaufmann Publishers

HIGH PERFORMANCE COMPUTING

SYLLABUS

Migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the cloud era, Enterprise cloud computing paradigm, Infrastructure as a Service (Iaas): Virtual Machines provisioning and migration services, management of virtual machines for cloud infrastructures, Enhancing Cloud Computing Environments Using a Cluster as a Service, Secure distributed data storage. PaaS & IaaS, Integration of Private and Public Clouds, Cometcloud, Workflow Engine, Scientific applications for Cloud Environments, The Map Reduce Programming Model and Implementations. Monitoring and Management: An Architecture for federated cloud computing, SLA management in cloud computing, performance prediction for HPC on Clouds, Applications in the AWS Cloud, Online game hosting on cloud resources, Content delivery networks, Organizational readiness and change management, Data Security and Legal Issues, Achieving Production Readiness for Cloud Services. Technologies and Applications, Key Enabling Technologies for Virtual Private Clouds, Role of Networks and Grid Computing Technologies, Data-Intensive Technologies, Storage and Fault Tolerance Strategies, Adaptive Agent Based Approach, Cloudweaver, Enterprise Knowledge Clouds, Integration of High-Performance Computing into Cloud Computing Services, Vertical Load Distribution for Cloud Computing, HPC on Competitive Cloud Resources, Scientific Data Management.

TEXTBOOKS :

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,"Cloud Computing Principles and Paradigms", Wiley (2011).
2. Furht B., Escalante A, "Handbook of cloud computing", Springer (2010).

REFERENCE BOOKS :

1. Syed A. Ahson, Mohammad Ilyas, "Cloud Computing and Software Services Theory and Techniques", CRC Press, 2010.
2. Jack J Dongarra, Kavi Hawng, Geoffrey C Fox, "Distributed and Cloud Computing", Elsevier, 2012.
3. Sitaram, Manjunath, "Moving to the Cloud", Elsevier, 2011.
4. Nick Antonopoulos, Lee Gillam, "Cloud Computing Principles Systems And Applications", Springer, 2012.
5. Tom White, "Hadoop: The Definitive Guide", O'Reilly.

NETWORK MANAGEMENT SYSTEMS

SYLLABUS

Data communications and Network Management Overview : Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

SNMPV1 NETWORK MANAGEMENT

Organization and Information and Information Models. Managed network : Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

SNMPv1 Network Management : Communication and Functional Models. The SNMP Communication Model, Functional model.

SNMP MANAGEMENT

SNMPv2 : Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility With SNMPv1.

SNMP MANAGEMENT

RMON : What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

Telecommunications Management Network : Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, mplementation Issues.

Network Management Tools and Systems:Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions.

WEB-BASED MANAGEMENT

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network: , Future Directions.

TEXTBOOK :

1. Network Management, Principles and Practice, Mani Subrahmanian, Pearson Education.

REFERENCE BOOK :

1. Network management, Morris, Pearson Education. 2. Principles of Network System Administration, Mark Burges, Wiley Dreamtech. 3. Distributed Network Management, Paul, John Wiley.

SERVICE ORIENTED ARCHITECTURE

SYLLABUS

Computing with Services-Basic Standards for Web Services, Programming Web Services, Enterprise Architectures, Principles of Service-Oriented Computing, Description- Modeling and Representation, Resource Description Framework, Web Ontology Language, Ontology Management, Engagement- Execution Models, Transaction Concepts, Coordination Frameworks for Web Services, Process Specifications, Formal Specification and Enactment. Collaboration-Agents, Multiagent Systems, Organizations, Communication, Solutions-Semantic Service Solutions, Social Service Selection, Economic Service Selection, Engineering- Building SOC Applications, Service Management, Security, Directions- Challenge and Extensions. On The Impact of AOSE In Service-Oriented Computing, Testing Object-Oriented Software. SOA — Architecture Fundamentals, Designing Service Interfaces, Designing Service Implementations, Composing Services , Using Services to Build Enterprise Solutions. Enterprise Service Bus: JDO, Data Services, Service Data Objects, Service Component Architecture, Message-Oriented Middleware, Enterprise Service Bus, Business Process Enterprise Language (BPEL). Service Inventory Design Patterns: Foundational Inventory Patterns, Logical Inventory Layer Patterns, Inventory Centralization Patterns, Inventory Implementation Patterns, Inventory Governance Patterns, And Service Design Patterns

TEXTBOOKS :

1. Munindar P. Singh, Michael N. Huhns, “Service-Oriented Computing: Semantics, Processes, Agents”, John Wieley, 2005.
2. Andrea De Lucia, Filomena Ferrucci, Genny Tortora, Maurizio Tucc, “Emerging Methods, Technologies and Process Management in Software Engineering”, Wiley, 2008.

REFERENCE BOOKS :

1. Nathan Griffiths, Kuo-Ming Chao, “Agent-Based Service-Oriented Computing”, Springer, 2010.
2. Michael Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer, “Applied SOA: Service-Oriented Architecture and Design Strategies”, Wiley, 2010.
3. Binildas A. Christudas, Malhar Barai, “Service Oriented Architecture with Java”, Packt publishing, 2008.
4. Thomas Erl, “SOA Design Patterns”, Pearson , 2009.
5. Douglas K. Barry, “Web Services, Service-Oriented Architectures, and Cloud Computing”, Elsevier, 2003.
6. James Bean, “SOA and Web Services Interface Design: Principles, Techniques, and Standards”, Elsevier, 2010.

VISUAL PROGRAMMING

SYLLABUS

The Internet and Visual C#, Dive Into Visual C# 2010 Express. Introduction to C# Applications, Introduction to Classes, Objects, Methods and strings, Control Statements. Methods: A Deeper Look, Arrays, Introduction to LINQ and the List Collection, Classes and Objects: A Deeper Look. Object-Oriented Programming: Inheritance, OOP: Polymorphism, Interfaces and Operator Overloading, Exception Handling: A Deeper Look. graphical User Interfaces with Windows Forms, Strings and Characters, Files and Streams, Databases and LINQ, Web App Development with ASP.NET.

TEXTBOOK :

1. Visual C# 2012 How to Program by Paul Deitel, Harvey Deitel, Prentice Hall; 5 edition.

REFERENCE BOOKS :

1. Starting Out With Visual Basic 2008 Update, 4th Edition, By Tony Gaddis, Kip R. Irvine, Published by Addison-Wesley Copyright © 2010.
2. Starting Out With Visual Basic 2010, 5th Edition, By Tony Gaddis, Kip R. Irvine, Published by Addison-Wesley, Copyright © 2011.

DIGITAL IMAGE PROCESSING

SYLLABUS

FUNDAMENTALS

Digital image Representation, Fundamental steps in Image processing, Elements of Digital Image processing systems. Elements of Visual perception, Sampling and Quantization, Basic relationships between pixels. Imaging geometry, basic transformations, perspective transformation. IMAGE TRANSFORMATION: Image transforms, Fourier transform, Discrete Fourier transform, properties of 2D Fourier transform, FFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar, Slant, Hotelling Transforms, KL transform – Wavelet Transform. IMAGE ENHANCEMENT AND RESTORATION TECHNIQUES: Image Enhancement, Spatial Domain and Frequency domain enhancement methods – Histogram processing, Color image processing, Image restoration, Degradation model, Diagonalisation of restoration, Inverse filtering, Wiener Filter, Constrained Least squares restoration, Interactive Restoration, Restoration in the spatial Domain, Geometric transformation. IMAGE COMPRESSION TECHNIQUES: Image Compression, Redundancy, fidelity Criteria, Image compression models, Elements of Information Theory – Lossless and Lossy image compression, Fractal and wavelet image compression, Image compression

standards, Data Compression, Huffman coding, Arithmetic coding, Dictionary Based Techniques, Static Dictionary, Adaptive Dictionary, Predictive coding, Differential coding, Transform coding, Subband coding. IMAGE ANALYSIS: Image segmentation, Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region- oriented segmentation, use of motion in segmentation, Image representation and description, representation schemes, Boundary descriptors, regional descriptors, Morphology

TEXTBOOKS :

1. Rafael C. Gonzalez, Richard E Woods, "Digital Image Processing", third edition, Pearson Education, New Delhi, 2007.

REFERENCE BOOKS :

1. Pratt, "Digital Image Processing", John Wiley & sons, New York, 2004.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall, New Delhi, 1988.

BIG DATA ANALYTICS

SYLLABUS

Big Data, Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Big Data Business Value, Data Warehouse, Re-Engineering the Data Warehouse, Workload Management in the Data Warehouse, New Technology Approaches. Integration of Big Data and Data Warehouse, Data Driven Architecture, Information Management and Lifecycle, Big Data Analytics, Visualization and Data Scientist, Implementing The "Big Data" Data. Choices in Setting up R for Business Analytics, R Interfaces, Manipulating Data, Exploring Data, Building Regression Models, Clustering and Data Segmentation, Forecasting and Time Series Models. Writing Hadoop Map Reduce Programs, Integrating R and Hadoop, Using Hadoop Streaming with R, Learning Data Analytics with R and Hadoop, Understanding Big Data Analysis with Machine Learning. Big Data, Web Data, A Cross-Section of Big Data Sources and the Value They Hold, Taming Big Data, The Evolution of Analytic Scalability, The Evolution of Analytic Processes, The Evolution of Analytic, Processes The Evolution of Analytic Tools and Methods. Legacy Data, Hypothesis Testing, Prediction, Software, Complexity, Business problems suited to big data analytics, High Performance Appliances for Big Data Management, Using Graph analytics, The New Information Management Paradigm, Big Data's Implication for Businesses, Big Data Implications for Information Management, Splunk's Basic Operations on Big Data.

TEXTBOOKS :

1. Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann.
2. A.Ohri, "R for Business Analytics", Springer, 2012.

REFERENCE BOOKS :

1. Big Data Analytics with R and Hadoop by Vignesh Prajapati
2. Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1st Edition, by J Berman, published by Morgan Kaufmann
3. "Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph" By David Loshin, Morgan Kaufmann
4. Big Data Imperatives: Enterprise 'big Data' Warehouse, 'BI' Implementations and Analytics by Soumendra Mohanty, Apress
5. Big Data Analytics Using Splunk By Peter Zadrozny , Raghu Kodali, Apress 2013
6. Franks, Bill, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley, 1st Edition, 2012.
7. Big Data Application Architecture Q&A: a Problem - Solution Approach Nitin Sawant, Himanshu Shah
8. Big Data Now: Current Perspectives from O'Reilly Radar By O'Reilly Radar Team

CSE

MACHINE LEARNING AND COMPUTING

FIRST YEAR (FIRST SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS5109	Optimization Techniques	3	0	0	3
2	18 CS5110	Applied Statistics	3	0	0	3
3	18 CS5111	Data Mining	3	0	2	4
4	18 CS5112	Matrix Computation	3	0	2	4
5		Elective – I	3	0	0	3
6		Elective – II	3	0	0	3
7	18 IE5149	Seminar	0	0	4	2
		Total	**18**	**0**	**8**	**22**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS5113	Evolutionary And Natural Computing	3	0	2	4
2	18 CS5114	Discrete Mathematics	3	0	0	3
3	18 CS5115	Pattern Recognition And Machine Learning	3	0	2	4
4	18 CS5116	Computer Modeling & Simulation	3	0	2	4
5		Elective –III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**0**	**10**	**23**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 CS51E1	Computer Vision And Image Processing	3	0	0	3
2	18 CS51E2	Service Oriented Architecture	3	0	0	3
3	18 CS51E3	Data Analysis	3	0	0	3
4	18 CS51E4	Cloud Computing	3	0	0	3
Elective-2						
1	18 CS51F1	Artificial Neural Networks	3	0	0	3
2	18 CS51F2	Application Development Frameworks	3	0	0	3
3	18 CS51F3	Big Data Analytics	3	0	0	3
4	18 CS51F4	Cloud Security	3	0	0	3
Elective-3						
1	18 CS52G1	Control Theory	3	0	0	3
2	18 CS52G2	Web Semantics	3	0	0	3
3	18 CS52G3	Map Reduce Design Patterns	3	0	0	3
4	18 CS52G4	Data Centre Virtualization	3	0	0	3
Elective-4						
1	18 CS52H1	Reinforcement Learning	3	0	0	3
2	18 CS52H2	Multi Agent Systems	3	0	0	3
3	18 CS52H3	Network Security	3	0	0	3
4	18 CS52H4	Cloud Application Architectures	3	0	0	3

OPTIMIZATION TECHNIQUES

SYLLABUS

OPTIMIZATION

Need For Unconstrained Methods In Solving Constrained Problems, Necessary Conditions Of Unconstrained Optimization, Structure Methods, Quadratic Models, Methods Of Line Search, Steepest Descent Method, Quasi-Newton Methods: Dfp, Bfgs, Conjugate-Direction Methods:, Methods For Sums Of Squares And Nonlinear Equations

Linear Programming: Simplex Methods, Duality Ii Lpp, Transportation Problem

Nonlinear Programming: Lagrange Multiplier, Kkt Conditions, Convex Programing

TEXTBOOK :

1. E. K. Chong And S. H. Zak, An Introduction To Optimization, 2nd Ed., Wiley India, 2001.

REFERENCE BOOKS :

1. D. G. Luenberger And Y. Ye, Linear And Nonlinear Programming, 3rd Ed., Springer India, 2008.
2. N. S. Kambo, Mathematical Programming Techniques, East-West Press, 1997.

APPLIED STATISTICS

SYLLABUS

Review of Probability Distribution And Statistical Inference, Design Of Experiments, Single Factor, Randomized Block, Lotin Square.

Regression, Linear, Multiple, Curvilinear, Nonparametric Texts, Sign, Signed Rank, Randomness And Other Parametric Tests.

Statistical Quality Control, Control For Charts For Measurements And For Attributes. Tolerance Limits, Acceptance Sampling. Reliability And Life Testing.

DATA MININIG

SYLLABUS

Introduction To Datamining Concepts; Linear Methods For Regression; Classification Methods: K-Nearest Neighbour Classifiers, Decision Tree, Logistic Regression, Naive Bayes, Gaussian Discriminant Analysis; Regularized Cost Function; Model Evaluation & Selection; Unsupervised Learning: Association Rules; Apriori Algorithm, Fp Tree, Cluster Analysis, Self Organizing Maps,

Google Page Ranking; Dimensionality Reduction Methods: Supervised Feature Selection, Pca; Ensemble Learning: Bagging, Boosting, Adaboost; Outlier Mining ; Imbalance Problem; Multi Class Classification; Introduction To Semi Supervised Learning, Transfer Learning, Active Learning, Data Warehousing.

REFERENCE BOOKS :

1. C.M. Bishop. Pattern Recognition And Machine Learningspringer, 2006.
2. Hastie, R. Tibshirani And J. Friedman. The Elements Of Statistical Learning: Data Mining, Inference, And Prediction. Springer, 2002
3. Han, J., Kamber, M., And Pei, J., Data Mining: Concepts And Techniques, 3rd Ed., Morgan Kaufmann (2012).
4. Tom Mitchell, Machine Learning. Mcgraw-Hill, 1997.

MATRIX COMPUTATION

SYLLABUS

Floating Point Computations, Ieee Floating Point Arithmetic, Analysis Of Roundoff Errors; Sensitivity Analysis And Condition Numbers; Linear Systems, Lu Decompositions, Gaussian Elimination With Partial Pivoting; Banded Systems, Positive Definite Systems, Cholesky Decomposition - Sensitivity Analysis; Gram-Schmidt Orthonormal Process, Householder Transformation, Givens Rotations; Qr Factorization, Stability Of Qr Factorization. Solution Of Linear Least Squares Problems, Normal Equations, Singular Value Decomposition(Svd), Polar Decomposition, Moore-Penrose Inverse; Rank Deficient Least-Squares Problems; Sensitivity Analysis Of Least-Squares Problems; Review Of Canonical Forms Of Matrices; Sensitivity Of Eigenvalues And Eigenvectors. Reduction To Hessenberg And Tridiagonal Forms; Power, Inverse Power And Rayleigh Quotient Iterations; Explicit And Implicit Qr Algorithms For Symmetric And Nonsymmetric Matrices; Reduction To Bidiagonal Form; Golub- Kahan Algorithm For Computing Svd.

TEXTBOOKS :

1. D. S. Watkins, Fundamentals Of Matrix Computations, 2nd Ed., John Wiley, 2002.
2. L. N. Trefethen And D. Bau, Numerical Linear Algebra, Siam, 1997.

REFERENCE BOOKS :

1. G. H. Golub And C. F. Van Loa ical Linear Algebra, Siam, 1997.

EVOLUTIONARY AND NATURAL COMPUTING

SYLLABUS

INTRODUCTION

To Natural Evolution, Genetic Algorithms, Classification Of Genetic Algorithm, Genetic Programming, Genetic Algorithm Optimization Problems, Evolutionary Programming, Ant Colony Optimisation, Swarm Intelligence, Artificial Immune Systems, Computational Embryology, Artificial Life.

TEXTBOOKS :

4. Programming: An Introduction, Academic Press/Morgan Kaufmann, 1998.

REFERENCE BOOKS :

1. An Introduction To Genetic Algorithms Melanie Mitchell. Mit Press. 1998.
2. Self-Organisation In Biological Systems, Camazine, Deneubourg, Franks, Sneyd, Theraulaz, Bonabeau, Princeton University Press, 2002.
3. Wolfgang Banzhaf, Peter Nordin, Robert E. Keller, And Frank D. Francone, Genetic

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DISCRETE MATHEMATICS

SYLLABUS

Basic Counting Principle: Pigeonhole Principle, Inclusion - Exclusion Principle, Recurrence Relations, Generating Functions. Fundamentals Of Logic, Set Theory, Language And Finite State Machines. Undirected And Direct Graphs, Modelling With Graphs, Trials And Cycles, Connectivity And Trees. Graph Algorithms: Bfs, Dfs, Shortest Path, Optimal Spanning Trees, Matching, Job Assignment Problem, Optimal Transportation Through Flows In Networks.

TEXTBOOKS :

1. C. L. Liu, Elements Of Discrete Mathematics, 2nd Ed., Tata Mcgraw-Hill, 2000.
2. R.P.Grivaldi And B.V.Ramana , Discrete And Combinatorial Mathematics, Pearson 2008

REFERENCE BOOKS :

1. R. L. Graham, D. E. Knuth, And O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
2. K. H. Rosen, Discrete Mathematics And Its Applications, 6th Ed., Tata Mc-graw-Hill, 2007.

PATTERN RECOGNITION AND MACHINE LEARNING

SYLLABUS

Kernel Methods: Introduction To Metric Space, Vector Space, Normed Space, Inner Product Space; Rkhs; Learning Theory; Svm For Classification & Regression; Implementation Techniques Of Svm; Kernel Ridge Regression; Kernel Density Estimation; Kernel Pca; Kernel Online Learning.

Spectral Clustering; Model Based Clustering, Expectation Maximization; Independent Component Analysis; Hidden Markhov Models; Factor Analysis; Introduction To Graphical Models & Sampling Methods.

TEXTBOOKS :

1. B. Scholkopf And A. J. Smola. Learning With Kernels. The Mit Press, 2002.
2. J. S. Taylor And N. Cristianini. Kernel Methods For Pattern Analysis. Cambridge University Press, 2004

REFERENCE BOOKS :

1. C.M. Bishop. Pattern Recognition And Machine Learningspringer, 2006.
2. Cristianini, N. And Shawe-Taylor, J., An Introduction To Support Vector Machines And Otherkernel-Based Methods, Cambridge Univ. Press (2000).

COMPUTER MODELLING AND SIMULATION

SYLLABUS

Meaning And Importance Of Simulation And Modelling, Classification Of Models, Variables And Problem Formulation, Performance Measures, Data Collection And Analysis , Simscript Language Concept: General Syntax, Discrete Event Modelling, Process And Resources, Timing And Pending List, Accumulate And Tally, Process Instance And Object Oriented Aspects, Sets And Data Structures, Probability Distribution, Random Number And Random Variant Generation. Input Modelling And Output Analysis. Generation Of Graphical Output, User Interface And Animation In Simscript, Development Of Simulation Models Of Real System Through Integration Of Programming And Statistical Concepts, Issues Related To Credibility Of Models.

TEXTBOOKS :

1. Simulation Modeling and Analysis by Law, Mcgraw - hill Publications

REFERENCE BOOKS :

1. Hastie, R. Tibshirani And J. Friedman. The Elements Of Statistical Learning: Data Mining, Inference, And Prediction. Springer, 2002.

ELECTIVES- GROUP 1

COMPUTER VISION AND IMAGE PROCESSING

SYLLABUS

IMAGE PROCESSING

Introduction To Image Processing, Fundamentals Of Imaging, Imaging Systems, Projection Geometry, Image File Formats, Colour Maps And Tables, Spatial Operations Including Point Processes, Frequency Domain Operations, Mathematical Morphology, Basic Algorithms, Applications.

COMPUTER VISION

Discrete Geometry And Quantization, Length Estimations, Automated Visual Inspection, Object Recognition And Matching, Depth Perception Problems, Stereo Geometry And Correspondence, Motion Analysis, Optical Flow, Applications Of Computer Vision, Remote Sensing, Biomedical Imaging, Document Processing, Target Tracking.

TEXTBOOKS :

1. Principles of Digital Images Processing by Wilhelm Burger , Mark J. Burge

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SERVICE ORIENTED ARCHITECTURE

SYLLABUS

INTRODUCING SOA

Fundamental Soa- Common Misperceptions About Soa- Common Tangible Benefits Of Soa- Common Pitfalls Of Adopting Soa. The Evolution Of Soa:-From Xml To Web Services To Soa, The Continuing Evolution Of Soa, The Roots Of Soa. Web Services And Primitive Soa: The Web Services Framework- Services, Service Descriptions, Messaging With Soap. Web Services And Contemporary Soa: Message Exchange Patterns- Service Activity-Coordination-Atomic Transactions- Business Activities-Orchestration-Choreography- Web Services And Contemporary Soa: Addressing- Reliable Messaging- Correlation- Policies-Metadata Exchange- Security- Notification And Eventing. Soa And Service-Orientation: Principles Of Service-Orientation-Service-Orientation. - Anatomy Of A Service-Oriented Architecture- Common Principle Of Service-Orientation-Service Layers –Service Orientation. Building Soa: Soa Delivery Strategies- Soa Delivery Lifecycle Phases. Service-Oriented Analysis: Introduction To Service-Oriented Analysis- Benefits Of A Business-Centric Soa-Deriving Business Services- Service-Oriented Analysis: Service Modeling, Service Modeling Guidelines- Classifying Service Model Logic- Contrasting Service Modeling Approaches.Service-Oriented Design Introduction To Service-Oriented Design-Wsdl-Related Xml Schema Language Basics- Wsdl Language Basics- Soap

Language Basics- Service Interface, Design Tools. Soa Composition Guidelines: Steps To Composing So Considerations For Choosing Service Layers And Soa Standards, Positioning Of Cores And Soa Extensions. Soa Service Design: -Overview-Service Design Of Business Service, Application Service, Task Centric Service And Guidelines. Soa Business Process Design: Ws-Bpel Language Basics-Ws Coordination

TEXTBOOK :

1. Thomas Erl ," Service-Oriented Architecture: Concepts, Technology & Design", Pearson Education Pte Ltd 2008.

REFERENCE BOOKS :

1. Thomas Erl,"Soa Principles Of Service Design"Pearson Exclusives 2007.
2. Tomas Erl And Grady Booch,"Soa Design Patterns"Printice Hall 2008.111
3. Michael Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer, "Applied Soa: Service- Oriented Architecture And Design Strategies", Wiley, 2010.
4. Douglas K. Barry, "Web Services, Service-Oriented Architectures, And Cloud Computing", Elsevier, 2003.
5. James Bean, "Soa And Web Services Interface Design: Principles, Techniques, And Standards", Elsevier, 2010

DATA ANALYSIS

SYLLABUS

MEANING OF MULTIVARIATE ANALYSIS, MEASUREMENTS SCALES:

Metric Measurement Scales And Non-Metric Measurement Scales, Classification Of Multivariate Techniques (Dependence Techniques And Inter-Dependence Techniques), Applications Of Multivariate Techniques In Different Disciplines. Factor Analysis: Meanings, Objectives And Assumptions, Designing A Factor Analysis, Deriving Factors And Assessing Overall Factors, Interpreting The Factors And Validation Of Factor Analysis. Cluster Analysis: Objectives And Assumptions, Research Design In Cluster Analysis, Deriving Clusters And Assessing Overall Fit (Hierarchical Methods, Non Hierarchical Methods And Combinations), Interpretation Of Clusters And Validation Of Profiling Of The Clusters. Basics Of Forecasting: Basic Steps In Forecasting Task. The Forecasting Scenario:

Averaging Methods, Exponential Smoothing Methods, Holt's Linear Method, Holt-Winters Trend And Seasonality Method. Box-Jenkins Methodology For Arima Models: Examining Correlation And Stationarity Of Time Series Data, Arima Models For Time Series Data (An Auto-Regressive Model Of Order One And A Moving Average Model Of Order One).

TEXTBOOKS :

1. Joseph F.Hair, William C.Black, Barry J.Babin, Rolph E.Anderson And Ronald L.Tatham ultivariate Data Analysis, 6th Edition, Pearson Education, Inc.,, 2006
2. Spyros Makridakis, Steven C.Wheelwright And Rob J. Hyndman. Forecasting Methods And Applications, Third Edition, John Wiley & Sons Inc., New York ,2005

REFERENCE BOOKS :

1. Bendat, J. S. And A. G. Piersol, 1986: Random Data: Analysis And Measurement Procedures. John Wiley & Sons, 566 Pp.
2. Daley, R., 1991: Atmospheric Data Analysis. Cambridge University Press, 457 Pp.
3. Emery, W. J. And R. E. Thomson, 2001: Data Analysis Methods In Physical Oceanography, 2nd Edition. Elsevier, 638 Pp.

CLOUD COMPUTING

SYLLABUS

Cloud Computing Basics-Overview, Applications, Intranets And The Cloud. Your Organization And Cloud Computing- Benefits, Limitations, Security Concerns. Hardware And Infrastructure- Clients, Security, Network, Services. Software As A Service (Saas)- Understanding The Multitenant Nature Of Saas Solutions, Understanding Soa. Platform As A Service (Paas)-It Evolution Leading To The Cloud, Benefits Of Paas Solutions, Disadvantages Of Paas Solutions. Infrastructure As A Service (Iaas)-Understanding Iaas, Improving Performance Through Load Balancing, System And Storage Redundancy, Utilizing Cloud-Based Nas Devices, Advantages, Server Types. Identity As A Service (Idaas)-Understanding Single Sign-On (Sso), Openid, Mobile Id Management. Cloud Storage-Overview, Cloud Storage Providers. Virtualization-Understanding Virtualization, History, Leveraging Blade Servers, Server Virtualization, Data Storage Virtualization. Securing The Cloud- General Security Advantages Of Cloud-Based Solutions, Introducing Business Continuity And Disaster Recovery. Disaster Recovery- Understanding The Threats. Service Oriented Architecture-Understanding Soa, Web Services Are Not Web Pages, Understanding Web Service Performance, Reuse And Interoperability. Developing Applications-Google, Microsoft, Cast Iron Cloud, Bungee Connect, Development. Migrating To The Cloud-Cloud Services For Individuals, Cloud Services Aimed At The Mid-Market, Enterprise-Class Cloud Offerings, And Migration. Designing Cloud Based Solutions-System Requirements, Design Is A Give-And-Take Process. Coding Cloud Based Applications-Creating A Simple Yahoo Pipe, Using Google

App Engine And Creating A Windows Azure Application. Application Scalability-Load-Balancing Process, Designing For Scalability, Capacity Planning Versus Scalability, Scalability And Diminishing Returns And Performance Tuning.

TEXTBOOKS :

1. Cloud Computing : A Practical Approach By Anthony T. Velte Toby J. Velte, Robert Elsenpeter, 2010 By The Mcgraw-Hill. 2. Cloud Computing: Saas, Paas, Iaas, Virtualization And More. By Dr. Kris Jamsa.

REFERENCE BOOKS :

1. Cloud Computing Bible By Barrie Sosinsky, Published By Wiley Publishing, 2011.
2. Cloud Computing For Dummies By Judith Hurwitz, Robin Bloor, Marcia Kaufman, And Dr. Fern Halper, Wiley Publishing, 2010.
3. Moving To The Cloud, Dinakar Sitaram, Elsevier, 2014.
4. Cloud Computing Theory And Practice Danc.Marinercus, Elsevier, 2013.

ELECTIVES- GROUP 2

ARTIFICIAL NEURAL NETWORKS

SYLLABUS

Foundations Of Biological Neural Networks And Artificial Neural Networks (Learning, Generalization, Memory, Abstraction, Applications), Mcculloch-Pitts Model, Historical Developments.Ann Architectures, Learning Strategy (Supervised, Unsupervised, Reinforcement), Applications: Function Approximation, Prediction, Optimization.

ASSOCIATIVE MEMORIES

Matrix Memories, Bidirectional Associative Memory, Hopfield Neural Network. Neural Architectures With Unsupervised Learning: Competitive Learning, Principal Component Analysis Networks (Pca), Kohonen's Self-Organizing Maps, Linear Vector Quantization, Adaptive Resonance Theory (Art) Networks, Independent Component Analysis Networks (Ica).

LOGIC

Prepositional Calculus And Predicate Calculus, Satisfiability And Validity, Notions Of Soundness And Completeness.

INTELLIGENT AGENTS

Concepts Of Agency And Intelligent Agents. Action Of Agents, Percepts To Actions. Structure Of Intelligent Agents, Agent Environments, Communicating, Perceiving, And Acting. Concepts Of Distributed Ai, Cooperation, And

Negotiation. Applications: Web-Based Agents, Database Applications. Agent Programming.

REFERENCE BOOKS :

1. Introduction to the math of neural Netwoks by Jeff Heaton
2. Artificial Neural Networks by B. Yegnanarayana.

APPLICATION DEVELOPMENT FRAMEWORKS

SYLLABUS

SPRING FRAMEWORK FUNDAMENTALS

Inversion Of Control And Containers, Using Spring To Configure An Application: Bean Configuration In Spring, Understanding The Bean Life-Cycle, Simplifying Application Configuration, Annotation-Based Dependency Injection. Effective Middle-Tier Architecture: Adding Behavior To An Application Using Aspects, Introducing Data Access With Spring, Simplifying Jdbc-Based Data Access, Driving Database Transactions In A Spring Environment. Implementing Enterprise Information Connectivity: Introducing Object-To-Relational Mapping (Orm), Getting Started With Hibernate In A Spring Environment, Effective Web Application Architecture, Getting Started With Spring Mvc. Integration With Enterprise Services: Securing Web Applications With Spring Security, Understanding Spring's Remoting Framework, Simplifying Message Applications With Spring Jms, Adding Manageability To An Application With Spring Jmx.

TEXTBOOK :

1. Rod Johnson [Et Al.] 2005, Professional Java Development With The Spring Framework, Wiley Pub. Indianapolis

REFERENCE BOOKS :

1. Mark Fisher 2011, Spring Integration In Action, 1st Ed., Manning Publications
2. Craig Walls, Ryan Breidenbach, Spring In Action, 2011.
3. Paul Fisher, Solomon Duskis, Spring Persistence With Hibernate, 2010.
4. Gary Mak, Spring Recipes: A Problem-Solution Approach, Apress Publication, 2008.

BIG DATA ANALYTICS

SYLLABUS

Big Data Processing Architectures, Big Data Technologies, Data Driven Architecture, Information Management And Lifecycle, Big Data Analytics, Visualization And Data Scientist, Implementing The "Big Data" Data. Writing Hadoop Map Reduce Programs, Integrating R And Hadoop, Learning Data Analytics With R And Hadoop, Understanding Big Data Analysis With Machine Learning, The Evolution Of Analytic Scalability, The Evolution Of Analytic Processes, Creating A Culture Of Innovation And Discovery, Think Bigger. Choices In Setting Up R For Business Analytics, R Interfaces, Manipulating Data, Exploring Data, Building Regression Models, Forecasting And Time Series Models.

TEXTBOOKS :

1. Data Warehousing In The Age Of Big Data By Krish Krishnan, Morgan Kaufmann,2013.
2. Ohri, "R For Business Analytics", Springer, 2012.
3. Big Data Analytics With R And Hadoop By Vignesh Prajapati,2013.

REFERENCE BOOKS :

1. Principles Of Big Data Preparing, Sharing, And Analyzing Complex Information, 1st Edition, By J Berman, Published By Morgan Kaufmann,2013
2. "Big Data Analytics - From Strategic Planning To Enterprise Integration With Tools,

Techniques, Nosql, And Graph" By David Loshin, Morgan Kaufmann,2013.

3. Franks, Bill, "Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley, 1st Edition, 2012.

CLOUD SECURITY

SYLLABUS

SECURITY CONCEPTS

Confidentiality, Privacy, Integrity, Authentication, Non-Repudiation, Availability, Access Control, Defence In Depth, Least Privilege, Importance Of Security In The Cloud, Importance In Paas, Iaas And Saas; Cryptographic Systems: Symmetric Cryptography, Stream Ciphers, Block Ciphers, Modes Of Operation, Public-Key Cryptography, Hashing, Digital Signatures, Public-Key Infrastructures, Key Management, X.509 Certificates, Openssl. Multi-Tenancy Issues: Isolation Of Users/Vms From Each Other. Virtualization System Security Issues: E.G. Esx And Esxi Security, Esx File System Security, Storage Considerations,

Backup And Recovery; Virtualization System Vulnerabilities: Management Console Vulnerabilities, Management Server Vulnerabilities, Administrative Vm Vulnerabilities, Guest Vm Vulnerabilities, Hypervisor Vulnerabilities, Hypervisor Escape Vulnerabilities, Configuration Issues, Malware (Botnets Etc). Virtualization System-Specific Attacks: Guest Hopping, Attacks On The Vm (Delete The Vm, Attack On The Control Of The Vm, Code Or File Injection Into The Virtualized File Structure), Vm Migration Attack, Hyperjacking. Technologies For Virtualization-Based Security Enhancement: Ibm Security Virtual Server Protection, Virtualization-Based Sandboxing; Storage Security: Hidps, Log Management, Data Loss Prevention. Location Of The Perimeter, Legal And Compliance Issues: Responsibility, Ownership Of Data, Right To Penetration Test. Local Laws, Examination Of Modern Security Standards (Eg Pcidss), Standards To Deal With Cloud Services And Virtualization, Compliance For The Cloud Provider Vs. Compliance For The Customer.

TEXTBOOK :

1. Tim Mather, Subrakumaraswamy, Shahedlatif, Cloud Security And Privacy: An Enterprise Perspective On Risks And Compliance, O'reillymedia Inc, 2009

REFERENCE BOOKS :

1. Ronald L. Krutz, Russell Dean Vines, Cloud Security,2010.
2. John Rittinghouse, James Ransome, Cloud Computing,2009.
   J.R. ("Vic") Winkler, Securing The Cloud,2011.

ELECTIVES- GROUP3

CONTROL THEORY

SYLLABUS

MATHEMATICS OF DYNAMIC PROCESSES

Existence And Uniqueness Theorems, Linearization, Fundamental System And Fundamental Matrix, Solution Of Linear Differential Equations.

CONTROLLABILITY

Characterization Of Controllability, Continuous Systems And Time Invariant System, Kalman Decomposition Theorem, Single Input Systems, Multiple Input Systems.

OBSERVABILITY

Continuous Systems, Duality, Multiple Input Systems.

STABILITY AND STABILIZABILITY

Stable Linear Systems, Lyapunov Stability, Bibo Stability, Stabilizability Theorems.

TEXTBOOKS :

1. William J. Terell, Stability And Stabilization: An Introduction, Princeton University Press, 2009.

SAME AS REFERENCE

REFERENCE BOOKS :

1. F.Szidarovszky And A.T.Bahill, Linear Systems Theory, 2nd Edition, Crc Press, 1997.
2. J.Zabczyk, Mathematical Control Theory: An Introduction, Birkhauser, Boston, 1992.
3. Eduardo D. Sontag, Mathematical Control Theory: Deterministic Finite Dimensional Systems, 2nd Edition, Springer.

WEB SEMANTICS

SYLLABUS

THE FUTURE OF THE INTERNET.

Concepts.- Ontology In Computer Science.- Knowledge Representation In Description Logic.- Rdf And Rdf Schema.- Owl.- Rule Languages.-Semantic Web Services.- Technologies.- Methods For Ontology Development.- Ontology Sources.- Semantic Web Software Tools.- Applications.- Software Agents.- Semantic Desktop.-Ontology Applications In Art.- Geospatial Semantic Web.

TEXTBOOK :

1. Breitman, Karin, Casanova, Marco Antonio, Truszkowski, Walt, “Semantic Web: Concepts, Technologies And Applications” Nasa Monographs In Systems And Software Engineering 2007, Xiv, 327 P.

REFERENCE BOOKS :

1. Vipul Kashyap, Christoph Bussler, Matthew Moran, “The Semantic Web: Semantics For Data And Services On The Web (Data-Centric Systems And Applications)”, Springer; 2008 Edition (August 15, 2008)
2. Grigoris Antoniou, Paul Groth, Frank Van Harmelen And Rinke Hoekstra, “A Semantic Web Primer, Third Edition”, Mit Press, 2012
3. Toby Segaran Colin Evans Jamie Taylor, “Programming The Semantic Web” O’reilly Media, Inc. Publisher, July 9, 2009

MAP REDUCE DESIGN PATTERNS

SYLLABUS

DESIGN PATTERNS AND MAPREDUCE

Design Patterns, Mapreduce History ,Mapreduce And Hadoop,Refresher, Hadoop Example: Word Count ,Pig And Hive. Summarization Patterns: Numerical Summarizations, Pattern Description,Numerical Summarization, Examples, Inverted Index Summarizations, Pattern Description, Inverted Index Example, Counting With Counters, Pattern Description, Counting With Counters Example. Filtering Patterns: Filtering,Pattern Description, Filtering Examples, Bloom Filtering, Pattern Description, Bloom Filtering Examples, Top Ten, Pattern Description, Top Ten Examples, Distinct , Pattern Description , Distinct Examples. Data Organization Patterns.: Structured To Hierarchical, Pattern Description , Structured To Hierarchical Examples, Partitioning, Pattern Description, Partitioning Examples, Binning, Pattern Description, Binning Examples , Total Order Sorting , Pattern Description , Total Order Sorting Examples, Shuffling, Pattern Description, Shuffle Examples, Join Patterns: A Refresher On Joins, Reduce Side Join , Pattern Description, Reduce Side Join Example, Reduce Side Join With Bloom Filter, Replicated Join , Pattern Description, Replicated Join Examples , Composite Join ,Pattern Description , Composite Join Examples ,Cartesian Product , Pattern Description, Cartesian Product Examples, Metapatterns Job Chaining, With The Driver, Job Chaining Examples, With Shell Scripting, With Jobcontrol, Chain Folding, The Chainmapper And Chainreducer Approach, Chain Folding Example , Job Merging, Job Merging Examples, Input And Output Patterns: Customizing Input And Output In Hadoop, Inputformat, Recordreader, Outputformat, Recordwriter , Generating Data, Pattern Description, Generating Data Examples, External Source Output, Pattern Description, External Source Output Example, External Source Input , Pattern Description, External Source Input Example , Partition Pruning , Pattern Description, Partition Pruning Examples , Final Thoughts And The Future Of Design Patterns: Trends In The Nature Of Data, Images, Audio, And Video, Streaming Data, The Effects Of Yarn, Patterns As A Library Or Component.

TEXTBOOK :

1. Donald Miner And Adam Shook, Mapreduce Design Patterns, O'reilly Media Inc, 2013

REFERENCE BOOKS :

1. Thomas Erl, Cloud Computing Design Patterns, Pearson Education, 2014
2. Christoph Fehling, Frank Leymann, Ralph Retter, Walter Schupeck, Peter Arbitter, Cloud Computing Patterns: Fundamentals To Design, Build, And Manage Cloud Applications, Springer, 2014
3. Bill Wilder, Cloud Architecture Patterns, Oreilly, 2012
4. Srinanth Perera, Thilina Gunarathne, Hadoop Mapreduce Cook TextBook :, Packt Publishning, 2013

DATA CENTRE VIRTUALIZATION

SYLLABUS

DATA CENTER CHALLENGES

Reducing Data Centre Footprint Through Server, Desktop, Network Virtualization And Cloud Computing, Environmental Impact And Power Requirements By Driving Server Consolidation; Evolution Of Data Centres: The Evolution Of Computing Infrastructures And Architectures From Stand Alone Servers To Rack Optimized Blade Servers And Unified Computing Systems (Ucs). Enterprise-Level Virtualization: Provision, Monitoring And Management Of A Virtual Datacenter And Multiple Enterprise-Level Virtual Servers And Virtual Machines Through Software Management Interfaces; Networking And Storage In Enterprise Virtualized Environments: Connectivity To Storage Area And Ip Networks From Within Virtualized Environments Using Industry Standard Protocols. Virtual Machines & Access Control: Virtual Machine Deployment, Modification, Management. Monitoring And Migration Methodologies. Resource Monitoring: Physical And Virtual Machine Memory, Cpu Management And Abstraction Techniques Using A Hypervisor. Virtual Machine Data Protection: Backup And Recovery Of Virtual Machines Using Data Recovery Techniques; Scalability: Scalability Features Within Enterprise Virtualized Environments Using Advanced Management Applications That Enable Clustering, Distributed Network Switches For Clustering, Network And Storage Expansion; High Availability : Virtualization High Availability And Redundancy Techniques.

TEXTBOOK :

1. Mickey Iqbal 2010, It Virtualization Best Practices: A Lean, Green Virtualized Data Center Approach, Mc Press

REFERENCE BOOKS :

1. Mike Laverick, Vmware Vsphere 4 Implementation,2010
2. Jason W. Mccarty, Scott Lowe, Matthew K. Johnson, Vmware Vsphere 4 Administration Instant Reference,2009. Brian Perry, Chris Huss, Jeantet Fields, Vcp Vmware Certified Professional On Vsphere 4 Study Guide,2010

ELECTIVES- GROUP 4

REINFORCEMENT LEARNING

SYLLABUS

The Reinforcement Learning Problem; Dynamic Programming; Monto-Carlo Methods; Temporal Difference Learning; Eligibility Traces; Function Approximation; Planning And Learning; Dimensions Of Reinforcement Learning

TEXTBOOK :

1. R. S. Sutton And A. G. Barto: “Reinforcement Learning: An Introduction”. Cambridge, Ma: Mit Press, 1998

MULTI AGENT SYSTEMS

SYLLABUS

INTELLIGENT AGENTS

Environments, Intelligent Agents, Agents And Objects, Agents And Expert Systems, Agents As Intentional Systems, Abstract Architectures For Intelligent Agents.

DEDUCTIVE REASONING AGENTS

Agents As Theorem Provers, Agent-Oriented Programming, Concurrent Metatem.

PRACTICAL REASONING AGENTS

Practical Reasoning Equals Deliberation Plus Means-Ends Reasoning, Means-Ends Reasoning, Implementing A Practical Reasoning Agent, The Procedural Reasoning System.

REACTIVE AND HYBRID AGENTS

Reactive Agents, Hybrid Agents.

UNDERSTANDING EACH OTHER

Ontology Fundamentals, Ontology Languages, Rdf, Constructing An Ontology, Software Tools For Ontologies

COMMUNICATION

Speech Acts, Agent Communication Languages.

WORKING TOGETHER

Cooperative Distributed Problem Solving, Task Sharing And Result Sharing, Result Sharing, Combining Task And Result Sharing, Handling Inconsistency, Coordination, Multiagent Planning And Synchronization

METHODOLOGIES

Appropriate Agent-Based Solution, Agent-Oriented Analysis And Design Techniques, Pitfalls Of Agent Development, Mobile Agents.

APPLICATIONS

Agents For Distributed Sensing, Agents For Information Retrieval And Management, Agents For Electronic Commerce, Agents For Human-Computer

Interfaces, Agents For Virtual Environments, Agents For Social Simulation.

TEXTBOOK :

1. Michael Wooldridge, “An Introduction To Multiagent Systems”, 2/E, John-Wiley & Sons, (2009).

REFERENCE BOOKS :

1. Adelinde M. Uhrmacher, Danny Weyns, Multi-Agent Systems: Simulation And Applications, Crc Press, (2009).
2. Shoham, Kevin Leyton-Brown, “Multiagent Systems - Algorithmic, Game-Theoretic, And Logical Foundations”, Cambridge University Press, (2009).
3. Stuart Russell, Peter Norvig, “Artificial Intelligence -A Modern Approach”, 2/E, Pearson, (2003).
4. Nils J Nilsson, “Artificial Intelligence: A New Synthesis”, Morgan Kaufmann Publications, (2000).

NETWORK SECURITY

SYLLABUS

INTRODUCTION TO NETWORK SECURITY

Attacks, Services, Security. A Model Of Inter Network Security, Steganography, One Time Pads. Basic And Esoteric Cryptographic Protocols:

Key Exchange, Authentication, Formal Analysis Of Authentication And Key Exchange Protocols, Multiple & Public Key Cryptography, Secret Splitting & Sharing Secure Elections, Secure Multiparty, Communication, Digital Cash. Crypto Graphic Algorithms (Block Cipher): Rc2, Gost, Cast, Blow Fish, Safeer, Rc5, Newdes, Crab, Theory Of Block Cipher Design. Key Management: Key Lengths, Generating Keys, Transferring, Verification, Updating, Storing, Backup, Compromised, Lifetime Of, Destroying Keys, Public Key Management. Digital Signature Algorithms: Digital Signature, Dsa, Dsa Variants, Gost, Discrete Lagorithm, One – Schnorr – Shamir Digital Signatures, Esign, Cellular Automata. Mails: Electronic Mail & Io Security Good Privacy, Simime, Ip Security Architecture, Authentication Header, Encapsulating Security, Pay Load Key Management Issues. Security: Web Security Web Security Requirements, Secure Sockets Layer And Transport Layer Security, Secure Electronic Transaction. Viruses And Threats: Intruders, Viruses, Worms And Firewalls Intruders, Viruses And Related Threats, Firewall Design Principles, Trusted Systems.

TEXTBOOK :

1. Eric Cole, Ronald L. Krutz, James Conley 2005, Network Security Bible, Wiley.

REFERENCE BOOKS :

1. Applied Cryptography, 7/E, Bruce Schneier John Wiley & Sons Inc,1996.
2. Cryptography And Network Security, William Stallings, Phi,2013.
3. Introduction To Cryptography With Coding Theory, 7/E, Wade Trappe, C. Washington, Pea,2005.

CLOUD APPLICATION ARCHITECTURES

SYLLABUS

CLOUD COMPUTING

The Cloud, Cloud Application Architectures, The Value Of Cloud Computing, Cloud Infrastructure Models, An Overview Of Amazon Web Services, Amazon Cloud Computing: Amazon S3,Amazon Ec2, Before The Move Into The Cloud: Know Your Software Licenses , The Shift To A Cloud Cost Model, Service Levels For Cloud Applications, Security, Disaster Recovery, Ready For The Cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management Security: Data Security, Network Security, Host Security, Compromise Response, Disaster Recovery: Disaster Recovery Planning, Disasters In The Cloud, Disaster Management, Scaling A Cloud Infrastructure: Capacity Planning, Cloud Scale

TEXTBOOK :

1. George Reese, Cloud Application Architectures, O'rielly Media Inc, 2009

REFERENCE BOOKS :

1. Gautamshroff, Enterprise Cloud Computing Technology Architecture Applications,2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach,2009.
3. Dimitris N. Chorafas, Cloud Computing Strategies,2009.


CSE
DIGITAL FORENSICS &
CYBER SECURITY

FIRST YEAR (FIRST SEMESTER)`

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS 5117	Introduction to Cyber Security & ICS	3	0	2	4
2	18 CS 5118	Digital Forensics	3	0	2	4
3	18 CS 5119	Advance Network Security & Investigations	3	0	2	4
4	18 CS 5120	Software Security	3	0	2	4
5		Elective – I	3	0	0	3
6		Elective – II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	**18**	**4**	**8**	**24**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 CS 5221	Cryptography for Cyber Defense	3	0	2	4
2	18 CS 5222	Malware Analysis & Reverse Engineering	3	0	2	4
3	18 CS 5223	Cyber Incident Response & Resilience	3	0	2	4
4	18 CS 5224	Cyber Law, Governance & Compliance	3	0	2	4
5		Elective –III	3	0	0	3
6		Elective – IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 CS 51I1	Mobile Device Threats & Investigation	3	0	0	3
2	18 CS 51I2	Fundamentals of E-Discovery	3	0	0	3
3	18CS 51I3	Fuzzy sets and Fuzzy Logic	3	0	0	3
Elective-2						
1	18 CS 51J1	Introduction to Big Data Analytics	3	0	0	3
2	18 CS 51J2	Social Media Forensics	3	0	0	3
3	18 CS 51J3	Critical Information Infrastructure Security	3	0	0	3
Elective-3						
1	18 CS 52K1	Infrastructure Attacks and Defense	3	0	0	3
2	18 CS 52K2	Software Vulnerability Analysis and Resilience	3	0	0	3
3	18 CS 52K3	Parallel & Cloud Computing	3	0	0	3
Elective-4						
1	18 CS 52L1	Applied Cryptography and Steganography	3	0	0	3
2	18 CS 52L2	Software Modeling	3	0	0	3
3	18 CS 52L3	Digital Image Processing	3	0	0	3

INTRODUCTION TO CYBER SECURITY & ICS

SYLLABUS

Introduction to Cyber Crime: Types of Cyber Crimes, Threat vectors, Cyberspace and Criminal profiling, Cyber security, Computer as a target, Introduction to Incident Response, Introduction to Digital Forensics, Recent threats to cyber domain, Internet, Destruction of Data, Privacy, Cyber Laws and Ethics.Cyber Security Threats Unauthorized Access, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses. Malware Fundamentals Types of malware, Malware analysis techniques, How malware can affect the system security, Malware analysis lab setup, Financial malwares, Code review, Behavioral analysis, online malware analysis. BCP, DR planning & AuditIntroduction to Risk Analysis, Risk Assessment, Risk Mitigation, Need for BCP, Overview of BCP Life Cycle, Identifying and Selecting Business Continuity Strategies, DR Strategies, Plans fo Business Resumption, BCM Program Management and System Audit.

TEXTBOOK :

1) Cyber Security & Cyber War – P.W.Singer and Allan Friedman
2) Principles of Cybercrime By Jonathan Clough

DIGITAL FORENSICS

SYLLABUS

DIGITAL FORENSICS AND INVESTIGATIONS

Locard's Principal as applicable to Digital Forensics, Digital Forensics & its terminology, Classification of Digital Forensics, Digital Forensics basic Practices, Computing Devices, Storage Media, Potential Digital Evidence, Artifacts, Search & seizure, Forensic acquisition of digital devices, Digital evidence handling, Chain of Custody, Legal Report Writing Computing Device Forensics

Hardware & software, Data Storage system, Hard Disk Geometry & Fundamentals, Disk Forensics, Types of OS, Data Recovery Tools, Open Source tools for investigation, Peripherals forensics, Tools and Techniques, *nix Forensics, Command line tools, Rootkits, RAM Forensics Mobile Phone Forensics Recent developments in mobile technology, Cell Phone Theory, Smart devices, Smart Operating Systems, Android, iOS, RIM OS, Windows, Mobile Phone Forensics, Logical v/s Physical extraction, Mobile phone forensics tools, SIM Forensics, Call Data Records, Smartphones Artifact analysis & Anti Forensics Operating Systems related Artifact analysis, Internet Artifacts, OS Artifacts, File System

Artifacts, Registry Artifacts, Application Artifacts, Log analysis, Windows Logs, UNIX Logs, Application Logs, Network Log Analysis, File System Analysis, Anti-Forensics of Windows & Linux, Tool Development, Tool Strategy, Smart phone Anti-forensics, Log Manipulation, Application Manipulation, Time Date based Anti-forensics concepts

TEXTBOOKS :

1) Digital Forensics and Cyber Crime: by Pavel Gladyshev, Andrew Marrington, Ibrahim Baggili
2) The Basics of Digital Forensics: The Primer for Getting Started in Digital ... By John Sammons

ADVANCE NETWORK SECURITY & INVESTIGATIONS

SYLLABUS

INTRODUCTION TO NETWORK SYSTEMS

Networking concepts, How network works, LAN, MAN, WAN, Network Topology, Protocols & Technologies governing Internet, OSI Model, TCP/IP, IP Calculation, List of well-known ports & services, Internet Relay Chat, Point to Point, Packet Switching, Network services and applications: DNS, FTP, BGP, HTTP, SMTP, P2P Network Network Connectivity Network transport architectures, TCP, UDP, ICMP, ARP, NETBIOS, Network Devices, Modem, DSL/ADSL, Router, Switch, Hub, Repeater, Ethernet, Wi-Fi, Windows Networking, Workgroups and Domains, NETBIOS, RPC, pstools, Unix Networking, SSH, Routing and forwarding, intra-domain and inter-domain routing algorithms, Link layers and local area networksNetwork Protocols & Email Forensics Network Basics & Concepts, Types of Network, How network works, Protocols & Technologies, TCP/IP, IP Calculation, DNS, BGP, FTP, HTTP, List of well-known ports & services, Internet Relay Chat, Point to Point, Packet Switching, Packet Capture, Sniffing, Instant Messaging and IRC, Network Forensics, Email Forensics, Email header analysis, tracing & tracking of emails, Cloud ForensicsNetwork Attacks Network Threat Vectors, MITM, OWAPS, ARP Spoofing, IP & MAC Spoofing, DNS Attacks, SYN Flooding attacks, UDP ping-pong and fraggle attacks, TCP port scanning and reflection attacks, DoS, DDOS. Network Penetration Testing Threat assessment, Penetration testing tools, Penetration testing, Vulnerability Analysis, Threat matrices, Firewall and IDS/IPS, Wireless networks, Wireless Fidelity (Wi-Fi), Wireless network security protocols, Nmap, Network fingerprinting, BackTrack, MetasploitNetwork Investigation Network Artifact analysis, Sqlite database file analysis for various browsers, Introduction to Social engineering, Port Scanning, Peer to Peer Networking, Torrent Forensics, LAN Security assessment, HTTPS, Secure socket layer, Network Surveillance, Intelligence Gathering

TEXTBOOKS :

1) Introduction to Network Security: Theory and Practice By Jie Wang, Zachary A. Kissel
2) The Practice of Network Security Monitoring: Understanding Incident ... By Richard Bejtlich
3) Penetration Testing: A Hands-On Introduction to Hacking By Georgia Weidman

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SOFTWARE SECURITY

SYLLABUS

WEB SECURITY

Evolution of Web applications, Web application security, Core Defense Mechanisms, Web Application Management, Web Architecture, Web Hacking, Internet Filtration, Pornographic evidence, Link Redirection Attacks, Web Messenger, Unblocking applications, OWASP, Code Injecting.Web Hacking Review of attack methods and tools, Penetration testing methodology, Port scanning, denial of service, attack on authentication system, and input validation attacks, Web application attacks, SQL injection, Cross-Site Scripting, Directory traversalProtocol based Attacks

TCP Syn Flooding, Frame busting, Web Anonymity, Cookie Reusing, SSL/TLS Attacks, Forceful browsing, Session Stealing, DNS Changer, APT Secure coding: Programming Fundamentals, Introduction to JAVA, .NET and PHP, Secure coding for SQL Injection, XSS, XSRF and Response splitting, Buffer overruns and format string problems.Web Investigation Web Hacking Investigations, Web site Crime Scene, web Logs, Investigation of hacking incident, database logs, web server intrusion investigations, Code bugs.

