ACHARYA NAGARJUNA UNIVERSITY

(Syllabus of Pre-Ph.D course work in Engineering with effect from the batch of students admitted during the academic year 2010-11

Part-I	:	**Research Methodology** **(Common to all branches of Engineering)**
Part-II	:	**Chemical Engineering** 1. Advanced Mass Transfer 2. Advanced Chemical Engineering Thermodynamics 3. Process Modeling And Simulation 4. Particulate Technology 5. Environment And Safety In Process Industries **Civil Engineering** 1. Fibre Reinforced Plastic Composites 2. Ground Improvement Techniques 3. Foundations On Expansive Soils 4. Alternative Building Materials And Technologies 5. Finite Element Analysis Of Structures **Computer Science & Engineering** 1. Advanced Data Structures And Algorithms 2. Data Mining And Knowledge Discovery 3. Digital Image Processing 4. Network Security 5. Object Oriented Software Engineering **Electronics & Communication Engineering** 1. Microwave antennas 2. VLSI Technology & Design 3. Image & Video Processing 4. Embedded System Design 5. Wireless Communications and Networks **Electrical & Electronics Engineering** 1. Analysis of Power Electronic Converters 2. Modern Control Systems Design 3. AC Drives & Special Machines 4. Power System Stability & Control **5.** HVDC & FACTS **Mechanical Engineering** 1. Finite element Analysis 2. Thermal Engineering 3. Manufacturing Engineering 4. Optimization and Industrial Engineering 5. Advanced Materials and Processing

Acharya Nagarjuna University

(Syllabus of Pre-Ph.D course work in Engineering with effect from the batch of students admitted during the academic year 2010-11

PART – I

(Common to all branches of Engineering)

RESEARCH METHODOLOGY

Unit-I

Introduction to Research Methodology: Objectives of Research, Motivation in Research, Types of Research, Research process and Phases of Research.

Unit-II

Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research.

Unit-III

Research Modeling: Types of Models, Model building and stages, Data consideration and Testing, Heuristic and Simulation modeling. **Simulation:** Need for simulation, Types of simulation.

Unit-IV

Report Writing: Pre-writing considerations, Thesis writing, formats of report writing, Formats of publications in Research Journals. Technique of Interpretation, Precaution in Interpretation, Significance of Report writing, Different steps in writing Report, Layout of the Research Report, Types of Reports, Report Format, Typing Instructions, Oral Presentations.

Unit-V

Research Ethics and Morals: Issues related to plagiarism, collaborative models and ethics, acknowledgements. *Intellectual Property Rights:* copy rights, copy left; Patents, Industrial designs, Trade marks.

Textbooks:

1. C.R. Kothari: Research Methodology, Methods & Techniques, 2nd Edition, New Age International Publications.
2. Krishnaswamy, K N SivaKumar, Appa Iyer and Mathiranjan M (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Person Education, New Delhi).
3. R Pannerselvam, Research Methodology. PHI.

References:

1. Graziano,A.M.,Raulin,M.L : Research Methods – A Process of Inquiry, Pearson Publications.
2. Bhandarkar & Wilkinson: Methodology and Techniques of Social Research, Himalaya publications, 2009.
3. Bell. J.2005: Doing your Research Project, 4th Edition, Open University Press, Berkshire.
4. How to write a Thesis:, Murray.R. Tata Mc Graw-Hill.
5. Writing for Academic Journals, Murray. R. 2009, McGraw-Hill International.
6. A Handbook of Academic Writing, Murray, R. and Moore, S. 2006, Tata Mc Graw-Hill.
7. Writning for Publication, Henson, K.T. 2005.
8. Ranjit Kumar, Research Methodology; a step-by-step Guide for Beginners, SAGE Publications Ltd.

PART – II

CHEMICAL ENGINEERING

ADVANCED MASS TRANSFER

UNIT I

Steady and Un-steady state diffusion into fluids at rest and in laminar flow, continuity equation, Fick's law, diffusion coefficient, diffusion in binary gas mixtures–one component stagnant, equimolar counter diffusion, non-equimolar counter diffusion, estimation of diffusivities in liquids and gases, diffusion in solids.

UNIT -II

Multicomponent Distillation vapour-liquid equilibria, key components, Underwood's methods for minimum reflux, product distribution at total reflux. Theoretical Plate calculation by Lewis-Matheson, Thiele-Gieddes and Relaxation method. Multiple feeds and multiple product streams.