TEXTBOOKS :

1) Security Controls Evaluation, Testing, and Assessment Handbook - Leighton Johnson
2) Securing Systems: Applied Security Architecture and Threat Models - By Brook S. E. Schoenfield

CRYPTOGRAPHY FOR CYBER DEFENSE

SYLLABUS

Introduction to Cryptography, Encryption & Decryption, Cipher text, Review of number theory and algebra, Security definitions and secure padding schemes, computational complexity, probability and information theory, primarily testing. Cryptography and cryptanalysis, Best practices and standardized cryptographic algorithms, Key generation and management, symmetric key encryption, DES, Triple DES, AES, RC4, OpenSSL, HTTPS, modes of operation. Public key encryption, RSA cryptosystem, Diffie-Hellman, elliptic curve cryptography, Rabin, ElGamal, Goldwasser-Micali, Blum-Goldwasser cryptosystems, Security engineering principles, Smart cards and RFID Message authentication, Digital signatures and time stamping, Digital Certification, Security handshake pitfalls, Strong password protocols. Side-channel attacks and countermeasures, Applications of cryptographic algorithms, Bank cards and terminals, Electronic passports, RFID systems in public transportation and automobiles, Smart cards and mobile phone security, Financial cryptography, payment systems, crypto currencies, bitcoin

TEXTBOOKS :

1) Applied Cryptography for Cyber Security and Defense: Information Encryption and Cyphering: by Hamid R. Nemati and Li Yang

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MALWARE ANALYSIS & REVERSE ENGINEERING

SYLLABUS

INTRODUCTION TO MALWAREL

Malware Analysis Fundamentals & Approaches, Types of malware and their features, Malware distribution techniques, Web threats, Intrusion signatures, Honeypot technology, Project work. Malware taxonomy and characteristics, Understanding Malware Threats, Malware indicators, Malware examination Introduction to RE: Sandboxing Executable and Gathering Information from Runtime Analysis, The Portable Executable (PE32) File Format, Introduction to the IDA Pro Disassembler, Identifying Executable Metadata, Executable Packers and Compression, and Obfuscation Techniques, Memory Dumping, Kernel Rootkit, Kernel hook (function pointer) protection, File carving, Metadata Analysis

MALWARE ANALYSIS

Static Analysis, Code Review, Dynamic Analysis, Behavioral analysis of malicious executable, Sandbox Technologies, Reverse-engineering malware, Defeat anti-reverse engineering technique, automated analysis, intercepting

network connections, Network flow analysis, Malicious Code Analysis, Network analysis, Anti-disassembling techniques, Identifying assembly logic structures with a disassembler.Malware Handling: Malicious Documents and Memory Forensics - Reverse engineering of malicious executable using memory forensic techniques, Analyze malicious Microsoft Office (Word, Excel, PowerPoint) and Adobe PDF documents, Analyzing memory to assess malware characteristics and reconstruct infection artifacts. Using memory forensics to analyze rootkit infections, Legal & Ethical Issues - Reinforce understanding and the application of discipline specific legal and ethical issues, Reverse Engineering Malware (REM) Methodology

TEXTBOOKS :

1. Cameron H. Malin (Author), Eoghan Casey (Author), James M. Aquilina (Author), Linux Malware Incident Response: A Practitioner's Guide to Forensic Collection and Examination of Volatile Data: An Excerpt from Malware Forensic Field Guide for Linux Systems.
2. Malware Analyst's Cookbook: Tools and Techniques for Fighting Malicious Code, First Edition: Michael Ligh, Steven Adair, Blake Hartstein, and Matthew Richard. ISBN-10: 0470613033, ISBN-13: 978-0470613030. Wiley Publications
3. Malware: Fighting Malicious Code: Ed Skoudis and Lenny Zeltser. ISBN-10: 0131014056, ISBN-13: 978-0131014053. Prentice Hall Publications Practical Malware Analysis

CYBER INCIDENT RESPONSE & RESILIENCE

SYLLABUS

Introduction to Incident Response:Cyber Incident Statistics, Computer Security Incident, Information as Business Asset, Data Classification, Information Warfare, Key Concepts of Information Security, Vulnerability, Threat, and Attack, Types of Computer Security Incidents, Examples of Computer Security Incidents, Verizon Data Breach Investigations Report – 2008, Incidents That Required the Execution of Disaster Recovery Plans, Signs of an Incident, Incident Categories, Incident Categories: Low Level, Incident Categories: Middle Level, Incident Categories: High Level. Incident Response and Handling Process: Step 1: Identification, Step 2: Incident Recording, Step 3: Initial Response, Step 4: Communicating the Incident, Step 5: Containment, Step 6: Formulating a Response Strategy, Step 7: Incident Classification, Step 8: Incident Investigation, Step 9: Data Collection, Step 10: Forensic Analysis, Step 11: Evidence Protection, Step 12: Notify External Agencies, Step 13: Eradication, Step 14: Systems Recovery, Step 18: Incident Documentation, Step 16: Incident

Damage and Cost Assessment, Step 17: Review and Update the Response PoliciesIncident Response Team Development:Security Awareness and Training Checklist, Incident Management, Purpose of Incident Management, Incident Management Process, Incident Management Team, Incident Response Team, Incident Response Team Members, Incident Response Team Members Roles and Responsibilities, Developing Skills in, Incident Response Personnel, Incident Response Team Structure, Incident Response Team Dependencies, Incident Response Team Services

TEXTBOOKS :

1. CERT IN Guidelines.
2. Incident Response & Computer Forensics, Third Edition Paperback, Jason T. Luttgens, Matthew Pepe, Kevin Mandia
3. Computer Security Incident Handling Guide, NIST, http://csrc.nist.gov/publications/nistpubs/800-61rev2/SP800-61rev2.pdf

CYBER LAW, GOVERNANCE & COMPLIANCE

SYLLABUS

Computer ethics, Privacy & Legislation: Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, Code of ethics and professional conduct. Privacy, Computers and privacy issue, legislative background and better privacy protection. Intellectual property issues in cyberspace: Introduction to intellectual property, WIPO, Copyright, Trade Secrets, Trademarks, Patents, Design, protection of intellectual property, Protection options –Encryption, copyright on web-content, copyright on software. Ethical Decision Making: Types of ethical choices, Making defensible decisions. Cyber Forensics legal aspects: Cyber forensics, cyber crime examples, forensics casework, investigative incident response actions, computer forensics tools, Threats in cyberspaces. Compliances & Standards: IT Service Management Concept, IT Audit standards, ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster Recovery), RA (Risk Analysis/ Assessment).

TEXTBOOKS :

1. Deborah G Johnson, “Computer Ethics”
2. Earnest A. Kallman, J.P Grillo, “Ethical Decision making and IT: An Introduction with Cases”
3. Cyber Law - The Indian Perspective by Pawan Duggal
4. Michael E. Whitman, Herbert J. Mattord, “Principles of Information Security”, Cengage Learning Pub., 2012.

MOBILE DEVICE THREATS & INVESTIGATION

SYLLABUS

The evolution of mobile device and applications, common Mobile Application Functions, Mobile Application Security, Key problem factors, OWASP Mobile security practices. Mobile Hacking & Investigation, Android Process Dump, YAFFS, iOS Hacking, Tools for mobile device Anti forensics, Mobile device Security, Securing smart OS, Smart Phone Packet capturing, Firesheep, Mobile Device Management

TEXTBOOKS :

1) The Mobile Application Hacker's Handbook - Dominic Chell, Tyrone Erasmus
2) Mobile Forensic Reference Materials: A Methodology and Reification by U.s. Department of Commerce

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FUNDAMENTALS OF E-DISCOVERY

SYLLABUS

BASICS OF E-DISCOVERY

History and development of e-discovery, Overview of technology at issue in e-discovery matters, including distinction between data and metadata, General framework of e-Discovery, Legal aspects of e-Discovery, E-discovery industry, Electronic Discovery Reference Model Project, Developing "data maps" for enterprises, Technology tools for archiving and retrieving Electronically Stored Information.E-Discovery Data Collection: Data Preservation & Data Collection, Technology and data preservation - issues and means of preservation, Identifying the scope of data collection efforts - sources of data, Technical means of collecting ESI, including the use of forensic and non-forensic means and tools, Preservation of metadata and data during the collection process, International issues and privacy laws.Tools& ESI: Discovery Tools and E-Discovery Issues, Inspection of data collections, including inspection of computers and forensic imaging, Backup tape preservation and processing, Technological impediments to collection and data processing, The role of sampling in ESI production disputes, ESI Processing & Search, Reducing the volume of ESI through de-duplications, system file filtering, or other culling methodologies.E-Discovery investigation: Technical anatomy of e-mail messages and e-mail systems, Enterprise class e-mail vs. private e-mail systems such as G-Mail, Web 2.0 Technologies, HotMail, Yahoo!, etc. Collecting, processing, reviewing and producing e-mail messages, E-discovery of instant messaging, Discovery of online information assets like Facebook, web sites, wikis and other web 2.0 technologies, Investigatory opportunities using computer forensics (recovering

deleted files, retrieving internet activity, file fragment analysis, etc.)

TEXTBOOKS :

1. e-Discovery For Dummies by Linda Volonino, Ian Redpath, 2009.
2. Arkfeld on Electronic Discovery and Evidence, 3rd Ed. By Michael R. Arkfeld, Law Partner Publishing.
3. http://ediscoveryservicesinindia.blogspot.in/
4. Techno Security's Guide to E-Discovery and Digital Forensics: A Comprehensive Handbook by Jake Wiles, Syngress 1st edition, 2007.

FUZZY SETS AND FUZZY LOGIC

SYLLABUS

FUZZY SETS AND UNCERTAINTY

Uncertainty and information, fuzzy sets and membership functions, chance verses fuzziness, properties of fuzzy sets, fuzzy set operations.

FUZZY RELATIONS:

Cardinality, operations, properties, fuzzy cartesian product and composition, fuzzy tolerance and equivalence relations, forms of composition operation.

FUZZIFICATION AND DEFUZZIFICATION

Various forms of membership functions, fuzzification, defuzzification to crisp sets and scalars.

FUZZY LOGIC AND FUZZY SYSTEMS:

Classic and fuzzy logic, approximate reasoning, Natural language, linguistic hedges, fuzzy rule based systems, graphical technique of inference.

DEVELOPMENT OF MEMBERSHIP FUNCTIONS

Membership value assignments: intuition, inference, rank ordering, neural networks, genetic algorithms, inductive reasoning.

Fuzzy Arithmetic and Extension Principle:Functions of fuzzy sets, extension principle, fuzzy mapping, interval analysis, vertexmethod and DSW algorithm.

Fuzzy Optimization

One dimensional fuzzy optimization, fuzzy concept variables and casual relations, fuzzy cognitive maps, agent based models.

FuzzyControl Systems:Fuzzy control system design problem, fuzzy engineering process control, fuzzy statistical process control, industrial applications.

TEXTBOOKS :

1. Ross, T. J., “Fuzzy Logic with Engineering Applications”, Wiley India Pvt. Ltd., 3rdEd. 2011
2. Zimmerman, H. J., “Fuzzy Set theory and its application”, Springer India Pvt. Ltd., 4th Ed.2006
3. Klir, G. and Yuan, B., “Fuzzy Set and Fuzzy Logic: Theory and Applications”, Prentice Hall of India Pvt. Ltd. 2002
4. Klir, G. and Folger, T., “Fuzzy Sets, Uncertainty and Information, Prentice Hall of India Pvt. Ltd.

INTRODUCTION TO BIG DATA ANALYTICS

SYLLABUS

Introduction to Big Data and Database Evolution in Big Data:Introduction to Big Data, Relational Databases and SQL, Introduction to Hadoop, Pig, Hive, Casadenra, Mahout, Introduction to R, NoSQL databases and MongoDB, Comparison between SQL and NoSQL DBs, HDFS, Polyglot Persistence Data Analytics: What is data analytics?, Basics for Data Analytics, Data Analytics Lifecycle and methodology, Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Communicating results, Deployment, Data exploration & preprocessing, Measures and evaluation, Using R for Initial Analysis of the Data,Methods and Tools for Data Analytics: Methods and Tools for Data Analytics (Structured Data), Methods and Tools for Data Analytics (Unstructured Data), Text mining, Web mining

TEXTBOOKS :

1. Data-Intensive Text Processing with MapReduce, Jimmy Lin and Chris Dyer, Morgan & Claypool Publishers, 2010.
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Addison-Wesley April 2005.
3. Hadoop Beginner’s Guide, Garry Turkington, PACKT Publication, ISBN : 9789351101109
4. Mining of Massive Datasets, AnandRajaraman and Jeff Ullman, Cambridge Press.
5. Data Mining: Concepts and Techniques, Jiawei Han and MichelineKamber, The Morgan Kaufmann Series in Data Management Systems, Jim Gray, Series Editor Morgan Kaufmann Publishers, August 2000. ISBN 1-55860-489-8.
6. Hadoop in Action, Chuck Lam, December, 2010, ISBN: 978193518219

SOCIAL MEDIA FORENSICS

SYLLABUS

SOCIAL NETWORKING

Fundamentals of Social Networking, Social Networking viral, why social networking is popular, Psychology & Sociology for Online Media, Concepts of Geospatial Information System, How Facebook works? Social Media & Legal Implication:Graph Theory and Social Networks, Markets and Strategic Interactions in Networks, Information Networks and the World Wide Web, Network Dynamics: Population and Structural Models, Legal aspects of Privacy in India, Institutions and Aggregate Behavior, Social Media and its impact on Business, Politics, Law and Revolutions, Legal Responsibilities for Social Networking, Information Gathering from Resources: Intelligence gathering, People searching, OSINT, Deep Web, Defamatory content analysis, Multimedia forensics over Social Networking, Emerging Trends in Social Networks

Social Networking exploitation and hacking: Introduction: hacking on Twitter data Microformats: semantic markup and common sense collide, Twitter: friends, followers, and setwise operations, Twitter: the tweet, LinkedIn: clustering your professional network for fun (and profit?), Google buzz: TF-IDF, cosine similarity, and collocations, Facebook: the hackers outlook

TEXTBOOKS :

1. Open Source Intelligence Techniques: Resources for Searching and Analyzing Online Information, by Michael Bazzell, CreateSpace Independent Publishing Platform; 2 Edition, 2013.
2. Social Media Investigation for Law Enforcement, Joshua L. Brunty, Katherine Helenek, Larry S. Miller, Forensic Studies for Criminal Justice, Anderson; 1 edition, 2012.
3. http://inteltechniques.com/links.html

CRITICAL INFORMATION INFRASTRUCTURE SECURITY

SYLLABUS

BASICS OF SCADA

Define different types of SCADA control systems and various components, Describe control system protocols, Understand why controlling systems are at risk, Define IT security terminology, SCADA Security Policies SCADA cyber security: Introduction to SCADA cyber security, Define different security documents and techniques for writing policy statements, Understanding SCADA security policies, SCADA Physical and Logical Security, Understanding differences between physical and logical security, Define perimeter controls and

terms, Define various security zones, Understand communication cyber threats, Understand firewall, architectures

SCADA REMOTE ACCESS

Define different types of remote access, Explain security goals of remote access, Comparison of different security architectures and understanding remote access techniques, Lab of Implementing and Writing Security Policies, Identifying security policy mistakes, Writing security policies, Lab of Firewall and DMZ Architecture and Rules, Implement DMZ, Create firewall architecture, Create firewall rules, Lab of SCADA Protocols simulation Security Standards and Protocols: Define SCADA systems security documents and standards, Explanation of field protocols and their migration to IP, Explain security in field protocols, Lab for SCADA Monitoring Systems; Understanding SCADA protocols control field devices, Simulation of attacks and extracting monitored logs, Lab of SCADA Attacks, Setting up packet injection attack in VM environment, Capturing the attack using Wireshark, Lab of Creation of Custom Short Signature for SCADA Protocol

TEXTBOOKS :

1. An Architecture for SCADA Network Forensics, Tim Kilpatrick M.S., Jesus Gonzalez Ph.D., Rodrigo Chandia Ph.D., Mauricio Papa, SujeetShenoi, Springer 2006.
2. Handbook of SCADA/Control Systems Security, Robert Radvanovsky, Jacob Brodsky, CRC Press, 2013.

18 CS 52S1INFRASTRUCTURE ATTACKS AND DEFENSE

OPERATING SYSTEM INTERNALS

System Hacking, File Systems, Process Hacking, Sysinternals for manipulation detection, System Hacking Investigation, Virtual memory analysis, Hibernation concepts & Hibernation files, Inter Process Communication, System Security, Infrastructure Assessments. Mobile Operating System: Mobile Hacking & Investigation, Android Process Dump, YAFFS, iOS Hacking, Tools for mobile device Anti forensics, Mobile device Security, Securing smart OS, Smart Phone Packet capturing, Firesheep, Mobile Device Management. Introduction to Network Security and Wireless Attacks: Network Protocols, Network Attacks, Network Hacking, Network Hacking Investigation, Network security, Packet capturing, Deep Packet Injection, XSS Vulnerability, IPv4 & IPv6 Vulnerabilities, Session Hijacking, HTTP Authentication, Infrastructure Monitoring, Wireless Fundamentals, IEEE 802.11, Hardware, WEP Security, WEP Decryption Script, Analysis Wireless device Attacks, Virtual Private Network, Wireless Public Key Infrastructure, Wireless device Hacking Investigation, Wireless Security, Auditing

Tools, 3GPP, GSM Architecture. Introduction to Cloud: Different Cloud Services, IaaS, PaaS, SaaS, Sandboxing, Virtualization, Hypervisor, Cloud Attacks, Cloud Hacking and Investigation, Cloud Forensic, Virtualization host security.Misc: Web security and forensic overview, Web languages, Introduction to different web attacks, Overview of N-tier web applications, Web Servers(Apache, IIS), Database Servers, Securing databases, ODBC, Secure JDBC, Applet Security. Project work on Infrastructure Security Intrusion detection & Prevention, Server Security

TEXTBOOKS :

1. Don Murdoch, Blue Team Handbook: Incident Response Edition: A Condensed Field Guide for the Cyber Security Incident Responder: Version 2.0
2. Ben Clark, Rtfm: Red Team Field Manual
3. Metasploit - The Penetration Tester's Guide Paperback, by David Kennedy, Jim O'gorman, Devon Kearns, Mati Aharoni David Nathans, Designing and Building a Security Operations Center

18 CS 52S2 SOFTWARE VULNERABILITY ANALYSIS AND RESILIENCE

BASICS OF SOFTWARE ENGINEERING

Definitions, Characteristics of Software, Software Models, Unified Modelling Language, Different Testing Techniques. Cohesion and Coupling, Reverse Engineering, Re-engineering, Software Metrics.Introduction to Security & Authentication: Software Security,RISKS Digest, Security Goals, Prevention, Traceability and Auditing, Monitoring, Privacy and Confidentiality, Multilevel Security, Software Project Goals, Threat Modeling, CVSS, User authentication and session management, Cross Site Scripting, Cross Site Request Forgery, SQL Injection, Port Scanning, Penetration Testing.Application Security &Malicious Code: Different types of Application Attacks, Web Application Hacking, Database Attacks, Database Hacking and Investigation, Application Hacking and Investigation, Application Assessments, Software Risk Management Practices, Code Review (Tools), Bug Hunting in Code, Source Code Analysis, Reverse Engineering, IDA Pro, Disassembly, Secure Source Code development practices, Penetration Testing. Programming Security fundamentals: Buffer overflows, format string attacks, Web application security, Reference monitors, software-based fault isolation, Program verification, symbolic evaluation, secure information flow, Java security, Malware, DDoS, BOTNETS.Mobile Application Attacks: Android Hacking, IOS Hacking, Mobile Application Security, Mobile Application Hacking Investigation, Application Assessments, SMS architecture-Protocol Hierarchy, SMS PDU, SMS Fuzzing. Practical (As per Theory)

TEXTBOOKS :

1. John Viega& Gary McGraw: Building Secure Software: How to Avoid Security Problems the Right Way
(Addison-Wesley Professional Computing Series)
2. Gary McGraw: Software Security: Building Security In (Addison-Wesley Professional Computing Series)
3. Michael Howard, David LeBlanc, John Viega: 19 Deadly Sins of Software Security: Programming Flaws and How to Fix Them (Security One-off) (Addison-Wesley Professional Computing Series)
4. Jon Erickson: Hacking: The Art of Exploitation, 2nd Edition (No Starch Press, San Fransico)
5. Richard Sinn " Software Security , Theory Programming and Practice" Cengage Learning

18 CS 52S3 PARALLEL& CLOUD COMPUTING

PARALLEL COMPUTING

Concepts of parallelism, Advanced Processors and Interconnects, Scalable Multiprocessors and Multicomputer, Distributed CC-NUMA and cluster Scalability, Distributed Computing CPU, Memory, I/O, and System Virtualization. High Performance Computing: Introduction to High Performance, Cluster Computing, Meta-computing, Peer-to-Peer Computing, Internet Computing, Grid Computing – Types of grids - The Grid: Past, Present, Future - A New Infrastructure for 21st Century Science, Grid Application, Networking Protocols & I/O, Process Scheduling, Load Balancing, High Speed Network protocols, Forensic utility of High Performance Computing, Distributed Computer Forensics.Threats and Vulnerabilities: Code Vulnerabilities, Malware: Trojan Horse, Spyware, Worms/Viruses, Eavesdropping, Job Faults, Infrastructure Level Threats and Vulnerabilities, Network-Level Threats and Vulnerabilities, Grid Computing Threats and Vulnerabilities, Storage Threats and Vulnerabilities, Overview of Infrastructure Threats and Vulnerabilities, Transient Code Vulnerabilities.Basics of Cloud Computing: Cloud Computing, Fundamentals of Cloud Computing, SaaS, PaaS, IaaS, OS using in Cloud Computing, SOA - Web services- SaaS – Virtualization - Ajax and Mashup – Map Reduce Model - Cloud computing architectures. Case studies in cloud computing: the Amazon Elastic Compute Cloud and IBMs Blue Cloud – costing policies.Cloud Forensics: Cloud Security, Advanced study in forensics using cloud computing Forensics of Virtualization environment, Virtual environment use as a Forensic investigation, Cloud forensics, Data gathering from Cloud, Artifacts analysis, Multilevel Policy-Driven Solution Architecture

Tutorial (As per theory)

TEXTBOOKS :

1. K. Hwang and Z. Xu, Scalable Parallel Computing, McGraw-Hill, 1998, ISBN 0-07-031798-4.
2. Introduction to Parallel Computing By Shashi Kumar, PHI.
3. F. Berman, G. Fox, and T. Hey (Editors), Grid Computing, Wiley, 2003, ISBN: 0-470-85319-0
4. Handbook of Cloud Computing, BorkoFurht, Armando Escalante, Springer, 2010.
5. Abhijit Belapurakar, AnirbanChakrabarti and et al., "Distributed Systems Security: Issues. Processes and solutions", Wiley, Ltd., Publication, 2009.

18 CS 52T1APPLIED CRYPTOGRAPHYAND STEGANOGRAPHY

CRYPTOGRAPHIC FOUNDATION

Protocol Building Blocks, Basic Protocols, Intermediate Protocols, Advanced Protocols, Based Public-Key Cryptography, Oblivious Transfer, Oblivious Signatures, Esoteric Protocols, Key Length, Key Management, Electronic Codebook Mode, Block Replay, Cipher Block Chaining, Public Key Cryptography versus Symmetric Cryptography, Encrypting Communications Channels, Encrypting Data for Storage, Hardware Encryption versus Software Encryption, Compression, Encoding.Application of Cryptographic Concepts: Information Theory, Complexity Theory, Number Theory, Factoring, Prime Number Generation, Discrete Logarithms in a Finite Field, Data Encryption Standard (DES), Lucifer, Madryga, NewDES, GOST, 3 Way, Crab, RC5, Double Encryption, Triple Encryption, CDMF Key Shortening, Pseudo-Random-Sequence Generators and Stream Ciphers, Feedback with Carry Shift Registers, Stream Ciphers Using FCSRs, Nonlinear-Feedback Shift Registers, System, Hash - MD4 - MD5 - MD2 - Secure Hash Algorithm (SHA), One Way Hash Functions Using Symmetric Block Algorithms, Using Public-Key Algorithms, Message Authentication Codes. Cryptosystem: RSA, Pohlig-Hellman, McEliece, Elliptic Curve Cryptosystems, Digital Signature Algorithm (DSA), Gost Digital Signature Algorithm, Discrete Logarithm Signature Schemes, Ongchnorr-Shamir, Diffie-Hellman, Station-to-Station Protocol, Shamir's Three-Pass Protocol, IBM Secret-Key Management Protocol, Kerberos.Basic Steganography and Fundamentals of Steganalysis: Introduction, Information Hiding, Steganography and Watermarking, Steganography Techniques, Network Steganography, Steganography Tools, Cryptography V/S Steganography, Steganalysis techniques.Applied Steganography: Steganography communication, Notation and terminology, Information-theoretic foundations of steganography, Practical steganographic methods, Minimizing the embedding impact, importance of Steganalysis in Digital ForensicsProject/Practical work as per theory

TEXTBOOKS :

1. Bruce Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C” John Wiley & Sons,
2. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education
3. AtulKahate, “Cryptography and Network Security”, Tata McGrew Hill
4. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, “Digital Watermarking and Steganography”, Margan Kaufmann Publishers, New York
5. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, “Digital Watermarking”, Margan Kaufmann Publishers, New York
6. Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, “Techniques and Applications of Digital Watermarking and Contest Protection”, Artech House, London
7. JuergenSeits, “Digital Watermarking for Digital Media”, IDEA Group Publisher, New York
8. Peter Wayner, “Disappearing Cryptography – Information Hiding: Steganography & Watermarking

18 CS 52T2 SOFTWARE MODELING

Basics of Software Engineering: Definitions, Characteristics of Software, Software Engineering vs other engineering disciplines, Software Myths, Secure Software Life Cycle Models, Selection of Software Process models, Prototyping, Specification, Analysis modeling, Software design, Abstraction, Modularity, Software architecture. UML & Testing: Unified Modeling Language, Effective modular design, Cohesion and Coupling, Architectural design and procedural design, Data flow oriented design, Software testing, Path testing, Control structures testing, Black Box testing, Unit, Integration, Validation and system testing, Software Maintenance.Feasibility Analysis: Reverse Engineering and Re-engineering, wrappers, Case Study of CASE tools, Role of metrics in software development, Project metrics, Process metrics, Project initiation, Feasibility study, Planning, Estimation, Resource allocation, Root Cause Analysis, Scheduling, Tracking, Timeline chart. Java: Basic skills and concepts of computer programming in an object-oriented approach using Java, Classes, methods and argument passing, control structures, iteration, Basic graphical user interface programming, Problem solving, class discovery and stepwise refinement, Programming and documentation style.Python: Python Setup, Comments And Pound Characters, Numbers And Math, Variables And Names, Printing Strings, Text, Unpacking File, Handling Functions, Reading some Code, If, Else and If, Making Decisions Loops and Lists, Branches and

Functions, Designing and Debugging, Dictionaries Modules, Classes and Objects (OOP) Is-A, Has-A, Objects and Classes Inheritance and Composition, Sqlite integration.

TEXTBOOKS :

1. Roger S Pressman, “Software Engineering, A Practitioner’s Approach” Mc-Graw Hill Edition, New Delhi, 2008.
2. Watts Humphrey, “Managing the Software Process “, Pearson Education, New Delhi, 2000.
3. Pankaj Jalote, “Software Project Management in practice”, Pearson Education, New Delhi, 2002.
4. Sommerville I, “Software Engineering”, Pearson Education India, New Delhi, 2006.
5. Pfleeger, ”Software Engineering”, Pearson Education India, New Delhi, 1999.

18 CS 52T3DIGITAL IMAGE PROCESSING

INTRODUCTION AND FUNDAMENTALS

Motivation and Perspective, Applications, Components of Image Processing System, Elements of Visual Perception, A Simple Image Model, Sampling and Quantization, Image Enhancement in Frequency Domain, Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering.Image Enhancement in Spatial Domain: Introduction, Basic Gray Level Functions – Piecewise-Linear Transformation Functions, Contrast Stretching, Histogram Specification’ Histogram Equalization, Local Enhancement, Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian filter. Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening. Registration Introduction, Geometric Transformation – Plane to Plane transformation,

Mapping, Stereo Imaging–Algorithms to Establish Correspondence, Algorithms to Recover Depth. Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.

TEXTBOOKS :

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalez and Richard E. Woods. Published by: Pearson Education
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ

ECE

RADAR & COMMUNICATION

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5101	Modern Digital communication	3	1	2	5
2	18 EC 5102	Microwave Antennas	3	1	2	5
3	18 EC 5103	EMI / EMC Techniques	3	1	0	4
4	18 EC 5104	Radar Engineering	3	1	0	4
5		Elective –I	3	0	0	3
6		Elective –II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	**18**	**4**	**8**	**26**

FIRST YEAR (SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5205	Microwave and Millimetric wave Circuits	3	1	2	5
2	18 EC 5206	Antenna Measurements	3	1	2	5
3	18 EC 5207	Wireless Cellular Communication	3	1	0	4
4	18 EC 5208	Modern Radar Systems	3	1	0	4
5		Elective –III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**26**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 EC 51A1	Fundamentals of Electronic Warfare	3	0	0	3
2	18 EC 51A2	Microwave Semi Conductor Devices	3	0	0	3
3	18 EC 51A3	Smart Antennas	3	0	0	3
Elective-2						
1	18 EC 51B1	Phased Array Systems	3	0	0	3
2	18 EC 51B2	GPS & Global Navigation Satellite System	3	0	0	3
3	18 EC 51B3	Optical Communications	3	0	0	3
Elective-3						
1	18 EC 52C1	Estimation & Detection Theory	3	0	0	3
2	18 EC 52C2	Radar Signal Processing	3	0	0	3
3	18 EC 52C3	High Performance Communication Networking	3	0	0	3
Elective-4						
1	18 EC 52D1	RF & Microwave System Design	3	0	0	3
2	18 EC 52D2	VLSI Design	3	0	0	3
3	18 EC 52D3	Remote Sensing & Sensors	3	0	0	3

MODERN DIGITAL COMMUNICATION

SYLLABUS

MODERN DIGITAL MODULATION TECHNIQUES:

Introduction, Information Capacity, Bits, Bit Rate, Baud rate & M-ary Encoding, ASK, FSK, PSK QAM Bandwidth Efficiency Carrier Recovery, Clock Recovery, DPSK, Trellis Code Modulation, Probability of Error & Bit Error Rate, Error Performance.

BASEBAND DATA TRANSMISSION

Introduction – Baseband Binary PAM Systems – Baseband Pulse Shaping, Optimum Transmitting and Receiving Filters – Duobinary Baseband PAM System – Use of Controlled ISI in Duobinary Signaling Schemes, Transmitting and Receiving Filters for Optimum Performance – M-ary Signaling Schemes – Analysis and Design of M-ary Signaling Schemes, Binary Versus M-ary Signaling Schemes - Shaping of the Transmitted Signal Spectrum – Effect of Pre coding on the Spectrum, Pulse Shaping by Digital Methods - Equalization - Transversal Equalizer, Automatic Equalizers

BLOCK AND CONVOLUTIONAL CHANNEL CODES

Linear Block Codes - The Generator Matrix and Parity Check Matrix, Cyclic Codes, Bounds on Minimum Distance of Linear Block Codes, Non Binary Block Codes – Convolutional Codes – Transfer Function of a Convolutional Code, Optimum Decoding of Convolutional Code –Distance Properties of Binary Convolutional Codes

SPREAD SPECTRUM SIGNALS FOR DIGITAL COMMUNICATION

Model of Spread Spectrum Digital Communication System – Direct Sequence Spread Spectrum Signals – Error Rate Performance of the DeCoder, Some Applications of DS Spread Spectrum Signals, Generation of PN Sequences – Frequency Hopped Spread Spectrum Signals – Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum

SIGNALS EMERGING DIGITAL COMMUNICATION TECHNOLOGIES

The North American Hierarchy, Digital Services, Broad band Digital Communication: SONET, Digital Switching Technologies, Broadband Services for Entertainment and Home office Applications, Video Compression, High Definition Television(HDTV)

TEXTBOOKS :

1. Advanced Electronic Communications Systems, by Wayne Tomasi, 6 Edition Pearson Education.
2. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and sons (Asia) Pvt Ltd.

REFERENCE BOOKS :

1. Simon Haykin, Digital communications, John Wiley and sons, 1998
2. Wayne Tomasi, Advanced electronic communication systems, 4th Edition

Pearson Education Asia, 1998
3. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press

MICROWAVE ANTENNAS

SYLLABUS

INTRODUCTION TO ANTENNA THEORY

Antenna Radiation concept, Types of Antennas, Antenna parameters, Friis Transmission equation.

Aperture Antenna: Introduction, Pyramidal Horns- Design Procedure, Conical and Corrugated Horns, Aperture Corrugated Horns, Reflected Antennas-Parameters, Analysis of front-fed parabolic reflector, Feed methods and feed types, Cassegrain Reflector Horns.

MICROSTRIP RADIATORS

Introduction, Rectangular Microstrip Antenna analysis and Design, Circular Microstrip Antenna Analysis and Design.

PENCIL-BEAM AND FANNED-BEAM ANTENNAS

Pencil-beam Requirements and Techniques, Geometrical Parameters, The Surface-current and Aperture-field distributions, The Radiation Field of the Reflector, The Antenna Gain, Primary Pattern Designs for maximizing gain, Impedance Characteristics, The Vertex-plate matching Technique, Rotation of Polarization Technique, Structural Design Problems. Simple Fanned-Beam Antennas: Applications of Fanned Beams and methods of Production, Symmetrically Cut Paraboloids, Feed Offset and Contour Cutting of Reflectors, The Parabolic Cylinder and Line Source, Parallel-plate Systems, Pillbox Design Problems.

SHAPED-BEAM ANTENNAS

Shaped-beam Applications and Requirements, Effect of a Directional Target Response Survey of Beam-shaping Techniques, Design of Extended Feeds, Cylindrical Reflector Antennas, Reflector Design on the Basis of Ray Theory, Radiation Pattern Analysis, Double Curvature Reflector Antennas, Variable Beam Shape.

TEXTBOOKS :

1. Constantine A. Balanis – “Antenna Theory-Analysis and Design”, 3rd Edition, John Wiley, 2005.
2. Samuel Silver, “Microwave Antenna - Theory and design”, IEE Press, 1984.

REFERENCE BOOKS :

1. Ramesh Garg, Prakash Bhatia, “Microstrip Antenna Design - Hand Text-Book :” Architect House Inc. 2001.
2. Bahl IJ, and Bhartia N, “Microstrip Antennas”, Artech House, 1982.
3. James.J R. Hall, P S. Wood.C., “Micro strip Antenna-Theory and Design”, PeterPeregrinu, 1981.

EMI / EMC TECHNIQUES

SYLLABUS

INTRODUCTION, NATURAL AND NUCLEAR SOURCES OF EMI / EMC

Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

EMI FROM APPARATUS, CIRCUITS AND OPEN AREA TEST SITES

Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive inter-modulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

RADIATED AND CONDUCTED INTERFERENCE MEASUREMENTS AND ESD

Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

GROUNDING, SHIELDING, BONDING AND EMI FILTERS

Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

CABLES, CONNECTORS, COMPONENTS AND EMC STANDARDS

EMI suppression cables, EMC connectors, EMC gaskets, Isolation Transformers, optoisolators, National / International EMC standards.

TEXTBOOKS:

1. Dr. V.P. Kodali, “Engineering Electromagnetic Compatibility”, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules1 – 9.

REFERENCE BOOKS :

1. C.R. Pal, “Introduction to Electromagnetic Compatibility”, A John Wiley & Sons, Inc. Publication, 1992.
2. Terence Rybak, Mark Steffka, “Automotive Electromagnetic Compatibility (EMC)”, Kluwer Academic Publisher, London.

RADAR ENGINEERING

SYLLABUS

The Radar and its Ground Environment: Primary and Secondary Radar, Coordinate systems and range, Main monostatic radar components, Basic quantities, maximum range, Secondary radar, Bistatic radar, Performance.

Transmitters: Transmitter power, Power output stage, Spectrum and side bands, Pulse compression, Harmonics from the Transmitter.

Factors outside the Radar, propagation, scattering and clutter: Amplitude and phase of the echo, Effects of the atmosphere, Scattering without fading, overview of scattering models, second-time-around effect, scenario to simulate a typical radar environment.

RECEIVER

Dynamic range, the control of gain, and sensitivity time control, radio frequency section, Intermediate frequency amplifier and filter, limiters, receiver characteristics.

DETERMINATION OF POSITION

Fire control radars, sector scan radars, fast scanning radars, surveillance radars, accuracy.

TEXTBOOK :

1. Hamish Meikle, “Modern Radar Systems”, Second Edition, Artech House Radar Library.

FUNDAMENTALS OF ELECTRONIC WARFARE

SYLLABUS

TARGETS OF ELECTRONIC WARFARE OPERATIONS

A General Description of Targets of Electronic Warfare Operations, Mathematical Models of Electronic Systems as Targets of Electronic Warfare, Mathematical Models of Automated Systems for the Control of AAD Forces as Targets of EW, Mathematical Models of Automated Systems for the Control of AAD Weapons as Targets of Electronic Warfare Mathematical Models of Signals, Systems and Techniques for Electronic Jamming: A General Description of the Basic Elements of Electronic Jamming, Mathematical Models of Jamming Signals, Mathematical Models of Systems and Techniques for Jamming.

Electronic Warfare Effectiveness Criteria: General Characteristics of the Criteria, Information Indicators of the Effectiveness of Jamming Signals, Systems and Techniques of Electronic Attack, Energy Effectiveness Criteria of Jamming Signals and Techniques of Electronic Jamming, Operational and Tactical Indicators of EW Effectiveness

Active Jamming of Radar -The Jamming Equation: Fundamental Concepts, The Jamming Equation for Monostatic Radar Using Active Jamming, Reduction of the Jamming Equation to Canonical Form -Methods of Determining Information Damage, Specifics of the Jamming Equation Using Active Jamming against Various Types of Radar, Particulars of Jamming Radar Using Screening Jamming with Limited Information Quality Indicators -Use of the Jamming Equation for Analysis of the Electronic Environment

TARGETS AND DECOYS: TYPES OF FALSE RADAR

Targets, Decoys and Disposable EW Devices, Parameters Simulated by False Radar Targets and Radar Decoys, Thermal Decoys, The Use of Towed and Launched Decoys, Selecting Decoy Launch Time.

TEXTBOOK :

1. Sergei A. Vakin,Lev N. Shustov, Robert H. Dunwell, “Fundamentals of Electronic Warfare, Artech House

MICROWAVE SEMICONDUCTOR DEVICES

SYLLABUS

INTRODUCTION

Transient and ac behavior of p-n junctions, effect of doping profile on the capacitance of p-n junctions, noise in p-n junctions, high-frequency equivalent circuit, varactor diode; Schottky effect, Schottky barrier diode; Heterojunctions.

TUNNEL AND AVALANCHE TRANSIT TIME DIODES

Tunneling process in p-n junction and MIS tunnel diodes, V-I characteristics and device performance, backward diode. Impact ionization, IMPATT diode, small-signal analysis of IMPATT diodes.

GUNN DIODE:

Two-valley model of compound semiconductors, vd-E characteristics, Gunn effect, modes of operation, power frequency limit.

PIN DIODES

Construction and operation of microwave PIN diodes, equivalent circuit, PIN diode switches and modulators.

MICROWAVE TRANSISTOR

High frequency limitations of BJT, microwave bipolar transistors, Operating characteristics of MISFETs and MESFETs, short-channel effects, high electron mobility transistor.

TEXTBOOKS :

1. Liao, S.Y., “Microwave Devices and Circuits”, 4th Ed., Pearson Education 2002.
2. Rebeiz, M.G., “R.F. MEMS: Theory, Design and Technology”, 2nd Ed.,Wiley-Interscience 2003.

REFERENCE BOOKS :

1. Sze, S.M., and Ng, K.K., “Physics of Semiconductor Devices”, 3rd Ed.,Wiley-Interscience 2006.
2. Glover, I.A., Pennoek, S.R. and Shepherd P.R., “Microwave Devices, Circuits and Sub-Systems”, 4th Ed., John Wiley & Sons 2005.
3. Golio, M., “RF and Microwave Semiconductor Devices Handbook”, CRC Press 2002.

SMART ANTENNAS

SYLLABUS

SMART ANTENNAS

Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

DOA ESTIMATION FUNDAMENTALS

Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Auto-covariance, Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates .

BEAM FORMING FUNDAMENTALS

Classical Beam former, Statistically Optimum Beam forming Weight Vectors, Maximum SNR Beam former, Multiple Side-lobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming

INTEGRATION AND SIMULATION OF SMART ANTENNAS

Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading, Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Ad Hoc Networks (MANETs), Protocol, Simulations, Discussion.

SPACE–TIME PROCESSING

Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beam forming, Inter-symbol and Co-Channel Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Discussion.

TEXTBOOKS :

1. Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007
2. Joseph C. Liberti Jr., Theodore S Rappaport - "Smart Antennas for Wireless Communications IS-95 and Third Generation CDMA Applications", PTR – PH publishers, 1st Edition, 1989.

REFERENCE BOOKS :

1. T.S Rappaport - "Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location", IEEE press 1998, PTR – PH publishers 1999.
2. Lal Chand Godara, "Smart Antennas", CRC Press, LLC-2004.

PHASED ARRAY SYSTEMS

SYLLABUS

CONVENTIONAL SCANNING TECHNIQUES

Mechanical versus electronic scanning, Techniques of Electronic scanning, Frequency, Phase and time delay scanning principle, Hybrid scanning techniques.

ARRAY THEORY

Linear and Planner arrays, various grid configuration, Concept of cell and grid, Calculation of minimum number of elements, Radiation pattern, Grating lobe formation, Rectangular and triangular grid design of arrays.

FEED NETWORKS FOR PHASED ARRAYS

Corporate Feed, Lens and Reflect feed Techniques, Optimum f/d ratio basic building block for corporate feed network, Series, Parallel feed networks, Comparison of various feeding techniques, Antenna Array Architecture, Brick/ Tile Type construction.

FREQUENCY SCANNED ARRAY DESIGN

Snake feed, Frequency-phase scanning, Phase scanning, Digital phase shifter PIN diode and Ferrite phase shifters for phased arrays, Beam pointing errors due to digitalization, Beam pointing accuracy.

SEARCH PATTERNS

Calculation of search frame time, airborne phased array design, Electronic scanning radar parameter calculation, Application of phased arrays, Phased Array Radar Systems, Active Phased Array, TR/ATR Modules.

TEXTBOOKS :

1. Olliner, A.A, and G.H. Knittel, “Phased Array Antennas”, Artech House, 1972.
2. Kahrilas. PJ, “Electronic Scanning Radar Systems Design Handbook”, Artech House, 1976.

REFERENCE BOOKS :

1. Skolnik. MI, “Radar Handbook”, Mcgraw Hillso, NY,McGrow Hills-2007.
2. Galati,G-(editor), “Advanced Radar Technique and Systems”, Peter Peregrims Ltd, London,1993.

GPS & GLOBAL NAVIGATION SATELLITE SYSTEM

SYLLABUS

GPS SIGNALS

GPS and UTC Time, Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 datum, Important components of receiver and specifications.

GPS ERROR MODELS

Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna phase center variation, multipath, estimation of Total Electron Content(TEC) using Dual Frequency measurement, Various DOP's, UERE.

GPS DATA PROCESSING AND POSITION FIXING

RINEX navigation and observation formats, Code and Carrier phase observables, Linear combinations and derived observables, Ambiguity resolutions, Cycle slips, Position estimation.

GNSS FUNDAMENTALS

Trilateration, Hyperbolic navigation, Transit, GNSS principle of operation, Architecture, Operating frequencies, orbits, Keplerian elements. Other satellite Navigation Systems: Galileo, GLONASS, IRNSS, Space, control and ground segments and Signal characteristics.

TEXTBOOKS :

1. Global Navigation Satellite Systems – G. S. Rao, McGraw-Hill publications, New Delhi, 2010.
2. GPS Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, Springer Wien, New York, 2000.

REFERENCE BOOKS :

1. Introduction to GPS - Ahmed El -Rabbany, Artech House, Boston, 2002.
2. Global Positioning System Signals, Measurements, and Performance - Pratap Misra and Per Enge, Ganga-Jamuna Press, Massachusetts, 2001.

OPTICAL COMMUNICATIONS

SYLLABUS

SIGNAL PROPAGATION IN OPTICAL FIBERS

Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solutions.

Fiber Optic Components for Communication & Networking: Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.

MODULATION AND DEMODULATION

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

Transmission System Engineering: System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.

FIBER NON-LINEARITIES AND SYSTEM DESIGN CONSIDERATIONS

Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

TEXTBOOKS :

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers, Elsevier.
2. Gerd Keiser, “Optical Fiber Communications”, 3rd Ed., 2000, McGraw Hill.

REFERENCE BOOKS :

1. John.M.Senior, “Optical Fiber Communications: Principles and Practice” 2nd Ed., PE, 2000.
2. Harold Kolimbris, “Fiber Optics Communication”, 2nd Ed., PEI, 2004.
3. Uyless Black, “Optical Networks: Third Generation Transport Systems”, 2nd Ed., PEI, 2009.
4. Govind Agarwal, “Optical Fiber Communications”, 2nd Ed., TMH, 2004.
5. S.C.Gupta, “Optical Fiber Communications and Its Applications”, PHI, 2004.

MICROWAVE AND MILLIMETRIC WAVE CIRCUITS

SYLLABUS

ANALYSIS OF MICROWAVE CIRCUITS

Introduction, Microwave Components – E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.

TRANSFORMERS & RESONATORS

Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.

FILTERS AND PERIODIC STRUCTURES

Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures.

OBSTACLES IN WAVE GUIDES

Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures.

MILLIMETER WAVE CIRCUITS

Wave Propagation in microstriplines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits

TEXTBOOKS :

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mc graw-hill
2. Robert E Collin, "Foundation for Microwave Engineering", Mc Graw-Hill.

REFERENCE BOOKS :

1. Cam Nguyun, "Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures", John Wiley & Sons, Inc. 2000.
2. Hoffman R. K., "Handbook of Microwave Integrated Circuits", Artech House Publishers, 1987.

ANTENNA MEASUREMENTS

SYLLABUS

ANTENNA PATTERN MEASUREMENTS

Basic Considerations, Pattern Formats, Fresnel Region Measurements, Modeling Techniques,Antenna Range Design and Evaluation: Introduction, Electromagnetic Design Consideration, Antenna Range Evaluation.

ANTENNA TESTING

Introduction, Types of of Ranges: Elevated Ranges, Ground Ranges, Near Field Ranges, Radar Cross Section Ranges.

FAR FIELD RANGE DESIGN

Introduction, Designing the Range, Source Design, Receiving Site Design, Ground Ranges.

FAR FIELD ANTENNA TESTS

Introduction, Pattern Testing, Gain and Directivity, Polarization. Far Field Pattern Errors: Introduction, Error Estimates, Error Correction, Antenna Errors.

COMPACT RANGES

Introduction, Room Design, Feed Design, Reflector Design. Near Filed Testing: Introduction, Planar Near Field Ranges, Errors, Cylindrical and Spherical Scanning

TEXTBOOKS :

1. Evans, Gray E," Antenna measurements techniques", Artech House, Inc
2. J S Hollis, T J Lyon, L Clayton," Microwave Antenna Measurements" , Scientific Atlants, Inc

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WIRELESS CELLULAR COMMUNICATION

SYLLABUS

INTRODUCTION TO CELLULAR MOBILE SYSTEMS

CELLULAR MOBILE TELEPHONE SYSTEMS, A BASIC CELLULAR SYSTEM, OPERATION OF CELLULAR SYSTEMS. ELEMENTS OF CELLULAR MOBILE RADIO SYSTEM DESIGN: GENERAL DESCRIPTION OF THE PROBLEM, CONCEPT OF FREQUENCY REUSE CHANNELS, CO-CHANNEL INTERFERENCE REDUCTION FACTOR, HANDOFF MECHANISM, CELL SPLITTING.

Speech Coding for Wireless Systems Applications: Introduction to Digital Signal Processing (DSP) Techniques in Wireless Telephone and Broadcast Systems, Speech Coding Techniques for Audio and Voice – Pulse Code Modulation, DPCM, Delta Modulation, VoCoder and Linear Predictive Coding, Performance Comparison of Speech Processing Techniques.

RADIO PROPAGATION AND CELLULAR ENGINEERING CONCEPTS

Fundamental Radio Propagation and System Concepts, Propagation Characteristics, Models of Multipath-faded radio signals – Un modulated Carrier, Envelope and Phase faded, Level Crossing rate and fade Duration,

Delay Spread Measurements.

Digital Modulation-Demodulation (Modem) Principles and Architectures: Coherent Modem – Baseband Modem Equivalence, Coherent and Differentially Coherent Binary Phase Shift Keying Systems, Synchronization – Carrier Recovery and Symbol Timing Recovery, Differential Encoding and Decoding Requirement, Quadrature Phase shift Keying – Coincident and offset Types, Pi/4 DQPSK Modems – Architecture.

INTERFERENCE IN WIRELESS DIGITAL COMMUNICATION

Carrier-to-Interference and Carrier-to-Noise Limited Systems, Cochannel Interference, Adjacent Channel Interference. Externally caused Cochannel Interference, Definitions and performance of Spectral and Power Efficiency, Relationship of the Bit-Energy to Noise-Density Ratio and the Carrier-to-Noise Ratio, Power Efficiency and Bit-Error-Rate performance in an Additive White Gaussian Noise Environment, Concepts of Diversity Branch and Signal paths; Combining and Switching Methods.

TEXTBOOKS :

1. Dr Kamilo Feher Wireless Digital Communications, Prentice Hall of India, New Delhi – 1999
2. William Cy Lee, Mobile Cellular Telecommunications, 2nd Edition, MC Graw Hill.

MODERN RADAR SYSTEMS

SYLLABUS

Overview

Advanced Techniques in Modern Radar: Introduction, Radar Modes, Radar and System Topologies.

ADVANCED PULSE COMPRESSION WAVEFORM MODULATIONS AND TECHNIQUES:

Introduction, Stretch Processing, Stepped Chirp Waveforms, Nonlinear Frequency Modulated Waveforms, Stepped Frequency Waveforms, Quadriphase Signals, Mismatched Filters.

MIMO RADAR

Introduction, An Overview of MIMO Radar, The MIMO Virtual Array, MIMO Radar Signal Processing, Waveforms for MIMO Radar, Applications of MIMO Radar.

Radar Applications of Sparse Reconstruction and Compressed Sensing: Introduction, CSTheory, SR Algorithms, Sample Radar Applications.

Adaptive Digital Beamforming: Introduction, Digital Beamforming Fundamentals, Adaptive Jammer Cancellation, Adaptive Beamformer Architectures, Wideband Cancellation.

TEXTBOOKS :

1. William L.Melvin, James A. Scheer, "Principles of Modern Radar", volume II: Advanced Techniques, SciTech Publishing.

ESTIMATION AND DETECTION THEORY

SYLLABUS

DETECTION THEORY

Maximum likelihood decision criterion; Neymann-Pearson criterion; Probability of error criterion; Bayes risk criterion; Minimax criterion; Robust detection; Receiver operating characteristics.

DETECTION THEORY

Vector observations; The general Gaussian problem; Waveform observation in additive Gaussian noise; The integrating optimum receiver; Matched filter receiver. Maximum Likelihood Estimation; Bayes cost method Bayes estimation criterion – Mean square error criterion; Uniform cost function; absolute value cost function; Linear minimum variance - Least squares method;

Estimation in the presence of gaussian noise -Linear observation; Non-linear estimation. Properties of estimators: Bias, Efficiency, Cramer Rao bound Assymptotic properties; Sensitivity and error analysis

PREDICTION

Kalman filter. Sufficient statistics and statistical estimation of parameters: Concept of sufficient statistics; Exponential families of distributions; Exponential families and Maximum likelihood estimation; Uniformly minimum variance unbiased estimation.

TEXTBOOKS :

1.Steven M. Kay, Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory, Prentice Hall Inc., 1998.

2.Harry L. Van Trees, Detection, Estimation and Modulation Theory, Part 1, John Wiley & Sons

REFERENCE BOOKS :

1.James L. Melsa and David L. Cohn, Decision and Estimation Theory, Mc-Graw Hill, 1978.

2.Dimitri Kazakos, P. Papantoni Kazakos, Detection and Estimation, Computer Science Press,
3.Jerry M. Mendel, Lessons in Estimation Theory for Signal Processing, Communication and Control, Prentice Hall Inc.
4. Sophocles J. Orfanidis, Optimum Signal Processing 2nd edn., McGraw Hill.
5.Monson H. Hayes, Statistical Digital Signal Processing and Modelling, John Wiley & Sons
6. Scott C. Statistical Signal Processing , June 14, 2004.

RADAR SIGNAL PROCESSING

SYLLABUS

ANGLE-OF-ARRIVAL ESTIMATION IN THE PRESENCE OF MULTIPATH

The Low-Angle Tracking Radar Problem, Spectrum Estimation Background, Thomson's Multi-Taper Method, Comparison of Some Popular Spectrum Estimation Procedures, Multi-taper Spectrum Estimation, F-Test for the Line Components

TIME–FREQUENCY ANALYSIS OF SEA CLUTTER

An Overview of Non-stationary Behavior and Time–Frequency Analysis, Theoretical Background on Non-stationary, High-Resolution Multi-taper Spectrograms

DYNAMICS OF SEA CLUTTER

Statistical Nature of Sea Clutter: Classical Approach, Is There a Radar Clutter Attractor, Hybrid AM/FM Model of Sea Clutter, Modeling Sea Clutter as a Non-stationary Complex Autoregressive Process

SEA-CLUTTER NON-STATIONARY

The Influence of Long Waves: Radar and Data Description, Statistical Data Analyses, Modulation of Long Waves: Hybrid AM/FM Model, Non-stationary AR Model

TWO NEW STRATEGIES FOR TARGET DETECTION IN SEA CLUTTER

Bayesian Direct Filtering Procedure, Operational Details, Experimental Results on the Bayesian Direct Filter, Correlation Anomally Detection Strategy - Overview

TEXTBOOKS :

1. I. Haykin, Simon S, "Rader Adaptive signal processing", John Wiley & Sons
2. Mark A Richards, "Fundamentals of Radar signal processing", M C Graw Hill

HIGH PERFORMANCE COMMUNICATION NETWORKS

SYLLABUS

PRINCIPLES OF NETWORKS NETWORKING PRINCIPLES

Network services, High performance networks, Network elements, network mechanisms, layered architecture

PACKET SWITCHED NETWORKS PRINCIPLES:

OSI & TCP/IP models, transmission media, routing algorithms, Congestion control algorithms, Internetworking, Ethernet(IEEE 802.3), Tokenring (IEEE 802.5),Tokenbus (IEEE802.4), FDDI.

NETWORK SECURITY

(cryptography, symmetric key algorithms, private key algorithms, digital signatures, authtication protocols)

THE INTERNET AND TCP/IP NETWORKS & CIRCUIT SWITCHED NETWORKS

Overview of Internet protocols, Internet control protocols, Elements of transport Protocols, TCP & UDP , Performance of TCP/IP networks, SONET, DWDM, Solitons

OPTICAL NETWORKS

Fiber principles (elements of optical fiber communication, acceptanceangle, Numerical aperture, modes, fiber types), optical links(point to point links,attenuation,optical budgeting, dispersion),splices ,connectors optical Lans,non Semiconductors, opticalamplifiers,Erbium doped Fiber mplifiers, couplers/splitters, optical switches ATM networks Main features of ATM, Addressing , signaling, routing, ATM header structure

TEXTBOOKS :

1. Jean Walrand and Pravin variya , " High performance Communication networks", 2nd edition, Harcourt and Morgan Kauffman, London 2000
2. Andrew S. Tanenbaum, "Computer networks", PHI Private limited, new Delhi

REFERENCE BOOKS :

1. Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition
2. John M Senior, PHI limited, optical fiber communication , third edition
3. Leon Gracia, Widjaja, " Communication Networks", Tata Mc Graw –Hill, New Delhi, 2000.
4. Behroz a. Forouzan, "Data communication and networking ", Tata MC Graw –Hill, New Delhi
5. Sumit Kasera, Pankaj Sethi, " ATM Networks", Tata Mc Graw- Hill, New Delhi , 2000

RF & MICROWAVE SYSTEM DESIGN

SYLLABUS

INTRODUCTION

Importance of RF and Microwave Concepts and Applications- and Units-Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications. SINGLE AND MULTIPORT NETWORKS: Basic Definitions, Interconnecting Networks.

SCATTERING PARAMETERS SCATTERING PARAMETERS

Definition, Meaning, Chain Scattering Matrix, Conversion Between S- and Z-parameters, Signal Flow Chart Modelling.

Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles.

Rf Filters, Amplifiers And Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations. Introduction, Types and Characteristics of Amplifiers, Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of Transistor Oscillators.

TEXTBOOKS :

1.Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition,

2.Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition.

REFERENCE BOOKS :

1.Joseph . J. Carr, "Secrets of RF Circuit Design", McGraw Hill Publishers, Third Edition.

2.Ulrich L. Rohde and David P. New Kirk, "RF / Microwave Circuit Design", John Wiley & Sons USA, 2000.

3.Roland E. Best, "Phase - Locked Loops: Design, simulation and applications", McGraw Hill Publishers 5TH

4.Devendra K.Misra ,"Radio Frequency and Microwave Communication Circuits – Analysis and Design "John Wiley & Sons, Inc.

7. Ian Hickman, " RF HandBook ", Butter Worth Heinemann Ltd., Oxford, 1993.

8. Ulrich L.Rohde, T.T.N.Bucher, " Communication Recievers ", McGraw-Hill, New York, 1998.

VLSI DESIGN

SYLLABUS

DESIGN METHODOLOGY

Structured design techniques; Programmable logic; Gate array and sea of gates design; cell based design; full custom design; Design flow; Design Economics.

DATA PATH SUBSYSTEMS

Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off.

MEMORY AND ARRAY SUBSYSTEMS

SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array yield, reliability; Power dissipation in Memories.

SPECIAL-PURPOSE SUBSYSTEMS

Packaging; power distribution; I/O pads; Interconnect: Interconnect parameters; Electrical wire models, capacitive parasitics; Resistive parasitics; Inductive parasitic; Crosstalk; Advanced Interconnect Techniques.

TIMING ISSUES

Timing classification; Synchronous design; Self-timed circuit design; Clock Synthesis and Synchronization: Synchronizers; Arbiters; Clock Synthesis; PLLs; Clock generation; Clock distribution; Synchronous Vs Asynchronous Design.

TEXTBOOKS :

1.Neil H. E. Weste, David. Harris and Ayan Banerjee,, “CMOS VLSI Design” - Pearson Education, Third Edition, 2004.

2.Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits” Pearson Education,Second Edition.

REFERENCE BOOKS :

1.Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH, Third Edition, 2003

2. Wayne Wolf, “Modern VLSI Design “, 2nd Edition, Prentice Hall,1998.

SIMULATION BOOKS :

1. Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005.

REMOTE SENSING AND SENSORS

SYLLABUS

BASICS OF REMOTE SENSING

Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities: Nomenclature and Units Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltezman law), Interaction of EMR with the Earth Surface (Wien's displacement law, Kirchoffs Law) Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

Platforms and sensors : Platforms, Remote sensing sensors, resolutions Across track and along the track scanning, Optical sensors, Thermal scanners, Microwave sensing radar satellite missions, Landsat series, SPOT series, IRS satellite series, IKNOS

MICROWAVE REMOTE SENSING

Airborne and Space borne radar systems basic instrumentation. System parameters - Wave length, Polarization, Resolutions, Radar geometry. Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckie radiometric calibration. Radar - Grametry - Introduction, Mosaicing Stereoscope. Application : Geology, Forestry, Land use, Soils etc. Future trends and Research

THERMAL IMAGING SYSTEM

Thermal Imaging System: Introduction - IR region of theElectromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, Apparent thermal inertia, Thermal diffusivity. IR - radiometers, Airborne and Satellite TTR scanner system, Characteristics of IR images ,i) Scanner distortion, ii) image irregularities, iii) Film density and recorded iv)Temperature ranges. Effects of weather on images i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes. Interpretation of thermal imagery. Advantages of Thermal imagery

METEOROLOGICAL SATELLITES

Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N, SEASAT, GOES, METEOSAT, INSAT. Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites

TEXTBOOKS :

1. P.H. Swain and S.M. Davis, "Remote Sensing: The quantitative approach", McGraw Hill.
2. W Travelt, "Imaging Radar for Resource Survey: Remote Sensing Applications", Chapman & Hall.

REFERENCE BOOKS :

1. Floyd, F. Sabins, Jr: “Remote Sensing Principles and Interpretation”, Freeman and Co. San Franscisco, 1978
2. C.P.L.O., Longman, “Applied Remote Sensing”, Scientific and Technical Publishers.
3. E.C. Barrett & L.F Curtis, “Introduction to Environmental Remote Sensing”, Chapman and Hall, London
4. George Joseph, “Fundamentals of remote sensing”, Universities Press.

ECE

ATMOSPHERIC SCIENCE

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5117	Microwave & Satellite Communications	3	1	0	4
2	18 EC 5118	Foundations of Atmospheric Science & Space Technology	3	1	0	4
3	18 EC 5119	Global Navigation Satellite System	3	1	2	5
4	18 EC 5120	Physics & Dynamics of Lower Atmosphere	3	1	2	5
5		Elective –I	3	0	0	3
6		Elective -II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	18	4	8	26

FIRST YEAR (SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5221	Satellite Meteorology	3	1	2	5
2	18 EC 5222	Atmospheric & Space Instrumentation	3	1	0	4
3	18 EC 5223	Advanced Satellite Navigation Systems	3	1	0	4
4	18 EC 5224	Weather and Climate Applications	3	1	0	4
5		Elective –III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**25**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 EC 51I1	Atmospheric and Weather Radars	3	0	0	3
2	18 EC 51I2	Modern Digital Communications	3	0	0	3
Elective-2						
1	18 EC 51J1	GIS Analysis & Modeling	3	0	0	3
2	18 EC 51J2	Global Weather and Climate	3	0	0	3
Elective-3						
1	18 EC 52K1	Aeronomy	3	0	0	3
2	18 EC 52K2	Detection and Estimation Theory	3	0	0	3
Elective-4						
1	18 EC 52L1	Weather Hazards				
		& Risk Assessment	3	0	0	3
2	18 EC 52L2	Climate Change	3	0	0	3

MICROWAVE AND SATELLITE COMMUNICATIONS

SYLLABUS

INTRODUCTION

Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications.

ORBITAL MECHANICS

Orbital Mechanics, Look Angle determination, Orbital perturbations.

SATELLITE SUBSYSTEMS

Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas.

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

Propagation Effects & their impact on Satellite – Earth Links: Introduction, Atmospheric absorption, Cloud attenuation, Tropospheric Scintillations, Ionospheric Scintillations, Rain attenuation, Rain and Ice crystal Depolarization, Propagation impairment countermeasures.

TEXTBOOKS :

1. Satellite Communications - Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering – L.Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications

REFERENCE BOOKS :

1. Satellite Communications: Design Principles - M. Richharia, BS Publications, 2nd Edition.
2. Fundamentals of Satellite Communications - K. N. Raja Rao, PHI, 2004
3. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
4. Satellite Communications - Dennis Roddy, McGraw Hill, 4th Edition, 2009.
5. Satellite Communications - Robert M Gagliardi,, DTS Publishers Ltd.
6. Communication Systems - Simon Haykin, 4th Edition, John Wiley & Son

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FOUNDATIONS OF ATMOSPHERIC SCIENCE & SPACE TECHNOLOGY

SYLLABUS

Structure of atmosphere – Atmospheric composition, vertical thermal structure, environmental lapse rate; standard atmosphere; hydrostatic equation; Geopotential.

THERMODYNAMICS - THERMODYNAMICS OF DRY AIR AND MOIST AIR

Equation of state for water vapour; Moisture variables, vertical stability of the atmosphere: Dry and moist adiabatic lapse rates; stability of layers.

Radiation - Solar and terrestrial Radiation: Characteristics, absorption and transmission of radiation through the atmosphere; Radiative cooling or heating of the atmosphere; Mean heat balance of the earth - atmosphere system; Atmospheric greenhouse effect.

CLIMATE

Weather and climate concepts; World climate system: climate of the hemispheres. Global distribution of radaition, temperature, pressure, winds, precipitation; Atmospheric circulation patterns during winter and summer seasons. Jet streams. Monsoons – Asia, Australia, E. Africa and North America. Koppen and Thornthwaite climate classifications.

Electrodyanamics and radio wave propagation- Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Ground wave propagation, terrain and earth curvature effects. Tropospheric propagation; fading, diffraction and scattering; Ionospheric Propagation-refractive index, critical frequencies.

REMOTE SENSING

Electromagnetic (EM) energy and radiation; electromagnetic spectrum, wavelength; absorption, reflection and scattering of radiation in atmosphere, albedo, laws of radiation; active and passive remote sensing, radiation terminology; interaction between EM radiation and matter in the optical/ thermal and microwave region; spectral signatures; Spectral, spatial, temporal and radiometric resolutions. Kepler's laws of universal planetary motion, Geostationary, Sun-synchronous and special purpose orbits; visible, IR and microwave imagery, vertical sounding; Limb sounding.

Signal processing - DT Sequences and DT Systems - Analysis of LTI Systems, Z- Transforms and its applications; DFT and FFT Design and Realization of Digital IIR and FIR Filters:

Communications - Analog communication systems: amplitude and angle modulation and demodulation systems, Noise performance in communication systems.

TEXTBOOKS :

1. Compendium of Meteorology (WMO Pub.) - Physical Meteorology, 1973, Vol.1, No.2
2. General Climatology: by howard Critchfield. 2nd ed. Prentice-Hall, 1966
3. Fundamentals of Remote Sensing – George Joseph
4. John G Proakis, Dimtris G Manolakis, Digital Signal Processing: Principles, Algonithms and Applications, Pearson Education.
5. R. Collin, Antennas and Radio wave Propagation, McGraw Hill, 1985. ISBN 0070118086.

6. Advanced Electronic Communications Systems, by Wayne Tomasi, 6 Edition Pearson Education.

REFERENCE BOOKS :

1. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.
2. Dynamical and Physical Meteorology - G.J.Haltiner and F.L.Martin
3. Physical Meteorology - H.G.Houghton.
4. World Climatic Systems - by John G. Lockwood, Hodder Arnold, 1985.

GLOBAL NAVIGATION SATELLITE SYSTEM

SYLLABUS

GNSS FUNDAMENTALS

Trilateration, Hyperbolic navigation, Transit, GNSS principle of operation, Architecture, Operating frequencies, orbits, Keplerian elements.

GPS Signals: GPS and UTC Time, Signal structure, C/A and P-Code, ECEF and ECI coordinate systems and WGS 84 datum, Important components of receiver and specifications.

GPS error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna phase center variation, multipath, estimation of Total Electron Content (TEC) using Dual Frequency measurement, Various DOP's, UERE.

GPS data processing and position fixing: RINEX navigation and observation formats, Code and Carrier phase observables, Linear combinations and derived observables, Ambiguity resolutions, Cycle slips, Position estimation.

Other satellite Navigation Systems: Galileo, GLONASS, IRNSS, Space, control and ground segments and Signal characteristics.

TEXTBOOKS :

1. Global Navigation Satellite Systems – G. S. Rao, McGraw-Hill publications, New Delhi, 2010.
2. GPS Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, Springer Wien, New York, 2000.

REFERENCE BOOKS :

1. Introduction to GPS - Ahmed El -Rabbany, Artech House, Boston, 2002.
2. Global Positioning System Signals, Measurements, and Performance - Pratap Misra and Per Enge, Ganga-Jamuna Press, Massachusetts, 2001.

PHYSICS AND DYNAMICS OF LOWER ATMOSPHERE

SYLLABUS

Atmospheric Stability - Conditional, latent and potential instability, Stability of layers, Cloud formation, Precipitation mechanisms; Bergeron and Fendeisen process; Collision and coalescence processes.

Atmospheric motion - Inertial and Non-inertial frames- Fundamental Forces- Pressure Gradient forces, Gravitational force. Frictional force. Apparent forces - Centrifugal Force, Coriolis force. Equations of motion. Hydrostatic approximation. Balanced motion: Geostrophic Wind, Gradient Wind, Thermal wind.

Continuity equation – Horizantal divergence, Vertical motion; Circulation and Vorticity. Land and Sea breeze. Vorticity equation, barotropy and baroclinicity.

Atmospheric boundary layer (ABL) - Reynolds stresses, Laminar and Turbulent flow; Vertical subdivisions of ABL and their characteristics; Drag coefficient. Bulk aerodynamic formulae. Vertical profile of wind speed; Richardson's Number and Monin-Obukhov length.

Atmospheric Modelling - Dynamical equations for weather prediction; Numerical methods: Finite difference methods- forward, centered and Implicit schemes; CFL Criterion. Numerical Models: Quasi-Geostrophic Models: Linear and Non-linear Balance Models, Primitive Equation (PE) Models, Problem of initialization for PE models. Two Level PE Model in Momentum form; Staggered Grid Systems- Arakawa C grid, 3D General circulation models.

TEXTBOOKS :

1. Dynamical and Physical Meteorology - G.J.Haltiner and F.L.Martin
2. Compendium of Meteorology (WMO Pub.) - Physical Meteorology, 1973, Vol.1, No.2
3. Numerical Prediction and Dynamic Meteorology, G.J.Haltiner and R.T.Williams.
4. An Introduction to Dynamic Meteorology - J.R.Holton

REFERENCE BOOKS :

1. Physical Meteorology - H.G.Houghton
2. Atmospheric Thermodynamics - J.V.Iribarne and W.L.Godson
3. A first course in atmospheric radiation - G.W. Petty, Sundog Publishing
4. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.

ATMOSPHERIC AND WEATHER RADARS

SYLLABUS

PRINCIPLES OF RADAR

Doppler radar (Transmitting and receiving aspects) scattering cross section radar equation, Doppler Shift attenuation Practical considerations. Basic system antenna arrays, TR Duplexer and transmitting systems, receiving systems coding and decoding coherent integration.

RADAR SIGNAL PROCESSING

Spectral analysis of Radar signals discrete Fourier transform, power spectrum of random sequences spectral moment's extraction of structure constant velocity fields and turbulence parameters. Range ambiguities velocity ambiguities echo coherency direction of weakly scattering weather targets

Wind profilers and MST Radars: studies on clear Air turbulence (CAT) using ST / MST radar Systems Observations of structure (Cn2 and Stratified Layers) winds, waves and Turbulence parameters

TEXTBOOKS :

1. Doppler Radar & Weather Observations, R. J. Doviak, D. S. Zrnic, 2nd Edition, Dover Publications.
2. Electromagnetic waves & Radiation Systems – Edward C Jordan and Keith G.Balmain,PHI,Second Edition,India

REFERENCE BOOKS :

1. Elements of Electromagnetics - Matthew N. O. Sadiku, Oxford University Press.

ATMOSPHERIC AND WEATHER RADARS

SYLLABUS

MODERN DIGITAL MODULATION TECHNIQUES

Introduction, Information Capacity, Bits, Bit Rate, Baud rate & M-ary Encoding, ASK, FSK, PSK, QAM, Bandwidth Efficiency, Carrier Recovery, Clock Recovery, DPSK, Trellis Code Modulation, Probability of Error & Bit Error Rate, Error Performance.

SPREAD SPECTRUM SIGNALS FOR DIGITAL COMMUNICATION

Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Error Rate Performance of the DeCoder, Applications of DS Spread Spectrum Signals.

FREQUENCY HOPPED SPREAD SPECTRUM SIGNALS

Generation of PN Sequences, Frequency Hopped Spread Spectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum Signals.

TEXTBOOKS :

1. Principles of communication systems-Herbert Taub, Donald L. Schilling, Mc-Graw- Hill, 1986
2. Advanced Electronic Communications Systems - Wayne Tomasi, 6 Edition Pearson Education.
3. Digital and Analog Communication Systems - K Sam Shanmugam, John Wiley and sons (Asia) Pvt Ltd.

REFERENCE BOOKS :

1. Digital communications - Simon Haykin, John Wiley and sons, 1998
2. Advanced electronic communication systems - Wayne Tomasi, 4th Edition Pearson Education Asia, 1998
3. Modern digital and analog communication systems - B.P.Lathi, 3rd Edition, Oxford University press.
4. Digital Communications: Microwave Applications - Kamilo Feher, SciTech Publishing,1997

ATMOSPHERIC AND WEATHER RADARS

SYLLABUS

FUNDAMENTALS OF GIS

Map – scale, projection and symbolism. GIS - Introduction, definition and terminology, categories, components, fundamental operations, functional elements. Data structures, data models, GIS data acquisition, input, storage, output generation. Data preprocessing, database management, integrated analysis of spatial and attribute data.

GIS SPATIAL ANALYSIS

Introduction, Defining spatial objects - point, line and area objects based on their attributes, higher level point, line and area objects.

MEASUREMENT

Measuring length of linear objects, measuring polygons, measuring shape, measuring distance. Classification – Principles, Neighborhood functions, Polygonal neighborhoods, Buffers.

STATISTICAL SURFACES

Surface mapping, sampling the statistical surface, Digital Elevation Model (DEM). Interpolation - linear and non-linear, uses and problems. Terrain reclassification – steepness of slope, aspect, shape or form. Discrete surfaces - dot distribution maps, choropleth maps.

SPATIAL ARRANGEMENT

Spatial Arrangement - Point patterns, Theissen Polygons, Area patterns, Linear patterns, Directionality of Linear and Areal objects, Connectivity of Linear objects, Routing and allocation.

OVERLAY ANALYSIS

Cartographic overlay, point-in-polygon and line-in-polygon operations, Polygon overlay, Automating point-in-polygon and line-in-polygon procedures in Raster, Automating Polygon overlay in Raster, Automating vector overlay, types of overlay.

DATA MODELLING

The state of GIS for Environmental Problem Solving, A Perspective on the State of Environmental Simulation Modeling, GIS and Environmental Modeling, The Role of Software Venders in Integrating GIS and Environmental Modeling, Cartographic Modeling, Scope of GIS and relationship to environmental modeling, data models and data quality.

TEXTBOOKS :

1. Fundamentals of GIS by MICHAEL N DEMERS. Published By john Wiley & Sons Inc.
2. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert.

ATMOSPHERIC AND WEATHER RADARS

SYLLABUS

GLOBAL ATMOSPHERIC CIRCULATION - ATMOSPHERIC CIRCULATION PATTERNS. ZONALLY AVERAGED MERIDIONAL AND ZONAL CIRCULATIONS, ZONALLY ASYMMETRIC COMPONENTS OF THE GENERAL CIRCULATION - STANDING EDDIES AND WALKER CIRCULATIONS.

Monsoon systems - Land and sea breezes, Asian monsoons –onset, withdrawal, active and break monsoon situations. Monsoon rainfall distribution; monsoon rain bearing systems - monsoon depressions, Mid-tropospheric cyclones and Offshore vortices.

Mesoscale weather systems - CAPE and CINE, Thunderstorm, Dust storm, Hail storm, mesoscale convective system, fog, tropical cyclones, extra-tropical frontal systems.

Global and regional Circulation systems: Jet streams- Tropical Easterly jet, Subtropical Westerly jet, Somali jet over India. Easterly waves, Rossby waves and Kelvin waves. Atmospheric –Ocean phenomena: North Atlantic Oscillation, North Pacific Oscillation, El- Nino, La Nina, Southern Oscillation, Walker circulation, Hadley circulation, Tropical Biennial Oscillation, Indian Ocean Dipole.

TEXTBOOKS :

1. Physical climatology - William D. Sellers.
2. Essentials of Meteorology – C. Donald Ahrens
3. Global Physical Climatology - Dennis L. Hartmann

REFERENCE BOOKS :

1. Dynamical and physical Meteorology - George J.Haltiner and Frank L. Martin.
2. Monsoons - P.K.Das
3. Tropical Meteorology - G.C.Asnani
4. World Climate Systems, J.G.Lockwood

SATELLITE METEOROLOGY

SYLLABUS

Remote sensing for meteorology - Overview of remote sensing systems for meteorology; earth stations for remote sensing and meteorological satellites; space based measurement systems for meteorology; Active and passive remote sensing; imagery and sounding.

Radiation measurements and estimation– Mean Global Energy Balance; The First Satellite Experiment to Measure the Net Radiation; The Radiation Budget.

Radiative Transfer Equation (RTE) - Derivation of RTE; Temperature Profile Inversion; RTE in Cloudy Conditions;

Meteorological satellite systems – Series of Indian Remote Sensing Satellite, INSAT, Meteosat, NOAA, TRMM and SSMI; QuikSCAT, Oceansat2, Terra, Aqua, Megha- Tropiques satellite products.

Satellite meteorological data and products - Satellite image interpretation and enhancement techniques, cloud type identification.

Land surface temperatures from satellites; Infrared and microwave observations of sea surface temperatures (SST); Global SST retrieval algorithms from NOAA-AVHRR data.

Vegetation spectral response and vegetation indices; Normalized Difference

Vegetation Index; Normalized Difference Water Index; Normalized Difference Snow Index; Normalized Difference moisture Index.

Satellite based ocean and atmospheric parameters - Satellite based rainfall estimations; cloud motion vectors; outgoing longwave radiation (OLR) and cloud top.

Active and passive sensors for ocean surface winds; soil moisture using microwave radiometer; atmospheric temperature profile retrieval; limb sounding retrieval of trace gases; GPS-RO (Global Positioning System- radio Occultation) techniques to retrieve temperature and humidity profiles.

Total Water Vapour Estimation. Determination of total Ozone and Geopotential Height. Microwave Estimation of Tropical Cyclone Intensity. Satellite measurement of Atmospheric Stability. Detection of forest fire and area estimation; Aerosol optical thickness; ISCCP; CLAVR; CO2 slicing.

TEXTBOOKS :

1. Fundamentals of Remote Sensing – George Joseph
2. Satellite Meteorology: An introduction - S.Q. Kidder and T.H. Vonder Haar
3. Lecture Notes for Post Graduate Course on Satellite Meteorology and Global Climate, Vols.1, 2 and 3. ISRO Publications.
4. Applications with Meteorological Satellites - W. Paul Menzel, Technical document, WMO/TD No. 1078.

REFERENCE BOOKS :

1. The use of satellite data in rainfall monitoring- E.C. Barrett and W. N. Martin
2. Remote sensing of atmosphere - J.T. Houghton, F.W. Taylor and C.D. Rodgers.
3. Satellite Meteorology - R.R. Kelkar, B.S.Publications.

ATMOSPHERIC & SPACE INSTRUMENTATION

SYLLABUS

Observational Techniques of atmospheric parameters – Measurement of temperature:

Electrical Resistance thermometers, Semiconductor thermometers, Bimetallic thermometers, Thermocouples.

Measurement of Atmospheric Pressure – Mercury, Aneroid & Piezo – resistive barometers.

Measurement of Humidity- Psychrometer, Hygrometer

Measurement of Surface wind - Wind vane, Cup anemometer, Hotwire Anemometer, Sonic Anemometer.

Radiosonde & Rawin measurement sensors

Measurement of Precipitation – Recording & Non-recording precipitation gauges.

Measurement of Radiation - Pyrheliometer, Pyranometer, Net Radiometer, Pyrgeometer

Radar principles and technology - propagation, scattering and attenuation of microwaves in the lower atmosphere, weather radar signal processing and display, Weather Radar: Signal Processing and display, Phenomena observed, operational weather Radar.

Radar Measurements -,Observation and estimation of precipitating systems, radar equation for precipitation targets. Doppler radar – Velocity measurements, Radar wind profiler – MST Radar, Lidar & Sodar, Observation of Tropical Cyclones, use of weather Radar in Aviation, observation of clear air turbulence.

Satellite Sensors - Advance very high resolution radiometer, very high resolution radiometer, visible and infrared spin scan Radiometer, Atmospheric sounder – VAS, special sensor microwave imager – SSM/I, High resolution infrared Radiation sounder – HIRS, microwave sounding unit-MSU, Scatterometer, Synthetic Aperture Radar, Altimeter, Ocean Colour Monitor-OCM.

TEXTBOOKS :

1. Radar Meteorology - Henry Sauvageot, Artech House, 1992.
2. Satellite Meteorology – An Introduction, Stanely Q Kidder, Thomas H VanderHaus, Academic Press Inc.
3. Guide to Meteorological Instruments and Methods of Observation. WMO-No. 8, World Meteorological Organization, 2008.

REFERENCE BOOKS :

1. Radar Meteorology – S. Raghavan, Kluwer Academic Publishers, 2003
2. Weather Radar: Principles and Advanced Applications - Peter Meischner, Springer - Verlag, 2004

ADVANCED SATELLITE NAVIGATION SYSTEMS

SYLLABUS

Differential GPS systems: Introduction to Differential GPS systems, LADGPS, WADGPS, Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS, Local Area Augmentation system (LAAS).

INERTIAL NAVIGATION SYSTEMS

Introduction to Inertial Navigation, Inertial sensors, Navigation Co ordinates, System implementations, System-level error Models.

GPS/INS INTEGRATION

GPS receiver performance issues, inertial sensor performance issues, Kalman filter, GPS-INS integration methods. GPS receivers: Signal Conditioning, Signal acquisition and carrier and Code tracking.

TEXTBOOKS :

1. Understanding GPS Principles and Applications - E.Kaplan Artech House, 1996, ISBN 0890067937.
2. Global Positioning Systems, Inertial Navigation, and Integration - Mohinder S. Grewal, California State University at Fullerton, A John Wiley & Sons, Inc. Publication.

REFERENCE BOOKS :

1. Introduction to GPS - Ahmed El -Rabbany, Artech House, Boston, 2002.
2. Global Navigation Satellite Systems – G. S. Rao, McGraw-Hill publications, New Delhi, 2010.
3. GPS Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J .Collins, Springer Wien, New York, 2000.

WEATHER AND CLIMATE APPLICATIONS

SYLLABUS

Weather and climate data - Sources for local, regional and global meteorological data; data from national and international sources; spatial and temporal resolution of data; Observational and model generated data.

APPLICATIONS TO HYDROLOGY – RAINFALL

interception and infiltration, surface runoff and sub- surface run-flow. Rainfall-Runoff models, Flood forecasting. Drought categories and assessment techniques. Effects of urbanization on climate and stream flow. Urban hydrology modeling and risk assessment.

Applications to air quality - Sources and classification of atmospheric pollutants, Factors affecting atmospheric pollution. Atmospheric pollution at local, urban, regional, continental and global scales. Air quality standards and legislation.

Transport and dispersion of atmospheric pollutants: estimation of pollutants. Application of weather data for air quality assessment using models. Effects of atmospheric pollution on human health, animals, vegetation, materials and property. Air quality risk assessment.

Applications to agriculture - Relationship between weather and agriculture; climatic requirements of common agricultural crops, Plant phenology; effect of weather factors on the growth and development of plants; Weather factors conducive to infection; crop protection from adverse meteorological phenomena-

droughts, heavy rains, storms, cold waves and frost, heat waves, strong winds.

Crop-weather calendars; statistical analysis of crop and weather data; Agro-meteorological forecasting: basic principles, phenological forecasting, crop-yield forecasting, weather forecast and warning for agriculture. Principles of weather prediction for crops with special reference to India.

TEXTBOOKS :

1. Hydrometeorology - C.J.Wiesner
2. Guide to Agricultural Meteorological Practices: WMO No.134, 1981.
3. Agroclimatic/Agrometeorological Techniques, S.Jeevananda Reddy, Jeevan Charitable Trust, ICRISAT Colony, Secunderabad, 1993

REFERENCE BOOKS :

1. Physico, Chemical aspects of Air pollution - Henry.C Perkins.
2. Hand TextBook : of Applied meteorology – David D. Houghton (John Wiley & Sons, 1985)
3. Atmosphere, Weather and Climate - Barry and Chorley (Routledge Publ., 2009)

AERONOMY

SYLLABUS

NEUTRAL ATMOSPHERE

Structures and Composition: Nomenclature- Thermal structure of the atmosphere. Hydrostatic equation of the atmosphere structure. Scale height and geopotential height and geopotential height. Exosphere.

CHEMICAL CONCEPTS IN ATMOSPHERE

Thermodynamic considerations- Enthalpy. Elements chemical kinetics- Reaction rate constants and chemical life time of spieces. Unimolecular, biomolecular and termoecular reactions. Effect of dynamics on chemical species.

IONOIZED ATMOSPHERE

Photochemical processes in the ionosphere? Introduction to ionosphere-discovery. Continuity equation and photochemical equilibrium. Theory of photo-ionization and Chapman production function. Chemical recombination and electron density. Solar radiation and production of ionospheric layers.

Loss process in D, E and F regions: different types of recombination processes. Chemistry of D,E and F regions. D region balance equations. D region chemistry –formation of water cluster ions. Electron attachment and negative ions, Linear and square law loss formulae and splitting of F layer. Vertical transport, ambipolar diffusion.

MORPHOLOGY

Spatial and temporal structure of the ionosphere- Diurnal, seasonal and solar cycle variations of D, E and F regions and F region anomalies. Space weather disturbances, Sudden Ionospheric Disturbances (SIDs), magnetic storm effects.

TEXTBOOKS :

1. Introduction to Ionospheric Physics - H. Rishbeth and O.K Garriott
2. Upper Atmosphere and Solar Terrestrial Relations - J.K. Hargreaves

REFERENCE BOOKS :

1. An Introduction to the Ionosphere and Magnetosphere. John Ashworth Ratcliffe,1972.

DETECTION AND ESTIMATION THEORY

SYLLABUS

RANDOM - DISCRETE-TIME SIGNALS

Review of probability, Random data, Generation of Pseudo-random noise, Filtered signals, Autocorrelation and power spectral density, Sampling band-Limited random.

DETECTION OF SIGNALS IN NOISE

Minimum probability of Error Criterion, Neyman-Person criterion for Radar detection of constant and variable amplitude signals, Matched filters, Optimum formulation, Detection of Random signals.

ESTIMATION OF SIGNALS IN NOISE

Linear mean squared estimation, Non linear estimates, MAP and ML estimates, Maximum likelihood estimate of parameters of linear system, Simple problems thereon.

RECURSIVE LINEAR MEAN SQUARED ESTIMATION

Estimation of a signal parameter, Estimation of time-varying signals, Kalman filtering, Filtering signals in noise,

Case studies related to estimation and detection processes.

TEXTBOOKS :

1. Signal processing: Discrete Spectral analysis, Detection and Estimation - Mischa Schwartz and Leonard Shaw, Mc-Graw Hill TextBook : Company, 1975.
2. Signal Detection and Estimation - Mourad Barkat, Artech House Inc, , 2nd edition, Norwood, MA 02062, 2005,

3. Fundamentals of Statistical Signal Processing: Estimation Theory - Steven M. Kay, Prentice Hall New Jersey, 1993

REFERENCE BOOKS :

1. Probability, Random Variables and Random Signal Principles - Peyton Z.Peebles Jr, 4th Edition, Tata Mc Graw Hill.
2. Lessons in Estimation Theory for Signal Processing, Communication and Control - Jerry M. Mendel, Prentice Hall Inc., 1995.
3. Detection of signals in Noise and Estimation - Shanmugam and Breipohl, John Wiley & Sons, New York, 1985.
4. Intuitive Probability and Random Processes using Matlab - Steven M. Kay, Springer, 2006.

SIMULATION TEXTBOOKS :

1. Statistical Digital Signal Processing and Modeling - Monson Hayes, John Wiley & Sons.
2. Statistical Signal Processing Modell

WEATHER HAZARDS & RISK ASSESSMENT

SYLLABUS

WEATHER HAZARDS

TYPES OF WEATHER HAZARDS, VULNERABILITY TO WEATHER ELEMENTS, TROPICAL CYCLONES, SEVERE LOCAL STORMS, HEAVY PRECIPITATION, FLASH FLOODS, FOG, HEAT AND COLD WAVES, TORNADOES.

GIS based Modelling -Hydrological Modeling - water quality modeling, watershed management and modeling, saltwater intrusion models. Land-surface-subsurface Process Modeling - pipeline alignment studies, solid and hazardous waste disposal site selection, zoning atlas for industrial silting, environmental information system development. Ecosystem modeling, risk and hazard modelling.

DISASTER IMPACT AND DAMAGE ANALYSIS

The use of satellite imagery for disaster relief and recovery; Impact analysis and preliminary damage assessment.

Pre-Disaster Risk Assessment: Hazard Assessment; Elements at risk and vulnerability assessment; Types and methods of risk assessment, risk evaluation, cost-benefit analysis.

Risk Information for Risk Reduction Planning: Risk evaluation, Visualization of risk information; Risk information and spatial planning.

TEXTBOOKS :

1. Weather Risk Management: A guide for Corporations, Hedge Funds and Investors - Tang, K., Ed., Risk TextBooks :, 2010.
2. The transfer of weather risk faced with the challenges of the future - Finas, B., SCOR, 2012.
3. Climate Risk and the Weather Market: Financial Risk Management with Weather - Hedges, Robert S. Dischel Ed., Risk TextBooks :, 2002.
4. Weather Derivatives: Modeling and Pricing Weather-Related Risk - Antonis Alexandridis K. and Achilleas D. Zapranis , Springer, 2012.

REFERENCE BOOKS :

1. Climate risk assessment and management in agriculture - Ramasamy Selvaraju; http://www.fao.org/docrep/017/i3084e/i3084e06.pdf
2. Severe and hazardous weather: An introduction to high impact meteorology - Rauber Robert M, Walsh John E, Charlevoix Donna J, Kendall Hunt Publishing, 2013.
3. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.

CLIMATE CHANGE

SYLLABUS

The Climate system – energy balance of the earth-atmosphere. History of climate change – glacial cycle, inter-glacial and insterstadial events, year to decadal variations, natural variability.

Global warming – Anthropogenic climate change. Greenhouse gases (GHG) and global warming – GHGs trend, global temperature trend, global distribution of emissions, Sources of CO2 in the Land, Ocean and atmosphere.

Future Emissions and Energy Resources, Current and Future sources of Methane, Biological sources of Nitrous oxide, societal resilience. Mitigation strategies: Reducing Carbon Emissions, Energy use and Emission trading,

CLIMATE TRENDS

Teleconnections of the world climate system, consequences of global warming; Ozone hole; Volcanic eruptions and aerosols, Nuclear winter; Climate in relation to sunspot and cosmic activity.

IPCC ASSESSMENT OF CLIMATE CHANGE

Detection and Attribution of Climate Change: from Global to Regional scales. Short term climate change: Projections and Predictability. Long- term climate change: Projections, commitments and irreversibility. Climate phenomena and their relevance for future regional climate change.

The measurement of climate change. Climate change and extreme weather events. Climate change impacts on ecosystems, agriculture.

TEXTBOOKS :

1. Earth's Climate: Past and Future - Ruddiman, William F.2001.
2. Climate Change 2001 - Houghton, J.T., 2001, (ed). The Scientific Basis. 881pp.
3. Climate Change: A Multidisciplinary Approach - William James Burroughs
4. Current trends in Global Environment - A.L. Bhatia (2005).

REFERENCE BOOKS :

1. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC 2013 report. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
2. Causes of Climate - J.G.Lockwood

ECE

VLSI

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5128	MOS Circuit Design	3	1	2	5
2	18 EC 5129	Algorithm for VLSI Design Automation	3	1	0	4
3	18 EC 5130	HDL & PLD Architectures	3	1	2	5
4	18 EC 5131	IC Fabrication Technology	3	1	0	4
5		Elective –I	3	0	0	3
6		Elective –II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	**18**	**4**	**8**	**24**

FIRST YEAR (SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EC 5232	Advanced Analog IC Design	3	1	2	5
2	18 EC 5233	Low Power VLSI Circuits	3	0	2	4
3	18 EC 5234	VLSI System Design	3	1	0	4
4	18 EC 5235	Testing of VLSI Circuits	3	1	0	4
5		Elective –III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 EC 51Q1	Embedded System Design	3	0	0	3
2	18 EC 51Q2	VLSI Signal Processing	3	0	0	3
3	18 EC 51Q3	CMOS Mixed Signal Circuits	3	0	0	3
4	18 EC 51Q4	Nano Electronics	3	0	0	3
5	18 EC 51Q5	CAD Tools for VLSI	3	0	0	3
Elective-2						
1	18 EC 51R1	Image and Video Processing	3	0	0	3
2	18 EC 51R2	Bi-CMOS Technology & Applications	3	0	0	3
3	18 EC 51R3	Semiconductor Device Modeling	3	0	0	3
4	18 EC 51R4	Memory Design and Testing	3	0	0	3
5	18 EC 51R5	Reconfigurable Computing	3	0	0	3
Elective-3						
1	18 EC 52S1	System on Chip Design	3	0	0	3
2	18 EC 52S2	Process and Device Characterization Measurements	3	0	0	3
3	18 EC 52S3	Advanced VLSI Design	3	0	0	3
4	18 EC 52S4	MEMS System Design	3	0	0	3
5	18 EC 52S5	VLSI for Wireless Communication	3	0	0	3
Elective-4						
1	18 EC 52T1	Optimization Techniques and Application in VLSI Design	3	0	0	3
2	18 EC 52O1	CMOS RF Circuit Design	3	0	0	3
3	18 EC 52T2	Advanced Digital IC Design	3	0	0	3
4	18 EC 52T3	Nano Sensors and its applications	3	0	0	3
5	18 EC 52T4	ASIC Design Flow	3	0	0	3

MOS CIRCUIT DESIGN

SYLLABUS

INTRODUCTION

Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules. MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE. MOS Inverter static characteristics and Interconnect Effects: Introduction, Resistive-Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters. Combinational and Sequential MOS logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop. Dynamic logic Circuits: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, High-performance dynamic CMOS circuits.

TEXTBOOKS :

1. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits” TMH 2003
2. Neil H. E. Weste and David. Harris Ayan Banerjee,, “CMOS VLSI Design” - Pearson Education, 1999.

REFERENCE BOOKS :

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits” Pearson Education, 2003
2. Uyemura, “Introduction to VLSI Circuits and Systems” Wiley-India, 2006.
3. Wayne Wolf, “Modern VLSI Design “, 2nd Edition, Prentice Hall,1998.
4. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

SIMULATION BOOKS :

1. Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005.

ALGORITHMS FOR VLSI DESIGN AUTOMATION

SYLLABUS

INTRODUCTION TO DESIGN METHODOLOGIES

Design Automation tools, Algorithmic Graph Theory, Computational Complexity, Tractable and Intractable Problems

Layout

Compaction, Placement, Floor planning and Routing Problems, Concepts and Algorithms Modeling: Gate Level Modeling and Simulation, Switch level modeling and simulation, Basic issues and Terminology, Binary – Decision diagram, Two – Level Logic Synthesis. Hardware Models: Internal representation of the input algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some aspects of Assignment problem, High – level Transformations. FPGA technologies: Physical Design cycle for FPGA's partitioning and routing for segmented and staggered models. MCM technologies, MCM physical design cycle, Partitioning, Placement – Chip array based and full custom approaches, Routing –Maze routing, Multiple stage routing, Topologic routing, Integrated Pin – Distribution and routing, routing and programmable MCM's.

TEXTBOOKS :

1. S.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley 1999.
2. Naveed Sherwani, "Algorithms for VLSI Physical Design Automation" 3rd edition, Springer International Edition.

REFERENCE BOOKS :

1. Hill & Peterson, "Computer Aided Logical Design with Emphasis on VLSI" Wiley,1993
2. Wayne Wolf, "Modern VLSI Design: Systems on silicon" Pearson Education Asia, 2nd Edition.

HDL & PLD ARCHITECTURES

SYLLABUS

INTRODUCTION TO VERILOG HDL

Basic concepts, Design modeling, Tasks and functions, Timing and delays, user-defined primitives, PLI, Simulation and Synthesis Tools.Synthesis of Combinational & Sequential Logic: DeCoders and enCoders, Multiplexers and Demultiplexers, Priority enCoder, Priority deCoder, Comparators, Adders, synthesis of three-state devices and bus interfaces. , Latches & Flip-flops, counters, registers, explicit state machines, implicit state machines. Programmable Logic Devices: Full Custom Design, Semicustom Design,

Programmable Logic Devices, Read Only Memory (ROM), Programmable Read Only Memory (PROM), and Programmable Logic Array (PLA), and Programmable Array Logic (PAL). Complex Programmable Logic Devices : Basic Architecture, XC9500 CPLD, GAL, Altera series – Max 5000, Max 7000 Series , ALTERA FLEX Logic – 10000 Series CPLDs. AMD's – CPLD (Mach 1 to 5).Field Programmable Gate Arrays: Introduction, Basic Architecture, Design flow, Xilinx XC3000 & XC4000 Architectures, Actel Architectures, ALTERA's FLEX 8000, and ALTERA's FLEX 10000 FPGAs.

TEXTBOOKS :

1.Michael D.Celetti "Advanced Digital Design with the Verilog HDL" Prentice Hall.

2.S.Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Publications.

REFERENCE BOOKS :

1. Verilog Digital System Design RT Level synthesis TestBench and verification by Zainalabedin Navabi, 2008 Mc Graw Hill Publishers

2.Stephen Brown Zvonko Vranesic "Fundamentals of Digital Logic with VHDL Design" McGraw-Hill.

SIMULATION BOOKS :

1. Verilog HDL A Guide To Digital Design And Synthesis, Edition: 2 by Samir Palnitkar.

IC FABRICATION TECHNOLOGY

SYLLABUS

INTRODUCTION TO IC TECHNOLOGY

Basic fabrication steps and their Importance. Environment of IC Technology: Concepts of Clean room and safety requirements, Concepts of Wafer cleaning processes and wet chemical etching techniques. Impurity Incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing, characterization of Impurity profiles Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films, Oxidation technologies in VLSI and ULSI, Characterization of oxide films, High k and low k dielectrics for ULSI. Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation. Chemical Vapour Deposition Techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon: modeling and technology. Metal Film Deposition: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes. Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE

techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

TEXTBOOKS :

1. S.M.Sze(2nd Edition)"VLSI Technology", McGraw Hill Companies Inc.
2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc.

REFERENCE BOOKS :

1. Stephena, Campbell, "The Science and Engineering of Microelectronic Fabrication", Second Edition, Oxford University Press.
2. James D.Plummer, Michael D.Deal, "Silicon VLSI Technology" Pearson Education

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EMBEDDED SYSTEM DESIGN

SYLLABUS

INTRODUCTION TO EMBEDDED SYSTEMS

Embedded systems, processor embedded into a system, embedded hardware units and devices in a system, embedded software in a system, examples of embedded systems, embedded SOC and use of VLSI circuit design technology, Complex systems design and processors, Design process in embedded system, formalization of system design, design process and design examples, classification of embedded systems, skills required for an embedded system designer. PIC Microcontrollers: PIC 16 Series family overview, An architecture overview of the 16F84A, Status register, 16F84A memory, Some issues of timing, Power-up and Reset, PIC 16F84A parallel ports, 16F84A clock oscillator, 16F84A operating conditions, 16F84A interrupt structure. Larger systems and the PIC 16F873A: The main idea – the PIC 16F87XA, The 16F873A block diagram and CPU, 16F873A memory and memory maps, 16F873A interrupts, 16F873A oscillator, reset and power supply, 16F873A parallel ports. RTOS: Basic design using RTOS, Micro/OS-II and Vx works, windows CE, OSEK, real-time Linux functions, case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card, mobile phone software for key inputs.

TEXTBOOKS :

1. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
2. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.

REFERENCE BOOKS :

1. Embedded Systems Design by Steve Heath, II edition, Newnes publications
2. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.

SIMULATION BOOKS :

1. An embedded software primer by David E. Simon, Pearson Education, 1995.

VLSI SIGNAL PROCESSING

SYLLABUS

INTRODUCTION TO DSP SYSTEMS

Introduction; representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph. Iteration Bound: Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs. Pipelining and Parallel Processing: Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving. Retiming, Unfolding and Folding: retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodogy. Fast Convolution, Filters and Transforms: Cook-toom algorithm, modified cook-toom algorithm, winogard algorithm, iterated convolution Algorithm strength reduction in filters and transforms.

TEXTBOOK :

1.Keshab k. Parhi," VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, inter science.

REFERENCE BOOKS :

1.S.Y.kung, H.J.White house, T. Kailath," VLSI and Modern Signal Processing", Prentice hall,

CMOS MIXED SIGNAL CIRCUITS

SYLLABUS

Data Converter Modeling and SNR: Sampling and Aliasing: A modeling Approach, SPICE models for DACs and ADCs, Quantization noise, Viewing the quantization noise spectrum using simulations, quantization noise voltage spectral density, Data converter SNR: an overview, Improving SNR using averaging, Decimating filters for ADC, Interpolating filters for DACs, Using feedback to improve SNR. Submicron CMOS Circuit Design: Submicron CMOS overview and models, Digital circuit design, Analog circuit design. Implementing Data Converters: R-2R topologies for DACs, Op-Amps in data converters, Implementing ADCs. Noise-Shaping Data Converters: Noise-shaping fundamentals, Second-order noise-shaping, noise-shaping topologies. Integrator-Based CMOS Filters: Integrator building blocks, filtering topologies, Filters using Noise-shaping.

TEXTBOOKS :

1 R. Jacob Baker, "CMOS: Mixed-Signal Circuit Design", Wiley-Student Edition, IEEE Press,

REFERENCE BOOKS :

1. Behzad Razavi, "Principles of Data Conversion System Design, "John Wiley & Sons.
2. P. Allen and D. Holberg, "CMOS Analog Circuit design," Oxford Press.
3. E. Bogatin, "Signal and Power –Simplified," 2nd edition, Prentice Hall.

NANO ELECTRONICS

SYLLABUS

INTRODUCTION

Recent past, the present and its challenges, Future, Overview of basic Nano electronics. Nano electronics & Nanocomputer architectures: Introduction to Nanocomputers, Nanocomputer Architecture, Quantum DOT cellular Automata (QCA), QCA circuits, Single electron circuits, molecular circuits, Logic switches – Interface engineering – Properties (Self-organization, Size-dependent) – Limitations. Nanoelectronic Architectures: Nanofabrication – Nanopatterning of Metallic/Semiconducting nanostructures (e-beam/X-ray, Optical lithography, STM/AFM- SEM & Soft-lithography) – Nano phase materials – Self-assembled Inorganic/Organic layers. Spintronics: Introduction, Overview, History & Background, Generation of Spin Polarization Theories of spin Injection, spin relaxation and spin dephasing, Spintronic devices and applications, spin filters, spin diodes, spin transistors. Memory Devices And Sensors: Memory devices and sensors – Nano ferroelectrics – Ferroelectric random access memory – Fe-RAM circuit design –ferroelectric thin film properties and integration –

calorimetric -sensors – electrochemical cells – surface and bulk acoustic devices – gas sensitive FETs – resistive semiconductor gas sensors –electronic noses – identification of hazardous solvents and gases – semiconductor sensor array

TEXTBOOKS :

1. Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices: Karl Goser, JanDienstuhl and others.
2. Nano Electronics and Information Technology: Rainer Waser

REFERENCE BOOKS :

1. Concepts in Spintronics – Sadamichi Maekawa
2. Spin Electronics – David Awschalom

CAD TOOLS FOR VLSI

SYLLABUS

INTRODUCTION TO VLSI DESIGN METHODOLOGIES AND SUPPORTING CAD ENVIRONMENT. SCHEMATIC EDITORS:

Parsing: Reading files, describing data formats, Graphics & Plotting Layout. Layout Editor: Turning plotter into an editor. Layout language: Parameterized cells, PLA generators, Introduction to Silicon compiler, Data path. Compiler, Placement & routing, Floor planning. Layout Analysis: Design rules, Object based DRC, Edge based layout operations. Module generators. Simulation: Types of simulation, Behavioral simulator, logic simulator, functional simulator & Circuit simulator. Simulation Algorithms: Compiled Code and Event-driven. Optimization Algorithms: Greedy methods, simulated annealing, genetic algorithm and neural models. Testing ICs: Fault simulation, Aids for test generation and testing. Computational complexity issues: Big Oh and big omega terms. Recent topics in CAD-VLSI: Array compilers, hardware software co-design, high-level synthesis tools and VHDL modeling.