UNIT-III

Multicomponent gas absorption: Edmister's method for plate calculation. Absorption with chemical reaction. Multicomponent liquid-liquid extraction. Extraction with chemical reaction.

UNIT-IV

Basic overview membrane separation processes, terminologies: MWCO, concentration polarization, rejection coefficient, backwash, Basic principles of membrane processes with modeling of equations: reverse osmosis, nano-filtration, ultrafiltration, micro-filtration, Osmotic controlled filtration, gel layer controlled filtration, dialysis. Detailed module design: dead end and cross flow mode, tubular, flat plate, spiral wound and hollow-fiber modules. Principle of membrane reactors with affinity binding.

UNIT-V

Electric field enhanced separation processes: zeta potential, electric double layer. Basic modeling of electric field enhanced filtration. Liquid membrane and its concept. Basic modeling of gas separation and pervaporation processes Industrial application of membrane principles

Text Books:

1. Equilibrium-Stage Separation Operations in Chemical Engineering, Ernest J. Henley and J. D. Seader, John Wiley and Sons.
2. Basic Principles of membrane Technology, Marcel Mulder, 2nd Edition by Springer Publishers.

ADVANCED CHEMICAL ENGINEERING THERMODYNAMICS

UNIT – I

Volumetric Properties of Pure Fluids: PVT behavior of pure substances, Virial equations of state, the ideal gas, applications of Virial equations, cubic equations of state, generalized correlations for gases and liquids.

The Second Law of Thermodynamics: Statements of Second law, heat engines, thermodynamic temperature scales, entropy, entropy and probability, entropy changes of an ideal gas, mathematical statement of second law, entropy balance for open systems, calculation of ideal work and lost work, third law of thermodynamics.

UNIT – II

Heat effects: Sensible heat effects, temperature dependence of heat capacity, heat effects accompanying the phase changes, the standard heat of reaction, formation and combustion, temperature dependence of ΔH^0, heat effects of industrial reactions.

UNIT – III

Solution thermodynamics: Fundamental property relation, chemical potential, criterion for phase equilibria, partial properties, ideal gas mixtures, fugacity and fugacity coefficients, generalized correlations for fugacity coefficients, the ideal solution, excess properties.

Solution Thermodynamics Applications: Liquid phase properties from VLE data, activity coefficient, excess Gibb's energy, Gibb's Duhem equation, data reduction, thermodynamic consistency, models for excess Gibb's energy, property changes of mixing, heat effects of mixing processes.

UNIT – IV

Vapor-Liquid Equilibrium: Nature of equilibrium, Phase rule, Duhem's Theorem, VLE: Qualitative behavior, simple models for VLE, VLE, modified Raoult's Law, VLE from k – values correlations.

Phase Equilibrium: The Gamma / Phi formulation of VLE, VLE from cubic equations of state, equilibrium and stability, LLE, VLLE, SLE, SVE.

UNIT – V

Chemical Reaction Equilibrium: The reaction coordinate, application of equilibrium criteria to chemical reactions, the standard Gibbs-Energy change and the equilibrium constant, effect of temperature on the equilibrium constant, evaluation of equilibrium constants, relation of equilibrium constants to composition, equilibrium conversions for single reactions, phase rule and Duhem's theorem for reacting systems, multireaction equilibria.

Text Book:

Introduction to Chemical Engineering Thermodynamics, Smith, J.M., Van Ness,H.C., and Abbott, M.M., 6^{th} Edition (In SI units), Tata McGraw Hill.

Reference Books:

1. Chemical Engineering Thermodynamics, Dauber, McGraw Hill
2. Chemical Engineering Thermodynamics, Y.V.C.Rao, Universities press.
3. A textbook of Chemical Engineering Thermodynamics, K.V. Narayana, PHI.

PROCESS MODELING AND SIMULATION

UNIT- I

Introduction and fundamentals of process modeling and simulation; industrial usage of process modeling and simulation; Macroscopic mass, energy and momentum balances; incorporation of fluid thermodynamics, chemical equilibrium, reaction kinetics and feed/ product property estimation in mathematical models.

UNIT - II

Simulation of steady state lumped systems including simultaneous solution, modular solution, nested inside-out algorithms,partitioning and tearing with reference to chemical process equipments like reactors; distillation, absorption, extraction columns; evaporators; furnaces; heat exchangers; flash vessels etc.