TEXTBOOKS :

1. Stephen Trimberger," Introduction to CAD for VLSI", Kluwer Academic publisher, 2002
2. Naveed Shervani, "Algorithms for VLSI physical design Automation", Kluwer Academic Publisher,
   Second edition.

REFERENCE BOOKS :

1. Gaynor E. Taylor, G. Russell, "Algorithmic and Knowledge Based CAD for VLSI", Peter peregrinus ltd. London.
2. Gerez, "Algorithms VLSI Design Automation", John Wiley & Sons.

IMAGE AND VIDEO PROCESSING

SYLLABUS

FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations 2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXTBOOKS :

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI

REFERENCE BOOK :

1. M. Tekalp ,"Digital video Processing", Prentice Hall International

SIMULATION TEXTBOOKS :

1. Relf, Christopher G.,"Image acquisition and processing with LabVIEW", CRC press
2. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons
3. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons,

BICMOS TECHNOLOGY & APPLICATIONS

SYLLABUS

DEVICE MODELING

Modeling of the MOS Transistor, Modeling of the Bipolar Transistor. Device Design Considerations: Design Considerations for MOSFET's, Design Considerations for Bipolar Transistors, BiCMOS Device Synthesis. BiCMOS Device Scaling: MOS Device Scaling, Bipolar Device Scaling. BiCMOS Process Technology: BiCMOS Isolation Consideration, CMOS Well & Bipolar Collector tradeoffs, CMOS & BiCMOS Processes considerations, Interconnect Processes for submicron BiCMOS, Submicrometer BiCMOS Process for 5V Digital Applications, Analog BiCMOS Process Technology, Process Reliability. Digital Design: Delay Analysis, Gate Design, Performance Comparisons. Analog Design: BiCMOS Operational Amplifiers, BiCMOS Analog Subsystems. BiCMOS Digital Circuit Applications: Adders, Multiplier, Random Access Memory, Programmable Logic Arrays, BiCMOS Logic Cells, BiCMOS Gate Arrays.

TEXTBOOKS :

1. A L ALVAREZ, BICMOS Technology & Applications, Kluwer Academic Publishers.
2. Sherif H.K. Embabi, Abdellatif Bellaouar & Mohamed 1. Elmasry "Digital BiCMOS Integrated Circuit Design" Springer Science+ BusÎness Media, LLC.

REFERENCE BOOKS :

1. Kiat-Seng yeo, Samir S. Rofail, Wang-Ling Goh, CMOS/BiCMOS ULSI, Pearson Education.
2. James C. Daly, Denis P. Galipeau, Analog BiCMOS Design: Practices & Pitfalls, CRC Press
3. Klaas-Jan de Langen, Johan Huijsing, Compact Low-Voltage and High-Speed CMOS, BiCMOS and Bipolar Operational Amplifiers, Springer Science

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SEMICONDUCTOR DEVICE MODELING

SYLLABUS

BASIC DEVICE PHYSICS

Electrons and holes in silicon, p-n junction, MOS capacitor, Highfield effects. MOSFET Devices : Long-channel MOSFETs, Short-channel MOSFETs. CMOS Device Design : MOSFET Scaling, Threshold voltage, MOSFET channel length. CMOS Performance Factors : Basic CMOS circuit elements, Parasitic elements, Sensitivity of CMOS delay to device parameters, Performance factors of advanced CMOS devices. Bipolar Devices : n-p-n Transistors, Ideal current-

voltage characteristics, Characteristics of a typical n-p-n transistor, Bipolar device models for circuit and time-dependent analyses, Breakdown voltages. Bipolar Device Design : Design of the emitter design, Design of the base region, Design of the collector design, Modern bipolar transistor structures.

TEXTBOOK :

1. Yuan Taur, Tak.H.Ning, Fundamentals of Modern VLSI Devices, Cambridge University Press,

REFERENCE BOOKS :

1. Donald Neamen, Semiconductors Physics and Devices, Tata Mc Graw Hill, 2003
2. Tyagi, Introduction to Semiconductor Materials and Devices, Wiley Publications, 2002.
3. Semiconductor Devices, Basic Principles Jasprit Singh, Wiley Publications, 2001
4. S.M. Sze (Ed), Physics of Semiconductor Devices, 2nd Edition, Wiley Publications, 1998
5. Analysis and Design of Analog Integrated Circuits 4/e, Paul R. Gray, Paul J. Hurst, Robert G Meyer, 2001, Wiley Publications
6. Physics of Semiconductor Devices 3/e S. M. Sze, Wiley Publications, 2007.

MEMORY DESIGN AND TESTING

SYLLABUS

RANDOM ACCESS MEMORY TECHNOLOGIES-STATIC RANDOM ACCESS MEMORIES (SRAMS)

SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar, SRAM Technologies-Silicon On Insulator (SOI) Technology-Advanced SRAM Architectures and Technologies- Application Specific SRAMs. Dynamic Random Access Memories (DRAMs): DRAM Technology Development-CMOS DRAMs-DRAMs Cell Theory and Advanced Cell Structures- BiCMOS DRAMs-Soft Error Failures in DRAMs-Advanced DRAM Designs and Architecture-Application Specific DRAMs. Non-Volatile Memories-Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)- Bipolar PROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating- Gate EPROM Cell-One-Time Programmable (OTP) Eproms-Electrically Erasable PROMs (EEPROMs)- EEPROM Technology And Architecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-Advanced Flash Memory Architecture. Memory Fault Modeling, Testing, And Memory Design For Testability And Fault Tolerance-RAM Fault Modeling, Electrical Testing, Pseudo Random Testing-

Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing-Application Specific Memory Testing. Semiconductor Memory Reliability And Radiation Effects-General Reliability Issues-RAM Failure Modes and Mechanism-Nonvolatile Memory Reliability-Reliability Modeling and Failure Rate Prediction-Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification. Radiation Effects-Single Event Phenomenon (SEP)-Radiation Hardening Techniques-Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimeter-Water Level Radiation Testing and Test Structures. Advanced Memory Technologies And High-Density Memory Packaging Technologies-Ferroelectric Random Access Memories (FRAMs)-Gallium Arsenide (GaAs) FRAMs-Analog Memories-Magneto resistive Random Access Memories (MRAMs)-Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues-Memory Cards-High Density Memory Packaging Future Directions.

TEXTBOOKS :

1.Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability ", Prentice-Hall of India Private Limited, New Delhi, 1997.

REFERENCE BOOKS :

1. Luecke Mize Care, "Semiconductor Memory design & application", Mc-Graw Hill.
2. Belty Prince, " Semiconductor Memory Design Handbook".
3. Memory Technology design and testing 1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S).

RECONFIGURABLE COMPUTING

SYLLABUS

Introduction Goals and motivations - History, state of the art, future trends - Basic concepts and related fields of study - Performance, power, and other metrics - Algorithm analysis and speedup projections - RC Architectures - Device characteristics - Fine-grained architectures - Coarse-grained architectures . Fpga Design FPGA Physical Design Tools -Technology mapping - Placement & routing - Register transfer (RT)/Logic Synthesis - Controller/Data path synthesis - Logic minimization .Parallel Processing RC Application Design - Parallelism - Systolic arrays -Pipelining - Optimizations - Bottlenecks - High-level Design - High-level synthesis - High-level languages - Design tools. Architectures Hybrid architectures- Communication - HW/SW partitioning - Soft-core microprocessors- System architectures -System design strategies - System services - Small-scale architectures - HPC architectures - HPEC architectures

- System synthesis - Architectural design space explorations. Case Study Case Studies- Signal and image processing - Bioinformatics - Security - Special Topics - Partial Reconfiguration - Numerical Analysis -Performance Analysis/ Prediction - Fault Tolerance

TEXTBOOK :

1. Paul S. Graham and Maya Gokhale "Reconfigurable Computing Accelerating Computation with Field-Programmable Gate Arrays" springer .

ADVANCED ANALOG IC DESIGN

SYLLABUS

SMALL SIGNAL & LARGE SIGNAL MODELS OF MOS & BJT TRANSISTOR. ANALOG MOS PROCESS PASSIVE & ACTIVE CURRENT MIRRORS

Basic current mirrors, CasCode current mirror, Active loads, voltage and current references; Frequency response of integrated circuits: Single Stage (CS,CG,CD) amplifiers, Cascade Stage; frequency response(miller effect) of CG, CS, CD, Operation of Basic Differential Pair, differential pair with MOS loads, Frequency response of Cascade & Differential Pair; Operational Amplifiers with single ended outputs: Applications of operational amplifiers, basic two stage MOS operational amplifiers, Deviations from ideality in real operational amplifiers, Basic two-stage MOS operational amplifier, MOS Folded –casCode operational amplifiers, Feedback: Ideal feedback equation, gain sensitivity, feedback configurations, practical configuration and effect of loading Nonlinear Analog circuits & other applications: Precision rectification ,phased locked loops, Sampling Switches, switched capacitor integrator, oscillators, ADC, DAC.

TEXTBOOKS :

1. Gray & Meyer, Analysis & Design of Analog Integrated Circuits, 4th edition, Wiley, 2001.
2. Behzad Razavi, "Design Of Analog CMOS Integrated Circuits", Tata Mcgraw Hill,2005.

REFERENCE BOOKS :

1. Jacob Baker,"CMOS Mixed Signal Circuit Design", John Wiley.
2. Gray, Wooley, Brodersen, " Analog MOS Integrated Circuits ", IEEE Press, 1989.
3. Kenneth R. Laker, Willy M.C. Sansen, William M.C.Sansen, "Design of Analog Integrated Circuits and Systems ", McGraw Hill.

LOW POWER VLSI CIRCUITS

SYLLABUS

INTRODUCTION

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation. Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic. Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components. Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network. Special Techniques: Power Reduction in Clock networks, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques for SRAM.

TEXTBOOKS :

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic

REFERENCE BOOKS :

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
2. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" Pearson Education

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VLSI SYSTEM DESIGN

SYLLABUS

DESIGN METHODOLOGY

Structured design techniques; Programmable logic; Gate array and sea of gates design; cell based design; full custom design; Design flow; Design Economics. Data path Subsystems: Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off. Memory and Array Subsystems: SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array

yield, reliability; Power dissipation in Memories. Special-purpose Subsystems: Packaging; power distribution; I/O pads; Interconnect: Interconnect parameters; Electrical wire models, capacitive parasitics; Resistive parasitics; Inductive parasitic; Crosstalk; Advanced Interconnect Techniques. Timing Issues: Timing classification; Synchronous design; Self-timed circuit design; Clock Synthesis and Synchronization: Synchronizers; Arbiters; Clock Synthesis; PLLs; Clock generation; Clock distribution; Synchronous Vs Asynchronous Design.

TEXTBOOKS :

1. Neil H. E. Weste, David. Harris and Ayan Banerjee,, "CMOS VLSI Design" - Pearson Education, Third Edition, 2004.
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, Second Edition.

REFERENCE BOOKS :

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH, Third Edition, 2003
2 Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.

SIMULATION BOOKS :

1. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2005.

TESTING OF VLSI CIRCUITS

SYLLABUS

Basics of Testing And Fault Modeling Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation. Test Generation For Combinational and Sequential Circuits Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits. Design For Testability Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches. Self Test and Test Algorithms Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs. Fault Diagnosis Logic Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

TEXTBOOKS :

1.M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.

2.M.L. Bushnell and V.D. Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers.

REFERENCE BOOKS :

1.P.K. Lala, “Digital Circuit Testing and Testability”, Academic Press, 2002.
2.A.L. Crouch, “Design Test for Digital IC’s and Embedded Core Systems”, Prentice Hall International.

SYSTEM ON CHIP DESIGN

SYLLABUS

SYSTEM LEVEL DESIGN

System level design-Tools & methodologies for system level design, System level space & modeling languages, SOC block based design & IP assembly, Performance evaluation methods for multiprocessor SOC design, Power Management And Synthesizing System level power management, Processor modeling & design tools, Embedded software modeling & design Using performance metrics to select microprocessor for IC design, Parallelizing High-Level Synthesize ,A Code transformational approach to High Level Synthesize.

Micro-Architecture Design And Power Optimization Micro-architecture design, Cycle accurate system – level modeling, Performance evaluation, Micro architectural power estimation optimization, Design planning. Software Design Verification logical verification, Design & Verification languages, Digital simulation, using transactional, level models in an SOC design, Assertion based verification. Hardware Design Verification Hardware acceleration & emulation, Formal property verification, TEST, DFT, ATPG,Analog

& mixed signal test.

TEXTBOOK :

1. Louis Scheffer Luciano Lavagno and Grant Martin, “EDA for IC System verification and Testing”, CRC, 2006.

REFERENCE BOOKS :

1. Wayone Wolf,” Modern VLSI Design: SOC Design”
2. Prakash Rashnikar, Peter Paterson, Lenna Singh” System-On-A-Chip Verification methodlogy & Techniques”, Kluwer Academic Publishers.
3. Alberto Sangiovanni Vincentelli,” Surviving the SOC Revolution: A Guide to Platformbased Design”, Kluwer Academic Publishers

PROCESS AND DEVICE CHARACTERIZATION & MEASUREMENTS

SYLLABUS

INTRODUCTION AND PRELIMINARY CONCEPTS

Macro-Meso, Micro and Nanostructure of Materials, Fundamentals of crystallography and Crystal structures Optical Microscopy: Geometry of Optics, Resolution, and Construction of a Microscope, Image Contrast, and Phase Contrast. Electron Microscopy: SEM: Electron Optics - Interaction of Electrons and Matter - Elastic and Inelastic Scattering, Backscattered Electrons, Secondary Electrons, Scanning Electron Microscopy – Image Formation, EPMA, Magnification, and Depth of Field, Distortion, Detectors, Contrast, and Resolution. TEM: Electron diffraction, different electron Diffraction techniques. Semiconductor Material Impurity Characterization: Spectroscopic Ellipsometry (SE), X-ray Reflectivity (XRR), X-ray Fluorescence (XRF), X-ray Diffraction (XRD), Secondary Ion Mass Spectrometry (SIMS), Auger Electron Spectrometry (AES), Rutherford Backscattering Spectrometry (RBS), EDAX, FTIR. Electrical Characterization: Four-probe technique, Hall Effect, sheet resistance C-V measurements, DLTS, Carrier lifetime, impurity profiling, I-V measurements . Process And Spice Model Parameter Extraction

TEXT /REFERENCE BOOKS :

1) W.R. Reunyan, “Semiconductor Measurements and Instrumentation”, Mc-Graw Hill
2) Micro structural Characterization of Materials - David Brandon and Wayne Kaplan, John Wiley and Sons, New York, NY.
3) Schroder, “Semiconductor Material and Device Characterization”
4) Philips F. Kare and Greydon B. Lauabee, “Characterization of semiconductor Materials”, Mc-Graw Hill.
5) K.V. Ravi, “Imperfections and Impurities in Semiconductor Silicon”, John Wiley and Sons.

ADVANCED VLSI DESIGN

SYLLABUS

REVIEW OF MOS CIRCUITS

MOS and CMOS static plots, switches, comparison between CMOS and BI - CMOS. MESFETS: MESFET and MODFET operations, quantitative description of MESFETS. MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS. Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization Beyond CMOS: Evolutionary

advances beyond CMOS, carbon Nano tubes, conventional vs. tactile computing, computing, molecular and biological computing Mole electronics-molecular Diode and diode- diode logic ,Defect tolerant computing. Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks - NMOS and CMOS functional blocks. Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NORNOR, and AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module lay out. System Design: CMOS design methods, structured design methods, Strategies encompassing hierarchy, regularity, modularity & locality, CMOS Chip design Options, programmable logic, Programmable inter connect, programmable structure, Gate arrays standard cell approach, Full custom Design.

TEXTBOOKS :

1. Kevin F Brennan “Introduction to Semi Conductor Device”, Cambridge publications
2. Eugene D Fabricius “Introduction to VLSI Design”, McGraw-Hill publications

REFERENCE BOOKS :

1. D.A Pucknell “Basic VLSI Design”, PHI Publication
2. Wayne Wolf, “Modern VLSI Design” Pearson Education, Second Edition

MEMS SYSTEM DESIGN

SYLLABUS

MEMS and Microsystems, Microsystems and microelectronics, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, MEMS with Micro actuators. Materials For MEMS - Substrate and wafer, silicon as a substrate material, silicon compound, silicon Piezo-resistors, Gallium Arsenide, quartz, Piezoelectric crystals, polymers and packaging Materials. Fabrication Process - Photolithography, Ion implantation, Oxidation, Chemical vapor deposition (CVD), Physical vapor deposition, Deposition by Epitaxy, Etching. Manufacturing Process - Bulk Micromachining, Surface Micromachining, LIGA Process. Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Mechanical packaging of Microsystems, Microsystems packaging, interfacing in Microsystems packaging, packaging technology, selection of packaging materials, signal mapping and transduction. Case study on strain sensors, Temperature sensors, Pressure sensors, Humidity sensors, Accelerometers,

Gyroscopes , RF MEMS Switch, phase shifter, and smart sensors. Case study of MEMS pressure sensor Packaging.

TEXTBOOKS :

1.Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.
2.Julian W Gardner, "Microsensors MEMS and smart devices", John Wiley and sons Ltd,2001.
3.Chang Liu, "Foundation of MEMS", Pearson International Edition,2006.

REFERENCE BOOKS :

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000.
2. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House,
3. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
4. Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003.

VLSI FOR WIRELESS COMMUNICATION

SYLLABUS

COMMUNICATION CONCEPTS

Wireless Channel Description, Path Loss, Multipath Fading, Channel Model and Envelope Fading, Frequency Selective and Fast Fading Receiver Architectures: Receiver Front End:, Filter Design, Rest of Receiver Front End, Derivation of NF, IIP3 of Receiver Front End, Low Noise Amplifier: Wideband LNA Design, Narrow Band LNA:, Impedance Matching, Core Amplifier Active Mixer: Balancing, Qualitative Description of the Gilbert Mixer, Distortion, Low Frequency Case: Analysis of Gilbert Mixer, Distortion, High-Frequency Case, Noise Passive Mixer: Switching Mixer, Distortion in Unbalanced Switching Mixer, Conversion Gain in Unbalanced Switching Mixer, Noise in Unbalanced Switching Mixer, practical Unbalanced Switching Mixer, Sampling Mixer, Conversion Gain in Single-Ended Sampling Mixer Analog-to-Digital Converters: Demodulators, A/D converters Used in a Receiver, Low-Pass Sigma-Delta Modulators, Implementation of Low-Pass Sigma-Delta Modulators, Bandpass Sigma-Delta Modulators, Implementation of Bandpass Sigma-Delta Modulators

TEXTBOOK :

1. Bosco Leung, "VLSI for Wireless Communication, Second Edition, Springer

REFERENCE BOOKS :

1. Emad N Farag, M.I Elmasry, "Mixed Signal VLSI Wireless Design Circuits

and Systems", KluwerPublication.
2. David Tsee, Pramod Viswanath," Fundamentals of Wireless Communication", Cambridge Univ Press.

OPTIMIZATION TECHNIQUES AND APPLICATIONS IN VLSI DESIGN

SYLLABUS

STATISTICAL MODELING

Modeling sources of variations, Monte Carlo techniques, Process variation modeling- Pelgroms model, principal component based modeling, Quad tree based modeling, Performance modeling-Response surface methodology, delay modeling, interconnect delay models Statistical Performance, Power And Yield Analysis Statistical timing analysis, parameter space techniques, Bayesian networks Leakage models, High level statistical analysis, Gate level statistical analysis, dynamic power, leakage power, temperature and power supply variations, High level yield estimation and gate level yield estimation Convex Optimization Convex sets, convex functions, geometric programming, trade-off and sensitivity analysis, Generalized geometric programming, geometric programming applied to digital circuit gate sizing, Floor planning, wire sizing, Approximation and fitting- Monomial fitting, Max-monomial fitting, Polynomial fitting. Genetic Algorithm Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion GA for VLSI Design, Layout and Test automation- partitioning-automatic placement, routing technology, Mapping for FPGA- Automatic test generation- Partitioning algorithm Taxonomy-Multiday Partitioning Hybrid genetic-encoding-local improvement-WDFR-Comparison of Cas-Standard cell placement-GASP algorithm-unified algorithm. Ga Routing Procedures And Power Estimation Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures. Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding- fitness function-GA vs Conventional algorithm.

REFERENCE BOOKS :

1.Ashish Srivastava, Dennis Sylvester, David Blaauw "Statistical Analysis and Optimization for VLSI:Timing and Power" , Springer, 2005.
2. Pinaki Mazumder, E.Mrudnick, "Genetic Algorithm for VLSI Design,Layout and test Automation", Prentice Hall,1998.
3. Stephen Boyd, Lieven Vandenberghe "Convex Optimization", Cambridge University Press,

CMOS RF CIRCUIT DESIGN

SYLLABUS

INTRODUCTION TO RF DESIGN AND WIRELESS TECHNOLOGY

Design and Applications, Complexity and Choice of Technology. Basic concepts in RF design: Nonlinearly and Time Variance, Inter symbol interference, random processes and noise. Sensitivity and dynamic range, conversion of gains and distortion RF Modulation: Analog and digital modulation of RF circuits, Comparison of various techniques for power efficiency, Coherent and non-coherent detection, Mobile RF communication and basics of Multiple Access techniques. Receiver and Transmitter architectures, Direct conversion and two-step transmitters RF Testing: RF testing for heterodyne, Homodyne, Image reject, Direct IF and sub sampled receivers. BJT and MOSFET behavior at RF Frequencies: BJT and MOSFET behavior at RF frequencies, modeling of the transistors and SPICE model, Noise performance and limitations of devices, integrated parasitic elements at high frequencies and their monolithic implementation RF Circuits Design: Overview of RF Filter design, Active RF components & modeling, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design in various technologies, Design of Mixers at GHz frequency range, Various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers, Design issues in integrated RF filters.

TEXTBOOKS :

1. B. Razavi, “RF Microelectronics” PHI 1998
2. R. Jacob Baker, H.W. Li, D.E. Boyce “CMOS Circuit Design, layout and Simulation”, PHI

REFERENCE BOOKS :

1. Thomas H. Lee “Design of CMOS RF Integrated Circuits” Cambridge University press 1998.
2. Y.P. Tsividis, “Mixed Analog and Digital Devices and Technology”, TMH 1996

ADVANCED DIGITAL IC DESIGN

SYLLABUS

IMPLEMENTATION STRATEGIES FOR DIGITAL ICS

Introduction, From Custom to Semicustom and Structured Array Design Approaches, Custom Circuit Design, Cell-Based Design Methodology,

Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches, Pre-diffused (or Mask-Programmable) Arrays, Prewired Arrays, Perspective—The Implementation Platform of the Future. Coping with Interconnect: Introduction, Capacitive Parasitics, Capacitance and Reliability—Cross Talk, Capacitance and Performance in CMOS, Resistive Parasitics, Resistance and Reliability—Ohmic Voltage Drop, Electromigration, Resistance and Performance—RC Delay. Timing Issues in Digital Circuits: Introduction, Timing Classification of Digital Systems,Synchronous Interconnect, Mesochronous interconnect, Plesiochronous Interconnect, Asynchronous Interconnect, Synchronous Design — An In-depth Perspective, Synchronous Timing Basics, Sources of Skew and Jitter, Clock-Distribution Techniques, Synchronizers and Arbiters, Synchronizers— Concept and Implementation, Arbiters, Clock Synthesis and Synchronization Using a Phase-Locked Loop, Basic Concept, Building Blocks of a PLL. Designing Arithmetic Building Blocks: Introduction, The Adder, The Binary Adder: Definitions, The Full Datapaths in Digital Processor Architectures, Adder: Circuit Design Considerations, The Binary Adder: Logic Design Considerations, The Multiplier, The Multiplier: Definitions, Partial- Product Generation, Partial Product Accumulation, Final Addition, Multiplier Summary, The Shifter, Barrel Shifter, Logarithmic Shifter. Designing Memory and Array Structures: Introduction, Memory Classification, Memory Architectures and Building Blocks, The Memory Core, Read-Only Memories, Nonvolatile Read-Write Memories, Read-Write Memories (RAM), Contents-Addressable or Associative Memory (CAM), Memory Peripheral Circuitry, The Address DeCoders, Sense Amplifiers, Voltage REFERENCE Books : , Drivers/Buffers, Timing and Control.

TEXTBOOKS :

1.Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, “Essentials of VLSI Circuits and Systems” – PHI, EEE, 2005 Edition.

2.Neil H. E. Weste and David. Harris Ayan Banerjee,, “CMOS VLSI Design” - Pearson Education.

REFERENCE BOOKS :

1. Sung-Mo Kang, Yusuf Leblebici,”CMOS Digital Integrated Circuits” TMH 2003

2. Jan M. Rabaey, “Digital Integrated Circuits” Pearson Education, 2003

3. Wayne Wolf, “Modern VLSI Design “, 2nd Edition, Prentice Hall,1998.

SIMULATION BOOKS :

1. Etienne Sicard, Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, TMH, EEE, 2005.

NANO SENSORS AND ITS APPLICATIONS

SYLLABUS

SENSOR CHARACTERISTICS AND PHYSICAL EFFECTS

Active and Passive sensors – Static characteristic - Accuracy, offset and linearity – Dynamic characteristics - First and second order sensors – Physical effects involved in signal transduction- Photoelectric effect – Photo dielectric effect – Photoluminescence effect – Electroluminescence effect – Hal effect – Thermoelectric effect – Peizoresistive effect – Piezoelectric effect – Pyroelectric effect –Magneto-mechanical effect (magnetostriction) – Magneto resistive effect. Nano Based Inorganic Sensors: Density of states (DOS) – DOS of 3D, 2D, 1D and 0D materials – one dimensional gas sensors:- gas sensing with nanostructured thin films – absorption on surfaces – metal oxide modifications by additives – surface modifications – nano optical sensors – nano mechanical sensors – plasmon resonance sensors with nano particles – AMR, Giant and colossal magneto resistors – magnetic tunneling junctions. Organic / Biosensors: Structure of Protein – role of protein in nanotechnology – using protein in nanodevices – antibodies in sensing – antibody in nano particle conjugates – enzymes in sensing – enzyme nanoparticle hybrid sensors – Motor proteins in sensing – transmembrane sensors – Nanosensors based on Nucleotides and DNA – Structure of DNA – DNA deCoders and microarrays – DNA protein conjugate based sensors – Bioelectronic sensors – DNA sequencing with nanopores – sensors based on molecules with dendritic architectures – biomagnetic sensors. Nano Sensors:Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry Biosensors. Applications: Cantilever array sensors - Cantilever sensors for diagnosis of diabetes mellitus - Cantilever sensors for cancer diagnosis - Nanotube based sensors - Nanotube based sensors for DNA detection - Nanotube based sensors for capnography - Nanowire based sensors - Nanowire based electrical detection of single viruses - Nanowire based electrical detection of biomolecules. Detectors and Applications: Bio receptors –Bio detectors - Nano array based detector - Nano Particle based detector - Ultra-sensitive detection of pathogenic biomarkers - Ultra-sensitive detection of single bacteria.

REFERENCE BOOKS :

1. Kourosh Kalantar – Zadeh, Benjamin Fry, “Nanotechnology- Enabled Sensors”, Springer,
2. H.Rosemary Taylor, “Data acquisition for sensor systems”, Chapman & Hall, 1997.
3. Jerome Schultz, Milan Mrksich, Sangeeta N. Bhatia, David J. Brady, Antonio J. Ricco, David 4 R. Walt, Charles L. Wilkins, “Biosensing: International Research and Development”, Springer,
5. Ramon Pallas-Areny, John G. Webster, “Sensors and signal conditioning” John Wiley & Sons, 2001.

6. Vijay.K.Varadan, Linfeng Chen, Sivathanupillai, “Nanotechnology Engineering in Nano and Biomedicine”, John Wiley & Sons, 2010.

ASIC DESIGN FLOW

SYLLABUS

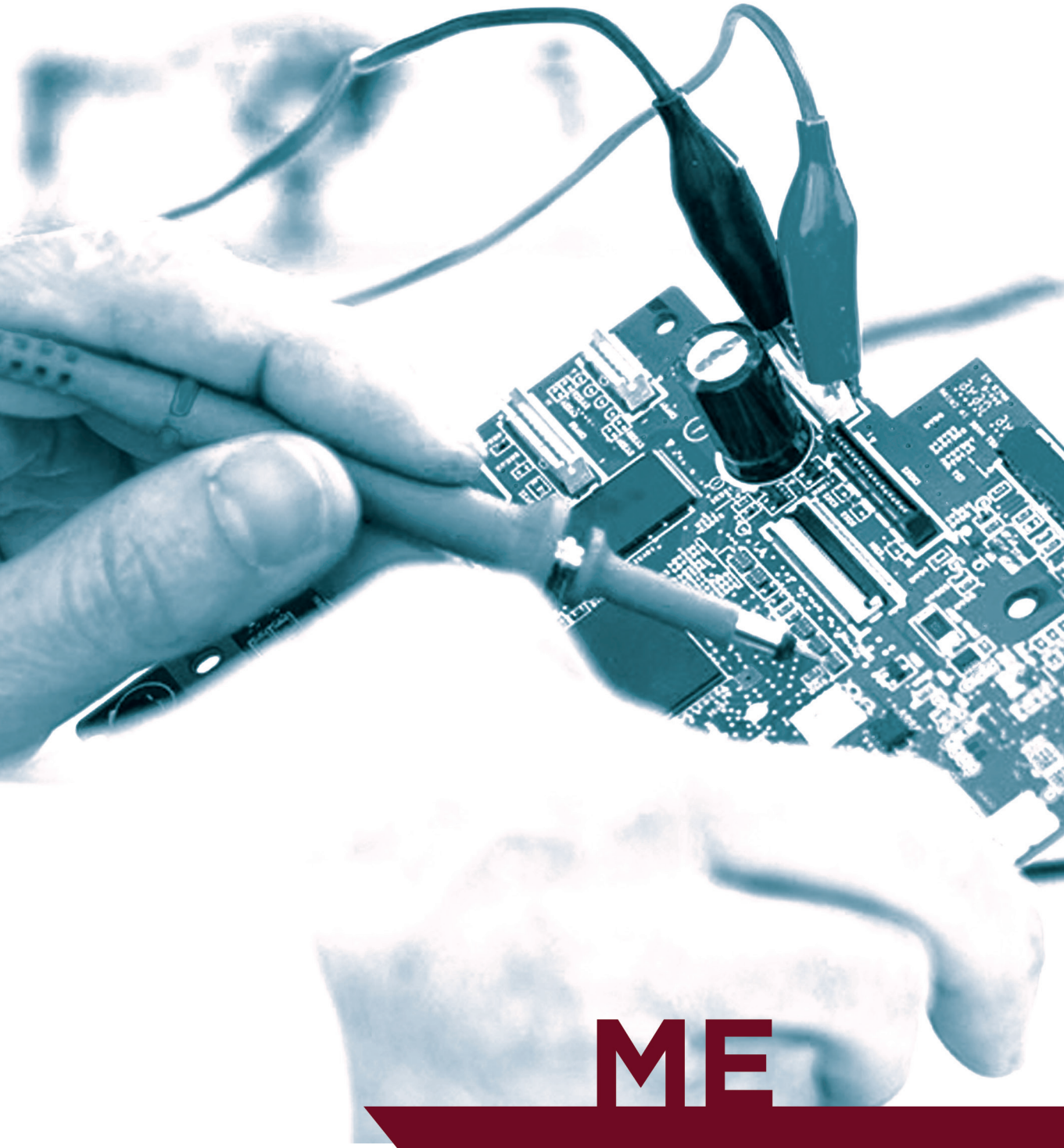
Types of ASICs – Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers. ASIC Library design: Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC. Low level design entry: Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog. Logic synthesis in verilog and & VHDL simulation. CMOS System case studies: Dynamic warp processor: Introduction, the problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication. pixels-planes graphic engine: introduction, raster scan graphic fundamental, pixels-planes system overview, chip electrical design, chip organization and layout, clock distribution. Hierarchical layout and design of single chip 32 bit CPU: Introduction ,design methodology, technology updatability and layout verification. Floor planning & placement: Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools ,I/O and Power planning, Clock planning ,Placement Algorithms. Routing: Global routing, Detailed routing ,Special routing.

TEXTBOOKS :

1. Application specific Integrated Circuits”, J.S. Smith, Addison Wesley.
2. Principles of CMOS VLSI Design : A System Perspective, N. Westle & K. Eshraghian ,Addison – Wesley Pub.Co.1985.

REFERENCE BOOKS :

1. Basic VLSI Design :Systems and Circuits, Douglas A. Pucknell & Kamran Eshraghian, Prentice Hall of India Private Ltd. , New Delhi , 1989.
2. Introduction to VLSI System,C. Mead & L. Canway, Addison Wesley Pub
3. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall,
4. The Design & Analysis of VLSI Circuits, L. A. Glassey & D. W. Dobbepahl, Addison Wesley Pub Co. 1985.
5. Digital Integrated Circuits: A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt Ltd



ME

EMBEDDED SYSTEMS

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EM 5101	Advanced Micro Processors and Microcontrollers	3	0	2	4
2	18 EM 5102	Embedded Linux	3	2	0	4
3	18 EM 5103	Networking Embedded Systems	3	0	2	4
4	18 EM 5104	Artificial Intelligence	3	2	0	4
5		Elective – I	3	0	0	3
6		Elective – II	3	0	0	3
7	18 IE 5149	Seminar	0	0	4	2
		Total	**18**	**4**	**8**	**24**

FIRST YEAR (SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 EM 5205	Digital Signal Processing	3	0	2	4
2	18 EM 5206	Embedded Linux Drivers	3	2	0	4
3	18 EM 5207	Wireless Networks	3	2	0	4
4	18 EM 5208	Securing Embedded Systems	3	0	2	4
5		Elective –III	3	0	0	3
6		Elective - IV	3	0	0	3
7	18 IE 5250	Term Paper	0	0	4	2
		Total	**18**	**4**	**8**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 EM 51A1	Digital Image Processing	3	0	0	3
2	18 EM 51A2	Natural Language Processing	3	0	0	3
3	18 EM 51A3	Sensors and Actuators	3	0	0	3
4	18 EM 51A4	Sensing Principles	3	0	0	3
Elective-2						
1	18 EM 51B1	Digital Video Processing	3	0	0	3
2	18 EM 51B2	Machine Learning	3	0	0	3
3	18 EM 51B3	Fundamentals of IOT	3	0	0	3
4	18 EM 51B4	Digital Instrumentation	3	0	0	3
Elective-3						
1	18 EM 52C1	Digital Audio Processing	3	0	0	3
2	18 EM 52C2	Deep Learning	3	0	0	3
3	18 EM 52C3	Developing IOT Applications through Python	3	0	0	3
4	18 EM 52C4	Wireless Sensor Networks	3	0	0	3
Elective-4						
1	18 EM 52D1	Video and Audio Streaming	3	0	0	3
2	18 EM 52D2	Cloud Computing and Big Data Analytics	3	0	0	3
3	18 EM 52D3	Data Analytics for IOT	3	0	0	3
4	18 EM 52D4	Sensor Network Programming	3	0	0	3

DETAILED SYLLABUS DESIGN – SEMESTER – 1

ADVANCED MICRO PROCESSORS AND CONTROLLERS

DETAILED SYLLABUS

Introduction to advanced features built into Advanced Micro processors and controllers: Review of the Features supported in Basic Micro Controllers (8051 + Atmega) and Advanced processors and micro controllers, a brief review of the features supported in advanced micro processors and controllers

Introduction to ARM Technologies: Variants of ARM processors and controllers, Advanced ARM processors and controllers

ARM Processor (ARM7): Features, Components, Connectivity, Acorn RISC Machine

– Architecture inheritance – 3 and 5 stage pipeline ARM organizations – Advanced Microcontroller bus architecture- Little Endian Big Endian architecture

ARM Controller (LPC2148): Features, Pin configuration, On Chip Devices: GPIO, Serial communication, A/D Converters: single and Multiple Channels, Interrupts,

Basic Interfacing, GPIO and interfacing devices to the GPIO, Fast GPIO

ARM programming through C++ using IDE-IAR: Overview on KEIL/IAR, installing KEIL/IAR, Drill down using C/C++: Variable declaration, includes, Conditional and Looping instructions, Computational instructions,loops,

Interfacing with LPC2148: Developing application for effecting communication between PC and LPC2148, Interfacing RFID, GSM, Smart card and developing small applications, Implementing application through RTOS: Interrupt processing and inter-task communication

TEXTBOOKS :

1. ARM System on Chip Architecture – Steve Furber – 2nd ed., 2000, Addison Wesley Professional
2. Volume 1: LPC214x User Manual, UM10139, http://www.semiconductors.philips.com
3. John H. Davies, “MSP430 Microcontroller Basics”, Newnes (Elsevier Science), 2nd Edition, 2008.

EMBEDDED LINUX

Detailed Syllabus

Fundamentals of Linux: Basic Linux System Concepts: Working with Files and Directories- Introduction to Linux File system- Working with Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command – Line Commands - Working with the Bash Shell.

ARCHITECTURE OF EMBEDDED LINUX

Linux Kernel Architecture - Porting Linux into controllers, GNU Cross Platform Tool chain Host - target setup and overall architecture: Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/ Target, Development Setups - Types of Host/Target Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations – System Memory Layout – Processor Architectures - Buses and Interfaces - I/O Storage

KERNEL CONFIGURATION

A Practical Project Workspace - GNU Cross - Platform Development Toolchain - C Library Alternatives - Other Programming Languages

Porting Linux into the target using Eclipse: An Integrated Development Environment – Terminal Emulators - Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel - Basic Root Filesystem Structure – Libraries - Kernel Modules and Kernel Images – Device Files – Main System Applications - System Initialization

TEXTBOOKS :

1. Karim Yaghmour, Jon Masters, Gilad Ben - Yossef, and Philippe Gerum, ‘Building Embedded Linux Systems 2nd Edition’, SPD - O’Reilly Publications, 2008
2. P.Raghavan, AmolLad, Sriram Neelakandan,”Embedded Linux System Design & Development,Auerbach Publications, 2012
3. William von Hagen, ‘Ubuntu Linux Bible 3rd Edition’, Wiley Publishing Inc., 2010
4. Jonathan Corbet, Alessandro Rubini & Greg K roah Hartman, ‘Linux Device Drivers 3 rd Edition’, SPD - O’Reilly Publications , 2011
5. Robert Love,”Linux System Programming, SPD - O’Reilly Publications, 2010

NETWORKING OF EMBEDDED SYSTEMS

DETAILED SYLLABUS

Introduction to networking Peer to peer connectivity, Any to Any connectivity, Rs232C review. A small review on essential of communication Networking through RS485: RS485 Standards, balanced Differential Lines, Termination resistors, Topologies, cable length and data rate, Maximum number of devices in a RS485 network, Grounding and Common wires, Connections, Half- duplex- RS485, RS485 converters, Full-duplex-RS485

Networking through USB: Introduction, Speed identification on the bus, USB states, USB bus communication – Packets, Data flow types, Enumeration, descriptors, interfacing PIC 18 with USB, Developing Sample networking of embedded systems using USB

Meaning, the I2C Bus, Acknowledgments and negative Acknowledgements, addressing, I2C Firmware, Developing Sample networking of embedded systems using I2C

Networking through CAN: Introduction, Frames, bit stuffing, error detection, types of errors, Nominal bit timing, Interfacing PIC controller with CAN, Development of Sample Networking of embedded systems using PIC Micro Controllers

Networking through Ethernet: Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure. Developing small application

TEXTBOOKS :

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software
2. Introduction', Wiley Publications
3. Jan Axelson, 'Parallel Port Complete', Penram publications
4. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
5. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications

ARTIFICIAL INTELLIGENCE

DETAILED SYLLABUS DESIGN

Introduction to AI: Intelligent Agents, Solving problems by searching, problem-solving agents, well defined problems and solutions with examples.

Applications of AI: ANN, Fuzzy Systems, NLP. Introduction to Expert systems. Uninformed search strategies: BFS, DFS, Iterative deepening, bidirectional search. Heuristic Search Techniques: Greedy BFS, A*, memory bounded,

heuristic functions.

Local & Adversarial search: Optimization problems, hill climbing search, simulated annealing, local beam search, genetic algorithms. Online search agents and unknown environments. Optimal decisions in games, alpha-beta pruning, cutting of search, forward pruning, stochastic games, partially observable games. Constraint satisfaction problems:-Inference in CSPs, back tracking search foe CSPs, Local search for CSPs.

Knowledge and reasoning: knowledge based agents, Logic, propositional logics and horn clauses, first order logic, Inference in first order logic, Propositional versus first order inference, unification and lifting, forward & backward chaining, resolution.

Handling Uncertainty: Quantifying uncertainty, basic probability notation, Bayes theorem, Probabilistic reasoning, representation of conditional distributions, probabilistic reasoning overtime, hidden Markov model, and Kalman filters.

TEXTBOOKS :

1. Russel and Norvig, 'Artificial Intelligence', third edition, Pearson Education, PHI, (2015)
2. Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3nd Edition, Tata McGraw Hill Edition, Reprint(2008)

REFERENCE BOOKS :

1. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education (2003)
2. G. Luger, W. A. Stubblefield, "Artificial Intelligence", Third Edition, Addison-Wesley,(2007)
3. William F. Clocks in, Christopher S. Mellish-Programming in Prolog- Springer (2003)

ELECTIVE – 1

DIGITAL IMAGE PROCESSING

DETAILED SYLLABUS DESIGN

INTRODUCTION

Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.

DIGITAL IMAGE FUNDAMENTALS

Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations.

DIGITAL IMAGE TRANSFORMS

Image Transforms – The Discrete Fourier Transform, The FFT, Walsh, Hadamard, Discrete Cosine Transform, The Haar Transform, And The Slant Transform,

IMAGE ENHANCEMENT IN SPATIAL DOMAIN

Some basic Grey level transformations, histogram processing, enhancement using Arithmetic/Logic operations, Smoothing Spatial Filters, Sharpening Spatial Filters.

Image enhancement in frequency domain: Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters.

IMAGE RESTORATION

Noise models, Restoration in the presence of Noise, only Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Inverse Filtering, Wiener Filtering, Least mean square Filtering.

IMAGECOMPRESSION

Fundamentals –Image Compression models–Error Free Compression, Lossy Compression.

IMAGE SEGMENTATION

Detection of discontinuities, Thresholding, Edge based Segmentation and Region based Segmentation.

Image representations and description Representation schemes, Boundary Descriptors, Regional Descriptors

TEXTBOOKS :

1. Rafael C Gonzalez, Richard E Woods," Digital Image Processing", Second Edition, Pearson Education Asia, 2002. (Chapter 1, 3, 4, 5, 6, 7, 8, 9)
2. Jorg Arndt, " DSP Algorithms for Programmers"(Chapter 3)
3. Gonzalez. R & Woods B.E.," Digital Image Processing", Addison Wesley Longman Pearson Education, 2000.

REFERENCE BOOKS :

1. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, Second Edition, 2001.
2. William J Prati, "Digital Image Processing", John Wiley & sons
3. Tinku Acharya, Ajoy K Ray, "Image Processing Principles and Applications Principles and Applications", Wiley- Inter science.

2.5.2 NATURAL LANGUAGE PROCESSING

DETAILED SYLLABUS DESIGN

INTRODUCTION

overview, Statistical machine translation, Language models and their role in speech processing, The problem of ambiguity, NLP tasks in syntax, semantics, and pragmatics. Words: Structure, Semantics,

PARTS OF SPEECH AND SENTENCES

Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down,

DYNAMIC PROGRAMMING: CYK PARSER). SENTENCES

Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters.

N-gram Language Models and Information Theory: The role of language models. Simple N-gram models, Entropy, relative entropy, cross entropy, Statistical estimation and smoothing for language models.

Statistical Machine Translation (MT) Alignment Models: Statistical Alignment Models and Expectation Maximization (EM) EM and its use in statistical MT alignment models, EM algorithm.

SPEECH PROCESSING

Part of Speech Tagging and Sequence Labelling, Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training). N-gram models.

SYNTACTIC-PARSING

Grammar formalisms, treebanks. Efficient parsing for context-free grammars (CFGs), Statistical parsing, probabilistic CFGs (PCFGs, Top-down and bottom-up parsing, empty constituents, left recursion.

Modern Statistical Parsers Search methods in parsing: Agenda-based chart, A*, “best-first” parsing, Dependency parsing, Discriminative parsing.

SEMANTIC ANALYSIS

Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Reference, pronoun resolution algorithm, text coherence, discourse structure. Labelling and parsing of semantics. Syllabus

INFORMATION EXTRACTION (IE)

Named entity recognition and relation extraction, sequence labelling, Information sources, rule-based methods, evaluation (recall, precision.

Machine Translation (MT): Basic issues in MT. Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase-based translation, and synchronous grammars,

ADDITIONAL TOPICS

Advanced Language Modelling (including LDA), other applications like summarization.

TEXTBOOKS :

1. Daniel Jurafsky and James H. Martin "An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Second Edition.
2. Bird, S., Klein, E., Loper, E. (2009). Natural Language Processing with Python. Sebastopol, CA: O'Reilly Media.

REFERENCE BOOKS :

1. James A.. Natural language Understanding 2e, Pearson Education, 1994
2. Bharati A., Sangal R., Chaitanya V.. Natural language processing: a Paninian perspective, PHI, 2000
3. Siddiqui T., Tiwary U. S.. Natural language processing and Information retrieval, OUP, 2008.
4. Manning, Christopher D.; Hinrich Schuetze; Foundations of Statistical Natural Language Processing Cambridge, MIT Press, 1999.
5. Kiraz, George Anton; Computational Nonlinear Morphology: With Emphasis on Semitic Languages Cambridge University Press, 2001, 171 pages

SENSORS AND ACTUATORS

DETAILED SYLLABUS

INTRODUCTION TO SENSORS AND ACTUATORS

Role of sensors and actuators, sensors and Actuators in Automobile Systems, Sensors and Actuators in feedback control system, Importance of estimation in sensing, Innovative Sensor technologies, Application scenarios, Analog and digital transducers and Actuators

Component interconnection. Signal modification conditioning, Importance of Impedance Matching in Component Interconnection, Impendence matching methods

ANALOG SENSORS

Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Temperature sensors, Humidity sensors, LDR, stepper motor, Level sensor, pressure, Piezo Vibration sensor, and Flow sensor, Potentiometers, differential transformers, tachometers, piezoelectric devices, gyros, Keyboards

ANALOG ACTUATORS

Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Stepper Motors, PieZo Actuator, Solenoid Valve, relay systems, Ultrasonic Motor Actuator

DIGITAL SENSORS

Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Temperature sensors, Humidity sensors, LDR, Level sensor, pressure, and Flow sensor

DIGITAL ACTUATORS

Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering DC, servo Motors, PieZo Actuator, Solenoid Valve, relay systems, Ultrasonic Motor Actuator

TEXTBOOKS :

1. Sensors and actuators, Engineering System for instrumentation, 2nd Edition, Clarence W d Selva, CRC Press
2. Data Sheets downloaded from different WEB sites

SENSING PRINCIPLES

DETAILED SYLLABUS DESIGN

SENSOR FUNDAMENTALS

Basic sensor technology, sensor characteristics, static and dynamic Principles of sensing: capacitance, magnetic and electromagnetic induction, resistance, piezoelectric effect, Pyroelectric effect, Hall effect, See beck and Pettier effect, heat transfer, light, Sensor Characteristics

ANALYSIS OF EXPERIMENTAL DATA

causes and types of experimental errors, statistical analysis of experimental data, –method of least squares, correlation coefficient, multivariable regression, graphical analysis and curve fitting.

PRINCIPLES OF PHYSICAL MEASUREMENT

Position, Displacement, Level, Velocity, Acceleration, Force, Strain, Tactile and pressure.

PRINCIPLES OF CHEMICAL SENSING

chemical sensing Mechanisms, potential sensing, Conduct metric Sensors, Amperometric Sensors, Catalytic gas sensing.

PRINCIPLES FOR OPTICAL SENSORS

Optical Radiation, Electromagnetic Spectrum, Snell's Law and Total internal reflection, Diffraction principles, Optical Detectors and Sources-Photo diodes and transistors, Photo-darling ton pairs, Photoconductive sensors, CCD sensors, Fiber optic sensors.

PRINCIPLES OF SOLID STATE SENSING

LED, Diode lasers, Semiconductor laser optical cavity resonator.

PRINCIPLES OF BIO SENSING:

Transmission of bioelectrical Signals, Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), sensing through electrodes: Catalytic, mono-enzyme, bi-enzyme electrodes. cell sensing, sensing bio arrays

TEXTBOOKS :

1. Biosensor Principles and Applications, Edited by Loïc J.Blum, Pierre R. Coulet Agarwal, Govind P, "fiber Optic Communication Systems", 2nd edition, Wiley, NewYork,1997
2. Principles of Biochemistry Albert L.Lehninger, David Lee Nelson, Michael M. 2005, Fourth Edition.
1. 3. Sensors and Transducers D. Patranabis Prentice-Hall of India Pvt.Ltd August 15, 2004
2. 4.Jacob Fraden, " Hand TextBook : of Modern Sensors: physics, Designs and Applications",3rded.,Springer,2003.

ELECTIVE – 2

DIGITAL VIDEO PROCESSING

DETAILED SYLLABUS

REPRESENTATION OF DIGITAL VIDEO

Basics of Video: Analog Video, Digital Video, Digital Video Processing, Time Varying image formation models: 3D motion models, Geometric image formation, Photometric image formation, Photometric effects of 3D motion, Spatio temporal sampling: Sampling for analog and digital sampling, Sampling on 3D Structures, Reconstruction from samples.

2D MOTION AND ESTIMATION

Optical Flow Methods: 2D motion, 2D Motion Estimation, Methods using optical flow equation, PEL Recursive Methods: Displaced frame difference, Gradient based optimization, Steepest decent based algorithms, Wiener estimation

based algorithms, Bayesian Methods: Optimization methods, Basics of MAP motion estimation, MAP motion estimation algorithms.

3D MOTION ESTIMATION AND SEGMENTATION

Methods using point correspondences: Modeling the projected displacement field, methods based on the orthographic model, methods based on the perspective model, case of 3D planar surfaces,

MOTION SEGMENTATION

Direct methods, Optical flow segmentation, Simultaneous estimation and segmentation, Stereo and motion tracking: Motion and structure from stereo, Motion tracking – 2D and 3D.

VIDEO FILTERING

MOTION COMPENSATED FILTERING

Spatio temporal Fourier Spectrum, Sub Nyquist spatio temporal sampling, filtering along motion trajectories, Applications: motion compensated noise filtering, motion compensated reconstruction filtering, Noise Filtering: Intraframe filtering, Motion adaptive filtering, Motion compensated filtering.

VIDEO COMPRESSION AND DIGITAL VIDEO SYSTEMS

The H.261 Standard, The MPEG-1 Standard, The MPEG-2 Standard, Software and Hardware Implementations, Video Conferencing, interactive video and multimedia, Digital Television, Low bitrate video and videophone.

TEXTBOOK :

1. Digital Video Processing by A M Tekalp, Prentice Hall.

MACHINE LEARNING

DETAILED SYLLABUS DESIGN
INTRODUCTION AND DECISION TREES

Introduction to Learning problems. Designing a Learning System: Choosing Training Experience, Choosing target Function, Choosing a Representation for the Target function, choosing a Function Approximation Algorithm, the final Design.

PERSPECTIVES AND ISSUES IN MACHINE LEARNING

Issues in Machine Learning. Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning. The Basic Decision Tree Learning Algorithm: Which attribute is the Best classifier, an illustrative example, Hypothesis Space Search in Decision Tree Learning?

INDUCTIVE BIAS IN DECISION TREE LEARNING

Restriction Biases and preference Biases, why prefer short Hypotheses. Issues in Decision Tree Learning: Avoiding Over fitting the Data, Incorporating Continuous-valued Attributes, Alternative Measures for Selecting Attributes, Handling Training Examples with Missing Attribute Values, Handling Attributes with Differing Costs.

BAYESIAN LEARNING

Introduction, Bayes Theorem. Bayes Theorem and Concept Learning: Brute-Force Bayes Concept Learning, MAP Hypothesis and Consistent Learners. Maximum Likelihood and Least-squared Error Hypotheses, Maximum Likelihood Hypothesis for predicting probabilities: Gradient Search to Maximize Likelihood in a Neural Net. Minimum Description Length Principle,

Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, and An Example: Learning to classify Text.

BAYESIAN BELIEF NETWORKS

Conditional Independence, Representation, Inference, Learning Bayesian Belied Networks, Gradient Ascent Training of a Bayesian Networks, Learning the structure of Bayesian Networks. The EM Algorithm: Estimate Means of K Gaussians, General Statement of EM Algorithm, Derivation of the K Means Algorithm.

ARTIFICIAL NEURAL NETWORKS

Introduction, Neural Network Representations, Appropriate Problems for Neural Network Learning, Perceptron, and Multi-Layer Networks and BACK PROPAGATION Algorithm, Remarks on the BACK PROPAGATION Algorithm, Advanced Topics in Artificial Neural Networks.

GENETIC ALGORITHMS

Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

LEARNING SETS OF RULES

Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First-Order Rules, Learning Sets of First-order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution.

INTRODUCTION TO ANALYTICAL LEARNING

Inductive and Analytical Learning Problems, and Learning with Perfect Domain Theories: PROLOG-EBG, Remarks on Explanation Based Learning, Explanation Based Learning of

TEXTBOOKS :

1. Tom M.Mitchell ,"Machine Learning", McGraw Hill,1997
2. Stephen Marsland, "Machine Learning an Algorithmic Perspective", CRC Press,(2009). nd
3. Chun, J Wesley, Core Python Programming, 2 Edition, Pearson,

2007 Reprint 2010.
4. Programming Python by Mark Lutz, O'Reilly.

REFERENCE BOOKS :

1. Ethem Alpadin, "Introduction to Machine Learning", The MIT Press, (2010)

FUNDAMENTALS OF IOT

DETAILED SYLLABUS

INTRODUCTION TO IOT

Definition, Characteristics, things in IOT, Challenges of IOT based Systems, IOT Device: Building Blocks, Raspberry Pi as an IOT device, Raspberry PI components, Porting LINUX on Raspberry PI, Raspberry PI frequently used commands, Raspberry PI interfaces: Serial, SPI and I2C, Other IOT devices

IOT Communication model and Protocols: Link Layer: 802.3 Ethernet, 802.11 WiFi, 802.16 WiMax, 802.15.4 LR-WPAN, 2G/3G/4G Mobile Communication, Network/Internet Layer: IPv4, IPv6, IPv6 Low power, Transport Layer: TCP, UDP, Application Layer:HTTP, CaAP, WebSocket, MQTT, XMPP, DDS, AMQP

IOT Design Components: Function Blocks, Communication Models, Communication API

IOT ENABLING TECHNOLOGIES

Wireless sensor networks, Cloud Computing, Big data Analytics, Embedded Systems, Communication protocols

IOT TOPOLOGIES AND DEPLOYMENT MODELS

IOT Deployment components (Devices, resources, controller service, database, web services (stateless/Stateful, Unidirectional / Bi Directional, Request-response/Full duplex, TCP Connections, Header Overhead , Scalability), Analysis Components, Applications, Communication Topologies: Level-1, Level-2, Level-3, Level-4, Level-5, Level-6

TEXTBOOK :

1. Arshdeep Bahga and Vijay Madisetti,, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547 .

REFERENCE BOOKS :

2. Wolfram Donat "Learn Raspberry Pi programming in python", Apress (2014), ISBN – 9781430264255
3. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759.
4. "Learning Python", Fifth Edition by Mark Lutz, Published by O'Reilly

Media, ISBN: 978-1-449-35573-9.

DETAILED SYLLABUS DESIGN SEMESTER – 2

DIGITAL SIGNAL PROCESSING

DETAILED SYLLABUS DESIGN

INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Introduction, A Digital signal- processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time- invariant systems, Digital filters, Decimation and interpolation

COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of erroring DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

Programmable DSP Devices: Basic features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

ANALOG DEVICES FAMILY OF DSP DEVICES

Analog Devices Family of DSP Devices- ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP2100, ADSP-2181 high performance Processor. Introduction to Blackfin Processor – The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TEXTBOOKS :

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing – K Padmanabhan, R. Vijayarajeswaran, Ananthi.S, New Age International, 2006/2009.
3. Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan, Sen M. Kuo, Wiley-IEEE Press, 2007.

REFERENCE BOOKS :

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architecture & Features- Lapsley et al. 2000, S. Chand & Co. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI.
4. The Scientist and Engineering's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0- 9660176-3-3, 1997.
5. Embedded Media Processing by David J. Katz and Rick Gentile of Analog Devices, Newnes, and ISBN 0750679123, 2005.

EMBEDDED LINUX DRIVERS

DETAILED SYLLABUS

INTRODUCTION

Introduction in to basics on Linux drivers, introduction to GNU cross platform Tool chain, Device driver basics - module utilities - file systems - MTD subsystems – busy box.

DEVELOPMENT TOOLS

Embedded development environment - GNU debugger - tracing & profiling tools - binary utilities - kernel debugging - debugging embedded Linux applications - porting Linux - Linux and real time - SDRAM interface.

EMBEDDED STORAGE AND DRIVERS

Flash Map, MTD—Memory Technology Device, MTD Architecture, Flash-Mapping Drivers, MTD Block and Character devices, device drivers, Embedded File systems;

DEVELOPING OTHER EMBEDDED DRIVERS

Linux Serial Driver, Ethernet Driver, I2C subsystem on Linux, USB driver, RS485

Driver, CAN driver

DEVELOPING APPLICATIONS

Asynchronous serial communication interface - parallel port interfacing - USB interfacing - memory I/O interfacing - using interrupts for timing.

TEXTBOOKS :

1. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, "Building embedded Linux systems", O'Reilly, 2008.
2. Christopher Hallinan, "Embedded Linux Primer : A practical real worldapproach", Prentice Hall, 2007.
3. Craig Hollabaugh, "Embedded Linux: Hardware, software and Interfacing", Pearson Education, 2002.
4. Doug Abbott, "Linux for embedded and real time applications", Elsevier Science, 2003.
5. Embedded Linux System Design and Development, P. Raghavan, Amol Lad, Sriram Neelakandan, 2006, Auerbach Publications

WIRELESS NETWORKS

DETAILED SYLLABUS

INTRODUCTION

The Global Cellular Network, Broadband, Transmission Fundamentals: Wireless Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, and Transmission Media, Multiplexing, Communication Networks: LANs, MANs, WANs, Switching Techniques, Circuit Switching, Packet Switching, Asynchronous Transfer mode.

THE TCP/IP SUITE

The Need for Protocol Architecture. The TCP/IP Protocol Architecture, The OSI Protocol Architecture, internetworking

Wireless communication technology: Antennas and Propagation: Antennas. Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment

SIGNAL ENCODING TECHNIQUES

Signal Encoding Criteria. Digital Data, Analog Signals. Analog Data, Analog Signals. Analog Data, Digital signals.

SPREAD SPECTRUM

The Concept of Spread Spectrum. Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum. Code Division Multiple Access. Generation

of Spreading Sequences, Coding and Error Control,

CELLULAR WIRELESS NETWORKING

Principles of Cellular Networks. First Generation Analog networking, Second Generation TDMA and CDMA based systems, Third Generation GSM Systems.

IEEE 802.11 WIRELESS LAN STANDARDS:

IEEE 802 Protocol Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layers.

BLUETOOTH

Overview. Radio Specifications, Baseband Specification, Link Manager Specification, Logical Link Control, Adaptation protocol. Mobile IP and Wireless Access Protocol: Mobile IP, Wireless Application Protocol. Cordless Systems and Wireless Local Loop: Cordless Systems, Wireless Local Loop, IEEE 802.16 Fixed Broadband Wireless Access Standards.

WIRELESS NETWORKING

Overview, Infrared LANs, Spread Spectrum LANs, Narrowband Microwave LANs

TEXTBOOKS :

1. William Stallings, "Wireless Communications and Networks", Pearson Education, 2005
2. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2001.

REFERENCE BOOKS :

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", First edition, Pearson Education, 2001.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2001.

SECURING EMBEDDED SYSTEMS

DETAILED SYLLABUS DESIGN

INTRODUCTION TO CRYPTOGRAPHY

Ciphering, types of cypher, Theory of Ciphers, Public and private Key Management: Key lengths, Generating Keys, Transferring, Verification, Updating, Storing, and Backup, destroying keys

ENCRYPTION AND DECRYPTION ALGORITHMS

DEA, TDEA, RSA, Block Cipher Algorithms: RC2, BLOW FISH, RC5, Digital

Signature and Algorithms: Meaning, creation, storage and distribution, Algorithms: DSA and Its variants, Digital Certificates: Meaning, Creation. Distribution, Algorithms

SECURING EMBEDDED SYSTEMS

Vulnerabilities, Classification of attacks, Attacking: Timing, Fault Injection, Power Analysis, electromagnetic emanation, crypto servers, Counter Attacking: Methods that can be employed for counter attacking Timing, Fault Injection, Power Analysis, electromagnetic emanation based attacks, Sample applications and developments

REFERENCE BOOKS :

1. Applied Cryptography, 7/e, Bruce SCHNEIER John Wiley & Sons Inc.
2. Cryptography and Network Security, William Stallings, PHI.
3. Introduction to cryptography with coding Theory, 7/e, Wade Trappe, C. Washington, PEA.
4. Cryptography and Information Security, V.K. Pachghare, PHI.
5. Cryptography and Network Security, Forouzan, TMH, 2007.
6. Cryptography and Network Security, 2/e, Kahate , TMH.
7. Modern Cryptography, Wenbo Mao, PEA
8. Securing the embedded systems from side channels, PhD thesis, K. Subba Rao, KL University

TERM PAPER

DETAILED SYLLABUS DESIGN

1. Choose the problem
2. Literature Survey
3. Conduct Literature Review
4. Find the gaps
5. Investigate and Innovate new solutions or enhancement of the existing solutions
6. Experiment and prove results

ELECTIVE – 3

DIGITAL AUDIO PROCESSING

DETAILED SYLLABUS DESIGN

INTRODUCTION AND QUANTIZATION

Digital Transmission Systems, Storage media, Audio components at home, Signal quantization, Dither, Spectrum shaping of quantization – noise shaping,

Number representation.

A to D converters, D to A converters, Digital Signal Processors – Fixed point DSP, Floating point DSP, Digital audio interfaces, signal processor systems, Multiprocessor systems – Connection via serial links, Connection via parallel links, Connections via standard bus systems, scalable audio systems.

EQUALIZERS AND ROOM SIMULATION

Recursive audio filters- Design, parametric filter structures and Quantization effects, Non recursive audio filters – Fast convolution, Fast convolution of Long sequences, Filter design by frequency sampling, Multi complementary filter bank, Ando's investigations, Gerzon algorithms, Subsequent Reverberation – Schroeder Algorithm, General feedback systems, Approximation of room impulse response.

Static Curve, Dynamic behaviour, Implementation – Limiter, Compressor, Expander, Noise Gate, Combination System; Realization Aspects, Synchronous conversion,

Asynchronous conversion, Interpolation methods – Polynomial Interpolation, Lagrange Interpolation, Spline Interpolation.

COMPRESSING AUDIO FILES

Lossless data compression, Lossy data compression, Psychoacoustics – Critical bands and Absolute Threshold, Masking, ISO-MPEG1 audio coding, Dynamic bit allocation and coding.

TEXTBOOK :

1. Digital Audio Signal Processing by Udo Zolzer, Wiley Publications.

DEEP LEARNING

DETAILED SYLLABUS DESIGN

INTRODUCTION

Deep learning, moving from machine learning to Deep Learning Mathematical foundations: linear algebra, probability and information theory, Numerical computation.

DEEP LEARNING FOUNDATIONS

deep feedforward networks, regularization for deep learning, optimization for training deep models, convolutional networks,

Sequential Modelling: recurrent and recursive nets, practical methodology for deep networks, applications of deep learning, Expert Systems

TEXTBOOKS :

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning
2. Tensor Flow for Deep Learning – 2018, BY REZA ZADEH , BHARATH RAMSUNDAR

DEVELOPING IOT APPLICATIONS THROUGH PYTHON

DETAILED SYLLABUS

INTRODUCTION TO IOT APPLICATIONS

Home Automation: Cities: Environment:, Energy: Retail: Logistics: Agriculture: Industry: Health and Lifestyle:

INTRODUCTION TO RASPBERRY BOARD
ARCHITECTURE AND HARDWARE SPECIFICATIONS

Preparing Raspberry Board for application development: Installing OS on raspberry Pi, Setting up the board to work with Python as the programming language, Retrieving the board's assigned IP address, Connecting to the board's operating system, Installing and upgrading the necessary libraries to interact with the board, Installing pip and additional libraries, Invoking the Python interpreter

PROGRAMMING USING PYTHON

Installing Python, Python Data Types & Data Structures, Numbers Strings Lists, Tuples, Dictionaries, Type Conversion, Control Flow: if, for, while, range, break/continue, pass. Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages of Internet Of Things-JSON, XML, HTTPLib & URLLib, SMTPLib.

Requirement specification, Process specification, domain model specification, information model specification, Services Speciation, level specification, functional view specification, operational view specification, device and component integration, application development.

DEVELOPMENT OF IOT BASED SMART LIGHTING SYSTEMS

Deployment design, developing mode and state services, developing sterilizers, developing views for rest services, Developing URL patterns for rest services, Developing Main application, developing controller and integrated schematic for IOT home lighting system

TEXTBOOK :

1. Arshdeep Bahga and Vijay Madisetti,, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547 .

REFERENCE BOOKS :

1. Wolfram Donat “Learn RaspberryPi programming in python”, Apress (2014), ISBN – 9781430264255
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O’Reilly (SPD), 2014, ISBN: 9789350239759.
3. “Learning Python”, Fifth Edition by Mark Lutz, Published by O’Reilly
4. Media, ISBN: 978-1-449-35573-9.

WIRELESS SENSOR NETWORKS

DETAILED SYLLABUS

AD HOC WIRELESS NETWORKS

Applications of Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks: Medium Access Scheme, Routing, Multicasting Transport Layer Protocols, Quality of Service Provisioning, Self- Organization, Security Addressing , Service Discovery, Energy management, Scalability, Deployment Considerations, Ad Hoc Wireless Internet: Comparison with Adhoc wireless networks, Challenges for WSNs, Difference between sensor networks and Traditional sensor networks ,Types of Applications, Enabling Technologies for Wireless Sensor NetworksSingle Node Architectures , Hardware Components , Energy Consumption of Sensor Nodes, Issues in Designing a Multicast Routing Protocol.

DATA DISSEMINATION

Flooding and Gossiping, Data gathering, Sensor Network Scenarios,– Optimization Goals, Figures of Meri –

DESIGN PRINCIPLES FOR BUILDING WSNS GATEWAYS

Need for gateway, WSN to Internet Communication, Internet to WSN Communication, WSN Tunneling.

MAC PROTOCOLS FOR SENSOR NETWORKS

Location Discovery, Quality of Sensor Networks, Evolving Standards, Low duty cycle and wake up concepts- The IEEE802.15.4 MAC Protocols: Energy Efficiency, Geographic Routing. Mobile nodes Gossiping and Agent based Unicast Forwarding, Energy Efficient Unicast, Broadcast, Multicast, Geographic Routing,

TEXTBOOKS :

1. Holger Karl and Andreas Wiilig, “Protocols and Architectures for Wireless Sensor Networks” John Wiley & Sons Limited 2008.
2. I.F Akyildiz and Weillian, “A Survey on Sensor Networks”, IEEE Communication Magazine, August 2007.

REFERENCE BOOKS :

1. Wilson, “Sensor Technology hand TextBook :,” Elsevier publications 2005.
2. Anna Hac “Wireless Sensor Networks Design,” John Wiley& Sons Limited Publications 2003.
3. C.Siva Ram Murthy and B.S.Manoj “Ad Hoc Wireless Networks,” Pearson Edition 2005

ELECTIVE – 4

VIDEO AND AUDIO STREAMING

DETAILED SYLLABUS

Introduction to streaming Media: Applications, Architectures, Bandwidth, bytes and Bits, Proprietary Code architectures

VIDEO ENCODING

Introduction, capture, compression, encoding enhancements, encoding products, File limitations

AUDIO ENCODING

Introduction, capture, Encoding, Audio formats, file formats

STREAM SERVING

introduction, streaming, webcasting, On demand serving, inserting advertisements, play lists, logging and statistics, proprietary server architectures, server deployment

Content distribution: introduction, delivery networks, corporate intranets, satellite delivery, quality of delivery, Applications of streaming media

TEXTBOOK :

1. The technology of video and audio streaming, David Auster berry, Focal press, 2013 Edition

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CLOUD COMPUTING AND BIG DATA ANALYTICS

DETAILED SYLLABUS

INTRODUCTION TO CLOUD COMPUTING

meaning of Cloud Computing, variations of cloud computing from other models, Essential Characteristics, Cloud computing Architectures, Technological Influences. Cloud Computing Architecture, the three deployment models IaaS, PaaS, SaaS, and Types of clouds (Public, Private and Hybrid)

CLOUD INFRASTRUCTURE

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

SERVICE MODELS (XAAS)

Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

ESTABLISHING AND USING A PRIVATE CLOUD

Network topology, HW-SE specification, Installing open stack, configuring open stack availing services through open stacks, establishing virtual networks

Infrastructure as a Service (IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, One drive, drop box. Developing applications Using IaaS.

Introduction to big data and Analytics:– Sources of data through embedded systems: Video, audio, spectral, transactional, WEB Data, Different kinds of data Structures - Current Analytical Architecture - Drivers of Big Data. Big Data Overview, State of the Practice of Analytics, Big Data Analytics in

Industry Verticals. Data analytics lifecycle Discovery - Data Preparation - Model Planning – Model Building - Communicate Results - Operationalize Case Study

Data Collection though embedded systems: RS232C, RS485, I2C, CAN, USB, Ethernet and transmission of the same through internet to be stored in a remote server

INITIAL ANALYSIS OF THE DATA USING R:

Introduction to R: Graphical User Interface, data import and Export: Attributes and data types, Descriptive statistics,

Exploratory Data Analysis: visualization before Analysis, dirty data, visualizing a single variable, examine multiple variables, data exploration Vs Presentation,

Statistical methods for evaluation: Hypothesis testing, difference of means, Ranking tests, Sampling, ANOVA, Introduction to HADOOP and Map reduce and the uses of the same for effecting the data analytics.

TEXTBOOKS :

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services 2014
2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Ana-

lytics", EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015.
3. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press, 2016.

REFERENCE BOOKS :

1. Kris Jamsa, Cloud Computing, Jones & Bartlett,2012
2. Russell Dean Vines and Ronald L. Krutz ,Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010
3. Barrie Sosinsky, Cloud Computing Bible, Wiley India,2011
4. Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
6. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.
7. MapReduce Design Patterns, Author: Donald Miner, Publisher: O'Reilly (2012), ISBN-13:- 9789350239810
8. Agile data science: building data analytics applications with Hadoop- Russell Journey- O'Reilly Media-2013
9. An Introduction to Applied Multivariate Analysis with R-Brian Everett, Torstein Hothorn-Springer-2011

DATA ANALYTICS FOR IOT

INTRODUCTION TO DATA EMANATION FROM ES AND IOT DEVICES DEVICES, DATA FLOW, DATA STORAGE

OVERVIEW OF COMPUTING PARADIGM

Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing.

INTRODUCTION TO CLOUD COMPUTING

Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing; Role of Open Standards.

COMPUTING ARCHITECTURE

Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, Role of Networks in Cloud

computing, Protocols used, Role of Web services;

SERVICE MODELS (XAAS)

Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

EMBELLISHING AND USING A PRIVATE CLOUD

Network topology, HW-SE specification, Installing open stack, configuring open stack availing services through open stacks, establishing virtual networks

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and

manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, One drive, drop box. Developing applications that use IaaS.

INTRODUCTION TO BIG DATA AND ANALYTICS SOURCES OF DATA THROUGH EMBEDDED SYSTEMS

Video, audio, spectral, transactional, WEB Data, Different kinds of data Structures - Current Analytical Architecture - Drivers of Big Data. Big Data Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals. Data analytics lifecycle Discovery - Data Preparation - Model Planning – Model Building - Communicate Results - Operationalize Case Study

Overview on data capturing through IOT devices, transmission of the same through different stages, and storage of the same in Clouds.

INITIAL ANALYSIS OF THE DATA USING R

Introduction to R: Graphical User Interface, data import and Export: Attributes and data types, Descriptive statistics,

EXPLORATORY DATA ANALYSIS

visualization before Analysis, dirty data, visualizing a single variable, examine multiple variables, data exploration Vs Presentation,

STATISTICAL METHODS FOR EVALUATION

Hypothesis testing, difference of means, Ranking tests, Sampling, ANOVA, Introduction to HADOOP and Map reduce and the uses of the same for effecting the data analytics.

TEXTBOOKS:

1 Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services 2014
2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big Data Analytics”, EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015.
3. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, “Hand-

book of Big Data", CRC Press, 2016.

REFERENCE BOOKS :

1. Kris Jamsa, Cloud Computing, Jones & Bartlett,2012
2. Russell Dean Vines and Ronald L. Krutz ,Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010
3. Barrie Sosinsky, Cloud Computing Bible, Wiley India,2011
4. Parallel Processingto the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
6. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.
7. MapReduce Design Patterns, Author: Donald Miner, Publisher: O'Reilly (2012), ISBN-13:- 9789350239810
8. Agile data science: building data analytics applications with Hadoop- Russell Journey- O'Reilly Media-2013
9. An Introduction to Applied Multivariate Analysis with R -Brian Everett, Torstein Hothorn-Springer-2011
10. Statistical Modeling and Analysis for Database Marketing: Effective Techniques for Mining Big Data-Bruce Ratner-Chapman and Hall/CRC-2003

SENSOR NETWORK PROGRAMMING

DETAILED SYLLABUS DESIGN

Introduction: Foundational Information, Next-Generation Sensor Networked Tiny Devices, Sensor Network Software Performance Driven Network Software Programming, Unique Characteristics of Programming Environments for Sensor Networks, Introduction to TinyOS and NesC, Future Demands on Sensor-Based Software. Wireless Sensor Networks: Sensor Network Applications, Characteristics of Sensor Networks, Nature of Data in Sensor Networks.

STANDARDS FOR BUILDING WIRELESS SENSOR NETWORK APPLICATIONS

802.XX Industry Frequency and Data Rates, ZigBee Devices and Components, ZigBee Application Development, Dissemination and Evaluation for Real-Time Environment, Motivation and Background, Software Micro framework Requirements

SENSOR NETWORK IMPLEMENTATION

Sensor Programming, Programming Challenges, Sensing the World, Level / Server Level / Client Level Programming Tools, Tiny Operating System (TinyOS):

Components of TinyOS, Introduction to NesC, Event Driven Programming. Programming in NesC, A Simple Program

REAL-WORLD SENSING REQUIREMENTS

Sensor Deployment Abstraction, Sensor Network Abstraction, Data Aggregation, Collaboration, Group Abstractions, Programming Beyond Individual Nodes

SIMULATORS FOR DEVELOPING SENSOR NETWORKS

Introduction, Currently Available Simulators, Simulation Design, Implementation Details, Experimental Results, MATLAB Simulation of Airport Baggage-Handling System: Introduction, proposed Architecture

TEXTBOOKS :

1. Fundamentals of Sensor Network Programming: Applications and Technology Hardcover Dec 2010 by S. Sitharama Iyengar , Nandan Parameshwaran, Vir V. Phoha.
2. Fundamentals of Sensor Network Programming: Applications and Technology S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye ISBN: 978-0-470-87614-5

REFERENCE BOOK :

1. Developing a Wireless Sensor Network Programming Language Application Guide Using Memsic Devices and LabVIEW 5.0 Structure design Semester-3 and Semester-4

DETAILED SYLLABUS DESIGN SEMESTER–3 AND SEMESTER–4

DISSERETATION

DETAILED SYLLABUS DESIGN

1. Choose an application in the specialisation area
2. Draft Requirements that include platform specific, technology specific, operational and functional
3. Install and operate the platform required for development of the projects
4. Conduct Analysis
5. Conduct Design
6. Develop the application
7. Test the application
8. Install the application
9. Demonstrate the running of the application
10. Develop project report in standard format

EEE

POWER SYSTEMS

FIRST YEAR (FIRST SEMESTER)

S.No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18EE5101	Power System Dynamics & stability	3	1	0	4	4
2	18EE5102	Advanced Power System Analysis	3	1	2	6	5
3	18EE5103	Deregulated Operation of Power Systems	3	1	0	4	4
4	18EE5104	Modern Control Theory	3	1	0	4	4
5		Elective –I	3	0	0	3	3
6		Elective – II	3	0	0	3	3
7	18IE5149	Seminar	0	0	4	4	2
		Total	**18**	**4**	**6**	**28**	**25**

FIRST YEAR (SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18EE5205	Real Time Control of Power System	3	1	2	6	5
2	18EE5206	AI Techniques in Power Systems	3	1	0	4	4
3	18EE5207	Smart Grids Technologies	3	1	0	4	4
4	18EE5208	Digital Protection of Power Systems	3	1	0	4	4
5		Elective –III	3	0	0	3	3
6		Elective - IV	3	0	0	3	3
7	18IE5250	Term Paper	0	0	4	4	2
		Total	**18**	**4**	**6**	**28**	**25**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36
		Total Credits				**86**

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18EE51A1	Reactive Power Compensation & Management	3	0	0	3
2	18EE51A2	Distribution System Planning & Automation	3	0	0	3
3	18EE51A3	Power System Reliability	3	0	0	3
Elective-2						
4	18EE51B1	Alternate Sources of Electrical Energy	3	0	0	3
5	18EE51B2	Digital Signal Processors and Applications	3	0	0	3
6	18EE51B3	Optimization Techniques	3	0	0	3
Elective-3						
7	18EE52C1	FACTS	3	0	0	3
8	18EE52C2	Energy Conservation & Audit	3	0	0	3
9	18EE52C3	Adaptive Control Systems	3	0	0	3
Elective-4						
10	18EE52D1	EHVAC & HVDC Transmission	3	0	0	3
11	18EE52D2	Power Quality	3	0	0	3
12	18EE52D3	Integration of Energy Sources	3	0	0	3

SEMESTER-I

POWER SYSTEM DYNAMICS & STABILITY

SYNCHRONOUS MACHINE MODELING

Modeling of Synchronous Machine, Park's Transformation, Analysis of Steady State Performance, P. U. Quantities, Equivalent Circuit of Synchronous Machine, Vector diagrams in steady state and transient state, power angles curves of a salient pole machine. POWER SYSTEM STABILITY: Review of power system stability - classical model of a multi machines systems. SMALL SIGNAL STABILITY: Small signal stability of a single machine infinite bus system, Effects of excitation systems, Power system stabilizers, Sub Synchronous Resonance.

EXCITATION SYSTEMS

Typical Excitations configurations and Automatic Voltage regulators, Effect of excitation on (a) Power limits, (b) Transient stability, (c) Dynamic stability, VOLTAGE STABILITY: Basic Concepts Related to Voltage Stability – Voltage Collapse – Voltage Stability Analysis – Prevention of Voltage Collapse. Introduction to Frequency Stability.

TEXTBOOKS :

1. Power System Stability and Control – Prabha Kundur, TATA McGRAW – HILL, 2006.
2. Power System Stability by Kimbark, Vol- I, II & III – 1968, Dover Publication Inc, Newyork-1968.

REFERENCE BOOKS :

1. Power System Dynamics Stability & Control – K.R.Padiyar, 2nd Edition, B.S. Publication 2002.
2. Power System Control and Stability – P. M. Anderson & A.A. Fouad , 2nd Edition, Wiley IEEE press-2002.

ADVANCED POWER SYSTEM ANALYSIS

Network Modeling-Single phase and three phase modeling of alternators, transformers and transmission lines, Conditioning of Y Matrix- Incidence matrix method, Method of successive elimination, Triangular factorization. Load flow analysis- Newton Raphson method, Fast decoupled method, AC-DC load flow-Single and three phase methods-Sequential solution techniques and extension to multiple and multi-terminal DC systems, Load flow with FACTS devices. Fault studies- 3- analysis of balanced and unbalanced faults-fault calculations-Short circuit faults-open circuit faults. System Contingency Analysis – Zbus Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution

of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

TEXTBOOKS :

1. D. P. Kothari, I. J. Nagrath,' Modern Power System Analysis', Tata McGraw Hill-Education, New Delhi, 2003.
2. Arrillaga, J and Arnold, C. P., 'Computer analysis and power systems' John Wiley and Sons, New York, 1997

REFERENCE BOOKS :

1. Grainger, J. J. and Stevenson, W. D. 'Power System Analysis' Tata McGraw Hill, New Delhi, 2003.
2. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill, New Delhi, 2002.
3. Pai, M. A., 'Computer Techniques in Power System Analysis', Tata McGraw Hill, New Delhi, 2006.
4. P. Venkatesh,B V Manikandan,S Charles Raja and A Srinivasa Rao, "Electric Power System Analysis, Security & Deregulation", PHI, 2012.

DEREGULATED OPERATION OF POWER SYSTEMS

Key Issues in Electric Utilities Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing – Congestion Pricing – Management of Inter zonal/Intra zonal Congestion. Open Access Same-time Information System (OASIS) Structure of OASIS - Posting of Information – Transfer capability on OASIS. Available Transfer Capability (ATC) Transfer Capability Issues – ATC – TTC – TRM – CBM Calculations – Calculation of ATC based on power flow. Electricity Pricing Introduction – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing – Locational Marginal Pricing - Construction of Forward Price Curves – Short-time Price Forecasting. Power System Operation in Competitive Environment Introduction – Operational Planning Activities of ISO- The ISO in Pool Markets – The ISO in Bilateral Markets

Operational Planning Activities of a GENCO. Market Power : Introduction - Different types of market Power– Exercising Market Power - Examples, Transmission Cost Allocation Methods : Introduction - Postage Stamp Rate Method - Contract Path Method - MW-Mile Method – Unused Transmission Capacity Method - MVA-Mile method – Comparison of cost allocation methods.

TEXTBOOKS :

1. Loi Lei Lai, "Power System Restructuring and Deregulation", John Wiley &

Sons Ltd., England, 2001.
2. Kankar Bhattacharya, “Operation of Restructured Power System”, Math H.J. Boller and Jaap E.Daalder Kulwer Academic Publishers, 2001.

REFERENCE BOOKS :

1. Mohammad Shahidehpour and Muwaffaq alomoush, “Restructured Electrical Power Systems”, Marcel Dekker, Inc., 2001.
2. P. Venkatesh,B V Manikandan,S Charles Raja and A Srinivasa Rao, “Electric Power System Analysis, Security & Deregulation”, PHI, 2012

MODERN CONTROL THEORY

Digital Control Systems: Review of Z and inverse Z-transforms sampling process and rigid reconstruction. Difference equations pulse transfer function, purpose of linear discrete systems, Z-transform analysis of sample data control system. Z and S domain relationship. Jury’s stability method. Bilinear transformation compensation techniques. Controllability and observability of discrete systems. Stability: introduction – definitions of stability – stability in the sense of liapunov – stability of linear systems – transient response – behaviour of estimation – stability of non linear systems – generation of liapunov functions. Optimal control:formulation of the optimal control problem – method of calculus of variations – use of hamiltonian method – pontryagin’s minimum principle - optimal control problem – hamilton – jacobi approach – continuous time linear state regulator matrix riccati equation – methods of solution – state variable feedback design.

TEXTBOOKS :

1. Discrete Time Control Systems-K.Ogata Pearson Education-2005.
2. Digital Control systems and State Variables methods by M.Gopal-2006.

REFERENCE BOOKS :

1. Modern Control System Theory by M. Gopal – New Age International – 2005
2. M. Gopal : Modern Control Systems Theory, Wiley Eastern Limited, New Delhi, 1996.
3. Modern Control Engineering by Ogata. K – Prentice Hall –2006
4. Optimal control by Kirck

SEMESTER-II

REAL TIME CONTROL OF POWER SYSTEMS

System optimization- strategy for two generator systems-generalized strategies-effect of transmission losses-Sensitivity of the objective function-Formulation of optimal power flow-solution by Gradient method-Newton's method - Unit Commitment, Hydro-Thermal Coordination. Load frequency control - AGC multi area system, static and dynamic response, Load frequency control of 2-area system, Security control- Security analysis and monitoring, generator and line outages by linear sensitivity factors, State estimation- Power system state estimation, Weighted least square state estimation, state estimation of AC network, Treatment of bad data – network observability and pseudo measurements.

TEXTBOOKS :

1. Allen J. Wood and Bruce F. Wollenberg "Power Generation, Operation & Control" 2nd edition, John Wiley and Sons, 1996.
2. I.J. Nagarath & D. P. Kothari , "Modern power system analysis" 3rd Edition, TMH, New Delhi, 2003.

REFERENCE BOOKS :

1. I. Elgard , "Electric Energy Systems Theory – An Introduction" TMH, 1983.
2. Abhijit Chakrabarti & Sunita Halder " Power System Analysis operation and Control " 1st edition, PHI, 2006.
3. Mahalanabis A.K., Kothari D.P. and Ahson S.I., "Computer aided power system analysis and control", 4th Edition, 2011, TMH.
4. J.J.Grainger, W.D.Stevenson JR, Power system analysis, Tata McGraw Hill N.D. 2007.
5. A. Handschin and E. Petroiaenu," Energy Management Systems, Operations and Control of Electric Energy Transmission Systems", Springer-Verlag, Berlin, Heidelberg, 1991.

AI TECHNIQUES IN POWER SYSTEMS

Artificial Neural Networks: Introduction Models of Neuron Network – Architectures – Hebbian learning – Supervised learning – Unsupervised learning – Reinforcement learning. ANN Paradigms: Multi – layer perceptron using Back propagation Algorithm (BPA) – Radial Basis Function Network – Hopfield Network – Application to Load forecasting. Fuzzy Logic: Introduction – Fuzzy versus crisp – Fuzzy sets – Membership function – Basic Fuzzy set operations – Fuzzy Inference – Fuzzy Rule based system–Defuzzification methods – Application to Load Frequency Control. Genetic Algorithms: Introduction–Encoding – Fitness Function–Reproduction operators–Genetic

Modeling – Genetic operators–Cross over – Single site cross over – Two point cross over – Multi point cross over – Uniform cross over – Mutation operator – Elitism - Generational cycle – convergence of Genetic Algorithm – Application to economic dispatch.

TEXTBOOKS :

1. S.Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi, 2003.
2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011

REFERENCE BOOKS :

1. James A freeman, David M Skapura, ‘ Neural Networks’, Addison – Wesley, an imprint of Pearson Education, II Edition , 2000
2. S N Sivanandam, S sumathi, S. N deepa, ‘ Introduction to Neural Networks using Matlab 6.0, Tata Mc Graw Hill Publishing Company Private Limited, 2006
3. K Sundareswaran, ‘Fuzzy Logic Systems’, Jaico Publishing House, 2005

SMART GRIDS

Introduction to Smart Grid: What is Smart Grid? Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid.

Smart Grid Architecture: Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid – Demand Response, Dispersed Loads, Smart meters.

Tools and Techniques for Smart Grid: Computational Techniques – Static and Dynamic Optimization Techniques – Computational Intelligence Techniques – Evolutionary Algorithms – Artificial Intelligence techniques.

Distribution Generation Technologies: Introduction to Renewable Energy Technologies – Micro grids – Storage Technologies – Electric Vehicles and plug – in hybrids as ESS – Environmental impact and Climate Change – Economic Issues.

Communication Technologies and Smart Grid: Introduction to Communication Technology – Synchro Phasor Measurement Units (PMUs) – Wide Area Measurement Systems (WAMS).

Control of Smart Power Grid System: Decentralized Secondary Control for

frequency and voltage, Virtual inertia, Virtual impedance, Load Frequency Control (LFC) in Micro Grid System – Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXTBOOKS :

1. Smart Grid Fundamentals of Design and Analysis, James Momoh, Wiley IEEE Press, Ed 2012.
2. Smart Grid Technology and Applications, Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins, Wiley Press, Ed 2012.

REFERENCE BOOKS :

1. Control and Optimization Methods for Electric Smart Grids, Aranya Chakraborthy, Marija D Ilic Editor, Springer Publications.

DIGITAL PROTECTION OF POWER SYSTEMS

Protection of Power System Equipment - summation transformer, phase-sequence current segregating network. Load shedding and frequency relaying; Out of step relaying; Re-closing and synchronizing.

Digital Protection: Developments in computer relaying – mathematical basis for protective relaying algorithms, Fourier Transforms – Discrete Fourier transforms – Walsh - Hadamard, Haar - wavelet transforms. Microprocessor based protection relays – Working principles of mP based over current, directional, distance and current differential relays - digital relaying algorithms, various transform techniques employed like discrete Fourier, microprocessor implementation of digital distance relaying algorithms.

New developments in relaying principles – fundamentals of travelling wave protection – principle of travelling wave distance relay – adaptive relaying – fault location algorithms.

TEXTBOOKS :

1. Badri Ram & DN Viswakarma, “Power System Protection & Switch Gear”, Tata McGraw Hill Publishing Company Limited, New Delhi (1995).
2. Power System Protection – Static relays T.S.MadhavaRao, TMH, 2010.
3. Digital Protection for Power Systems A.T.Johns and S.K.Salman, 1995.
4. Computer Relaying for power Systems A.G.Phake, James S.Thorp, John–Wiley and sons
5. Protective relaying principles and applications J.Lewis Blackburn, Marcel & Dekker

ELECTIVE COURSES

REACTIVE POWER COMPENSATION AND MANAGEMENT (ELECTIVE-1)

LOAD COMPENSATION

Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads-example.: Steady – state reactive power compensation in transmission system: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples. TRANSIENT STATE REACTIVE

POWER COMPENSATION IN TRANSMISSION SYSTEMS

Characteristic time periods – passive shunt compensation – static compensations-series capacitor compensation –compensation using synchronous condensers –: Reactive power coordination: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences. DEMAND

SIDE MANAGEMENT

Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels: Distribution side Reactive power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks . USER SIDE REACTIVE

POWER MANAGEMENT

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations. REACTIVE POWER MANAGEMENT IN

ELECTRIC TRACTION SYSTEMS AND ARC FURNACES

Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

TEXTBOOKS :

1. T.J.E.Miller, “Reactive power control in Electric power systems”, John Wiley and sons, 1982.
2. D. M. Tagare, “Reactive power Management”, Tata McGraw Hill, 2004.

REFERENCE BOOKS :

1. Hong Chen, “Practices of reactive power management and compensation”, PJM Interconnection, Norristown, PA;
2. T E Miller, “Reactive Power Control in Power Systems”, John Wiley, 1982.

DISTRIBUTION SYSTEM PLANNING & AUTOMATION (ELECTIVE-1)

INTRODUCTION

General Concepts,Distribution of Power,Quality of supply, System Study, Benchmarking, Electricity Reforms, Future of Distribution Systems.

System Planning: Planning Process, Planning Criteria and Standards, System Development, Dispersed Generation, Distribution System Economics and Finance, Mapping, Enterprise Resource Planning, Modelling, System Calculations, Introductory Methods, Netwrok Elements, Load Flow, Automated Planning, Fault Studies, Effect of Abnormal Loads, Line Circuits, Urban Distribution, Outsourcing.

Design and Operation:Engineering Design, Operation Criteria and Standards, Sub Transmission, Sub Station and Feeder, Low Voltage three phase or single phase, Practices, Location of Sectionalizer, Voltage Control, Harmonics, Load Variations,Impact Loading of Transformers, Ferro resonance, System Losses, Energy Management, Model Distribution System.

CONSUMER SERVICES

Supply Industry, Natural Monopoly, Regulations, Other Legal Provisions, Distribution Code, Consumer Care, Standards, Consumer Code Requirements, Consumer Factors, Least Cost of Supply, Revenue and Return, Load Management, Energy Audit, Theft of Electricity, Metering of Energy, Periodical Testing of Meters, Consumer Load Monitoring.

POWER CAPACITORS

Reactive Power,Series and Shunt Capacitors, System Harmonics, HT Shunt Capacitors Installation Requirement, Size of Capacitators for power Factor Improvement, LT Capacitors, Construction Features, Failures.

DISTRIBUTION AUTOMATION

Distribution Automation(DA), Project Planning, Definition, Communications, Sensors, Supervisory Control and Data Acquisition(SCADA), Consumer Information Service (CIS), Geographical Informational Systems (GIS), Automatic Meter Reading (AMR), Automation Systems.

TEXTBOOK :

1. Electrical Power Distribution Engineering by Turan Gonen, McGraw Hill, 1986.

REFERENCE BOOKS :

1. Electrical Power Distribution by A. S. Pabla, TMH, 5th Ed., 2004.
2. Electrical Power Distribution by V Kamaraju, TMH,2009

POWER SYSTEM RELIABILITY (ELECTIVE-1)

Network Modelling and Reliability Analysis: Reliability concepts – exponential distributions – meantime to failure – series and parallel system – MARKOV process – recursive technique - Bath tub curve - reliability measures MTTF, MTTR, MTBF. Frequency & Duration Techniques: Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle time, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states. Generation System Reliability Analysis: Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE. Transmission System Reliability Analysis: System and load point reliability indices – Weather effects on transmission lines – Weighted average rate and Markov model.: Distribution System Reliability Analysis: Basic Techniques – Radial networks – Evaluation of Basic reliability indices, performance indices - Load point and system reliability indices – Customer oriented, loss and energy oriented indices – Examples. Parallel Configuration: Basic techniques – Inclusion of bus bar failures, scheduled maintenance – Temporary and transient failures – Weather effects –Evaluation of various indices – Examples.

TEXTBOOKS :

1. R. Billinton, R.N.Allan, “Reliability Evaluation of Power systems” second edition, Springer.
2. Charles E. Ebeling, “An Introduction to Reliability and Maintainability Engineering”, TATA Mc Graw - Hill – Edition.

REFERENCE BOOKS :

1. R. Billinton, R.N.Allan, “Reliability Evaluation of Engineering System”, Plenum Press, New York.
2. Eodrenyi, J., “Reliability modelling in Electric Power System”, John Wiley, 1980.

DIGITAL SIGNAL PROCESSORS AND APPLICATIONS (ELECTIVE-2)

FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING

Review of DSP fundamentals. Issues involved in DSP processor design - speed, cost, accuracy, pipelining, parallelism, quantization error, etc. Key DSP hardware elements - Multiplier, ALU, Shifter, Address Generator, etc.

TMS320C5X PROCESSOR 9 Architecture: Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals. TMS320C6X PROCESSOR 9 Architecture: of the C6x Processor - Instruction Set - DSP Development System: Introduction– DSP

Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

ADSP PROCESSORS 9 Architecture of ADSP-21XX: and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions –

Software development tools: assembler, linker and simulator. Applications using DSP Processor - spectral analysis, FIR/IIR filter, linear-predictive coding, etc.

TEXTBOOKS :

1. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSPMicroprocessors with Examples from TMS320C54xx, cengage Learning India PrivateLimited, Delhi 2012
2. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture", TATA McGraw-Hill Education, 2002.

REFERENCE BOOKS :

1. Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. NewDelhi, 2003.
2. RulphChassaing, Digital Signal Processing and Applications with the 6713 and C6416DSK, A JOHN WILEY & SONS, INC., PUBLICATION, 2005 5. User guides Texas Instrumentation, Analog Devices, Motorola. OPTIMIZATION TECHNIQUES (ELECTIVE-2) Algebraic and Differential Equations: lgebraic Equations: Iterative methods for solving linear equations: Gauss-Elimination method, Jacobi method. Iterative methods for solving Non-linear equations: Newton method, Bisection method Differential Equations: Finite difference method, Euler method, Runge- Kutta method 2nd and 4th order. Characterization of maxima and minima: Conditions of maxima and minima for unconstrained optimization, Convex and quadratic functions, Conditions of maxima and minima for constrained optimization, convex optimization problems and duality. Iterative methods for unconstrained optimization: Line search methods, Method of steepest descent and Newton's method, Method of conjugate directions, Quasi-Newton method. Iterative methods for onstrained optimization: Linear programming, Iterative methods for nonlinear constrained optimization. Evolutionary Techniques: Ant colony optimization method, Honey Bees Optimization method, ko-koo Search Technique, Bat optimization algorithm.

TEXTBOOKS :

1. Balaguruswamy, E., "Numerical Methods", Tata McGraw-Hill, 1999
2. Luenberger and Ye ., "Linear and nonlinear programming" , Springer
3. Rao S.S., "Applied Numerical Methods for Engineers and Scientists" Pearson Education, 2001

REFERENCE BOOKS :

1. Andreas Antoniou, "Practical optimization algorithms and engineering application", Spriger.
2. Edwin K. P. Chong, "An Introduction to Optimization", Wiley.

ALTERNATIVE SOURCES OF ELECTRICAL ENERGY (ELECTIVE-2)

INTRODUCTION

Renewable Sources of Energy – Grid–Supplied Electricity – Distributed Generation – Renewable Energy Economics – Calculation of Electricity Generation Costs –Demand–Side Management Options – Supply–Side Management Options – Modern Electronic Controls of Power Systems.

PHOTOVOLTAIC POWER PLANTS

Solar Energy – Generation of Electricity by Photovoltaic Effect –Dependence of a PV Cell Characteristic on Temperature – Solar Cell Output Characteristics – Equivalent Models and Parameters for Photovoltaic Panels –Photovoltaic Systems – Applications of Photovoltaic Solar Energy – Economical Analysis of Solar Energy.

WIND POWER PLANTS

Appropriate Location –Evaluation of Wind Intensity –Topography –Purpose of the Energy Generated –General Classification of Wind Turbines –Rotor Turbines –Multiple–Blade Turbines –Drag Turbines –Lifting Turbines –Generators and Speed Control Used in Wind Power Energy –Analysis of Small Generating Systems.

FUEL CELLS

The Fuel Cell –Low – and High–Temperature Fuel Cells –Commercial and Manufacturing Issues –Constructional Features of Proton Exchange–Membrane Fuel Cells –Reformers – Electrolyzer Systems and Related Precautions – Advantages and Disadvantages of Fuel Cells – Fuel Cell Equivalent Circuit –Practical Determination of the Equivalent Model Parameters – Aspects of Hydrogen as Fuel.

STORAGE SYSTEMS

Energy Storage Parameters – Lead–Acid Batteries – Ultra capacitors –Flywheels – Superconducting Magnetic Storage System – Pumped Hydroelectric Energy Storage – Compressed Air Energy Storage –Storage Heat –Energy Storage as an Economic Resource

TEXTBOOKS :

1. Felix A. Farret, M. Godoy Simo`es, Integration of Alternative Sources of Energy, John Wiley & Sons, 2006.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.

REFERENCE BOOKS :

1. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004

FACTS DEVICES (ELECTIVE-3)

FACTS CONCEPT AND GENERAL SYSTEM CONSIDERATIONS:

Transmission interconnections, Power Flow in AC system, Dynamic stability Considerations and the importance of the controllable parameters, Introduction to Facts devices, Basic types of FACTS Controllers, benefits from FACTS controllers.STATIC SHUNT COMPENSATION: Objectives of shunt compensation, Methods of controllable VAR generation, variable impedance type static VAR generators (SVC): TCR, TSR, TSC, FC-TCR, TSC-TCR, switching converter type VAR generators: STATCOM, Comparison between SVC and STATCOM, STATCOM for transient and dynamic stability enhancement. STATIC SERIES COMPENSATION: Objectives of series compensation, variable impedance type static series controllers: GCSC, TSSC, TCSC, switching converter type controller: SSSC, Operation and Control External system Control for series Compensator SSR and its damping – Static Voltage and Phase angle Regulators - TCVR and TCPAR – Operation and Control. UPFC AND IPFC: The unified power flow Controller – Operation –Comparison with other FACTS devices – control of P and Q – dynamic performance – special Purpose FACTS controllers – Interline Power flow Controller – Operation and Control.

TEXTBOOKS :

1. FACTS: Modelling and Simulation in Power Networks, By Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez, César Angeles-Camacho WILEY
2. K.R.Padiyar “FACTS Controller in power Transmission and Distribution” New Age Int Publisher,2007
3. Flexible AC Transmission Systems: Modelling and Control, By Xiao-Ping Zhang, Christian Rehtanz, Bikash Pal

REFERENCE BOOKS :

1. N.G Hingorani & L.Gyugyi “ Understanding FACTS: Concepts and Technology of Flexible AC Transmission System” , IEEE Press,2000
2. Ned Mohan et.al “Power Electronics” John wiley & Sons,2 nd edition ,2002
3. T.J.E Miller, “Reactive power control in electric Systems” John willey & sons,1982.

ENERGY CONSERVATION & AUDIT (ELECTIVE-3)

BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit- definitions, concept, types of audit, energy index, cost index, pie-charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit. ENERGY MANAGEMENT:

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting - Energy manger, Qualities and functions, language, Questionnaire - check list for top management. Demand side management. ENERGY EFFICIENT MOTORS: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage van at ion-voltage unbalance- over motoring- motor energy audit. POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS: Power factor - methods of improvement, location of capacitors, PF with non linear loads, effect of harmonics on PF , PF motor controllers - Good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's. ECONOMIC ASPECTS AND ANALYSIS: Economics Analysis - Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Energy efficient measures- calculation of simple payback method, net present worth method - Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

TEXTBOOKS :

1. W.C.Turner, "Energy management hand TextBook :", John wiley and sons Energy management and good lighting practice: fuel efficiency- TextBook : let 12-EEO
2. W.K. Murphy, G- Mckay Butier worth, "Energy management", Heine mann publications, 2007.

REFERENCE BOOKS :

1. Paulo Callaghan, "Energy management", Mc-graw Hill TextBook : company, 1st edition, 1998
2. Giovanni and Petrecca, "Industrial Energy Management: Principles and Applications", The Kluwer international series-207 (1999)
3. Howard E.Jordan, "Energy-Efficient Electric Motors and their applications", Plenum pub corp; 2nd ed. (1994)

ADAPTIVE CONTROL SYSTEMS (ELECTIVE-3)

ELEMENTS OF PROBABILITY THEORY

definition of probability and random variable, probability functions, expected value, mean and covariance, independence and correlation, Gaussian distribution and its properties. Stochastic processes and system models: Elements of the theory of stochastic processes, mean value function and covariance kernel, independent and correlated stochastic processes, stationery and non sequence model, Gaussian white process. Non parametric methods & parametric methods: Nonparametric methods: Transient analysis-frequency analysis-Correlation

analysis-Spectral analysis. Liner Regression: The Lease square estimate-best liner unbiased estimation under linear constraints-Prediction error methods: Description of Prediction error methods-Optimal Prediction –relationships between Prediction error methods and other identification methods theoretical analysis. Adaptive control schemes Introduction – users- Definitions-auto tuning-types of adaptive control-gain scheduling controller-model reference adaptive control schemes – self tuning controller. MRAC and STC: Approaches – The Gradient approach – Lyapunov functions – Passivity theory – pole placement method Minimum variance control – Predictive control. Adaptive control and application: Stability – Convergence – Robustness – Application of adaptive control, direct model reference adaptive control. Introduction: Basic approaches to adaptive control. Applications of adaptive control. Identification: Error formulations linear in the parameters. Direct adaptive control: Linear error equations with dynamics. Gradient and pseudo-gradient algorithms. Strictly positive real transfer functions. Kalman-Yacubovitch-Popov lemma. Passivity theory.

TEXTBOOKS :

1. Dan Simon, “Optimal State Estimation”, Wiley Intersience, 2006.
2. S. Sastry and M. Bodson, Adaptive Control: Stability, Convergence, and Robustness, Prentice-Hall, 1989.

REFERENCE BOOKS :

1. K.J. Astrom and B. Wittenmark, Adaptive Control, Addison-Wesley, 2nd edition, 1995.
2. I.D. Landau, R. Lozano, and M. M’Saad, Adaptive Control, Springer Verlag, London, 1998.
3. Meditch, “Stochastic Optimal Linear Estimation and Control” Mc-Graw Hill Company, 1969.
4. K.S. Narendra and A.M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989.
5. P.E. Wellstead & M.B. Zarrop, Self-Tuning Systems: Control and Signal Processing, J. Wiley & Sons, Chichester, England, 1991

EHVAC & HVDC TRANSMISSION (ELECTIVE-4)

INTRODUCTION

Need of EHV transmission, Limitations , EHV transmission, Comparison of EHV-AC & HVDC transmission, Interconnected Network and Role of Interconnecting Transmission Lines. EHV-AC Transmission: Parameters of EHV line, over-voltages due to switching, Ferro resonance, line insulator and clearance, corona, long distance transmission with series & shunt compensations, principle of half wave transmission, flexible AC transmission. HVDC Transmission: Types of DC

links, terminal equipments & their operations, HVDC system control, reactive power control, harmonics, multi terminal DC (MTDC) system, AC/DC system analysis, protection of terminal equipments. Insulation Requirement of EHV-AC and HVDC: Classification, Insulation design aspect, Difference between Insulation Coordination-EHV-AC and HVDC, Insulation Coordination, Surge arrester protection in HVDC and EHV-AC Substation, Clearance for HVDC and EHV-AC. Towers for (EHV-AC and HVDC): Types and configuration of self supporting and flexible towers, Foundation of towers, mechanical design of towers, Tower design based on switching surges and lightning strokes.

TEXTBOOKS :

1. K. R. Padiyar, HVDC Power Transmission System, Wiley Eastern Limited, 1990.
2. EHV-AC, HVDC Transmission and Distribution Engineering, S. Rao, Khanna Publishers, 2001.