UNIT- III

Unsteady state lumped systems and dynamic simulation; Commercial steady state and dynamic simulators; Computer algorithms for numerical solution of steady state and unsteady state models; Microscopic balances for steady state and dynamic simulation; process modeling with dispersion; axial mixing; micro-mixing; diffusion etc. Computer algorithms for microscopic models; Simulation of process flowsheets and Boolean digraph algorithms.

UNIT IV

Modeling and simulation of complex industrial systems in petroleum, petrochemicals, polymer, basic chemical industries.

UNIT - V

Introduction to application of advanced Artificial intelligence based modeling methods using Artificial Neural Networks, Wavelets and induced learning algorithms.

Text Books:

1. Process Modeling, Simulation and Control for Chemical Engineers, William L Luyben, 2nd Edition, Mc Graw Hill International Editions.
2. Process Flowsheeting, A.W.Westerberg, H.P.Hutchison, R.L.Motard, and P.Winter, Cambridge University Press.

PARTICULATE TECHNOLOGY

UNIT -1

Introduction: industrial significance of Solid Particulate systems, in particular fluidized bed systems. Single Particle Suspension: Motion of solid particles in a fluid, Drag coefficient, Terminal setting velocity, Particle characterization;

UNIT – II

Multiple Particle Systems: Momentum balance for multiphase system Fluid flow through particle beds, Ergun's equation, Fixed bed reactors

UNIT -III

Fluidization: Fundamentals, Minimum fluidization velocity, Geldart's classification of powders, Bubble mechanics, Stability and quality of fluidization; Fluidization Flow Regimes:

UNIT -IV

Flow regime diagrams for G/S, bubble column and GLS systems, Hydrodynamics of bubbling, turbulent, and fast fluidized beds, and pneumatic conveying, Flow regime characterization and transitions through signals

UNIT -V

Signal Analysis Methods: Statistical and spectral analysis methods, Chaos, fractal and wavelet transformation analysis; Fluidized Bed Reactor Modeling, Two-phase flow model Design and Scaling of Fluidized Bed Reactors: Scale-up issues,Industrial applications

Text Book

Fluidization Engineering, Kunii, D. and Levenspiel, O., Butterworth-Heinemann, Boston (1991),

Reference Books

1. Particulates and Continuum: Multiphase Fluid Dynamics, Soo, S.L., (1989).
2. Theory of Multicomponent Fluids, Drew, D.A. and Passman, S.L. Springer, New York (1999)
3. Fluidization-Dynamics: the Formulation and Application of a Predictive Theory for the Fluidized State, Gibilaro, L.G., Butterworth-Heinemann, Boston (2001).
4. Multiphase Flow and Fluidization: Continuum and Kinetic Theory Descriptions, Gidaspow, D., Academic Press, Boston (1994).
5. Thermo-Fluid Dynamic Theory of Two-Phase Flow, Ishii, M., Eyrolles, Paris (1975).
6. Introduction to Particle Technology, Rhodes, M., John Wiley & Sons, New York (1998).

ENVIRONMENT AND SAFETY IN PROCESS INDUSTRIES

UNIT-I

Resources Management, Clean Development Mechanism, Command and control and Market Based Initiatives for pollution control.

Pollution Abatement in Process Industries; Types of pollution in process industries, Modes of Surveillance, Evaluation and Techniques for abatement. Design for effluent treatment in specific process Industries such as, Fertilizer, Petroleum, Pulp and Paper, Dairy etc.

UNIT-II

Environmental Issues in Process Industries; Identifying and evaluating the probable environmental consequences of a proposed development project, Methods for Environmental Impact Assessment, Risk Assessment of the project. Uses, advantages and limitations of various environmental management tools. Case studies of Life cycle Assessment, Environmental Audit, Energy Audit and Water Audit.

UNIT-III

Environmental Regulations: Indian & International; Regulations to encourage pollution prevention and cleaner production. International standards on various aspects of environmental management

Safe (inherent) Process Design Practices; Chemical Process Industry (CPI) Safety Codes. Control technology to reduce accidents in CPI.

UNIT-IV

Process Hazard Evaluation; Hazard Evaluation techniques, Qualitative Risk Analysis (QRA) Techniques, Risk Assessment (RA) accident probability, Hazard Operability Studies (HAZOP) Hazard Analysis (HAZAN), Fault Tree Analysis (FTA) and Event Tree Analysis (ETA).