REFERENCE BOOKS :

1. Rakesh Das Begmudre, Extra High Voltage AC Transmission Engineering, Wiley Eastern Limited, New Delhi – 1987
2. E.W.Kimbark, EHV-AC and HVDC Transmission Engineering &Practice, Khanna Publishers.

POWER QUALITY (ELECTIVE-4)

INTRODUCTION- CHARACTERIZATION OF ELECTRIC POWER QUALITY

Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards. Transients – origin and classifications – capacitor switching transient – lightning-load switching – impact on users – protection – mitigation. CONVENTIONAL LOAD COMPENSATION METHODS -Principle of Load compensation and Voltage regulation – Classical load balancing problem: Open loop balancing – Closed loop balancing, Current balancing – Harmonic reduction and voltage sag reduction – Analysis of unbalance – instantaneous real and reactive powers – Extraction of fundamental sequence component. LOAD COMPENSATION USING DSTATCOM - Compensating single phase loads – Ideal three phase shunt compensator structure – Generating reference currents using instantaneous PQ theory – Instantaneous symmetrical components theory – Generating reference currents when the source is unbalanced – Realization and control of DSTATCOM –

DSTATCOM in Voltage control mode. SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM Rectifier supported Dynamic Voltage Restorer – DC Capacitor supported DVR – DVR Structure – voltage Restoration – Series Active Filter – Unified Power Quality Conditioner.

TOTAL : 45 PERIODS

TEXTBOOKS :

1. ArindamGhosh "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002
2. R.C. Duggan, Mark.F.McGranaghan,SuryaSantoas and H.WayneBeaty, "Electrical Power System Quality", McGraw-Hill, 2004.
3. G.T.Heydt, "Electric Power Quality", Stars in a Circle Publication, 1994.
4. Math H J Bollen, "Understanding Power Quality Problems: voltage sags and interruptions", Wiley-IEEE Press, 2000. Indian Reprint – 2013

REFERENCE BOOKS :

1 Jos Arrillaga and Neville R. Watson ," Power system harmonics",Wiley,2003.
2. Derek A. Paice , "Power Electronics Converter Harmonics :Multipulse Methods for Clean Power",Wiley,1999.
3. Ewald Fuchs, Mohammad A. S. Masoum Power Quality in Power Systems and Electrical Machines,Elseveir academic press publications,2011.

INTEGRATION OF ENERGY SOURCES

REVIEW OF CHARACTERISTICS OF POWER SOURCES

Basic review of power generation from wind - Solar PV - Thermal - Small hydro - Biomass power strategies in each of these energy conversion systems - Review of maximum power point tracking techniques in solar PV and wind (perturb & observe, hill climbs, incremental conductance). CONVERTER TOPOLOGIES: DC/DC converter (buck, boost, buck boost) - DC/AC inverters (sine, triangular, PWM techniques) - Phase locked loop for inverters.

HYBRID SYSTEMS

Advantages of hybrid power systems - Importance of storage in hybrid power systems - Design of hybrid power system based on load curve - Sizing of hybrid power systems.

ISOLATED SYSTEMS

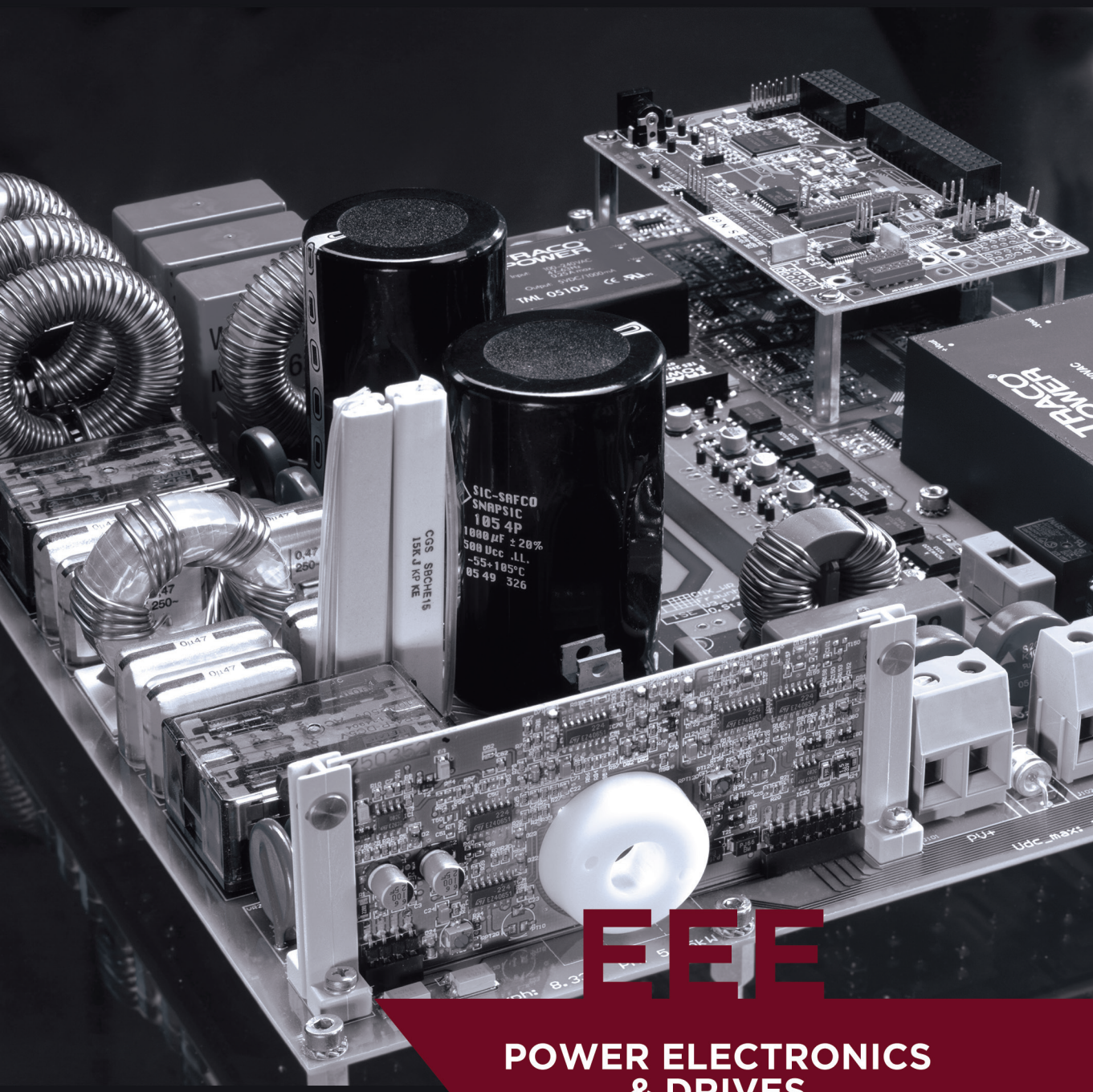
Control issues in isolated systems for voltage and frequency – Small signal stability in isolated power systems - Importance of storage and dump load in isolated systems.

ISSUES IN INTEGRATION OF RENEWABLE ENERGY SOURCES

Overview of challenges in integrating renewable sources to the grid - Impact of harmonics on power quality - Need to maintain voltage within a band and fluctuations in voltage because of renewable integration - Power inverter and converter technologies - Mechanism to synchronize power from renewable sources to the grid - Overview of challenges faced in designing power injection from offshore generation sources - Challenges in modeling intermittent nature of renewable power in a power system.

TEXTBOOKS :

1. Power Electronics, Converters, Applications and Design" by N. Mohan; T.M. Undeland; W.P. Robbins. 1995, John Wiley and Sons.
2. Renewable Energy Integration Challenges and Solutions Series: Green Energy and Technology Hossain, Jahangir,Mahmud, Apel (Eds.)
3. Integration of Alternative Sources of Energy Felix A. Farret, M. Godoy Simões,December 2005, Wiley-IEEE Press.



EEE

POWER ELECTRONICS & DRIVES

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18EE5109	Modeling and Analysis of Electrical Machines	3	1	0	4	4
2	18EE5110	Analysis of Power Converters	3	1	2	6	5
3	18EE5111	Electrical Drives	3	1	0	4	4
4	18EE5112	Modern Control Theory	3	1	0	4	4
5		Elective –I	3	0	0	3	3
6		Elective – II	3	0	0	3	3
7	18IE5149	Seminar	0	0	4	4	2
		Total	**18**	**2**	**4**	**28**	**25**

FIRST YEAR (SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18EE5113	Advanced Power Converters	3	1	2	6	5
2	18EE5114	Advanced Electrical Drives	3	1	0	4	4
3	18EE5115	Smart Grid Technologies	3	1	0	4	4
4	18EE5116	FPGA controllers and Applications	3	1	0	4	4
5		Elective – III	3	0	0	3	3
6		Elective - IV	3	0	0	3	3
7	18IE5150	Term Paper	0	0	4	4	2
		Total	**18**	**2**	**4**	**28**	**25**

SECOND YEAR (FIRST & SECOND SEMESTER)

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36
		Total Credits				**86**

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18EE51E1	Microcontrollers and Applications	3	0	0	3
2	18EE51E2	Digital Simulation of Power Electronic Systems	3	0	0	3
3	18EE51E3	Industrial Control Electronics	3	0	0	3
Elective-2						
4	18EE51F1	Soft Computing Techniques	3	0	0	3
5	18EE51B2	Digital Signal Processors and Applications	3	0	0	3
6	18EE51B3	Optimization Techniques	3	0	0	3
Elective-3						
7	18EE52G1	FACTS Devices	3	0	0	3
8	18EE52G2	Electric and Hybrid Vehicles	3	0	0	3
9	18EE52C3	Adaptive Control Systems	3	0	0	3
Elective-4						
10	18EE52D1	EHVAC & HVDC Transmission	3	0	0	3
11	18EE52D2	Power Quality	3	0	0	3
12	18EE52H3	Power Electronics for Renewable Energy Systems	3	0	0	3

SEMESTER-I

MODELING AND ANALYSIS OF ELECTRICALMACHINES

BASIC CONCEPTS AND DC MACHINE

Principles of Electromagnetic Energy Conversion, General expression of stored magnetic energy, co-energy and force/torque, example using single and doubly excited system. Basic Concepts of Rotating Machines-Calculation of air gap mmf and per phase machine inductance using physical machine data; Voltage and torque equation of dc machine.

INDUCTION MACHINE

Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form; Application of reference frame theory to three phase symmetrical induction and synchronous machines, dynamic direct and quadrature axis model in arbitrarily rotating reference frames.

SYNCHRONOUS MACHINE

Determination of Synchronous Machine Dynamic Equivalent Circuit Parameters, Analysis and dynamic modeling of two phase asymmetrical induction machine and single phase induction machine.

Special Machines - Permanent magnet synchronous machine: Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines. Construction and operating principle, dynamic modeling and self controlled operation; Analysis of Switch Reluctance Motors

REFERENCE BOOKS :

1. Charles Kingsley,Jr., A.E. Fitzgerald, Stephen D.Umans, 'Electric Machinery', Tata McgrawHill, 5th Edition, 1992.
2. R. Krishnan, 'Electric Motor & Drives: Modeling, Analysis and Control', Prentice Hall of India, 2nd Edition, 2001.
3. Miller, T.J.E., 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, 1st Edition, 1989
4. P.S.Bhimra, "Generalized theory of electrical machinery", Khanna publications
5. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition 1995

ANALYSIS OF POWER CONVERTERS

3-PHASE AC-DC CONVERTERS - Analysis of power semiconductor switched circuits with R, L, RL, RC loads, d.c. motor load, battery charging circuit. Single-Phase and Three-Phase AC to DC converters-half controlled configurations-Reactive power considerations-Three phase dual converters-PWM control of 3-phase controlled rectifier - twelve pulse converters- numerical problems. Extinction angle control-symmetrical angle control. POWER FACTOR CORRECTION CONVERTERS - Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state- analysis, three phase boost PFC converter. SWITCH-MODE DC-AC INVERTERS -Basic Concepts - Single Phase Inverters- PWM Principles- Sinusoidal Pulse Width Modulation in Single Phase Inverters-Choice of carrier frequency in SPWM-Spectral Content of output - Bipolar and Unipolar Switching in SPWM - Blanking Time Maximum Attainable DC Voltage Switch Utilization -Reverse Recovery Problem and Carrier Frequency Selection-Output Side Filter Requirements and Filter Design - Ripple in the Inverter Output - DC Side Current. – Three Phase Inverters -Three Phase Square Wave /Stepped Wave Inverters- Three Phase SPWM Inverters- Choice of Carrier Frequency in Three Phase SPWM Inverters - Effect of Blanking Time on Inverter Output Voltage. DC-DC CONVERTERS -Buck converter – Analysis and derivation of output voltage for continuous (CC) and discontinuous conduction mode (DCM). Boost converter – Analysis and derivation of output voltage for continuous (CC) and discontinuous conduction mode (DCM). BUCK-BOOST Converter - Analysis and derivation of output voltage for continuous (CC), Principle of operation of CUK and SEPIC Converter. 3- PHASE AC VOLTAGE REGULATORS -Three Phase AC Voltage regulators-Analysis of 3-phase regulators with star and delta connected R and RL loads – Load voltage harmonic Analysis-numerical problems.

TEXTBOOKS :

1. Ned Mohan et.al “Power electronics : converters, applications, and design” John Wiley and Sons, 2006
2. P.C. Sen “Power Electronics” Tata McGraw Hill, 2003.
3. Dewan &Straughen “Power Semiconductor Circuits” John Wiley &Sons., 1975 .
4. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First Indian Reprint- 2008
5. M.D.Singh &K.B. Khanchandani “Power Electronics” Tata McGraw Hill., 2007
6. B. K Bose Modern Power Electronics and AC Drives. Pearson Education (Asia)., 2007

POWER ELECTRONIC DRIVES

CONTROLLED CONVERTER FED DC MOTOR DRIVES

Steady state analysis of the single and three phase fully controlled converter fed series and separately excited D.C motor drives: Continuous and discontinuous conduction mode, control of output voltage by sequence and sector control. Chopper fed DC Motor Drives: Four quadrant chopper circuit – Chopper for inversion – closed loop control of chopper fed dc drive –Steady state analysis of chopper controlled DC motor drives. VSI and CSI fed Induction Motor Drives: Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with slip regulation-Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive. Current-Fed Inverter control-Independent current and frequency control-Speed and flux control in Current-Fed Inverter drive-Volts/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

Rotor Side Control of Induction Motor: Rotor resistance control- fixed resistance control, variable resistance control-converter controlled rotor resistance control, Slip power recovery schemes- Static Kramer drive-Phasor diagram-Torque expression-Speed control of a Kramer drive-Static scherbius drive-Modes of operation. Synchronous Motors : Speed control of synchronous motors, field oriented control, load commutated inverter drives, switched reluctance motors and permanent magnet motor drives.

TEXTBOOKS :

1. Power Electronics and Motor Control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press
2. R. Krishnan, 'Electric Motor Drives – Modeling, Analysis and Control', Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.
3. BimalK .Bose, 'Modern Power Electronics and AC Drives', Pearson Education Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS :

1. Power Electronic Circuits, Devices and Applications – M. H. Rashid – PHI.
2. Control of Induction Motors - Andrzej M. Trzynadlowski
3. Fundamentals of Electric Drives – G. K. Dubey – Narosa Publications – 1995.
4. Power Semiconductor drives – G. K. Dubey.

MODERN CONTROL THEORY

STATE VARIABLE ANALYSIS

The concept of state – State Equations for Dynamic systems – State diagram¬¬¬ - Linear Continuous time model for physical systems – Existence and Uniqueness of Solutions to Continuous – Time State Equations – Solutions – Linear Time Invariant Continuous – Time State Equations – State transition matrix and it's properties. State Variable Techniques: General concept of Controllability - General concept of Observability Controllability tests for Continuous &Time Invariant systems - Observability tests for Continuous &Time Invariant systems - Controllability and Observability of state model in Jordan Canonical form - Controllability and Observability Canonical forms of State model – State feedback controller design through pole assignment. Non Linear Systems – I: Introduction – Non Linear Systems – Types of Non – Linearities – Saturation – Dead – Zone – Backlash – Jump Phenomenon etc; - Singular Points – Introduction to Linearization of nonlinear systems, properties of Non Linear Systems – Describing function – describing function analysis of nonlinear systems- Stability analysis of Non – Linear systems through describing functions.

Non Linear Systems – II : Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase – plane analysis of nonlinear control systems. Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems – Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

TOTAL : 45 PERIODS

TEXTBOOK :

1. Modern Control System Theory by M. Gopal – New Age International – 1984
2. Modern Control Engineering by Ogata. K – Prentice Hall – 1997
3. Nonlinear systems, Hassan K. Klalil, Prentice Hall, 1996

REFERENCE BOOKS :

1. Modern control systems, Richard C. Dorf and Robert H. Bishop, 11th Edition, Pearson Edu, India, 2009
2. Control systems by R.C.Sukla-Dhanpat Rai and Co (Pvt) Ltd
3. Advanced Control Theory by A.Nagoor Kani-RBA
4. Optimal control by Kirck, PHI

SEMESTER-II

ADVANCED POWER CONVERTERS

RESONANT DC-DC CONVERTERS

Switching loss, hard switching, and basic principles of soft switching-classification of resonant converters- load resonant converters – series and parallel – resonant switch converters – operation and analysis of ZVS, ZCS converters comparison of ZCS/ZVS Introduction to ZVT/ZCT PWM converters - Numerical problems. Special Inverter Topologies: Series Inverters -Switched Mode Rectifier - Single phase and three phase boost type APFC and control -Three phase utility inter phases and control Push-Pull and Forward Converter Topologies - Voltage Mode Control Half and Full Bridge Converters - Flyback Converter.

SOFT SWITCHING CONVERTERS

Resonant (Pulsating) DC Link Inverter -Active-clamped Resonant DC Link Inverter- Quasi-resonant Soft-switched Inverter - Numerical problems. Multilevel Inverters- Multilevel & Boost Inverters - Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters - Comparison of multilevel inverters - application of multilevel inverters – PWM techniques for MLI – Single phase & Three phase Impedance source inverters - Introduction-Matrix converter circuit-Control strategies.

TEXTBOOKS :

1. N.Mohan, T.M.Undeland, W.P Robbins, “Power Electronics, Converters, Applications & Design”, Wiley India Pvt. Ltd.-2013
2. Power Converter Circuits , William Shepherd and Li Zhang, CRC press ,Taylor & Francis -2004

REFERENCE BOOKS :

1. Gyugyi, L., B. R. Pelly, “Static Power Frequency Changers,” Wiley, New York.
2. Rashid M.H., “Power Electronics Circuits, Devices and Applications “, Prentice Hall India, Third Edition, New Delhi, 2004
3. Ali Emadi, Alireza Khaligh, Zhong Nie, Young Joo Lee, “ Integrated Power Electronic Converters and Digital Control”, CRC press
4. Simon Ang, Alejandro Oliva, “Power-Switching Converters, Second Edition, CRC Press, Taylor & Francis Group, 2010
5. Marian.K.Kazimierczuk and DariuszCzarkowski, “Resonant Power Converters”, John Wiley & Sons limited, 2011

ADVANCED ELECTRICAL DRIVES

FIELD ORIENTED CONTROL OF INDUCTION MOTOR DRIVES - Field oriented control of induction machines – Theory – DC drive analogy – Direct and Indirect methods – Flux vector estimation - Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy. SENSORLESS VECTOR CONTROL OF INDUCTION MOTOR: Slip and Speed Estimation at Low performance, Rotor Angle and Flux-linkage Estimation at high performance -rotor Speed Estimation Scheme- estimators using rotor slot harmonics, Model Reference adaptive systems, Extended Kalman Filter. CONTROL OF SYNCHRONOUS MOTOR DRIVES: Self control-margin angle control-torque control-power factor control-Brushless excitation systems - SRM Structure-Stator Excitation-techniques of sensor less operation-convertor topologies-SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple-Instantaneous Torque control -using current controllers-flux controllers. CONTROL OF BLDC MOTOR DRIVES: principle of operation of BLDC Machine, Sensing and logic switching scheme, BLDM as Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive.

TOTAL : 45 PERIODS

TEXTBOOKS :

1. Electric Motor Drives Modeling, Analysis & control -R. Krishnan- Pearson Education
2. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications
3. Sensorless Vector Direct Torque control –Peter Vas, Oxford University Press

REFERENCE BOOKS :

1. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications-
2. Power Electronics control of AC motors – MD Murphy & FG Turn Bull Pergman Press -1st edition-1998
3. W.Leonhard, “Control of Electrical Drives”, Narosa Publishing House, 1992
4. VedamSubramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw-Hill publishing company Ltd., New Delhi, 2002

SMART GRIDS

INTRODUCTION TO SMART GRID - Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid. SMART GRID TECHNOLOGIES Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV). SMART METERS AND ADVANCED METERING INFRASTRUCTURE - Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection. POWER QUALITY MANAGEMENT IN SMART GRID - Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

REFERENCE BOOKS :

1. Stuart Borlase “Smart Grid :Infrastructure, Technology and Solutions”, CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley 2012.
3. Control and Optimization Methods for Electric Smart Grids, Aranya akraborthy, Marija D llic Editor, Springer Publications.
4. Smart Grid Fundamentals of Design and Analysis, James Momoh, Wiley IEEE Press, Ed 2012.
5. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The New and Improved Power Grid: A Survey” , IEEE Transaction on Smart Grids, vol. 14, 2012.

FPGA CONTROLLERS AND APPLICATIONS

PROGRAMABLE LOGIC DEVICES- Programming Techniques-Anti fuse-SRAM-EPROM and EEPROM technology Logical blocks, I/O blocks, Interconnects, Xilinx- XC9500,Cool Runner - XC5200, SPARTAN, Virtex - Altera MAX 7000. ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING - System partition – FPGA partitioning – Partitioning methods- floor planning – placement- physical design flow – global routing – detailed routing – special routing- circuit extraction – DRC. ANALOG VLSI DESIGN- Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS- Analog primitive cells-realization of neural networks. LOGIC SYNTHESIS AND SIMULATION -Overview of digital design with Verilog HDL, hierarchical modelling concepts, modules and port definitions, gate level modelling, data flow modelling, behavioural modelling, task & functions, Verilog and logic synthesis-simulation-PWM pulse generations for converter applications. MOTOR CONTROL USING FPGA: Introduction to Motor Drives- Digital Block Diagram for Robot Axis Control - Position Loop - Speed Loop- Power Module - Case Studies for Motor Control - Stepper Motor Controller- Permanent Magnet DC Motor - Brushless DC Motor -Permanent Magnet Rotor (PMR) Synchronous Motor - Permanent Magnet Synchronous Motor (PMSM).

TEXTBOOKS :

1. Kamran Eshraghian,Douglas A.Pucknell and Shole Eshraghian," Essentials of VLSI circuits and system", Prentice Hall India,2005.
2. Wayne Wolf, " Modern VLSI design", Prentice Hall India,2006.
3. Rahul Dubey, "Introduction to Embedded System Design Using Field Programmable Gate Arrays", 2009 Springer-Verlag London Limited

REFERENCE BOOKS :

1. Mohamed Ismail,Terri Fiez, "Analog VLSI Signal and information Processing", McGraw Hill International Editions,1994.
2. Samir Palnitkar, "Veri Log HDL, A Design guide to Digital and Synthesis" 2nd Ed, Pearson,2005.
3. Xilinx (2006) Spartan-3E Starter Kit Board User Guide. UG230 (v1.0) March 2006
4. Xilinx (2006) System Generator for DSP performing Hardware-in-the-loop with the SPARTAN-3E Starter Kit, December 2006

ELECTIVE COURSES

MICROCONTROLLERS AND APPLICATIONS (ELECTIVE -1)

PIC 18C7X MICROCONTROLLER- Architecture memory organization – Addressing modes – Instruction set – Programming techniques – simple programs- Timers – interrupts – I/O ports – I2C bus for peripheral chip access – A/D converter – UART. MOTOR CONTROL SIGNAL PROCESSORS- Introduction- System configuration registers - Memory Addressing modes - Instruction set – Programming techniques – simple programs. General purpose Input/Output (GPIO) Functionality- Interrupts - A/D converter -PWM signal generation. REAL TIME OPERATING SYSTEM FOR MICROCONTROLLERS: Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers. ARM 32 Bit MCUs: Introduction to 18/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set –Development-tools. Interfaces – Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing – Optical motor shaft enCoders – Industrial control – Industrial process control system – Prototype MCU based Measuring instruments – Robotics and Embedded control –TYPICAL APPLICATIONS – PWM pulse generation for converters- electric motor drives.

TEXTBOOKS :

2. Mazidi & Mc Kinley, " The 8051 Micro controller and Embedded Systems using Assembly and c", 2nd edition, published by Person Education, 2006
3. Rajkamal, "Embedded Systems Architecture, Programming and Design", TATA McGraw-Hill Publications, 2003.

REFERENCE BOOKS :

1. John B.Peatman , 'Design with PIC Microcontrollers,' Pearson Education, Asia 2004

DIGITAL SIMULATION OF POWER ELECTRONIC SYSTEMS (ELECTIVE 1)

MODELING OF POWER ELECTRONIC DEVICES

General purpose circuit analysis software – Methods of analysis of power electronic systems - Transients and the time domain analysis with Pspice – Fourier series and harmonic components – Pspice modeling of diode, BJT,MOSFET,IGBT, SCR,TRIAC in simulation. Diode with R, R-L, R-C and R-L-C load with ac supply. Modeling of SCR, TRIAC and IGBT, simulation of driver and snubber circuits. SIMULATION OF AC-DC CONVETERS USING PSPICE AND MATLAB SIMULINK: Modeling of single phase and three-phase

uncontrolled and controlled (SCR) rectifiers- simulation of converter fed DC drives-computation of performance parameters: harmonics, power factor, angle of overlap. SIMULATION OF DC-DC CONVERTERS USING PSPICE AND MATLAB SIMULINK : Modeling of Chopper circuits- Simulation of thyristor choppers with voltage, current and load commutation schemes- Simulation of chopper fed dc motor- computation of performance parameters. SIMULATION OF DC-AC CONVERTERS USING PSPICE AND MATLAB SIMULINK: Modeling of single and three phase inverters circuits – Space vector representation- Pulse-width modulation methods for voltage control- Simulation of inverter fed induction motor drives. SIMULATION OF AC-AC CONVERTERS USING PSPICE AND MATLAB SIMULINK: Modeling of AC voltage controllers, and Cyclo-converters- Simulation of AC voltage controllers and Cyclo-converters feeding different loads- Computation of performance parameters.

TEXTBOOKS :

1. Rashid, M., "Simulation of Power Electronic Circuits using PSPICE", Prentice Hall Inc., 2006
2. M. B. Patil, V. Ramnarayanan and V. T. Ranganathan., "Simulation of Power Electronic Converters", 1st Edition, Narosa Publishers, 2010.
3. John Keown., "Microsim, Pspice and circuit analysis"-Prentice Hall Inc., third edition, 1998.

REFERENCE BOOKS :

1. Robert Ericson, 'Fundamentals of Power Electronics', Chapman & Hall, 1997.
2. Issa Batarseh, 'Power Electronic Circuits', John Wiley, 2004Simulink Reference Manual, Math works, USA.

INDUSTRIAL CONTROL ELECTRONICS (ELECTIVE -1)

Review of switching regulators and switch mode power supplies - Uninterrupted power supplies- offline and on-line topologies-Analysis of UPS topologies, solid state circuit breakers, solid-state tap changing of transformer. Analog Controllers - Proportional controllers, Proportional – Integral controllers, PID controllers, derivative over run, integral windup, cascaded control, Feed forward control, Digital control schemes, control algorithms, programmable logic controllers - sensors for high voltage and current applications Signal conditioners- Instrumentation amplifiers – voltage to current, current to voltage, voltage to frequency, frequency to voltage converters; Isolation circuits – cabling; magnetic and electro static shielding and grounding. Opto-Electronic devices and control , electronic circuits for photo-electric switches-output signals for photo-electric controls; Applications of opto-isolation, interrupter modules and photo sensors;

Fibre-optics; Bar Code equipment, application of barCode in industry. Stepper motors – types, operation, control and applications; servo motors- types, operation, control and applications – servo motor controllers – servo amplifiers – linear motor applications-selection of servo motor.

REFERENCE BOOKS :

1. Michael Jacob, 'Industrial Control Electronics – Applications and Design', Prentice Hall, 1995.
2. Thomas E. Kissell, 'Industrial Electronics', Prentice Hall India, 2003
3. James Maas, 'Industrial Electronics', Prentice Hall, 1995

SOFT COMPUTING TECHNIQUES (ELECTIVE -2)

INTRODUCTION

Introduction and motivation. Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. ARTIFICIAL NEURAL NETWORKS: Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Networks: Hopfield network, Self-organizing network and Recurrent network. GENETIC ALGORITHM: Genetic Algorithm: Basic concept of Genetic algorithm: Mutation,Reproduction and cross over and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm, genetic algorithm as classifier and engineering applications. FUZZY SYSTEMS: Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to Fuzzy logic modeling and control of a system. Fuzzification, inference and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. FUZZY LOGIC & NEURAL NETWORK APPLICATIONS TO DRIVES

FUZZY LOGIC APPLICATIONS

Design of Fuzzy PI controller for speed control of DC motor- Flux programming efficiency improvement of three phase induction motor-Induction motor speed control. Neural network applications:-PWM Controller-Selected harmonic elimination PWM-Space vector PWM

TOTAL: 45 PERIODS

TEXTBOOKS :

1. Neural Networks: A comprehensive Foundation – Simon Haykins, Pearson Edition, 2003.

2. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
3. Genetic Algorithms- David E Goldberg.
4. Modern Power Electronics and AC Drives –B.K.Bose-Pearson Publications
5. Artificial Intelligent based Electrical Machines and Drives- Peter Vas, Oxford University Press

REFERENCE BOOKS :

1. Neural Network Fundamentals with Graphs, Algorithms and Applications, N.K. Bose and P.Liang, Mc-Graw Hill, Inc. 1996.
2. Intelligent System- Modeling, Optimization and Control- Yung C. Shin and Chengying Xu,CRC Press, 2009.
3. Soft computing & Intelligent Systems- Theory & Applications – N.K.Sinha and Modan M Gupta. Indian Edition, Elsevier, 2007.
4. Fuzzy logic Intelligence, Control, and Information- John Yen and Reza Langari, Pearson Education, Indian Edition, 2003.

DIGITAL SIGNAL PROCESSORS AND APPLICATIONS (ELECTIVE -2)

INTRODUCTION TO DSP

Architecture, Assembly language syntax, Addressing modes Assembly language Instructions - Pipeline structure, Operation Block Diagram of DSP starter kit, Application Programs for processing real time signals. Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control,, On-Chip peripherals, Interrupts of TMS320C54XX processors. I/O & CONTROL REGISTERS: Pin Multiplexing (MUX) and General Purpose I/O Overview, Multiplexing and General Purpose I/O Control Registers .Introduction to Interrupts, Interrupt Hierarchy, Interrupt Control Registers, Initializing and Servicing Interrupts in Software. ADC & EVENT MANAGER: ADC Overview , Operation of the ADC in the DSP , Overview of the Event manager (EV) , Event Manager Interrupts , General Purpose (GP) Timers , Compare UNITs, Capture UNITs and Quadrature Enclosed Pulse (QEP) Circuitry , General Event Manager Information.

TOTAL: 45 PERIODS

REFERENCE BOOKS :

1. Hamid.A.Toliyat and Steven G.Campbell “ DSP Based Electro Mechanical Motion Control “ CRC Press New York , 2004
2. Texas Instrument TI C2xx manual

OPTIMIZATION TECHNIQUES (ELECTIVE-2)

CLASSICAL OPTIMIZATION TECHNIQUES

Single variable optimization, multi-variable optimization with no constraints, with equality and inequality constraints, Karush- Kuhn- Tucker constraints Linear Programming (LP): Geometry of LP problem, graphical solution, simplex algorithm, two-phases of simplex algorithm, duality, dual simplex method, post-optimality analysis, quadratic programming. Non-Linear Programming: One-dimensional optimization – Fibonacci method, golden section method, quadratic and cubic interpolation methods, Newton's method. Unconstrained optimization - Steepest descent method, conjugate gradient method, Davidon-Fletcher-Powell method. Constrained Optimization - Methods of feasible directions, gradient projection method, generalized gradient method, penalty function methods, Augmented Legrangian multiplier method, Branch and bound method. Non-traditional Optimization Methods and Applications: Genetic algorithms (G A), G A Operators, G A for constrained optimization, real –Coded GAs. Particle swarm optimization.

TEXTBOOKS :

1. S.S. Rao, ' Engineering Optimization : Theory andPractice.III Edition, New Age International (p) Limited Publications
2. Kalyanmoy Deb, ' Optimization for Engineering Applications', PHI Learning Private Limited. REFERENCE Books :
1. Purnachandra Biswal, ' Optimization in Engineering', Scitech Publications (India) PVT Ltd.

FACTS DEVICES (ELECTIVE-3)

FACTS CONCEPT AND GENERAL SYSTEM CONSIDERATIONS

Transmission interconnections, Power Flow in AC system, Dynamic stability Considerations and the importance of the controllable parameters, Introduction to Facts devices, Basic types of FACTS Controllers, benefits from FACTS controllers.STATIC SHUNT COMPENSATION:Objectives of shunt compensation, Methods of controllable VAR generation, variable impedance type static VAR generators (SVC): TCR, TSR, TSC, FC-TCR, TSC-TCR, switching converter type VAR generators: STATCOM, Comparison between SVC and STATCOM, STATCOM for transient and dynamic stability enhancement. STATIC SERIES COMPENSATION: Objectives of series compensation, variable impedance type static series controllers: GCSC, TSSC, TCSC, switching converter type controller: SSSC, Operation and Control External system Control for series Compensator SSR and its damping – Static Voltage and Phase angle Regulators - TCVR and TCPAR – Operation and Control. UPFC AND IPFC: The unified power flow

Controller – Operation –Comparison with other FACTS devices – control of P and Q – dynamic performance – special Purpose FACTS controllers – Interline Power flow Controller – Operation and Control.

TOTAL : 45 PERIODS

TEXTBOOKS :

1. N.G Hingorani & L.Gyugyi " Understanding FACTS: Concepts and Technology of Flexible AC Transmission System" , IEEE Press,2000
2. K.R.Padiyar "FACTS Controller in power Transmission and Distribution" New Age Int Publisher,2007

REFERENCE BOOKS :

1. Vijay K Sood "HVDC and FACTS Controllers" Kluwer Academic Publishers,2004.
2. Xiao-Ping Zhang, Christian Rehtanz, Bikash Pal, "Flexible AC Transmission Systems- modeling and control" Springer, 2005.

ELECTRIC AND HYBRID VEHICLES (ELECTIVE -3)

ELECTRIC VEHICLES AND VEHICLE MECHANICS -Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics. ARCHITECTURE OF EV's & HEV's AND POWER TRAIN COMPONENTS - Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes. Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems. CONTROL OF DC AND AC DRIVES -DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and configuration and control of Permanent Magnet Motor drives – Switched reluctance motor (SRM) drives. BATTERY ENERGY STORAGE SYSTEM- Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries. ALTERNATIVE ENERGY STORAGE SYSTEMS- Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors- implementation issues of energy strategies.

TEXTBOOKS :

1. Iqbal Hussain, CRC Press, Taylor & Francis Group, Second Edition (2011).
2. Ali Emadi, Mehrdad Ehsani, John M.Miller "Vehicular Electric Power Systems" , Special Indian Edition, Marcel dekker, Inc 2010
3. Chris Mi, M. Abul Masrur .e.tal, "Hybrid Electric Vehicles Principles and Applications with Practical Perspectives", A John Wiley & Sons, Ltd.,

Publication 2011.
4. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, “Modern Electric, Hybrd Electric, and Fuel Cell Vehicles”, CRC Press LIC 2005.

ADAPTIVE CONTROL SYSTEMS (ELECTIVE-3)

ELEMENTS OF PROBABILITY THEORY

definition of probability and random variable, probability functions, expected value, mean and covariance, independence and correlation, Gaussian distribution and its properties. Stochastic processes and system models: Elements of the theory of stochastic processes, mean value function and covariance kernel, independent and correlated stochastic processes, stationery and non sequence model, Gaussian white process. Non parametric methods & parametric methods: Nonparametric methods: Transient analysis-frequency analysis-Correlation analysis-Spectral analysis. Liner Regression: The Lease square estimate-best liner unbiased estimation under linear constraints-Prediction error methods: Description of Prediction error methods-Optimal Prediction –relationships between Prediction error methods and other identification methods theoretical analysis. Adaptive control schemes Introduction – users- Definitions-auto tuning-types of adaptive control-gain scheduling controller-model reference adaptive control schemes – self tuning controller. MRAC and STC: Approaches – The Gradient approach – Lyapunov functions – Passivity theory – pole placement method Minimum variance control – Predictive control. Adaptive control and application: Stability – Convergence – Robustness – Application of adaptive control, direct model reference adaptive control. Introduction: Basic approaches to adaptive control. Applications of adaptive control. Identification: Error formulations linear in the parameters. Direct adaptive control: Linear error equations with dynamics. Gradient and pseudo-gradient algorithms. Strictly positive real transfer functions. Kalman-Yacubovitch-Popov lemma. Passivity theory.

TEXTBOOKS :

1. Dan Simon, “Optimal State Estimation”, Wiley Intersience, 2006.
2. S. Sastry and M. Bodson, Adaptive Control: Stability, Convergence, and Robustness, Prentice-Hall, 1989.

REFERENCE BOOKS :

1. K.J. Astrom and B. Wittenmark, Adaptive Control, Addison-Wesley, 2nd edition, 1995.
2. I.D. Landau, R. Lozano, and M. M’Saad, Adaptive Control, Springer Verlag, London, 1998.
3. Meditch, “Stochastic Optimal Linear Estimation and Control” Mc-Graw Hill

Company, 1969.
4. K.S. Narendra and A.M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989.
5. P.E. Wellstead & M.B. Zarrop, Self-Tuning Systems: Control and Signal Processing, J. Wiley & Sons, Chichester, England, 1991

EHVAC & HVDC TRANSMISSION (ELECTIVE-4)

INTRODUCTION

Need of EHV transmission, Limitations, EHV transmission, Comparison of EHV-AC & HVDC transmission, Interconnected Network and Role of Interconnecting Transmission Lines.

EHV-AC TRANSMISSION

Parameters of EHV line, over-voltages due to switching, Ferro resonance, line insulator and clearance, corona, long distance transmission with series & shunt compensations, principle of half wave transmission, flexible AC transmission.

HVDC TRANSMISSION

Types of DC links, terminal equipments & their operations, HVDC system control, reactive power control, harmonics, multi terminal DC (MTDC) system, AC/DC system analysis, protection of terminal equipments.

Insulation Requirement of EHV-AC and HVDC: Classification, Insulation design aspect, Difference between Insulation Coordination-EHV-AC and HVDC, Insulation Coordination, Surge arrester protection in HVDC and EHV-AC Substation, Clearance for HVDC and EHV-AC.

TOWERS FOR (EHV-AC AND HVDC)

Types and configuration of self supporting and flexible towers, Foundation of towers, mechanical design of towers, Tower design based on switching surges and lightning strokes.

TEXTBOOKS :

1. K. R. Padiyar, HVDC Power Transmission System, Wiley Eastern Limited, 1990.
2. EHV-AC, HVDC Transmission and Distribution Engineering, S. Rao, Khanna Publishers, 2001.

REFERENCE BOOKS :

1. Rakesh Das Begmudre, Extra High Voltage AC Transmission Engineering, Wiley Eastern Limited, New Delhi – 1987
2. E.W.Kimbark, EHV-AC and HVDC Transmission Engineering &Practice, Khanna Publishers.

POWER QUALITY (ELECTIVE-4)

INTRODUCTION- CHARACTERIZATION OF ELECTRIC POWER QUALITY

Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards. Transients – origin and classifications – capacitor switching transient – lightning-load switching – impact on users – protection – mitigation. CONVENTIONAL LOAD COMPENSATION METHODS -Principle of Load compensation and Voltage regulation – Classical load balancing problem: Open loop balancing – Closed loop balancing, Current balancing – Harmonic reduction and voltage sag reduction – Analysis of unbalance – instantaneous real and reactive powers – Extraction of fundamental sequence component. LOAD COMPENSATION USING DSTATCOM - Compensating single phase loads – Ideal three phase shunt compensator structure – Generating reference currents using instantaneous PQ theory – Instantaneous symmetrical components theory – Generating reference currents when the source is unbalanced – Realization and control of DSTATCOM – DSTATCOM in Voltage control mode. SERIES COMPENSATION OF POWER DISTRIBUTION SYSTEM Rectifier supported Dynamic Voltage Restorer – DC Capacitor supported DVR – DVR Structure – voltage Restoration – Series Active Filter – Unified Power Quality Conditioner.

TOTAL : 45 PERIODS

TEXTBOOKS :

1. ArindamGhosh “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002
2. R.C. Duggan, Mark.F.McGranaghan,SuryaSantoas and H.WayneBeaty, “Electrical Power System Quality”, McGraw-Hill, 2004.
3. G.T.Heydt, “Electric Power Quality”, Stars in a Circle Publication, 1994.
4. Math H J Bollen, “Understanding Power Quality Problems: voltage sags and interruptions”, Wiley-IEEE Press, 2000. Indian Reprint – 2013

REFERENCE BOOKS :

1 Jos Arrillaga and Neville R. Watson ,“ Power system harmonics”,Wiley,2003.
2. Derek A. Paice , “Power Electronics Converter Harmonics : Multipulse Methods for Clean Power”,Wiley,1999.
3. Ewald Fuchs, Mohammad A. S. Masoum Power Quality in Power Systems and Electrical Machines,Elseveir academic press publications,2011.

POWER ELECTRONICS FOR RENEWABLE

ENERGY SYSTEMS (ELECTIVE -4)

SOLAR POWER CONTROL- Introduction to PV-Cells, Array, Solar power extraction using PV-Cells, I-V Characteristics, PV-Inverters without D.C. to D.C. converters, Grid interfacing-with isolation, without isolation, Maximum power point tracking-Methods, PV-Inverters with D.C. to D.C. converters-on low

frequency side and high frequency side with isolation, without isolation. WIND POWER CONTROL-Fixed speed with capacitor bank, Rotor resistance control, DFIG, Synchronous Generator-external magnetized, Synchronous Generator-permanent magnets. ANALYSIS OF WIND AND PV SYSTEMS- Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system. INTRODUCTION TO MICRO-GRIDS - Types of micro-grids – autonomous and non-autonomous grids – Sizing of micro-grids- modeling & analysis- Micro-grids with multiple DGs – Micro- grids with power electronic interfacing units. Transients in micro-grids - Protection of micro-grids – Case studies.

TEXTBOOKS :

1. Frede Blaabjerg and Dan M. Ionel, “Renewable Energy Devices and Systems with Simulation”, CRC Press-2017
2. Renewable Energy Technologies /Ramesh & Kumar /Narosa
3. Integration of alternative sources of energy /Felix A. Farret, M. Godoy simoes
4. S.N.Bhadra, D. Kastha, & S. Banerjee “Wind Electrical Systems”, Oxford University Press, 2009
5. Li Fusheng, Li Ruisheng and Zhou Fengquan, “Microgrid Technology and Engineering Application”, Academic Press is an imprint of Elsevier -2016

ME

ROBOTICS & MECHATRONICS

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5101	Fundamentals of Mechatronics	3	1	0	4	4
2	18 ME 5102	Advanced Engineering Mathematics	3	1	0	4	4
3	18 ME 5103	Sensors and Actuators	3	1	0	4	4
4	18 ME 5104	Modeling and Simulation of Mechatronic Systems	3	0	2	4	4
5		Elective – I	3	0	0	3	3
6		Elective –II	3	0	0	3	3
7	18 IE 5149	Seminar	0	0	4	4	2
		Total	**18**	**3**	**6**	**26**	**24**

FIRST YEAR (SECOND SEMESTER):

S. No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5205	Robotics: Advanced Concepts and Analysis	3	1	0	4	4
2	18 ME 5206	Control of Mechatronic Systems	3	1	0	4	4
3	18 ME 5207	Mechatronics Product Design	3	1	0	4	4
4	18 ME 5208	Precision Engineering	3	1	0	4	4
5		Elective –III	3	0	0	3	3
6		Elective – IV	3	0	0	3	3
7	18 IE 5250	Term Paper	0	0	4	4	2
		Total	**18**	**4**	**4**	**26**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 ME 51A1	Signal Processing in Mechatronic Systems	3	0	0	3
2	18 ME 51A2	MEMS and NEMS	3	0	0	3
3	18 ME 51A3	Vehicle Dynamics and Multi-body Systems	3	0	0	3
Elective-2						
1	18 ME 51B1	Emerging Smart Materials for Mechatronics Applications	3	0	0	3
2	18 ME 51B2	Intelligent Visual Surveillance	3	0	0	3
3	18 ME 51B3	Microprocessors and Embedded Systems	3	0	0	3
Elective-3						
1	18 ME 52C1	Computational Fluid Dynamics	3	0	0	3
2	18 ME 52C2	Nonlinear Optimization	3	0	0	3
Elective-4						
1	18 ME 52D1	Industrial Automation	3	0	0	3
2	18 ME 52D2	Fuzzy Sets and Artificial Intelligence	3	0	0	3

FUNDAMENTALS OF MECHATRONICS

SYLLABUS

MODULE I

Introduction: Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.

MODULE II

Review of fundamentals of electronics. Data conversion devices, sensors, microsensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

MODULE III

Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, transfer systems.

MODULE IV

Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description

MODULE V

Description of PID controllers. CNC machines and part programming. Industrial Robotics.

TEXTBOOKS :

1. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988.
2. G.W. Kurtz, J.K. Schueller, P.W. Claar . II, Machine design for mobile and industrial applications, SAE, 1994.
3. T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall, 1996.
4. R. Iserman, Mechatronic Systems: Fundamentals, Springer, 1st Edition, 2005
5. Musa Jouaneh, Fundamentals of Mechatronics, 1st Edition, Cengage Learning, 2012.

ADVANCED ENGINEERING MATHEMATICS

SYLLABUS

LINEAR ALGEBRA

Matrix algebra; basis, dimension and fundamental subspaces; solvability of Ax = b by direct Methods; orthogonality and QR transformation; eigenvalues and eigenvectors, similarity transformation, singular value decomposition, Fourier series, Fourier Transformation, FFT.

VECTOR ALGEBRA & CALCULUS

Basic vector algebra; curves; grad, div, curl; line, surface and volume integral, Green's theorem, Stokes's theorem, Gauss-divergence theorem.

DIFFERENTIAL EQUATIONS

ODE: homogeneous and non-homogeneous equations, Wronskian, Laplace transform, series solutions, Frobenius method, Sturm-Liouville problems, Bessel and Legendre equations, integral transformations; PDE: separation of variables and solution by Fourier Series and Transformations, PDE with variable coefficient.

NUMERICAL TECHNIQUE

Numerical integration and differentiation; Methods for solution of Initial Value Problems, finite difference methods for ODE and PDE; iterative methods: Jacobi, Gauss-Siedel, and successive over-relaxation.
Complex Number Theory: Analytic function; Cauchy's integral theorem; residue integral method, conformal mapping.
Statistical Methods: Descriptive statistics and data analysis, correlation and regression, probability distribution, analysis of variance, testing of hypothesis.

TEXTBOOKS :

1. H. Kreyszig, "Advanced Engineering Mathematics", Wiley, (2006).
2. Gilbert Strang, "Linear Algebra and Its Applications", 4th edition, Thomson Brooks/Cole, India (2006).
3. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", McGraw-Hill Companies, Inc., New York (2004).
4. J. W. Brown and R. V. Churchill, "Fourier Series and Boundary Value Problems", McGraw-Hill Companies, Inc., New York (2009).
5. G. F. Simmons, "Differential Equations with Applications and Historical Notes", Tata McGraw-Hill Edition, India (2003).
6. S. L. Ross, "Differential Equations" 3rd edition, John Wiley & Sons, Inc., India (2004).

SENSORS AND ACTUATORS

SYLLABUS

Brief overview of measurement systems, classification, characteristics and calibration of different sensors. Measurement of displacement, position, motion, force, torque, strain gauge, pressure flow, temperature sensor sensors, smart sensor. Optical enCoder, tactile and proximity, ultrasonic transducers, opto-electrical sensor, gyroscope. Principles and structures of modern micro sensors, micro-fabrication technologies: bulk micromachining, surface micromachining, LIGA, assembly and packaging.

PNEUMATIC AND HYDRAULIC SYSTEMS

actuators, definition, example, types, selection. Pneumatic actuator. Electro-pneumatic actuator. Hydraulic actuator, control valves, valve sizing valve selection. Electrical actuating systems: solid-state switches, solenoids, voice coil; electric motors; DC motors, AC motors, single phase motor; 3-phase motor; induction motor; synchronous motor; stepper motors. Piezoelectric actuator: characterization, operation, and fabrication;shapememoryalloys.

TEXTBOOKS :

1. John G. Webster, Editor-in-chief, “Measurement, Instrumentation, and Sensors Handbook”, CRC Press (1999).
2. Jacob Fraden, “Handbook of modern Sensors”, AIP Press, Woodbury (1997).
3. Nadim Maluf, “An Introduction to Microelectromechanical Systems Engineering”, Artech House Publishers, Boston (2000).
4. Marc Madou, “Fundamentals of Microfabrication”, CRC Press, Boca Raton (1997).
5. Gregory Kovacs, “Micromachined Transducers Sourcebook”, McGraw-Hill, New York (1998).
6. E. O. Deobelin and D. Manik, “Measurement Systems – Application and Design”, Tata McGraw-Hill (2004).
7. D. Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw-Hill, eleventh reprint (2004).
8. B. G. Liptak, “Instrument Engineers’ Handbook: Process Measurement and Analysis”, CRC (2003).

MODELING AND SIMULATION OF MECHATRONIC SYSTEMS

SYLLABUS

Physical Modelling: Mechanical and electrical systems, physical laws, continuity equations, compatibility equations, system engineering concept, system modelling with structured analysis, modelling paradigms for mechatronic system, block diagrams, mathematical models, systems of differential-algebraic equations, response analysis of electrical systems, thermal systems, fluid systems, mechanical rotational system, electrical-mechanical coupling.

SIMULATION TECHNIQUES

Solution of model equations and their interpretation, zeroth, first and second order system, solution of 2nd order electro-mechanical equation by finite element method, transfer function and frequency response, non-parametric methods, transient, correlation, frequency, Fourier and spectra analysis, design of identification experiments, choice of model structure, scaling, numeric methods, validation, methods of lumped element simulation, modelling of sensors and actuators, hardware in the loop simulation (HIL), rapid controller prototyping, coupling of simulation tools, simulation of systems in software (MATLAB, LabVIEW) environment.

MODELLING AND SIMULATION OF PRACTICAL PROBLEMS:

1. Pure mechanical models
2. Models for electromagnetic actuators including the electrical drivers
3. Models for DC-engines with different closed loop controllers using operational amplifiers
4. Models for transistor amplifiers
5. Models for vehicle system

TEXTBOOKS :

1. L. Ljung, T. Glad, “Modeling of Dynamical Systems”, Prentice Hall Inc. (1994).
2. D.C. Karnopp, D.L. Margolis and R.C. Rosenberg, “System Dynamics: A Unified Approach”, 2nd Edition, Wiley-Interscience (1990).
3. G. Gordon, “System Simulation”, 2nd Edition, PHI Learning (2009).
4. V. Giurgiutiu and S. E. Lyshevski, “Micromechatronics, Modeling, Analysis, and Design with MATLAB”, 2nd Edition, CRC Press (2009).

SIGNAL PROCESSING IN MECHATRONIC SYSTEMS

SYLLABUS

DISCRETE- TIME SIGNALS

Sequences; representation of signals on orthogonal basis; Sampling and Reconstruction of signals

DISCRETE SYSTEMS

Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems.

FREQUENCY SELECTIVE FILTERS

: Ideal filter characteristics, lowpass, highpass, bandpass and bandstop filters, Paley-Wiener criterion, digital resonators, notch filters, comb filters, all-pass filters, inverse systems, minimum phase, maximum phase and mixed phase systems.

DESIGN OF FIR AND IIR FILTERS

Design of FIR filters using windows, frequency sampling, Design of IIR filters using impulse invariance, bilinear transformation and frequency transformations, Butterworth, Chebyshev Filters.

INTRODUCTION TO MULTI-RATE SIGNAL PROCESSING

Decimation, interpolation, polyphase decomposition; digital filter banks: Nyquist filters, two channel quadrature mirror filter bank and perfect reconstruction filter banks, subband coding.

Introduction to DSP Processors: Introduction to various Texas processors such as TMS320C6713, TMS320C6416, DM6437 Digital Video Development Platform with Camera, DevKit8000 OMAP3530 Evaluation Kit.

APPLICATIONS

Application of DSP to Speech and Radar signal processing,

A few case studies of DSP applications in multimedia using TI DSP kits.