UNIT-V

Safety Analysis; Safety Review, Preconditions and preparations, analytical procedures, analysis of safety relatedinformation and safety measures, Integrated approaches for safety management, Case studies in process safety management

Text Books:

1. Integrated Environmental Planning, Janes K. Lein, Blackwell Publishing.
2. Safety Assessment for Chemical Processes, J Steinbach, Willey – VCTT.

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PART – II
CIVIL ENGINEERING

FIBRE REINFORCED PLASTIC COMPOSITES

UNIT - I

1. Introduction

Definition; History of fibre reinforced composites; Constituent materials – Fibres, Polymeric matrix, Prepregs; Lamina and Laminate; General characteristics of FRP; Micromechanics and macromechanics; Properties of typical composite materials; Applications of FRPs in Civil engineering.

2. Processing of FRP Composites

Contact moulding; Compression moulding methods ; Filament winding

UNIT - II

3. Macromechanical behaviour of a lamina

Introduction; Stress-strain relations of a lamina with respect to its principal axes; Stress-strain relations of an arbitrarily oriented lamina; Typical elastic properties of a unidirectional lamina.

UNIT - III

4. Macromechanical behaviour of a laminate

Introduction; Classical lamination theory – Lamina stress strain behaviour, Strain and stress variation in a laminate, Resultant laminate forces and moments; Special cases of laminate stiffnesses.

UNIT - IV

5. Design of FRP structures

Introduction; Composite structural design; The design spiral; Design criteria; Design allowables; Material selection; Selection of configuration and manufacturing process; Laminate design – selection of laminate, laminate design problem, laminate design Procedure; Mathematical analysis of the laminate – estimation of shear force, estimation of deflection, mathematical algorithm; Design examples – design of tension member, laminate design for strength, laminate design for stiffness.

UNIT - V

6. **Composite Joints**

Introduction; Classes of laminate joints; Bonded joints- stress distribution, modes of failure, Merits and demerits of adhesive bonded joints; Mechanical joints – failure modes, advantages and disadvantages.

Text books:

1. Mechanics of composite materials and structures by Madhujit Mukhopadhay, Universities Press, 2004.
2. Mechanics of composite materials by R.M.Jones, Publisher : Taylor & Francis, 1998.

GROUND IMPROVEMENT TECHNIQUES

UNIT-I

1. Introduction

Need for engineered ground improvement; classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.

2. In-situ densification methods in granular soils

Introduction, Vibration at the ground surface, impact at the ground surface, vibration at depth, impact at depth.

UNIT-II

3. In-situ densification methods in cohesive soils

Introduction, preloading, sand drains, sand wicks, band drains, stone and lime columns.

4. Reinforced earth

Principles, components of reinforced earth, governing design of reinforced earth walls, design principles of reinforced earth walls.

UNIT-III

5. Geotextiles

Introduction, types of geotextiles, functions and their applications, tests for geotextiles, geogrids and its functions.

UNIT-IV

6. Mechanical Stabilization

Soil aggregate mixtures, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control.

7. Cement Stabilization

Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

UNIT-V

8. Lime and Bituminous Stabilization

Type of admixtures, mechanism, factors affecting, design of mixtures, construction methods.

TEXT BOOK

Hausmann M.R(1990) Engineering Principles of ground modification, McGraw-Hill International edition.

REFERENCES

1. Ground improvement Techniques, P.Purushothama Raju, Laxmi Publications Pvt. Ltd., New Delhi.
2. Robert M. Koerner, Designing with Geosynthatics, Prentice Hall New Jercy, USA.
3. Construction and Geotechnical methods in Foundation Engineering, R.M.Koerner, McGraw-Hill Book Company.
4. Current Practices in Geotechnical Engineering Vol.-I, Alam Singh and Joshi, International Book Traders, New Delhi.

FOUNDATIONS ON EXPANSIVE SOILS

UNIT-I

Origin and occurrence of expansive soils - Problems with expansive soils - mineralogical identification - clay - water interaction – swelling; Identification and classification of expansive soils based on index properties - Correlations by various investigators – limitations - IS classification of expansive clays - free swell index.