TEXTBOOKS :

1. S. K. Mitra, Digital Signal Processing: A computer-Based Approach, 3/e, TMcHI, 2006.
2. A. V. Oppenheim and R. W. Shafer, Discrete-Time Signal Processing, Prentice Hall India, 2/e, 2004.
3. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4/e, Pearson Education, 2007.

REFERENCE BOOKS :

1. V.K. Ingle and J.G. Proakis, “Digital signal processing with MATLAB”, Cengage, 2008.
2. T. Bose, Digital Signal and Image Processing, John Wiley and Sons, Inc., Singapore,04.

MEMS AND NEMS

SYLLABUS

Micro and nano mechanics – principles, methods and strain analysis, an introduction to microsensors and MEMS, Evolution of Microsensors & MEMS, Microsensors & MEMS applications, Microelectronic technologies for MEMS, Micromachining Technology – Surface and Bulk Micromachining, Micromachined Microsensors, Mechanical, Inertial, Biological, Chemical,Acoustic, Microsystems Technology, Integrated Smart Sensors and MEMS, Interface Electronics for MEMS, MEMS Simulators, MEMS for RF Applications, Bonding & Packaging of MEMS, Conclusions & Future Trends.
Nanoelectromechanical systems (NEMS) – a journey from MEMS to NEMS, MEMS vs. NEMS, MEMS based nanotechnology – fabrication, film formation and micromachining, NEMS physics – manifestation of charge discreteness, quantum electrodynamical (QED) forces, quantum entanglement and teleportation, quantum interference, quantum resonant tunneling and quantum transport, Wave phenomena in periodic and aperiodic media – electronic and photonic band gap crystals and their applications, NEMS architecture, Surface Plasmon effects and NEMS fabrication for nanophotonics and nanoelectronics, Surface Plasmon detection – NSOM/SNOM

TEXTBOOKS :

1. Electromechanical Sensors and Actuators, Ilene J. Busch-Vishniac, Springer, 2008.
2. Introduction to Microelectronics Fabrication, Vol. V, G. W. Neudeck and R. F. Pierret (eds.), Addison – Wesley, 1988.
3. Introduction to Microelectromechanical Microwave Systems, H. J. De Loss Santos, 2nd edition, Norwood, MA: Artech, 2004.
4. Microsystems Design, S. D. Senturia, Kluwer – Academic Publishers, Boston MA, 2001.
5. Principles and Applications of Nano-MEMS Physics, H. J. Delos Santos, Springer, 2008.
6. Materials and Process Integration for MEMS Microsystems, Vol. 9, Francis E. H. Tay, Springer, 2002.

REFERENCE BOOKS :

1. Quantum Mechanical Tunneling and its Applications, D. K. Roy, World Scientific, Singapore, 1986
2. Encyclopedia of Nanoscience and Technology, Vol. 5, H. S. Nalwa (ed.), American scientific Publishers, 2004
3. Carbon Nanotubes and Related Structures, P. J. F. Harris, Cambridge University Press, UK, 1986.

VEHICLE DYNAMICS AND MULTI-BODY SYSTEMS

SYLLABUS

INTRODUCTION TO VEHICLE DYNAMICS

Vehicle coordinate systems; loads on axles of a parked car and an accelerating car. Acceleration performance: Power-limited acceleration, traction-limited acceleration.

TIRE MODELS

Tire construction and terminology; mechanics of force generation; rolling resistance; tractive effort and longitudinal slip; cornering properties of tire; slip angle; camber thrust; aligning moments.

AERODYNAMIC EFFECTS ON A VEHICLE

Mechanics of airflow around the vehicle, pressure distribution, aerodynamic forces; pitching, rolling and yawing moments; crosswind sensitivity.

BRAKING PERFORMANCE

Basic equations for braking for a vehicle with constant deceleration and deceleration with wind-resistance; braking forces: rolling resistance, aerodynamic drag, driveline drag, grade, tire-road friction; brakes, anti-lock braking system, traction control, brakingefficiency.

STEERING SYSTEMS AND CORNERING

Geometry of steering linkage, steering geometry error; steering system models, neutral steer, under-steer, over-steer, steering ratio, effect of under-steer; steering system force and moments, low speed and high speed cornering; directional stability of the vehicle; influence of front-wheel drive.

SUSPENSION AND RIDE

Suspension types—solid axle suspensions, independent suspensions; suspension geometry; roll centre analysis; active suspension systems; excitation sources for vehicle rider; vehicle response properties, suspension stiffness and damping, suspension isolation, active control, suspension non-linearity, bounce and pitch motion.

ROLL-OVER

Quasi-static roll-over of rigid vehicle and suspended vehicle; transient roll-over, yaw-rollmodel,tripping.

MULTI-BODY SYSTEMS

Review of Newtonian mechanics for rigid bodies and system of rigid bodies; coordinate transformation between two set of axes in relative motion between one another; Euler angles; angular velocity, angular acceleration, angular momentum etc. in terms of Euler angle parameters; Newton-Euler equations of motion; elementary Lagrangian mechanics: generalised coordinates and constraints; principle of virtual work; Hamilton's principle; Lagrange's equation, generalized forces. Lagrange's equation with constraints, Lagrange's multiplier.

TEXTBOOKS :

1. T.D. Gillespie, “Fundamental of Vehicle Dynamics”, SAE Press (1995)
. 2.J.Y. Wong, “Theory of Ground Vehicles”, 4th Edition, John Wiley & Sons (2008).
3. Reza N. Jazar, “Vehicle Dynamics: Theory and Application”, 1st Edition, 3rd Printing, Springer (2008).
4. R. Rajamani, “Vehicle Dynamics and Control”, Springer (2006).
5. A.A. Shabanna, “Dynamics of Multibody Systems”, 3rd Edition, Cambridge University Press (2005).

REFERENCE BOOKS :

1. G. Genta, “Motor Vehicle Dynamics”, World Scientific Pub. Co. Inc. (1997).
2. H.B. Pacejka, “Tyre and Vehicle Dynamics”, SAE International and Elsevier (2005).
3. Dean Karnopp, “Vehicle Stability”, Marcel Dekker (2004).
4. U. Kiencke and L. Nielsen, “Automotive Control System”, Springer-Verlag, Berlin.
5. M. Abe and W. Manning, “Vehicle Handling Dynamics: Theory and Application”, 1st Edition, Elsevier (2009).
6. L. Meirovitch, “Methods of Analytical Dynamics”, Courier Dover (1970).
7. H. Baruh, “Analytical Dynamics”, WCB/McGraw-Hill (1999).

EMERGING SMART MATERIALS FOR MECHATRONICS APPLICATIONS

SYLLABUS

INTRODUCTION

Smart materials and their application for sensing and actuation, Mechatronics aspects.

PIEZOELECTRIC MATERIALS

Piezoelectricity and piezoelectric materials, Constitutive equations of piezoelectric materials, Piezoelectric actuator types, Control of piezoelectric actuators, Applications of piezoelectric actuators for precise positioning and scanning.

SHAPE MEMORY ALLOYS (SMA):

Properties of shape memory alloys, Shape memory effects, Pseudo-elasticity in SMA, Design of shape memory actuator, selection of materials, Smart actuation and control, Applications of SMA in precision equipments for automobiles, trains and medical devices.

ELECTRO-ACTIVE POLYMERS (EAPS)

onic polymer metal composites (IPMC), Conductive polymers, Carbon nanotubes, Dielectric elastomers, Design & control issues for EAP actuators, Applications of EAP for biomemetic, tactile display and medical devices.

MAGNETOSTRICTIVE MATERIALS

Basics of magnetic properties of materials, magnetostriction: constitutive equations, types of magnetostrictive materials, Design & control of magnetostrictive actuators, Applications of magnetostrictive materials for active vibration control.

SUMMARY, CONCLUSION AND FUTURE OUTLOOK

Comparative analysis of different smart materials based actuators, Conclusions, Future research trend and applications trends of smart materials and smart materials based actuator technology.

TEXTBOOKS :

1. Jose L. Pons, Emerging Actuator Technologies, a Micromechatronics Approach, John Wiley & Sons Ltd, 2005. .
2. Ralph Smith, Smart Material Systems: Model Development, SIAM, Society for Industrial and Applied Mathematics, 2005. .
3. F. Carpi, D. De Rossi, R. Kornbluh, R. Pelrine, P. Sommer-Larsen, Dielectric Elastomers as Electromechanical Transducers, Elsevier, Hungry, 2008. .
4. Y. B. Cohen, Electroactive Polymer (EAP) Actuators as Artificial Muscles Reality, Potential and Challenges, SPIE press, USA, 2004.

INTELLIGENT VISUAL SURVEILLANCE

SYLLABUS

BASICS OF IMAGE PROCESSING

Introduction to Image Processing methods, Image Transforms, Wavelet Transform, JPEG Image Compression, Image Formats, Color Spaces- RGB, CMY, HSI.

VIDEO COMPRESSION STANDARDS:

H. 261, H. 263, H.264, MPEG-1, MPEG-2, MPEG-4, MPEG-7, and MPEG-21, Video shot boundary detection, motion modeling and segmentation t echniques.

Object Detection and Classification- Shape based object classification, motion based object classification, Silhouette-Based Method for Object Classification,

Viola Jones object detection framework, Multiclass classifier boosting.

Multi-Object Tracking- Classification of multiple interacting objects from video, Region-based Tracking, Contour-based Tracking, Feature-based Tracking, Model-based Tracking, Hybrid Tracking, Particle filter based object tracking, Mean Shift based tracking, Tracking of multiple interacting objects.

Human Activity Recognition- Template based activity recognition, Sequential recognition approaches using state models (Hidden Markov Models), Human Recognition Using Gait, HMM Framework for Gait Recognition, Description based approaches, Human interactions, group activities, Applications and challenges.

Camera Network Calibration - Types of CCTV (closed circuit television) camera- PTZ (pan-tilt zoom) camera, IR (Infrared) camera, IP (Internet Protocal) camera, wireless security camera, Multiple view geometry, camera network calibration, PTZ camera calibration, camera placement, smart imagers and smart cameras.

TEXTBOOKS :

1. Murat A. Tekalp, “Digital Video Processing”, Prentice Hall, 1995.
2. Y. Ma and G. Qian (Ed.), “Intelligent Video Surveillance: Systems and Technology”, CRC Press, 2009.

MICROPROCESSORS AND IMBEDED SYSTEMS

SYLLABUS

INTRODUCTION TO EMBEDDED SYSTEMS AND MICROCOMPUTERS

Introduction to Embedded Systems, Embedded System Applications, Block diagram of embedded systems, Trends in Embedded Industry, Basic Embedded system Models, Embedded System development cycle, Challenges for Embedded system Design, Evolution of computing systems and applications. Basic Computer architecture: Von-Neumann and Harvard Architecture. Basics on Computer organizations. Computing performance, Throughput and Latency, Basic high performance CPU architectures, Microcomputer applications to Embedded systems and Mechatronics.

MICROPROCESSOR

8086 Microprocessor and its Internal Architecture, Pin Configuration and their functions, Mode of Operation, Introduction to I/O and Memory, Timing Diagrams, Introduction to Interrupts.

MICROPROCESSOR PROGRAMMING

Introduction to assembly language, Instruction format, Assembly language programming format, Addressing mode, Instruction Sets, Programming 8086 microprocessor.

MICROPROCESSOR INTERFACING

Introduction to interfacing, Memory Interfacing, Programmable Peripheral Interfacing, Programmable I/O, Programmable Interrupt Controller, Programmable Timers, Programmable DMA Controller, Programmable Key board Controller, Data acquisition Interfacing: ADC, DAC, Serial and parallel data Communication interfacing.

MICROCONTROLLER

Introduction to Microcontroller and its families, Criteria for Choosing Microcontroller. Microcontroller Architecture, Programming model, Addressing modes, Instruction sets, Assembly and C programming for Microcontroller, I/O programming using assembly and C language, Interrupt Controller, I/O interfacing, Timers, Real Time Clock, Serial and parallel Communication protocols, SPI Controllers. LCD Controller.

MICROCONTROLLER INTERFACING

Introduction to Microcontroller Interfacing and applications: case studies: Display Devices, controllers and Drivers for DC, Servo and Stepper Motor.

INTRODUCTION TO ADVANCED EMBEDDED PROCESSOR AND SOFTWARE

ARM Processor, Unified Model Language (UML), Embedded OS, Real Time Operating System (RTOS), Embedded C.

MICROPROCESSOR AND EMBEDDED SYSTEM LABORATORIES

Basic assembly language programming implementation on Microprocessor and Microcontroller. Interfacing Displays, Key boards and sensors with Microprocessors and Microcontrollers, Data Acquisition using Microprocessor and Microcontroller, Implementation of Controlling schemes for DC, Servo, Stepper motor using assembly and C programming in microprocessors and Microcontrollers.

TEXTBOOKS :

1. Introduction to Embedded Systems: Shibu K V, McGRAW Hill Publications.
2. Embedded Systems: Raj Kamal, TATA McGRAW Hill Publications.
3. Computer System Architecture: M. Morris Mano.
4. 8086 Microprocessors and Interfacings: D. Hall, TATA McGRAW Hill .
5. The Intel Microprocessors: B. Brey, Prentice Hall Publications.
6. PIC Microcontrollers and Embedded Systems: M. A. Mazidi, R.D. Mckinlay and D. Casey, Pearson Publications.
7. Programming and Customizing the PIC Microcontroller: M. Predko, Mc-GRAW Hill Publications.
8. Embedded C Programming and Microchip PIC: R. Barnett, L. O'Cull and S. Cox

ROBOTICS: ADVANCED CONCEPTS AND ANALYSIS

SYLLABUS

INTRODUCTION TO ROBOTICS

brief history, types, classification and usage and the science and technology of robots.

KINEMATICS OF ROBOT

direct and inverse kinematics problems and workspace, inverse kinematics solution for the general 6R manipulator, redundant and over-constrained manipulators.

VELOCITY AND STATIC ANALYSIS OF MANIPULATORS

Linear and angular velocity, Jacobian of manipulators, singularity, static analysis.

DYNAMICS OF MANIPULATORS

formulation of equations of motion, recursive dynamics, and generation of symbolic equations of motion by a computer simulations of robots using software and commercially available packages.

PLANNING AND CONTROL

Trajectory planning, position control, force control, hybrid control

INDUSTRIAL AND MEDICAL ROBOTICS

application in manufacturing processes, e.g. casting, welding, painting, machining, heat treatment and nuclear power stations, etc; medical robots: image guided surgical robots, radiotherapy, cancer treatment, etc;

ADVANCED TOPICS IN ROBOTICS

Modelling and control of flexible manipulators, wheeled mobile robots, bipeds, etc. Future of robotics.

REFERENCE BOOKS :

1. M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey, “Industrial Robotics-Technology, Programming and Applications”, McGraw-Hill TextBook : and Company (1986).
2. S. K. Saha, “Introduction to Robotics”, Tata McGraw-Hill Publishing Company Ltd. (2008).
3. S. B. Niku, “Introduction to Robotics–Analysis Systems, Applications”, Pearson Education (2001).
4. . A. Ghosal, Robotics: “Fundamental Concepts and Analysis”, Oxford University Press (2008).
5. Pires, “Industrial Robot Programming–Building Application for the Factories of the Future”, Springer (2007).
6. Peters, “Image Guided Interventions – Technology and Applications”, Springer (2008).
7. K. S. Fu, R. C. Gonzalez and C.S.G. Lee, “ROBOTICS: Control, Sensing, Vision and Intelligence”, McGraw-Hill (1987).

8. J. J. Craig, “Introduction to Robotics: Mechanics and Control”, 2nd edition, Addison-Wesley (1989).

CONTROL OF MECHATRONIC SYSTEMS

SYLLABUS

TIME RESPONSE DESIGN

Routh-Hurwitz test, relative stability, Root locus design, construction of root loci, phase lead and phase-lag design, lag-lead design.

FREQUENCY RESPONSE DESIGN

Bode, polar, Nyquist, Nichols plot, lag, lead, lag-lead compensator, time delay, process plant response curve. PID controller design.

MODERN CONTROL

Concept of states, state space model, different form, controllability, observability; pole placement by state feedback, observer design, Lunenburg observer, reduced order observer, observer based control.

OPTIMAL CONTROL DESIGN

Solution-time criterion, control-area criterion, performance indices; zero steady state step error systems; modern control performance index: quadratic performance index, Ricatti equation.

DIGITAL CONTROL

Sampling process, sample and hold, analog to digital converter, use of z-transform for closed loop transient response, stability analysis using bilinear transform and Jury method, digital control design using state feedback.

NON-LINEAR CONTROL SYSTEM

Common physical non-linear system, phase plane method, system analysis by phase plane method, stability of non-linear system, stability analysis by describing function method, Liapunov’s stability criterion, Popov’s stability criterion.

TEXTBOOKS :

1. K. Ogata, “Modern Control Engineering”, Prentice Hall India (2002).
2. Gene F. Franklin, J. D. Powell, A E Naeini, “Feedback Control of Dynamic Systems”, Pearson (2008).
3. John Van De Vegte, “Feedback Control Systems”, Prentice Hall (1993).
4. Thomas Kailath, “Linear Systems”, Prentice Hall (1980).
5. Alok Sinha, “Linear Systems: Optimal and Robust Control”, Taylor & Francis (2007).

6. Brian D. O. Anderson and John B. Moore, “Optimal Control: Linear Quadratic Methods”, Dover Publications (2007).
7. K. Ogata, “Discrete-Time Control Systems”, PHI Learning (2009).
8. H.K. Khalil, “Nonlinear Systems”, Prentice Hall (2001).

MECHATRONICS PRODUCT DESIGN

SYLLABUS

INTRODUCTION

Integrated Design issues in Mechatronics, Mechatronics Design process, Mechatronics Key Elements, Applications in Mechatronics.

MODELING AND SIMULATION OF PHYSICAL SYSTEM

Electrical systems, Mechanical systems- translational&rotational systems, fluid systems.

SENSORS AND TRANSDUCERS

Introduction, sensor for motion and position measurement, force, torque and tactile sensors, vibration – Acceleration sensors, sensor for flow measurement, temperature sensing devices, sensor applications.

ACTUATING DEVICES

DC Motors, Stepper motors, fluid power Actuation, fluid power design elements, piezoelectric Actuators.

SYSTEM CONTROL – LOGIC METHODS

Number Systems in Mechatronics, Binary Logic, Karnaugh Map Minimization, Programmable Logic Controllers.

SIGNAL CONDITIONING AND REAL TIME INTERFACING

Elements of a Data Acquisition and Control System, Transducers and Signal Conditioning, Devices for Data Conversion, Data Conversion Process.

CASE STUDIES

TEXTBOOKS :

1. DevdasShetty, Richard A.Kolk, “Mechatronics System Design”, PWS Publishing Company, 1997.
2. Boltan, “Mechatronics-Electronic Control Systems in Mechanical and Electrical Engineering”, 2nd Edition, Addison Wesley Longman Ltd., 1999

REFERENCE BOOK :

1. D.A Bradley, D.Dawson, N.C Burd and A.J.Loader, “Mechatronics” CRC Press, 2010.

PRECISION ENGINEERING

SYLLABUS

CONCEPT OF ACCURACY AND ACCURACY OF NC SYSTEMS

Introduction-General concept of accuracy of machine tool-spindle rotation accuracy-Displacement accuracy-Influence of Geometric Accuracy of Machine Tools on Work pieceAccuracy-Definition of Accuracy of NC system-Errors due to Numerical Interpolation-Errorsdue to displacement measurement system-Periodic errors-Errors due to velocity Lags-Transient Response.

GEOMETRIC DIMENSIONING AND TOLERANCING:

Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – DatumOddly Configured and Curved Surfaces as Datum Features, Equalizing Datums –DatumFeature of Representation – Form Controls, Orientation Controls – Logical Approach toTolerancing.

TOLERANCES AND FITS:

Sign convention-Tolerance zone-Fits-Basic Hole System of fits-Standards of Limits and Fits-Expected accuracy of a manufacturing process-Commonly used classification of types of fits-Tolerances and Fits for bearings-Methods of specifying Fits on splined shafts and holes-Selective assembly-Gauges for the control of distances between axes.

SURFACE ROUGHNESS AND MICRO FINISHING PROCESSES:

Relation among the various indices of surface roughness-Ideal and Final Roughness inMachining-Influence of machining parameters on surface roughness-Ideal surface roughnessin slab milling-Bearing area curves-Micro finishing processes in the machining of metals.

METHODS OF IMPROVING ACCURACY AND SURFACE FINISH:

Concept of precision Machining-Finish Turning, Boring and Grinding-Precision CylindricalGrinding-Internal Cylindrical Grinding-Errors in shape of surface grinding

APPLICATIONS AND FUTURE TRENDS IN NANO TECHNOLOGY:

Nano-grating system-Nanolithography, photolithography, electron beam lithography-Machining of soft metals, diamond turning, mirror grinding of ceramics-Devlopment ofintelligent products-Nano processing of materials for

super high density Ics-Nano-mechanicalparts and micromachines.

TEXTBOOKS :

1. Precision Engineering in Manufacturing / murthy R. L., / New Age International(P)
2. limited,1996.
3. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker
4. Inc.1995.
5. Norio Taniguchi,- " Nano Technology ", Oxford university,Press,1996.

REFERENCE BOOK :

1. Precision Engineering- V. C. Venkatesh, & Sudin Izman/ Tata McGraw-Hill

COMPUTATIONAL FLUID DYNAMICS

SYLLABUS

CONCEPT OF COMPUTATIONAL FLUID DYNAMICS

Different techniques of solving fluid dynamics problems, their merits and demerits, governing equations of fluid dynamics and boundary conditions, classification of partial differential equations and their physical behavior, Navier-Stokes equations for Newtonian fluid flow, computational fluid dynamics (CFD) techniques, different steps in CFD techniques, criteria and essentialities of good CFD techniques.

FINITE DIFFERENCE METHOD (FDM)

Application of FDM to model problems, steady and unsteady problems, implicit and explicit approaches, errors and stability analysis, direct and iterative solvers. Finite Volume Method (FVM): FVM for diffusion, convection-diffusion problem, different discretization schemes, FVM for unsteady problems.

PREDICTION OF VISCOUS FLOWS

Pressure Poisson and pressure correction methods for solving Navier-Stokes equation, SIMPLE family FVM for solving Navier-Stokes equation, modelling turbulence.

CFD FOR COMPLEX GEOMETRY

Structured and unstructured, uniform and non-uniform grids, different techniques of grid generations, curvilinear grid and transformed equations.

LATTICE BOLTZMAN AND MOLECULAR DYNAMICS

Boltzman equation, Lattice Boltzman equation, Lattice Boltzman methods for

turbulence and multiphase flows, Molecular interaction, potential and force calculation, introduction to Molecular Dynamics algorithms.

TEXTBOOK / REFERENCE BOOKS :

1. J. D. Anderson, "Computational Fluid Dynamics", McGraw-Hill Inc. (1995).
2. S. V. Patankar, "Numerical Heat Transfer and Fluid Flow", Hemisphere Pub. (1980).
3. K. Muralidhar, and T. Sundarajan, "Computational Fluid Flow and Heat Transfer", Narosa (2003).
4. D. A. Anderson, J. C. Tannehill and R. H. Pletcher, "Computational Fluid Mechanics and Heat Transfer", Hemisphere Pub. (1984).
5. M. Peric and J. H. Ferziger, "Computational Methods for Fluid Dynamics", Springer (2001).
6. H. K. Versteeg and W. Malalaskera, "An Introduction to Computational Fluid Dynamics", Dorling Kindersley (India) Pvt. Ltd. (2008).
7. C. Hirsch, "Numerical Computation of Internal and External Flows", Butter-worth-Heinemann, (2007).
8. J. M. Jaile, "Molecular Dynamics Simulation: Elementary Methods", Willey Professional, 1997.
9. A. A. Mohamad, "Lattice Boltzman Method: Fundamentals and Engineering Applications with Computer Codes", Springer (2011).

NONLINEAR OPTIMIZATION

SYLLABUS

NONLINEAR PROGRAMMING

Convex sets and convex functions, their properties, convex programming problem, generalized convexity, Pseudo and Quasi convex functions, Invex functions and their properties, KKT conditions.

GOAL PROGRAMMING

Concept of Goal Programming, Model Formulation, Graphical solution method.

SEPARABLE PROGRAMMING. GEOMETRIC PROGRAMMING

Problems with positive coefficients up to one degree of difficulty, Generalized method for the positive and negative coefficients.

SEARCH TECHNIQUES

Direct search and gradient methods, Unimodal functions, Fibonacci method, Golden Section method, Method of steepest descent, Newton-Raphson method, Conjugate gradient methods.

DYNAMIC PROGRAMMING

Deterministic and Probabilistic Dynamic Programming, Discrete and continuous dynamic programming, simple illustrations.

MULTI OBJECTIVE PROGRAMMING

Efficient solutions, Domination cones.

TEXTBOOK :

1. Mokhtar S. Bazaaraa, Hanif D. Shirali and M.C.Shetty, Nonlinear Programming, Theory and Algorithms, John Wiley & Sons, New York (2004).

REFERENCE BOOKS :

1. D. G. Luenberger, Linear and Nonlinear Programming, Second Edition, Addison Wesley (2003).
2. R. E. Steuer, Multi Criteria Optimization, Theory, Computation and Application, John Wiley and Sons, New York (1986).

INDUSTRIAL AUTOMATION

SYLLABUS

AUTOMATION

Introduction, automation principles and strategies, basic elements of advanced functions, levels modeling of manufacturing systems.

MATERIAL HANDLING

Introduction, material handling systems, principles and design, material transport system: transfer mechanisms automated feed cut of components, performance analysis, uses of various types of handling systems including AGV and its various guiding technologies.

STORAGE SYSTEM

Performance, location strategies, conventional storage methods and equipments, automated storage systems.

AUTOMATED MANUFACTURING SYSTEMS

Components, classification, overview, group technology and cellular manufacturing, parts classification and coding, product flow analysis, cellular manufacturing, application considerations in G.T.

FMS

Introduction, components, application, benefits, planning and implementation, transfer lines and fundamentals of automated production lines, application, analysis of transfer line without internal storage (numerical problems).

INSPECTION TECHNOLOGY

Introduction, contact and non-contact conventional measuring, gauging technique, CMM, surface measurement, machine vision, other optical inspection techniques, non-contact non-optical inspection technologies versus.

MANUFACTURING SUPPORT SYSTEM

Process planning and concurrent engineering- process planning, CAPP, CE and design for manufacturing, advanced manufacturing planning, production planning and control system, master production schedule, MRP.

Capacity planning, shop floor control, inventory control, MRP-II, J.I.T production systems. lean and agile manufacturing.

TEXTBOOKS :

1.M.P. Groover, Automation, "Production Systems and Computer Integrated manufacturing", 2nd Edition, Pearson Education (2004).

REFERENCE BOOKS :

1. Vajpayee, "Principles of CIM", PHI, 1992.
2. Viswanathan and Narahari, "Performance Modeling of Automated Manufacturing Systems", PHI, 2000.
3. R.S. Pressman, "Numerical Control and CAM, John Wiley , 1993.

FUZZY SETS AND ARTIFICIAL INTELLIGENCE

SYLLABUS

Basic Concepts of Fuzzy Sets, Fuzzy Logic, Zadeh's Extension Principle, Operations on Fuzzy Sets, Fuzzy Measures, Probability and Possibility Measures, Fuzzy Inference Methodologies, Fuzzy Relations, Applications of Fuzzy Sets in Management, Decision Making, Medicine and Computer Science.

Introduction to Artificial Intelligence, Production System and Artificial Intelligence, Problem Solving by Search, Predicate Calculus, Knowledge Representation, Semantics Nets, Frames, Conceptual Dependencies, Knowledge Bases and Expert Systems, Fuzzy Rule, Neuro Fuzzy Approaches, Case Studies in Various Domain.

TEXTBOOKS :

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 2nd Ed, Prentice Hall, 2003.
2. H.J.Zimmermann, Fuzzy Set Theory and Its Applications, 2nd Ed., Kluwer Academic Publishers, 1996.

3. D.Dubois and H. Prade, Fuzzy Sets and Systems: Theory and Applications, Academic Press, 1980.

REFERENCE BOOKS :

1. E. Charniak and D. McDermott, Introduction to Artificial Intelligence, Addison-Wesley, 1985.
2. E. Rich, Artificial Intelligence, McGraw-Hill, 1983.
3. P. H. Winston, Artificial Intelligence, Addison Wesley, 1993.
4. J.Yen and R.Langari, Fuzzy Logic Intelligence, Control, and Information, Pearson Education, 2005.
5. T.J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
6. J.Kacprzyk, Multistage Fuzzy Control, Wiley, 1997.

ME

THERMAL ENGINEERING

FIRST YEAR (FIRST SEMESTER)`

S.No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5109	Numerical Methods in Thermal engineering	3	1	0	4	4
2	18 ME 5110	Advanced Thermodynamics	3	1	0	4	4
3	18 ME 5111	Design of Thermal Systems	3	1	0	4	4
4	18 ME 5112	Advanced Heat and Mass Transfer	3	1	0	4	4
5		Elective –I	3	0	0	3	3
6		Elective – II	3	0	0	3	3
7	18 IE 5149	Seminar	0	0	4	4	2
		Total	**18**	**4**	**4**	**26**	**24**

FIRST YEAR (SECOND SEMESTER):

S.No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5213	Incompressible and Compressible Flows	3	1	0	4	4
2	18 ME 5214	Computational Fluid Dynamics	3	0	2	5	4
3	18 ME5215	Refrigeration and Cryogenics	3	1	0	4	4
4	18 ME 5216	Measurements in Thermal Engineering	3	1	0	4	4
5		Elective –III	3	0	0	3	3
6		Elective – IV	3	0	0	3	3
7	18 IE 5250	Term Paper	0	0	4	4	2
		Total	**18**	**3**	**6**	**27**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1	18 IE 6050	Dissertation	0	0	72	36

ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective-1						
1	18 ME 51E1	Heat Exchanger Design	3	0	0	3
2	18 ME 51E2	Convection and Two-Phase Flow	3	0	0	3
3	18 ME 51E3	Compact Heat Exchangers	3	0	0	3
Elective-2						
1	18 ME 51F1	Engine Systems and Performance	3	0	0	3
2	18 ME 51F2	IC Engine Combustion and Pollution	3	0	0	3
3	18 ME 51F3	Alternative Fuels	3	0	0	3
Elective-3						
1	18 ME 52G1	Principles of Turbo-machinery	3	0	0	3
2	18 ME 52G2	Gas Turbine Engineering	3	0	0	3
3	18 ME 52G3	Turbo-Compressors	3	0	0	3
Elective-5						
1	18 ME 52H1	Energy Conservation, Management & Audit	3	0	0	3
2	18 ME 52H2	Renewable Energy Technology	3	0	0	3
3	18 ME 52H3	Solar Energy and Wind Energy	3	0	0	3

NUMERICAL METHODS IN THERMAL ENGINEERING

SYLLABUS

MATHEMATICAL DESCRIPTION OF THE PHYSICAL PHENOMENA

Governing equations—mass, momentum, energy, species, General form of the scalar transport equation, Elliptic, parabolic and hyperbolic equations, Behavior of the scalar transport equation with respect to these equation type; Discretization Methods: Methods for deriving discretization equations-finite difference, finite volume and finite element method, Method for solving discretization equations, Consistency, stability and convergence; Diffusion Equation: 1D-2D steady diffusion, Source terms, non-linearity, Boundary conditions, interface diffusion coefficient, Under-relaxation, Solution of linear equations (preliminary), Unsteady diffusion, Explicit, Implicit and Crank-Nicolson scheme, Two dimensional conduction, Accuracy, stability and convergence revisited; Convection and Diffusion: Steady one-dimensional convection and diffusion, Upwind, exponential, hybrid, power, QUICK scheme,Two-dimensional convection-diffusion, Accuracy of Upwind scheme; false diffusion and dispersion, Boundary conditions; Flow Field Calculation: Incompressibility issues and pressure-velocity coupling, Primitive variable versus other methods, Vorticity-stream function formulation, Staggered grid, SIMPLE family of algorithms; Numerical Methods for Radiation: Radiation exchange in enclosures composed of diffuse gray surfaces, Finite volume method for radiation, Coupled radiation-conduction for participating media

TEXTBOOKS :

1. Numerical heat transfer and fluid flow, S. V. Patankar, Hemisphere publishing company (1980)
2. Computational Fluid Mechanics and Heat Transfer, J. C. Anderson, D. A. Tanehil and R. H. Pletcher, Taylor & Francis publications, USA (1997)

REFERENCE BOOKS :

1. Advances in numerical heat transfer, (Eds.) W. J. Minkowycz, E. M. Sparrow, Taylor & Francis publications (1997)
2. Heat Transfer - Mathematical Modelling, Numerical Methods and Information Technology, (Ed.) A. Belmiloudi, InTech Publications (2011)
3. Numerical heat transfer by T. M. Shih, Hemisphere publications company (1984)
4. Numerical methods in thermal problems: Proceedings of seventh international conference held in Staford, USA, Volumes 1-2, (Eds.) K. Morgan (1991)
5. Computational Heat Transfer, Mathematical Modelling, A. A. Samarskii, P. N. Vabishchevich, John Wiley & Sons (1995)
6. Hand TextBook : of numerical heat transfer, W. J. Minkowycz, E. M. Sparrow, G. E. Schneider, R. H. Pletcher, Wiley publishers (2001)

ADVANCED THERMODYNAMICS

SYLLABUS

Review of first and second law of thermodynamics, Maxwell equations, Joule-Thompson experiment, irreversibility and availability, exergy analysis, phase transition, types of equilibrium and stability, multi-component and multi-phase systems, equations of state, chemical thermodynamics, combustion. Third law of thermodynamics, Kinetic theory of gases- introduction, basic assumption, molecular flux, equation of state for an ideal gas, collisions with a moving wall, principle of equi-partition of energy, classical theory of specific heat capacity. Transport phenomena-intermolecular forces, The Vander Waals equation of state, collision cross section, mean free path, Statistical thermodynamics-introduction, energy states and energy levels, macro and micro-scales, thermodynamic probability, Bose-Einstein, Fermi-Dirac, Maxwell-Boltzmann statistics, distribution function, partition energy, statistical interpretation of entropy, application of statistics to gases-mono-atomic ideal gas.

TEXTBOOKS :

1. Advanced Engineering Thermodynamics, A. Bejan, Wiley and sons, (2006)
2. Thermodynamics, J. P. Holman, McGraw-Hill Inc., (1998)

REFERENCE BOOKS :

1. Advanced Thermodynamics for Engineers, Kenneth Wark, McGraw-Hill
2. Thermodynamics, Kinetic theory, and Statistical thermodynamics, F. W. Sears, and G. L. Salinger, Narosa Publishing House (1998)
3. Fundamentals of Engineering thermodynamics, M. J. Moron, and H. N. Shapiro, John Wiley& Sons
4. Heat and thermodynamics, M. W. Zemansky, and R. H. Dittman, Mc_Graw Hill International (2007)

DESIGN OF THERMAL SYSTEMS

SYLLABUS

MODELING OF THERMAL SYSTEMS

types of models, mathematical modeling, curve fitting, linear algebraic systems, numerical model for a system, system simulation, methods for numerical simulation; Acceptable Design of a Thermal System: initial design, design strategies, design of systems from different application areas, additional considerations for large practical systems; Economic Considerations: calculation of interest, worth of money as a function of time, series of payments, raising capital, taxes, economic factor in design, application to thermal systems; Problem Formulation for Optimization: optimization methods, optimization of

thermal systems, practical aspects in optimal design, Lagrange multipliers, optimization of constrained and unconstrained problems, applicability to thermal systems; search methods: single-variable problem, multivariable constrained optimization, examples of thermal systems; geometric, linear, and dynamic programming and other methods for optimization, knowledge-based design and additional considerations, professional ethics. Optimization, Objective function formulation, Constraint equations, Mathematical formulation, Calculus method, Dynamic programming, Geometric programming, linear programming methods, solution procedures. Equation fitting, Empirical equation, best fit method, method of least squares. Modeling of thermal equipments such as turbines, compressors, pumps, heat exchangers, evaporators and condensers

TEXTBOOKS :

1. W.F. Stoecker, Design of Thermal Systems - McGraw-Hill
2. Y. Jaluria, Design and Optimization of Thermal Systems –CRC Press

REFERENCE BOOKS :

1. Bejan, G. Tsatsaronis, M.J. Moran, Thermal Design and Optimization – Wiley.
2. R. F. Boehm, Developments in the Design of Thermal Systems – Cambridge University Press.
3. N.V. Suryanarayana, Design & Simulation of Thermal Systems – MGH.

ADVANCED HEAT AND MASS TRANSFER

SYLLABUS

Introduction - review of heat transfer Fundamentals - transient conduction and extended surface Heat Transfer, Unsteady heat conduction. Lumped capacity model, awareness of one-dimensional unsteady results (charts; Biot and Fourier numbers), Brief review of Steady Laminar and Turbulent Heat Transfer in External and Internal Flows - Heat Transfer at High Speeds - Unsteady Laminar and Turbulent Forced Convection in Ducts and on Plates - Convection with body forces, Boundary layers and internal flows. Awareness of these configurations, some knowledge of internal flow energy balances, Convection correlations. Finding heat transfer coefficients from Reynolds numbers and Rayleigh numbers, Heat Exchangers. Typical configurations and epsilon-NTU analysis, phase-change heat transfer. General awareness of processes of condensation and boiling in a pure substance, some use of correlations, Quenching of metals, Leidenfrost problem, heat transfer of sprays, jets and films, Radiation basics - Radiation in Enclosures - Gas Radiation - Diffusion and Convective Mass Transfer - Combined Heat and Mass Transfer from Plates and in Pipes.

TEXTBOOKS :

1. Heat transfer, A. Bejan, John Wiley & Sons (1993)
2. Advanced Heat and Mass Transfer, A. Faghri, Y. Zhang, J. Howell, Global Digital Press (2010)

REFERENCE BOOKS :

1. A Heat Transfer TextBook :, J. H. Lienhard iv, and J. H. Lienhard V, Phlogiston Press (2008)
2. Heat and Mass Transfer, H. D. Baehr, and K. Stephan, Springer-Verlag (1998)
3. Heat transfer, F. M. White, Addision-Wesley (1984)
4. Basic heat and mass transfer, K. C. Rolle, Prentice-Hall (2000)
5. Heat Transfer – A practical approach, Y. A. Cengel, Tata McGraw-Hill (2002)

HEAT EXCHANGER DESIGN

SYLLABUS

Heat Exchangers-Introduction, C1assfication, and Selection. Heat Exchanger Thermo-Hydraulic Fundamentals. Heat Exchanger Design. Compact Heat Exchangers. Shell and Tube Heat Exchanger Design. Regenerators. Plate Heat Exchangers and Spiral Plate Heat Exchangers. Heat-Transfer Augmentation. Fouling; Flow-Induced Vibration of Shell and Tube Heat Exchangers. Mechanical Design of Shell and Tube Heat Exchangers. Corrosion; Material Selection and Fabrication. Quality Control and Quality Assurance and Nondestructive Testing. Heat Exchanger Fabrication.

TEXTBOOKS :

1. Heat Exchanges: Selection, Design and Construction, E. A. Saunders, Longman Scientific and Technical (1988)
2. Fundamentals of Heat Exchanger Design, Ramesh K. Shah, Dusan P. Sekulic, Wiley (2002)

REFERENCE BOOKS :

1. Heat Transfer, J. P. Holman, McGraw Hill, New York (1989)
2. Process Heat Transfer, CRC Press, G.F. Hewitt, G.L. Shires, T.R. Bott (1994)
3. Fluid Dynamics and Heat Transfer, J.G. Knudsen and D.L. Katz, McGraw Hill, New York (1958)
4. Heat Exchanger Design Handbook, K. Thulukkanam, CRC Press (2013)
5. Heat Exchangers: Selection, Rating and Thermal Design, S. Kakaç and H. Liu, CRC Press (2002)

6. Fluid Mechanics and Transfer Processes, Cambridge University Press, J. M. Kay, and R. M. Nedderman (1985)
7. Heat exchanger design handbook, Hemisphere publishing corp., (1981)

CONVECTION AND TWO-PHASE FLOW

SYLLABUS

Introduction to two-phase flow and heat transfer technology, Liquid-vapor phase change phenomena, Interfacial tension, Wetting phenomenon, Contact angles, Transport effects, Dynamic behavior of interfaces, Phase stability and nucleation, Two-phase flow fundamentals, Flow patterns and map representation, Development of homogeneous, separated flow and drift flux models, Flooding mechanisms, Boiling Fundamentals, Homogeneous and heterogeneous nucleation, Pool boiling and convective flow boiling, Heat transfer and CFH mechanisms, Enhancement techniques, Condensation fundamentals, External and internal condensation, Film condensation theory, Drop-wise condensation theory, Enhancement techniques, Application of two-phase flow and heat transfer, Electronics thermal management, Latent heat storage devices, Gravity assisted thermo-siphons/Vapor chambers, Theory and operation of Conventional heat pipes, Micro heat pipes, Pulsating heat pipes, Capillary pumped loops/ Loop heat pipes, Micro two-phase heat exchangers, Static and dynamic instabilities, micro-scale boiling and condensation, atomistic nucleation models.

TEXTBOOKS :

1. Liquid Vapor Phase Change Phenomena, Van P. Carey, Taylor & Francis
2. Boundary layer theory, H. Schlichting, Springer (2002)

REFERENCE BOOKS :

1. Heat Transfer - Incropera and Dewitt, John Wiley and Sons
2. One Dimensional Two-Phase Flow, G. B. Wallis, McGraw Hill (1969)
3. Heat transfer, McGraw Hill TextBook :, C. Gebhart (1961)
4. Convective Boiling And Condensation by Collier John (Oxford Engineering Science)
5. Two-phase Flow and Heat Transfer - P. B. Whalley (Oxford Engineering Science)
6. Heat Transfer Characteristics in Boiling and Condensation by Karl Stephan (Springer)
7. Heat Pipe Technology and Applications by J. P. Peterson (John Wiley & Sons)

COMPACT HEAT EXCHANGERS

SYLLABUS

Classification of heat exchangers - compactness - heat transfer correlation for laminar and turbulent flow through channels, fins their geometries and efficiently. Applications and selection of compact heat exchangers. Basic heat exchangers theory related to compact heat exchangers - Definition of important HX parameters - εNTU, F - LMTD, P-NTU, P-$\varepsilon$and combination charts. Coupling of heat exchangers, effect of longitudinal conduction in compact heat exchangers, effects of variable property and heat transfer coefficient, core pressure drop and velocity distribution in compact heat exchangers. Contraction and expansion pressure loss. Compact recuperators - Advantages and disadvantages of plates fin and tube fin heat exchangers - fin configuration, heat transfer and pressure drop data in finned heat exchangers, importance of laminar flow in finned recuperators and entry length effect. Plate and frame heat exchangers - Advantages of PHE, Plate geometry and flow configurations, effectiveness and pressure drop in PHE, Fouling in PHE. Thermal regenerations - working principle of periodic flow and rotary regenerators, transient temperature profile, Hausen's chart, optimization of thermal storage. Heat Pipe Heat Exchangers - Working principles, Wick types, various operating limits of heat pipes, pressure gradient and heat transfer requirements in heat pipe heat exchangers. Use of compact heat exchangers in multiphase applications.

TEXTBOOKS :

1. Heat Exchangers Selection, Rating and Thermal design, Sadik Kakac, Hongtan Liu,CRC Press (2002)
2. Heat Exchanger Design, P Arthur. Frass, John Wiley & Sons (1988)

REFERENCE BOOKS :

1. Heat Exchangers, Theory and Practice, Taborek.T, Hewitt.G.F and Afgan.N, McGraw-Hill TextBook : Co. (1980)
2. Fundamentals of Heat Exchanger Design, Ramesh K. Shah, Dusan P. Sekulic, Wiley (2002)
3. Process Heat Transfer, Hewitt.G.F, Shires.G.L, Bott.T.R, CRC Press (1994)

ENGINE SYSTEMS AND PERFORMANCE

SYLLABUS

Working principle; Constructional details; Classification and application of different types of I.C. Engines; Wankel and other rotary engines; Operation of the Stirling engine; Mixture preparation systems for SI and CI engines; Combustion

chambers; Ignition, lubrication and cooling systems; Speed governing systems; Intake and exhaust systems; Supercharging methods; Turbocharger matching; Aero-thermodynamics of compressors and turbines; Engine Testing and performance; Effects of engine design and operating parameters on performance and emissions

TEXTBOOKS :

1. John B Heywood, Internal Combustion Engine Fundamentals, Tata Mc-Graw-Hill (1988)
2. Elements of gas turbine technology, J. D. Mattingly, Tata McGrawHill (2005)

REFERENCE BOOKS :

1. Ganesan V, Internal Combustion Engines , Third Edition, Tata Mcgraw-Hill , 2007
2. Gas turbine theory, Cohen, Rogers, Saravanamutto, Pearson education (2001)
3. Patterson D.J. and Henein N.A, "Emissions from combustion engines and their control" Ann Arbor Science publishers Inc, USA, 1978
4. Gupta H.N, "Fundamentals of Internal Combustion Engines" ,Prentice Hall of India,2006
5. Ultrich Adler ," Automotive Electric / Electronic Systems, Published by Robert Bosh, GmbH,1995

IC ENGINE COMBUSTION AND POLLUTION

SYLLABUS

Role of fuel in engine combustion, selection of fuels, Basic combustion processes for SI and CI engines - Factors affecting combustion in these engines - Combustion chambers - Instrumentation to study the combustion process in engines. Pollution formation in SI and CI engines - Factors affecting emissions - Control measures for evaporative emissions - Thermal reactors and catalytic converters - Engine modifications to reduce emissions - Instrumentation to measure pollutants - Emission standards and testing.

TEXTBOOKS :

1. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-Mc-Graw Hill, New York
2. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub. PHI, India

REFERENCE BOOKS :

1. Fundamentals of I.C. Engines - P.W. Gill, J.H. Smith & Ziurys- IBH & Oxford pub.

2. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
3. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York

ALTERNATIVE FUELS

SYLLABUS

Fossil fuels and their limitations; Engine requirements; Potential alternative liquid and gaseous fuels; Methods of production; Properties, safety aspects, handling and distribution of various liquid alternative fuels like alcohols, vegetable oils, Di-methyl and Di-ethyl ether etc., their use in engines, performance and emission characteristics; Conversion of vegetable oils to their esters and effect on engine performance; Use of gaseous fuels like biogas, LPG, hydrogen, natural gas, producer gas etc. in SI/CI engines; Production, storage, distribution and safety aspects of gaseous fuels. Different approaches like dual fuel combustion and surface ignition to use alternative fuels in engines; Use of additives to improve the performance with alternative fuels; Hybrid power plants and fuel cell.

TEXTBOOKS :

1. Richard.L.Bechfold – Alternative Fuels Guide TextBook : - SAE International Warrendale - 1997.
2. Handbook of Alternative Fuel Technologies, Sungyu Lee, CRC Press

REFERENCE BOOKS :

1. Alternative Fuels: Emissions, Economics, and Performance, Timothy T. Maxwell, Jesse C. Jones, SAE International (1991)
2. Nagpal - “Power Plant Engineering” - Khanna Publishers – 1991
3. Maheswar Dayal - Energy Today & Tomorrow - I & B Horishr India - 1982.
4. “Alcohols as motor fuels progress in technology” - Series No.19 - SAE Publication USE – 1980
5. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

INCOMPRESSIBLE AND COMPRESSIBLE FLUID FLOWS

SYLLABUS

Definition and properties of Fluids, Fluid as continuum, Langragian and Eulerian description, Velocity and stress field, Fluid statics, Fluid Kinematics, Reynolds transport theorem, Integral and differential forms of governing equations: mass, momentum and energy conservation equation, Couette flows, Poiseuille flows, Fully developed flows in non-circular cross-sections, Unsteady flows, Creeping flows, Revisit of fluid kinematics, Stream and Velocity potential function, Circulation, Irrotational vortex, Basic plane potential flows: Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows, Flow past a circular cylinder, Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag, Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similarity solutions, Integral form of boundary layer equations, Approximate Methods, Flow separation, Entry flow into a duct, Basic concepts of thermodynamics, governing equations in various forms, concept of Mach number, one dimensional flows and normal shock wave, Rayleigh and Fanno flows, Two dimensional flows and oblique shock waves, β-M relations, understanding of shock interaction and shock reflection with various graphs, Prandtl- Mayer expansion, shock-expansion theory, quasi one dimensional flows, method of characteristics and, unsteady wave motion and introduction to various experimental facilities for these speed ranges.

TEXTBOOKS :

1. Boundary layer theory, H. Schlichting, and K. Gersten, Springer (2000)
2. Elements of gas Dynamics, H. W. Liepmann & A. Roshko, Dover Publications (2002)
3. Viscous fluid flow, F. M. White, Mc-Graw Hill (2005)

REFERENCE BOOKS :

1. Introduction to Fluid Mechanics, E. J. Shaughnessy, I. M. Katz and J. P. Schaffer, Oxford University Press (2004)
2. Compressible fluid flow, M. A. Saad, Prentice Hall (1985)
3. Incompressible flow, R. L. Panton, John Wiley & Sons (2005)
4. Advanced Fluid Mechanics, Som, and Biswas, Tata McGraw Hill (2008)
5. The dynamics and thermodynamics of compressible fluid flow, Vol. 1 & 2, A. H. Shapiro, Ronald Press (1954)

COMPUTATIONAL FLUID DYNAMICS

SYLLABUS

Introduction: Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description, Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods, Finite Difference Technique: Finite difference methods; different means for formulating finite difference equation; Taylor series expansion, integration over element, local function method; treatment of boundary conditions; boundary layer treatment; variable property; interface and free surface treatment; accuracy of FD method, Finite Volume Technique: Finite volume methods; different types of finite volume grids; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem, Finite Element Methods: Finite element methods; Rayleigh-Ritz, Galerkin and Least square methods; interpolation functions; one and two dimensional elements; applications, Methods of Solution: Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform, Time integration Methods: Single and multilevel methods; predictor-corrector methods; stability analysis; Applications to transient conduction and advection-diffusion problems, Numerical Grid Generation: Numerical grid generation; basic ideas; transformation and mapping, Navier-Stokes Equations: Explicit and implicit methods; SIMPLE type methods; fractional step methods, Turbulence modeling: Reynolds averaged Navier-Stokes equations, RANS modeling, DNS and LES.

TEXTBOOKS :

1. Numerical Computation of Internal and External Flows, C. Hirsch, Vols. I & II, John Wiley & Sons (2004)
2. An Introduction to Computational Fluid Dynamics, H. K. Versteeg & W. Malalasekera, Longman Scientific & Technical (1995)

REFERENCE BOOKS :

1. Computational Fluid Mechanics and Heat Transfer, J. C. Anderson, D. A. Tannehil and R. H. Pletcher, Taylor & Francis publications, USA (1997)
2. Fundamentals of CFD, T. K. Sengupta, Universities Press (2004)
3. Computational Fluid Dynamics, T. J. Chung, Cambridge University Press (2002)
4. Computational Methods for Fluid Dynamics, J. H. Ferziger and M. Peric, Springer (1997)
5. Computational Techniques for Fluid Dynamics, C. A. J. Fletcher, Vols. I & II, Springer-Verlag (1996)

REFRIGERATION AND CRYOGENICS

SYLLABUS

Review of Basic Thermodynamics, Properties of Cryogenic fluids, First and Second Law approaches to the study of thermodynamic cycles, Isothermal, Adiabatic and Isenthalpic processes. Production of Low Temperatures: Liquefaction systems, ideal, Cascade, Linde Hampson and Claude cycles and their derivatives; Refrigerators: Stirling, Gifford-McMahon cycles and their derivatives. Cryogenic Insulations: Foam, Fibre, powder and Multilayer. Applications of Cryogenics in Industry, Space Technology, Nuclear Technology, Biology and Medicine, Matter at low temperatures: specific heat, thermal conductivity, electrical conductivity, magnetic and mechanical properties; Review of free electron and band theory of solids: Basic properties of Superconductors; out lines of Ginzbarg Landau and Bardeen-Cooper-Schrieffer theories of superconductivity: Super-conducing tunneling phenomena; Introduction to type II superconductivity including flux flow and critical current density: High temperature superconductivity. Properties of liquid 4He and 3He; Production of very low temperatures by Adiabatic demagnetization, dilution refrigeration and nuclear demagnetization and their measurements.

TEXTBOOKS :

1. Refrigeration and Air conditioning, Stoecker, and Jones ()
2. Cryogenics Systems, R. F. Barron, Oxford Univesity Press (1985)
3. Cryogenics: Theory, Processes and Applications, Allyson E. Hayes, Nova Science Pub Incorporated (2010)

REFERENCE BOOKS :

1. Refrigeration and Air Conditioning, Jordan, and Priester, Prentice Hall India
2. A text TextBook : of Cryogenics, V. V. Kostionk, Discovery publishing house pvt. Ltd. (2003)
3. Principles of Refrigeration by Dossat. , Thomas J. Horan: TextBooks :.
4. Heating, Ventilating, Air-Conditioning and Refrigeration by Billy C. Langley, Prentice Hall
5. Haselden, G. G. (1971) Cryogenic fundamentals Academic Press, New York

MEASUREMENTS IN THERMAL ENGINEERING

SYLLABUS

Introduction to measurements for scientific and engineering applications - need and goal - broad category of methods for measuring field and derived quantities; Principles of measurement - parameter estimation - regression

analysis - correlations - error estimation and data presentation - analysis of data; Measurement of field quantities - thermometry - heat flux measurement - measurement of force, pressure, flow rate, velocity, humidity, noise, vibration - measurement of the above by probe and non intrusive techniques; Measurement of derived quantities - torque, power, thermo-physical properties - radiation and surface properties; Analytical methods and pollution monitoring - mass spectrometry -chromatography - spectroscopy.

TEXTBOOKS :

1. Measurement in fluid mechanics, S. Tauvulorais, Cambridge University Press (2009)
2. Experiments and Uncertainty Analysis for Engineers, H.W. Coleman and W.G. Steele Jr., Wiley & Sons, New York, (1989)
3. Fundamentals of temperature, pressure and flow measurement, R. P. Benedict, John Wiley and Sons (2003)

REFERENCE BOOKS :

1. Fluid mechanics & measurements, R. J. Goldstein, Taylor & Francis (1996)
2. Hand TextBook : of experimental fluid mechanics, C. Tropea, Y. Alexander, J. F. Foss, Springer (2007)
3. The measurement of turbulent fluctuations, Smolyakov, and Tkachenko, Springer-Verlag (1983)
4. Thermal and flow measurements, T. W. Lee, CRC Press (2008)

PRINCIPLES OF TURBO MACHINERY

SYLLABUS

Classification - Specific work - Representation of specific work in T-s and h-s diagrams - Internal and external losses - Euler's equation of turbo-machinery - Ideal and actual velocity triangles - Slip and its estimation - Impulse and reaction type machines - Degree of reaction - Effect of outlet blade angle on blade shape - Model laws, specific speed and shape number - Special features of hydro, steam and gas turbines - Performance characteristics of turbo-machines - Cavitation, Surge and Stall - Thin aerofoil theory - Cascade mechanics. Use of CFD for Turbo-machinery analysis and design.

TEXTBOOKS :

1. Fundamentals of Turbomachinery by William W. Peng, John Wiley & Sons
2. Principles of turbomachinery, D. G. Shepherd, Macmilan, 1969

REFERENCE BOOKS :

1. Ahmed F. El-Sayed; Aircraft Propulsion and Gas Turbine Engines; CRC press, 2008.

2. Turbine, Compressors and Fans by S.M.Yahya, TMH
3. Hydraulic and Compressible Flow Turbomachines by A.T.Sayers, Mc-Graw Hill
4. Principles of Turbomachinery by Seppo A. Korpella, John Wiley & Sons
5. Nicholas Cumpsty, Compressor Aerodynamics, 2004, Kreiger Publications, USA.
6. Elements of gastubine technology, J. D. Mattingly, Tata McGrawHill (2005)

GAS TURBINE ENGINEERING

SYLLABUS

Thermodynamics of gas turbines: Cycle analysis; Gas Turbine Components: compressor, combustor, heat exchangers, turbine - description: analytical considerations, performance; Matching of compressor and turbine: cooling of turbine blades. Compressor and turbine impeller construction, blade fixing details, sealing; Material selection for components, Protective coating for hot turbine parts, Components fabrication techniques, Gas turbine turbocharger, gas turbine power generation, turbo expander, gas turbine application, Closed cycle gas turbines, Co-generation - Introduction, Thermodynamics of co-generation, Criteria for component performance, Some practical schemes.

TEXTBOOKS :

1. Elements of gas turbine technology, J. D. Mattingly, Tata McGrawHill (2005)
2. Gas turbine theory, Cohen, Rogers, Saravanamutto, Pearson education (2001)

REFERENCE BOOKS :

1. Ahmed F. El-Sayed; Aircraft Propulsion and Gas Turbine Engines; CRC press, 2008.
2. Turbine, Compressors and Fans by S.M.Yahya, TMH

TURBO COMPRESSORS

SYLLABUS

Thermodynamics of fluid flow and thermodynamic analysis of compression and expansion processes: Sonic velocity and Mach number; Classification of

fluid flow based on Mach number; Stagnation and static properties and their relations; Compression process – Overall isentropic efficiency of compression; Stage efficiency; Comparison and relation between overall efficiency and stage efficiency; Polytropic efficiency; Preheat factor; Expansion Process – Overall isentropic efficiency for a turbine; Stage efficiency for a turbine; Comparison and relation between stage efficiency and overall efficiency for expansion process; polytropic efficiency of expansion; Reheat factor for expansion process. Axial flow compressors, propellers, centrifugal compressors. Equations of motion in axial and radial turbomachines. Operation and performance of compressors. Compressor cascades and loss correlations. Compressor instrumentation and testing. Supersonic compressors. Special aspects. Future trends.

TEXTBOOKS :

1. Hydraulic and Compressible Flow Turbomachines by A.T.Sayers, Mc-Graw Hill
2. Aerodynamics of turbines and compressors, (Ed.) W. R. Hawthorne, Vol. 10, Princeton university press, 1964

REFERENCE BOOKS :

1. Turbine, Compressors and Fans by S.M.Yahya, TMH
2. Theory of turbo machinery, G.T. Csandy, McGrawHill, 1964
3. J H Horlock, Axial Flow Turbines, Butterworths, 1965, UK.

ENERGY CONSERVATION, MANAGEMENT AND AUDIT

SYLLABUS

Energy Scenario - Basics of Energy and its various forms - Energy Management and - Audit - Material and Energy Balance - Energy Action Planning - Financial Management –Project Management - Energy Monitoring and Targeting - Global Environmental Concerns. Energy Efficiency in Thermal Utilities - Fuels and Combustion – Boilers - Steam System - Furnaces - Insulation and Refractory - FBC Boilers -Cogeneration - Waste heat recovery. Energy Efficiency in Electrical Utilities - Electrical Systems - Electric Motors - Compressed Air System - HVAC and Refrigeration System - Fans and Blowers - Pumps and Pumping System - Cooling Tower - Lighting System - Diesel Generating System - Energy Efficient Technologies in Electrical Systems

Energy Performance Assessment for Equipment and Utility systems – Boilers – Furnaces - Cogeneration, Turbines (Gas, Steam) - Heat Exchangers - Electric Motors and Variable Speed Drives - Fans and Blowers - Water Pumps – Compressors. HVAC Systems - Lighting Systems - Performing Financial Analysis - Applications of Non - Conventional and Renewable Energy Sources - Waste Minimization and Resource Conservation

TEXTBOOKS :

1. CB Smith, Enegy Management Principles, Pergamon Press, NewYork, 1981
2. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management & Case study, Hemisphere, Washington, 1980

REFERENCE BOOKS :

1. Trivedi, PR, Jolka KR, Energy Managemnent, Commonwealth Publication, NewDelhi, 1997
2. Witte, Larry C, Industrial Energy Management & Utilization, Hemisphere Publishers, Washington,1988
3. Diamant, RME, Total Energy, Pergamon, Oxford, 1970.
4. Guide TextBook : for National Certification Examination for Energy Managers and Energy Auditors, Bureau of energy efficiencies, 2005.

RENEWABLE ENERGY TECHNOLOGY

SYLLABUS

Sources: Renewable Energy Sources in India - Potential sites, availability. Solar Energy: Measurement and collection, flat plate collectors, concentrating collectors, solar ponds, photovoltaic conversion, Thermal energy storage. Ocean Energy: Principles of OTEC; wave energy, tidal energy, energy conversion systems. Wind Energy: Principle, potential and status; Wind Characteristics; National Wind Atlas; Theory of wind turbine blades; Types of wind turbines and their characteristics. Biofuels: Sources and potential, properties and characterization; Biogas generation through aerobic and anaerobic digestion; Thermochemical methods of biofuel utilization: Combustion and gasification; Status of biofuel technology. Geothermal Energy-Nature, types and utilization. Applications: Applications of renewable energy sources - Typical examples.

TEXTBOOKS :

1. Renewable Energy Resources, Twidell & Wier, CRC Press
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.

REFERENCE BOOKS :

1. L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990
2. Renewable energy resources - Tiwari and Ghosal - Narosa.
3. Renewable Energy Technologies - Ramesh & Kumar - Narosa
4. Non-Conventional Energy Systems / K Mittal /Wheeler
5. Renewable energy sources and emerging technologies by D.P.Kothari,K.C.Singhal, P.H.I
6. Non-Conventional EnergySources - G.D.Rai, KhannaPublishers

SOLAR ENERGY AND WIND ENERGY

SYLLABUS

SOLAR RADIATION

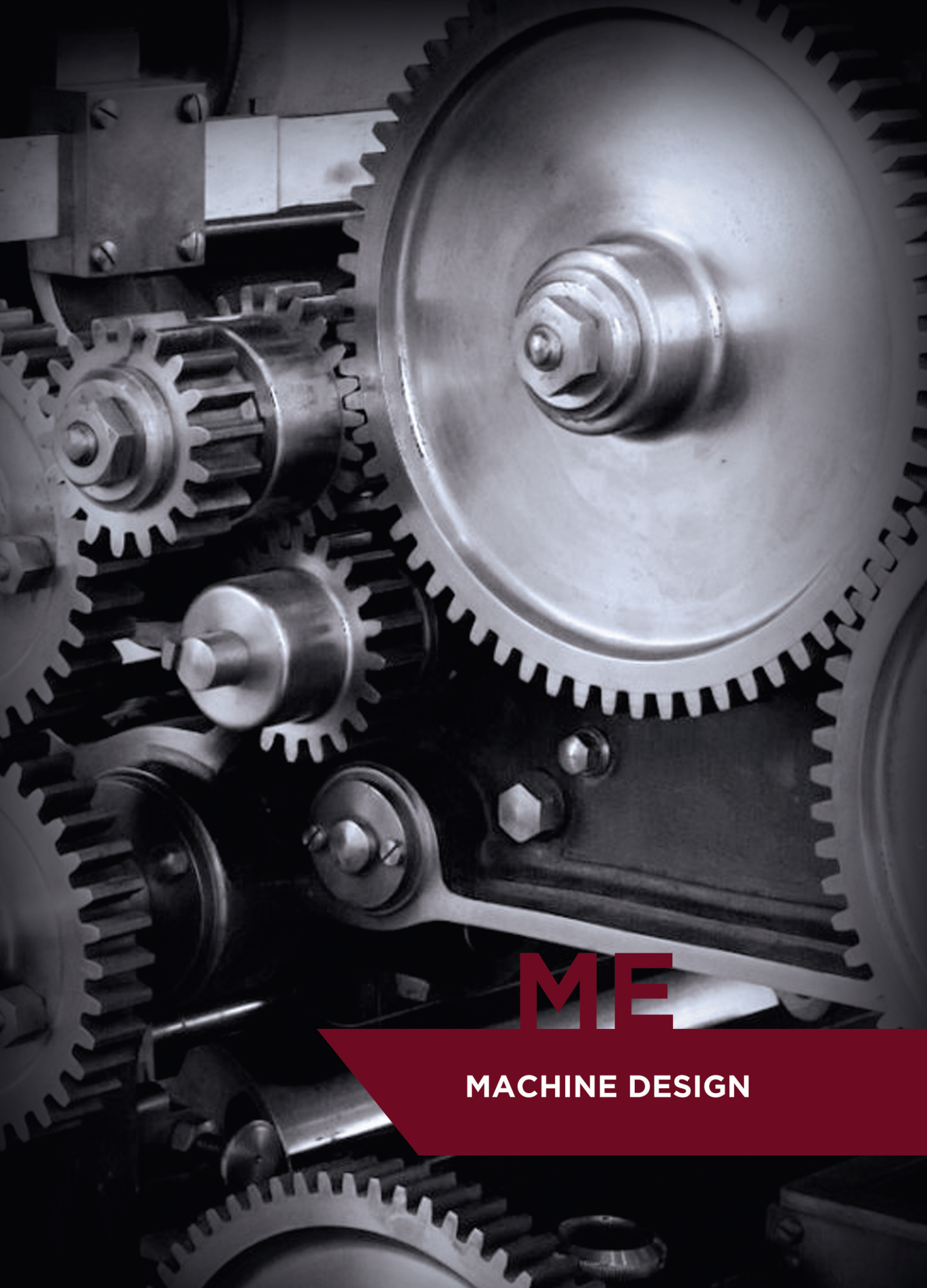
Availability - Measurement and Estimation - Isotropic and an Isotropic Models – Introduction to Solar Collectors (Liquid Flat - Plate Collector, Air Heater and Concentrating Collector) and Thermal Storage - Steady State Transient Analysis - Solar Pond - Solar Refrigeration. Modeling of Solar Thermal Systems And Simulations In Process Design: Design of Active Systems by f-chart and Utilizability Methods - Water Heating Systems - Active and Passive - Passive Heating and Cooling of Buildings - Solar Distillation - Solar Drying. Photovoltaic Solar Cell: P-N Junction - Metal - Schottky Junction, Electrolyte - Semiconductor Junction, Types of Solar Cells - their Applications - Experimental Techniques to determine the Characteristics of Solar Cells - Photovoltaic Hybrid Systems Photovoltaic Thermal Systems – Storage Battery - Solar Array and their Characteristics Evaluation - Solar Chargeable Battery. Wind: Its Structure - Statistics - Measurements and Data Presentation - Wind Turbine Aerodynamics - Momentum Theories - Basics Aerodynamics - Airfoils and their Characteristics - HAWT - Blade Element Theory - Prandtl's Lifting Line Theory (prescribed wake analysis) - VAWT Aerodynamics - Wind Turbine Loads - Aerodynamic Loads in Steady Operation - Wind Turbulence - Yawed Operation and Tower Shadow. Wind Energy Conversion System (WECS): Siting - Rotor Selection - Annual Energy Output - Horizontal Axis Wind Turbine (HAWT) Vertical Axis Wind Turbine - Rotor Design Considertions - Number of Blades – Blade Profile -2/3 Blades and Teetering - Coning - Upwind/Downwind - Power Regulation - Yaw System - Tower - Synchronous and Asynchronous Generators and Loads – Integration of Wind Enengy Converters to Electrical Networks - Inverters - Testing of WECS - WECS Control System - Requirements and Startegies - Miscellaneous Topics - Noise etc - Other Applications.

TEXTBOOKS :

1. L.L.Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.
2. J.A.Duffie and W.A.Beckman-Solar Engineering of Thermal Processes-John Wiley (1991).

REFERNECE BOOKS

1. S.P.Sukhatme-Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2. J.F.Kreider and F.Kreith-Solar Energy Handbook McGraw-Hill (1981).
3. D.A.Spera, Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering, ASME Press.



ME

MACHINE DESIGN

FIRST YEAR (FIRST SEMESTER)

S. No	Course Code	Course Title	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5117	Design Methods	4	0	0	4	4
2	18 ME 5118	Design with Advanced materials	3	0	0	3	3
3	18 ME 5119	Theory of Elasticity and Plasticity	3	1	0	4	4
4	18 ME 5120	Modeling & Analysis-1 (CAD)	4	0	2	6	5
5		Elective-I	3	0	0	3	3
6		Elective-II	3	0	0	3	3
7	18 IE 5149	Seminar	0	0	4	4	2
		Total	**20**	**1**	**6**	**27**	**24**

FIRST YEAR (SECOND SEMESTER)

S.	Course No	Course Title Code	Periods			Contact Hours	Credits
			L	T	P		
1	18 ME 5221	Mechanical Vibrations	3	0	0	3	3
2	18 ME 5222	Design for Optimization	3	1	0	4	4
3	18 ME 5223	Advanced strength of materials	3	1	0	4	4
4	18 ME 5224	Modeling & Analysis-2 (FEM)	4	0	2	6	5
5		Elective-III	3	0	0	3	3
6		Elective-IV	3	0	0	3	3
7	18 IE 5250	Term Paper	0	0	4	4	2
		Total	**19**	**2**	**6**	**27**	**24**

SECOND YEAR (FIRST & SECOND SEMESTER)

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1.		Major Project	0	0	72	- 36
		Total Credits	**0**	**0**	**72**	**- 36**

ELECTIVE COURSES

S. No	Course Code	Course Title	Periods			Credits
			L	T	P	
Elective – 1						
1	18 ME 51I1	Precision and Quality Engineering	3	0	0	3
2	18 ME 51I2	Advanced Mechanisms	3	0	0	3
3	18 ME 51I3	Concurrent Engineering	3	0	0	3
Elective – 2						
1	18 ME 51J1	Design of Pressure Vessels and Plates	3	0	0	3
2	18 ME 51J2	Tribological System Design	3	0	0	3
3	18 ME 51J3	Product Design and Development	3	0	0	3
Elective – 3						
1	18 ME 52K1	Mechanics of Composite Materials	3	0	0	3
2	18 ME 52K2	Machine Tool Design	3	0	0	3
3	18 ME 52K3	Fracture Mechanics	3	0	0	3
Elective – 4						
1	18 ME 52L1	Engineering Noise & Control	3	0	0	3
2	18 ME 52L2	Engineering Failure Analysis and prevention	3	0	0	3
3	18 ME 52L3	Design for Manufacturing, Assembly and Environment	3	0	0	3

DESIGN METHODS

SYLLABUS

THE DESIGN PROCESS

The design process – Morphology of design – Design Drawings – Computer Aided Engineering - Design of Standards – Concurrent Engineering – Product Life Cycle – Technological Forecasting – Market Identification – Competition bench marking – System engineering – Life Cycle Engineering – Human Factors in Design – Industrial Design.

DESIGN METHODS

Creativity and Problem Solving – Product Design Specification – Conceptual Design – Decision Theory – Decision Tree – Embodiment Design – Detail Design – Mathematical Modeling – Simulation – Geometric Modeling – Fine Element Modeling – Optimization – Search Methods – Geometric Programming – Structural and shape Optimization.

MATERIAL SELECTION PROCESS AND DESIGN

Material Selection Process – Economics – Cost Vs Performance – Weighted Property Index – Value Analysis – Role of Processing in Design – Classification of Manufacturing Process – Design of Manufacture – Design of Assembly – Design for Casting, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue, Fracture and Failure.

ENGINEERING STATISTICS AND RELIABLITY

Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design for Reliability – Reliability Centered Maintenance.

LEGAL AND ETHICAL ISSUES IN DESIGN AND QUALITY ENGINEERING

Introduction- the Origin of Laws – Contracts – Liability – Tort Law – Product Liability – Protecting Intellectual Property – Legal and Ethical Domains – Codes of Ethics – Solving Ethical Conflicts – Case Study.

Total Quality Concept – Quality Assurance – Statistics Processes Control – Taguchi Methods – Robust Design – Failure Model Effect Analysis.

TEXTBOOKS :

1. Dieter, George E, Engineering Design – “A Material and Processing Approach” McGraw Hill, International Editions, Singapore, 2000.
2. Karl T. Ulrich and Steven D. Eppinger “Product Design and Development” McGraw Hill Edition 2000.

REFERENCE BOOKS :

1. Pahl, G, and Betiz, W., ”Engineering Design”, Springer – Verlag, NY 1984.
2. Ray, MS, “Elements of Engg. Design”, Prentice Hall Inc. 1985.
3. Suh, N.P., “The Principles of Design”, Oxford University Press, NY 1990.

DESIGN WITH ADVANCED MATERIALS

SYLLABUS

FERROUS MATERIALS AND ALLOYS

ALUMINUM

Wrought and cast aluminum alloys- Properties.

COPPER

Propertied of wrought copper alloys and copper alloy casting. Selection and application of copper alloys.

ZINC AND TIN

Properties, selection and application.

PLASTICS

General properties of plastic: Introduction, Polymeric materials to designer and selection of Plastics. Plastic additives, Mechanical behavior of plastic.

COMPOSITES

Introduction; conventional engineering materials, what are composites? Function of fiber and matrix special features, drawbacks, procession, product fabrication, application.

INTERMETALLIC

Properties and application of titanium aluminides, Nickel aluminides, Iron Luminides, Beryllides and silicides.

SUPER ALLOYS

Properties, Selection and Engineering application of Nickel based super alloy, cobalt based super alloy and iron based super alloy.

CERAMICS

Oxides surfaces, Ceramic forming and metal ceramic interface.

TEXTBOOK :

1. Engineering materials, properties and selection- Ken Budinski and Michael K. Budinski, Prentice Hall.

REFERENCE BOOKS :

1. Material selction in machine design- Michael Ash by Butterworth- Heinemann.
2. Material selection and application in Machanical Engineering – Dr. A. Raman, Industrial Press Inc.
3. Selection and use of Engineering Materials – F.A.A. Crane, J.A.Charles and Justin Furness, Butterworth – Heinemann.

THEORY OF ELASTICITY AND PLASTICITY

SYLLABUS

ELASTICITY: Two dimensional stress analysis - Plane stress - Plane strain – Equations of compatibility - Stress function - Boundary conditions.

PROBLEM IN RECTANGULAR COORDINATES - Solution by polynomials - Saint Venent'sprinciples - Determination of displacement - Simple beam problems.

PROBLEMS IN POLAR COORDINATES - General equations in polar coordinates – Stressdistribution symmetrical about axis - Strain components in polar coordinates - Simple andsymmetric problems.

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS

Principle stresses -Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

GENERAL THEOREMS

Differential equations of equilibrium and compatibility - Displacement -Uniqueness of solution - Reciprocal theorem.

BENDING OF PRISMATIC BARS

Stress function - Bending of cantilever beam - Beam ofrectangular cross-section - Beams of circular cross-section.

PLASTICITY

Plastic deformation of metals - Structure of metals - Deformation - Creep stressrelaxation of deformation - Strain rate condition of constant maximum shear stress - Condition ofconstant strain energy - Approximate equation of plasticity.

METHODS OF SOLVING PRACTICAL PROBLEMS

The characteristic method – Engineeringmethod - Compression of metal under press - Theoretical and experimental data drawing.

REFERENCE BOOKS :

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. An Engineering Theory of Plasticity/E.P. Unksov/Butterworths
3. Applied Elasticity/W.T. Wang/TMH
4. Theory of Plasticity for Engineers/Hoffman and Sacks/TMH
5. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers
6. Theory of Elasticity and Plasticity/Harold Malcolm Westergaard/Harvard University Press

MODELING AND ANLALYSIS – I (CAD)

SYLLABUS

CAD TOOLS

Definition of CAD Tools, Types of System, CAD/CAM system evaluation criteria, brief treatment of input an output devices. Graphics standards, functional areas of CAD, Modeling and Viewing, Software documentation efficient use of CAD Software.

GEOMETRIC MODELING

Types of Mathematical representation of curves, wire frame models, wire frame entities, parametric representation of synthetic curves hermit cubic splines, Bezier curves, B-Splines rational curves.

SURFACE MODELING

Mathematical representation surfaces, surface model, surface entities, surface representation, parametric representation of surfaces, plane surface, rule surface, surface of revolution, tabular cylinder.

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES

Hermit Bi-Cubic surface, Bezier curve surface, B-Spline surface, COONs, Blending Surface, Sculptured surface, Surface Manipulation- Displaying, segmentation, trimming, intersection, Transformations (2D and 3D).

GEOMETRIC MODELING 3D

Solid modeling, solid representation, Boundary Representation (B-Rep), Constructive Solid Geometry.

CAD/CAM DATA EXCHANGE

Evaluation of data – Exchange format, IGES Data representations and structure, STEP Architecture, Implementation, ACIS and DXF.

DESIGN APPLICATIONS

Finite Element Modeling and Analysis and Mechanical Assembly.

COLLABORATIVE ENGINEERING

Collaborative Design, Principles, Approaches, tools, designs system.

REFERENCE BOOKS :

1. CAD/CAM Theory and Practice/Ibrhim Zeid/Mc Graw Hill International.
2. MASTERING CAD/CAM / Ibrahim Zeid / Mc Graw Hill International.
3. CAD/CAM PN Rao / TMH.
4. CAD/CAM Principles, Practice and Manufacturing Management / Chris Mc. Mohan, Jimmie Browne / Pearson edu. (LPE)
5. Concurrent Engineering Fundamentals: Integrated Product Development/ Prasad / Prentice Hall.
6. Successful implementation of concurrent Product and Process / Sammy G Sinha / Wiley John and Sons Inc.

MODELING AND ANLALYSIS – I (CAD)

LIST OF EXPERIMENTS

1. Introduction to CAD Modeling
2. Basics of 2D modeling using solid works – Sketcher Module
3. Part modeling using Extrude
4. Part modeling using Revolve
5. Part modeling using Rib
6. Part modeling of symmetric object using Mirror
7. Part modeling using Sweep and Loft
8. Part modeling and assembly of Screw jack
9. Part modeling and assembly of Pipe vice
10. Part modeling and assembly of Crane hook
11. Part modeling and assembly of Swivel bearing
12. Surface modeling using Extrude feature
13. Surface modeling using Swept feature
14. Surface modeling using Loft feature
15. Part Modeling using Surface Module

MECHANICAL VIBRATIONS

SYLLABUS

Review of Mechanical Vibrations: Basic concepts; Free vibration of single degree of freedom systems with and without damping, Forced vibration of single DOF-systems. Force and motion isolation. Two DOF-system: natural frequency.

Transient Vibration of single Degree-of freedom systems: Impulse excitation, arbitrary excitation, Laplace transforms formulation, Pulse excitation and rise time, Shock response spectrum, Shock isolation, Finite difference numerical computation.

Non Linear Vibrations: Introduction, Sources of nonlinearity, Qualitative analysis of nonlinear systems. Phase plane, Conservative systems, Stability of equilibrium, Method of isoclines, Perturbation method, Method of iteration, Self-excited oscillations.

Random Vibrations : Random phenomena, Time averaging and expected value, Frequency response function, Probability distribution, Correlation,

Power spectrum and power spectral density, Fourier transforms, FTs and response.

CONTINUOUS SYSTEMS

Vibrating string, Longitudinal vibration of rods, Torsional vibration of rods, Suspension bridge as continuous system, Euler equation for beams, Vibration of membranes.

VIBRATION CONTROL

Introduction, Vibration isolation theory, Vibration isolation theory for harmonic excitation, practical aspects of vibration analysis, shock isolation, Dynamic vibration absorbers, and Vibration dampers.

VIBRATION MEASUREMENT AND APPLICATIONS

Introduction, Transducers, Vibration pickups, Frequency measuring instruments, Vibration exciters, Signal analysis.

MODAL ANALYSIS & CONDITION MONITORING

Dynamic Testing of machines and Structures, Experimental Modal analysis, Machine Condition monitoring and diagnosis.

TEXTBOOKS :

1. Theory of Vibration with Application, - William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, 5th edition Pearson Education.
2. Fundamentals of Mechanical Vibration. - S. Graham Kelly. 2nd edition Mc-Graw Hill.
3. Mechanical Vibrations, - S. S. Rao., 4th edition Pearson Education.

REFERENCE BOOKS :

1. Mechanical Vibrations - S. Graham Kelly, Schaum's Outlines, Tata McGraw Hill, 2007

DESIGN FOR OPTIMIZATION

SYLLABUS

INTRODUCTION

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints-Classification of Optimization problem.

OPTIMIZATION TECHNIQUES

Single variable and multivariable optimization, techniques of unconstrained minimization- Golden selection, Random, Patter and Gradient search methods-interpolation methods, Optimization with equality and inequality constraints.

MULTI OBJECTIVE OPTIMIZATION

Direct methods – Indirect methods using penalty functions, Lagrange multipliers, Geometric programming and stochastic programming, multi objective optimization, Genetic algorithms and stimulated Annealing techniques.

STATIC APPLICATION

Structural applications – Design of simple truss members, Design applications – Design of simple axial, transvers loaded members for minimum cost, maximum weight- Design of shafts and torsion ally loaded members- Design of springs.

DYNAMIC APPLICATION

Dynamic applications- Optimum design of single, two degree of freedom systems , vibration absorbers. Application in mechanisms – Optimum design of simple linkage mechanisms.

TEXTBOOK :

1. Sigeresus S.Rao "Engineering Optimization – Theory and Practice" New age Intl. Ltd., Published, 2000.

REFERENCE BOOKS :

1. Johnson Ray. C., "Optimum Design of mechanical elements", Wiely, John &sons, 1990.
2. Goldberg. D.E., "Genetic algorithms in search optimization and machines", Barnen, Addison Wesley, New York, 1989.
3. Kalyanamoy Deb, "Optimization for Engineering Design algorithm and Examples", Prentice Hall of India Pvt. 1995.

ADVANCED STRENGTH OF MATERIALS

SYLLABUS

SHEAR CENTER

Bending axis and shear center- shear center of axisymmetric and unsymmetrical sections.

UNSYMMETRICAL BENDING:

Bending stress in beams subjected to non-symmetrical bending, deflection of straight beams due to non symmetrical bending.

CURVED BEAM THEORY:

Winkler Bach formula for circumferential stress- limitation – correct factors- radial stress in curved beams – closed ring subjected to concentrated and uniform loads- stress in chain links.

TORSION

Linear elastic solution, Pradtl elastic membrane (Soap-Film) Analogue, Narrow rectangular cross section, Hollow thin wall torsion members, multiply connected cross section.

CONTACT STRESS

Introduction, problem of determining contact stresses, assumptions on which a solution for contact stresses is based, expression for principle stresses, method of computing contact stresses, deflections of bodies in point contact, stresses for tow bodies in contact over narrow rectangular area (Line of contact). Loads normal to area, stressed for two bodies in line contact normal and tangent to contacts area.

TWO DIMENSIONAL ELASTICITY PROBLEMS:

Plane stress and plain strain – problems in rectangular Coordinates bending of cantilever beam loaded at the end, bending of a beam by uniform load.

TWO DIMENSIONAL ELASTICITY PROBLEMS:

In polar coordinates, general equations in polar coordinates, stress distribution symmetrical about the axis, pure bending of curved bars, and displacements for symmetrical stress distributions, rotating discs.

INTRODUCTION TO THREE DIMENSIONAL PROBLEMS

Uniform stress stretching of a prismatic bar by its own weight, twist o circular shafts of constant cross section, pure bending of plates.

REFERENCE BOOKS :

1. Advanced Mechanics of materials by Boresi and Sidebottom- Wiely International.
2. Theory of Elasticity by Timoschenko S.P. and Goodier J.N Mc Grawhill Publishers.
3. Advanced strength of material by Den Hortog J.P..
4. Theory of plates- Timoshenko.
5. Strength of Materials and Theory of Structures (Vol I&II) by B.C Punmai.

MODELING AND ANALYSIS- 2 (ADVANCED FEM)

SYLLABUS

BENDING OF PLATES AND SHELLS

Review of Elasticity equation – Bending of plates and shells – Finite Element formulation of plates and shell elements – Conforming and Non-Conforming elements- C0 and C1 Continuity elements – application and examples.

NON-LINEAR PROBLEM

Introduction- Iterative Techniques – Material Non- Linearity – Elasto Plasticity – Plasticity – Viscos Plasticity – Geometric Non linearity – Large displacement formulation – application in metal forming process and contact problems.

DYNAMIC PROBLEMS

Direct formulation- free, transient and forced response – Solution procedures- Subspace iterative Techniques – Houbot, Wilson, Newmark – Methods – Examples.

FLUID MECHANICS AND HEAT TRANSFER

Governing equations of fluid mechanics – in viscid and incompressible flow – Potential formulations – Slow Non- Newtonian Fluid Flow – Metal and Polymer forming – Navier stocks equation – Steady and Transient solution.

ERROR ESTIMATES AND ADAPTIVE REFINEMENT

Error norms and convergence rates- N Refinement with adaptively – Adaptive refinement.

TEXTBOOK :

1. Zienkiewicz, O.C. and Taylor, R.L., “The Finite Element Method”, Fourth Edition, Volume I and 2, McGraw Hill International Edition, Physics services, 1991.

REFERENCE BOOKS :

1. Cook R.D., “Concept and Applications of Finite Element Analysis:, John Wiely and Sons Inc., New York 1989.
2. Bathe K.J., “Finite Element Procedure in Engineering Analysis”, Prentice Hall, 1990.

MODELING AND ANALYSIS- 2 (ADVANCED FEM)

LIST OF EXPERIEMENTS

A Introduction to ANSYS using APDL

1. Static analysis on Beams subjected to Angular loads
2. Static analysis on Flat Plate and Flat Plate with Hole
3. Static analysis of thin Cylindrical Shell subjected to Internal Pressure
4. Static Analysis on an Airplane wing model
5. Non-linear Analysis on Cantilever Beam
6. Application of Non-linear Materials

7. Modal analysis on cantilever Beam
8. Dynamic analysis on beam subjected to force function
9. Thermal Analysis - Solidification of metal Casting
10. Thermal analysis - Heat flow through furnace wall
11. Thermal analysis – Heat flow through composite wall
12. Thermal analysis on plane wall
13. CFD Analysis - Pressure distribution along transition duct

PRECISION AND QUALITY ENGINEERING

SYLLABUS

INTRODUCTION

Importance of Precision Engineering, Tolerance and Technology, Definition of Tolerance, Impact of specifying Tolerance.

MEASUREMENT OF PRECISION

Application of displacement transducers to machines and instruments, introduction to Precision Machine Design, Principles of Precision of Machine Design, Principle of Accuracy, Repeatability and resolution.

INTRODUCTION TO QUALITY

Quality of design, Quality of Conformance to Design, Quality of Performance, Growth of Quality Control, Process Monitoring, Acceptance Sampling, Quality of Performance Reliability, Management of Quality, Quality and Productivity.

FUNDAMENTAL OF STATISTICS AND PROBABILITY IN QUALITY CONTROL

Events and Probability, Laws of Probability, Distribution and Frequency, Binomial Distribution, Normal Distribution, Poisson's Distribution, Exponential and Weibull and Distribution, Random Experiments, Probability, Random Variable, Distribution Functions, Discrete Distributions, Continuous Distribution, Uniform Distribution, Numerical Characteristics of Random Variables.

STATISTICAL QUALITY CONTROL

Variability in Materials, Machines and people, Statistical Understanding of Variability, Basic form of control chart, use of Control charts, Development of a Control Chart, Control charts for Variable and attributes.

BASIC CONCEPT OF RELIABILITY

Introduction, Reliability and Quality, Failures and Failure Modes, Causes of Failures and Un reliability, maintainability and Availability, History of Reliability, Reliability literature.

TOTAL QUALITY MANAGEMENT

Objectives of TQM, Management in TQM, Implementation of TQM.
I.S.O 9000 Series.
Introduction Characteristics, Area covered in ISO 9000

ADVANCED MECHANISMS

SYLLABUS

Introduction: Elements of Mechanisms; Mobility Criterion for Planar mechanisms and manipulators; Mobility Criterion for spatial mechanisms and manipulators. Spherical mechanisms-spherical trigonometry.

ADVANCED KINEMATICS OF PLANE MOTION- I

The Inflection circle ; Euler – Savary Equation; analytical and graphical determination of di ; Bobillier's Construction; collineastion axis ; Hartmann's Construction ;Inflection circle for the relative motion of two moving planes; Application of the Inflection circle to kinematic analysisAdvanced Kinematics of plane motion - II: Polode curvature; Hall's Equation; Polode curvature in the four bar mechanism; coupler motion; relative motion of the output and input links; Determination of the output angular acceleration and its Rate of change; Freudenstein's collineation –axis theorem; Carter – Hall circle; The circling – point curve for the Coupler of of a four bar mechanism.

INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS - I

The Four bar linkage; Guiding a body through Two distinct positions; Guiding a body through Three distinct positions; The Rotocenter triangle; Guiding a body through Four distinct positions; Burmester's curve.

INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS - II

Function generation- General discussion; Function generation: Relative–Rotocenter method, Overlay's method, Function generation- Velocity – pole method; Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

INTRODUCTION TO SYNTHESIS - ANALYTICAL METHODS

Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesis of Fourbar Mechanisms for specified instantaneous condition; Method of components; Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link; Method of components.

MANIPULATOR KINEMATICS – I

D-H notation, D-H convention of assignment of co-ordinate frames and link

parameters table; D-H transformation matrix; Direct and Inverse kinematic analysis of Serial manipulators: Articulated ,spherical & industrial robot manipulators- PUMA, SCARA,STANFORD ARM, MICROBOT.

Manipulator kinematics – II: Differential kinematics Formulation of Jacobian for planar serial manipulators and spherical manipulator; Singularity analysis

TEXTBOOKS :

1. Jeremy Hirschhorn, Kinematics and Dynamics of plane mechanisms,Mc-Graw-Hill,1962.
2. L.Sciavicco and B.Siciliano, Modelling and control of Robot manipulators,Second edition, Springer -Verlag,London,2000.
3. Amitabh Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines. E.W.P.Publishers.

REFERENCE BOOKS :

1. Allen S.Hall Jr., Kinematics and Linkage Design, PHI,1964.
2. J.E Shigley and J.J . Uicker Jr., Theory of Machines and Mechanisms , Mc-Graw-Hill, 1995.
3. Mohsen Shahinpoor, A Robot Engineering Text TextBook :,Harper & Row Publishers, New York,1987.

CONCURRENT ENGINEERING

SYLLABUS

CONCURRENT ENGINEERING DEFINITIONS

Introduction. Basic Principles of CE. Components of CE. Concurrency and Simultaneity. Modes of Concurrency. Modes of Cooperation. Benefits of Concurrent Engineering. REFERENCE Books : . Test Problems: CE Definitions.

COOPERATIVE WORK TEAMS

Introduction. Cooperative Concurrent Teams. Program Organization. Supplier Rationalization. Types of CE Organization. Management Styles or Philosophies. Workplace Organization and Visual Control. Employee Excellence Development (New Technologies and Team Capabilities). REFERENCE Books : . Test Problems: Cooperative Work Teams.

SYSTEM ENGINEERING

Introduction. An Automobile Manufacturing Process. System Engineering. Systems Thinking. Approaches to System Complexity. Sharing and Collaboration in CE 300. System Integration. Management and Reporting Structure. Agile Virtual Company. REFERENCE Books : . Test Problems: System Engineering.

INFORMATION MODELING- INTRODUCTION

Information Modeling. Modeling Methodology. Foundation of Information Modeling. Concurrent Engineering Process Invariant. Enterprise Model-Class. Specification Model-Class. Product Model-Class. Process Model- Class. Cognitive Models. Merits and Demerits. Summary. REFERENCE Books : . Test Problems: Information Modeling.

THE WHOLE SYSTEM

Introduction. Conventional Design and Development Process. A Transformation Model for a Manufacturing System. CE Enterprise System Taxonomy. Integrated Product and Process Development. Transformation System for Product Realization. Key Dimensions of a CE Specification Set. Artifact's Intent Definitions. REFERENCE Books : . Test Problems: The Whole System.

REFERENCE BOOK :

1. Biren Prasad – "Concurrent Engineering Fundamentals: Integrated Product and Process Organization" Volume I - Prentice Hall, 1996

DESIGN OF PRESSURE VESSELS AND PLATES

SYLLABUS

INTRODUCTION

Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

STRESSES IN PRESSURE VESSELS

Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

DESIGN OF VESSELS

Design of Tall cylindrical self supporting process columns – supports for short vertical vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design.

BASIC EQUATIONS OF THIN PLATE THEORY

Introduction-assumptions-slopes and curvatures of bent plate-strain curvature relations-moment curvature relations-equilibrium equations-rectangular plate, circular plate-boundary conditions- rectangular plate, circular plate-summery of basic equations-basic equations in Cartesian coordinate system-basic equations in polar co-ordinate system.

BENDING OF PLATES

Introduction-pure bending and cylindrical bending of rectangular plates-navier solution for an all-round simply supported rectangular plate-levy solution for rectangular plates- Method of superposition for the analysis of rectangular plates with arbitrary boundary conditions.

BENDING OF CIRCULAR PLATES

Circular plates subjected to an arbitrary load- Symmetric bending of circular plates, circular plate subjected to asymmetric load.

TEXTBOOKS :

1. John F. Harvey, Theory and Design of Pressure Vessels, CBS Publishers and Distributors, 1987.
2. K Chandrashekara, “Theory of plates”, University Press, 2001

REFERENCE BOOKS :

1. Henry H. Bedner, “Pressure Vessels, Design Hand TextBook :, CBS publishers and Distributors, 1987.
2. Stanley, M. Wales, “Chemical process equipment, selection and Design. Butterworth series in Chemical Engineering, 1988.
3. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Pre ASME Pressure Vessels and Piping Conference, 1997.
4. Timoshenko S.P. and Goodier J.N, “Theory of elasticity” McGraw-Hill Publishers
5. Timoshenko S, “ Theory Of Plates And Shells” McGraw-Hill Publishers.

TRIBOLOGICAL SYSTEM DESIGN

SYLLABUS

SURFACES, FRICTION AND WEAR

Topography of Surfaces – Surface features – Surface interaction – Theory of Friction – Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials – friction in extreme conditions – wear, types of wear – mechanism of wear – wear resistance materials – surface treatment – Surface modifications – surface coatings.

LUBRICATION THEORY

Lubricants and their physical properties lubricants standards – Lubrication

Regimes Hydrodynamic lubrication – Reynolds Equation, Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

DESIGN OF FLUID FILM BEARINGS

Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design – lubricant flow and delivery – power loss, Heat and temperature rotating loads and dynamic loads in journal bearings – special bearings – Hydrostatic Bearing design.

ROLLING ELEMENT BEARINGS

Geometry and kinematics – Materials and manufacturing processes – contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects, Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling Bearings Failures.

TRIBO MEASUREMENT INSTRUMENTATION

Surface Topography measurements – Electron microscope and friction and wear measurements – Laser method – instrumentation - International standards – bearings performance measurements – bearing vibration measurement.

REFERENCE BOOKS :

1. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., OK, 1981
2. Hulling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.
3. Williams J.A. “ Engineering Tribology”, Oxford Univ. Press, 1994.
4. Neale, M.J. “Tribology Hand TextBook :”, Butterworth Heinemann, 1995.

WEB REFERENCE BOOKS :

1. http://www.csetr.org/link.htm
2. http://www.me.psu.edu/research/tribology.html

PRODUCT DESIGN & DEVELOPMENT SYLLABUS

COLLABORATIVE PRODUCT DESIGN

Product lifecycle management-concepts, benefits, value addition to customer. Lifecycle models-creation of projects and roles, users and project management, system administration, access control and its use in life cycle. Product development process and functions. Data transfer. Variants of e-commerce. Multi system information sharing. Workgroup collaboration. Development of standard classification for components and suppliers. Model assembly process-link product and operational information. Customization factors-creation of

business objects, user interfaces,

search facile ties as designed by the enterprise. Software-PDM/PLM and their comparison.

PRODUCT DEVELOPMENT

Quality function deployment-quality project approach and the problem solving process. Design creativity-innovations in design alternatives. Concurrent engineering, industrial design principles. Product development versus design, types of design and redesign, modern production development process, reverse engineering and redesign

product development process, examples of product development process, scoping product development – S-curve, new product development.

UNDERSTANDING CUSTOMER NEEDS

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality.

PRODUCT TEAR DOWN AND EXPERIMENTATION

Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

GENERATING CONCEPTS

Information gathering, brain ball, C-sketch/6-3-5 method, morphological analysis, concept selection, technical feasibility, ranking, measurement theory, DFMA, design for robustness.

PHYSICAL PROTOTYPES

Types of prototypes, use of prototypes, rapid prototyping technique scale, dimensional analysis and similitude, physical model and experimentation-design of experiments, statistical analysis of experiments.

REFERENCE BOOKS :

1. John W Gosnay and Christine M Mears, Business Intelligence with Cold Fusion , Prentice Hall India, New Delhi, 2000.
2. David S Linthicum, “B2B Application Integration”, Addison Wesley, Boston, 2001.
3. Alexis Leon,Enterprise Resource Planning, Tata McGraw Hill, New Delhi, 2002.
4. David Ferry and Larry Whipple,Building and Intelligent e-business, Prima Publishing, EEE Edition, California, 2000.
5. David Bedworth, Mark Hederson and Phillip Wolfe, Computer Integrated Design and Manufacturing, McGraw Hill Inc., New York, 1991.
6. Kevin Otto and Kristin Wood, Product Design – Techniques in Reverse Engineering and New Product Development, Pearson Education, New Delhi.
7. Karl T Ulrich and Stephen D Eppinger, Product Design and Development, McGraw Hill, New York, 1994.

MECHANICS OF COMPOSITE MATERIALS

SYLLABUS

BASIC CONCEPTS AND CHARACTERISTICS

Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites,

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

MICROMECHANICS

Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations.

CHARACTERIZATION AND TESTING OF COMPOSITE MATERIALS

Characterization of Constituent Materials, Physical Characterization of composite materials, Determination of Tensile, Compressive and shear properties of Uni-dimensional lamina, Inter Lamina Fracture Toughness, Bi-Axial Testing, Characterization of Composites with Stress Concentration, Structural Testing.

ELASTIC BEHAVIOR OF COMPOSITE LAMINA- MACRO MECHANICS

Stress Strain Relations, Relations between Mathematical and Engineering constants, Stress-strain Relations for a thin Lamina (Two-Dimensional), Transformation of Stress and Strain (Two-Dimensional), Transformation of Elastic Parameters (Two-Dimensional), Transformations of stress-strain Relations in Terms of Engineering Constants (Two-Dimensional)

STRENGTH OF UNI DIRECTIONAL LAMINA

Introduction, Longitudinal tension- Failure Mechanisms and strength, Longitudinal Compression, Transverse Tension and compression, In-plane shear, Out-of-plane Loading,

STRENGTH OF COMPOSITE LAMINA

Failure Theories, Maximum Stress theory, Max Strain theory, Tsai-Hill, Tsai-Wu, Hashin-Rotem Failure theories, Evaluation and Applicability of Lamina Failure Theories.

TEXTBOOKS :

1. Isaac M Daniel and Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press, 1994.
2. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, WileyInter-science, New York, 1980.

REFERENCE BOOKS :

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.

2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

MACHINE TOOL DESIGN

SYLLABUS

FUNDAMENTALS OF MACHINE TOOL DESIGN

Introduction, working motions in machine tools, machine tool drives: electric motor, transmission arrangement, Hydraulic transmission of elements: pumps, hydraulic cylinders, throttles.

General requirements of machine tool design: Productivity, accuracy, simplicity of design, safety, low cost of manufacturing, engineering process applied to machine tools.

DESIGN OF SPEED & FEED RATES

Aim of speed & feed rate regulation; various laws of stepped regulation of speed- Design of speed box, Design of feed box, classification of speed & feed boxes. Step less regulation of speed & feed rates for hydraulics.

DESIGN OF MACHINE TOOL STRUCTURES

Functions of machine tool structures & their requirements, Design criteria for machine tool structures, Basic design procedure of machine tool structures.

DESIGN OF BEDS, TABLES, COLUMNS

Various types of beds used in machine tools- their construction & design feature; Determination of forces acting on horizontal table, Column design of milling machine & maximum deflection error in milling machine.

DESIGN OF GUIDE WAYS & HOUSINGS

Functions & types of guide ways, Design of guide way- shapes, materials. Design of guide ways for wear resistance, stiffness. Design of housings- solid.

DESIGN OF POWER SCREWS OF MACHINE TOOLS

Types & classifications, Design of sliding friction power screws, Design of rolling friction power screws.

DESIGN OF SPINDLE UNITS IN MACHINE TOOLS

Functions, requirements, materials for spindles, Design calculations of spindles: deflection of spindle axis due to bending, due to compliance of spindle supports.

NUMERICAL CONTROL OF MACHINE TOOLS

Fundamentals, classification & structure of NC systems, Program readers,

DeCoder, Buffer storage, comparators.

EXTENSION OF NUMERICAL CONTROL SYSTEMS

Introduction to DNC, CNC, Machining centers.

TEXTBOOKS :

1. NK Mehta," Machine Tool Design and Numerical Control', second Edition, Tata McGraw Hill TextBook : Company, (1997)
2. Gopal Chandra sen & Amitabha Bhattacharya,"Principles of Machine Tools", New Central TextBook : agency, Calcutta,(1998)

REFERENCE BOOKS :

1. SK Basu, DK Pal," Design of Machine Tools", Oxford & IBH Publication Co Pvt Ltd, New Delhi (1995)
2. CMTI "Machine Tool design Course , Vol 4,5 & 6, Central Machine Tool Institute, Bangalore. (1997)

FRACTURE MECHANICS

SYLLABUS

ELEMENTS OF SOLID MECHANICS

The geometry of stress and strain, elastic deformation, plastic and elasto-plastic deformation - limit analysis.

STATIONARY CRACK UNDER STATIC LOADING

Two dimensional elastic fields – Analytical solutions yielding near a crack front – Irwin's approximation - plastic zone size – Dugdale model – J integral and its relation to crack opening displacement.

ENERGY BALANCE AND CRACK GROWTH

Griffith analysis – Linear Fracture Mechanics-Crack Opening displacement – Dynamic energy balance – crack arrest.

FATIGUE CRACK GROWTH CURVE

Empirical Relation describing crack growth by fatigue – Life calculations for a given load amplitude – effects of changing the load spectrum – Effects of Environment.

ELEMENTS OF APPLIED FRACTURE MECHANICS

Examples of crack-growth Analysis for cyclic loading - leak before break – crack Initiation under large scale yielding – Thickness as a Design parameter – crack instability in Thermal or Residual – stress fields.

REFERENCE BOOKS :

1. David Broek, “Elementary Engineering Fracture Mechanics”, Fifthoff and Noerdhoff International Publisher, 1978.
2. Kare Hellan, “Introduction of Fracture Mechanics”, McGraw-Hill TextBook : Company, 1985.
3. Preshant Kumar, “Elements of Fracture Mechanics”, Wheeler Publishing, 1999.

WEB REFERENCE BOOK :

1. www.elsevier.com/locate/engfracmech

ENGINEERING NOISE AND CONTROL

SYLLABUS

FUNDAMENTALS AND BASIC TERMINOLOGY

Introduction, Noise-Control Strategies, Acoustic Field Variables and the Wave Equation, Plane and Spherical Waves, Mean Square Quantities, Energy Density, Sound Intensity, Sound Power, Units, Spectra, Combining Sound Pressures, Impedance, Flow Resistance

INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS:

Microphones, Weighting Networks, Sound Level Meters, Grades of Sound Level Meter, Sound Level Meter Calibration, Noise Measurements Using Sound Level Meters, Time-Varying Sound, Noise Level Measurement, Statistical Analyzers, Noise Dosimeters, Tape Recording of Noise, Spectrum Analysers, Intensity Meters, Energy Density Sensors

CRITERIA

Introduction, Hearing Loss, Hearing Damage Risk, Hearing Damage Risk Criteria, Implementing a Hearing Conservation Program, Speech Interference Criteria, Psychological Effects of Noise, Ambient Noise Level Specification, Environmental Noise Level Criteria, Environmental Noise Surveys

SOUND POWER AND SOUND PRESSURE LEVEL ESTIMATION PROCEDURES

Introduction, Fan Noise, Air Compressors, Compressors for Refrigeration Units, Cooling Towers, Pumps, Jets, Control Valves, Pipe Flow, Boilers, Turbines, Diesel and Gas-Driven Engines, Furnace Noise, Electric Motors, Generators, Transformers, Gears, Transportation Noise

ACTIVE NOISE CONTROL

Introduction, Active Control of Sound Propagation in Ducts, Active Control of Sound Radiation From Vibrating Structures, Sound Transmission into Enclosed Spaces, Active Vibration Isolation, Electronic Controller Design

TEXTBOOK :

1. David A. Bies and Colin H. Hansen; “Engineering noise control: theory and practice”

ENGINEERING FAILURE ANALYSIS AND PREVENTION

SYLLABUS

1. Common causes of failure.
2. Principles of failure analysis.
3. Fracture mechanics approach to failure problems.
4. Techniques of failure analysis.
5. Service failure mechanisms ductile and brittle fracture, fatigue fracture, wear failures, fretting failures, environment induced failures, high temp. failure.
6. Faulty heat treatment and design failures, processing failures (forging, casting, machining etc.), failure problems in joints and weldments.
7. Case studies for ferrous and non-ferrous metallic parts and parts made from polymers and ceramic.

TEXTBOOKS :

1. Metals Hand TextBook :, Vol.10, “Failure Analysis and Prevention “, (10th Edition), 1994.
2. Failure Analysis of Engineering Structures: Methodology and Case Histories- V. Ramachandran
3. Practical Engineering Failure Analysis by Hani M. Tawancy, Anwar Ul-Hamid, Nureddin M. Abbas.

DESIGN FOR MANUFACTURING, ASSEMBLY AND ENVIRONMENT

SYLLABUS

INTRODUCTION

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances ¬Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

FACTORS INFLUENCING FORM DESIGN

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

COMPONENT DESIGN - MACHINING CONSIDERATION

Design features to facilitate machining - drills - milling cutters - keyways - Doweling

procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clamp ability - Design for accessibility - Design for assembly.

COMPONENT DESIGN - CASTING CONSIDERATION

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

DESIGN FOR THE ENVIRONMENT

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

REFERENCE BOOKS :

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel Dekker.
2. Bralla, Design for Manufacture handbook, McGraw hill, 1999.
3. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
4. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
5. Fixel, J. Design for the Environment McGraw hill., 1996.
6. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
7. Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.