UNIT-II

Swelling characteristics - Swell potential, percent swell - swelling pressure - factors affecting; Methods of measurement of swelling pressure - stress paths followed and field conditions - prediction of heave - factors affecting heave - Methods of predicting heave.

UNIT-III

Shear strength of expansive clays - flow of moisture - Principle of effective stress in partially saturated clays - Determination of χ – parameter - shear strength of partly saturated clays - Fredlund's strength parameters, Katti's work.

UNIT-IV

Foundation practices in expansive clays; Traditional methods - sand cushion method, belled pier, under reamed pile foundations - Construction and design concepts - CNS layer method of Katti - in-situ stabilization of expansive clays by lime - soil columns, lime - sand columns - Stone and granular columns - lime slurry pressure injection.

UNIT-V

Moisture control in expansive clays - Horizontal and vertical moisture barriers – Sub -surface drainage – pre - wetting and ponding - Stabilization of remoulded expansive clays - Lime stabilization - Stabilization with chemicals.

References

1. F.H.Chen "Foundations of expansive soils" Elsevier Publications
2. "Hand book of under –reamed pile foundations" Jain Publishers.
3. "Search for solutions to problems on Black –Cotton Soils" IGS annual lecture by R.K.Katti, Indian Geotechnical Journal, Vol. I, 1979.

ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES

UNIT - I

INTRODUCTION: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, and Environmental friendly and cost effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture.

UNIT - II

ALTERNATIVE BUILDING MATERIALS: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks. Concrete blocks. Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block

UNIT - III

a) LIME-POZZOLANA CEMENTS Raw materials, Manufacturing process, Properties and uses
b) Fibre reinforced concretes. Matrix materials. Fibers: metal and synthetic Properties and Applications, Fibre reinforced plastics, Matrix materials Fibers: organic and synthetic .Properties and applications Building materials from agro and industrial wastes. Types of agro wastes. Types of industrial and mine wastes. Properties and applications. Field quality control test methods

UNIT - IV

ALTERNATIVE BUILDING TECHNOLOGIES: Alternative for wall construction. Types, Construction method. Masonry mortars. Types. Preparation. Properties. Ferrocement and ferroconcrete building components Materials and specifications. Properties, Construction methods . Applications. Alternative roofing system. Concepts. Filler slabs. Composite beam panel roofs. Masonry vaults and domes

UNIT -V

1. 1. IS Code provisions 2. Design of masonry compression elements 3.Concepts in lateral load resistance
2. COST EFFECTIVE BUILDING DESIGN: Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost Analysis: Case studies using alternatives.

Textbooks:

1. Properties of Concrete-A.M.Neville. Pitman Publishing Limited-London.
2. Alternative building methodologies for engineers and architects, K.S. Jagadish and B.V.Venkatarama Reddy, Indian Institute of Science, Bangalore.
3. Structural Masonry by Arnold W. Hendry.
4. Light weight concrete- Academic kiado- Rudhai .G – Publishing home of Hungarian Academy of Sciences 1963.
5. Low cost Housing – G.C. Mathur.
6. Modern trends in housing in developing countries – A.G. Madhava Rao-D.S.Ramachandra Murthy & G.Annamalai

Reference Books:

1. Relevant IS Codes.
2. Alternative building materials and technologies.
3. Proceedings of workshop on Alternative building material and technology, 19th to 20th December 2003 @ BVB College of Engineering. & Tech.

FINITE ELEMENT ANALYSIS OF STRUCTURES

UNIT - I

1. Basic Principles

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

UNIT - II

2. 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

UNIT - III

3. 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

UNIT - IV

4. Plane-stress and Plane-strain analysis

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

UNIT - V

5. Analysis of plate bending

Basic theory of plate bending; Shear deformation plates; Plate bending analysis using four noded isoparametric element

Text books :

1. Finite element analysis by C.S.Krishnamurthy, Tata-McGraw-Hill, 1994.
2. Matrix and finite element analyses of structures by M.Mukhopadhay and A.H.Sheikh, Ane Books, 2004.
3. Concepts and applications of finite element analysis by R.D.Cook et.al., John Wiley and Sons, 1989.

PART-II
COMPUTER SCIENCE & ENGINEERING

ADVANCED DATA STRUCTURES AND ALGORITHMS

Unit I:
Lists, Stacks, Queues and Trees:
Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, vector and list in the STL, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT.
Trees: The Search Tree ADT - Binary Search Trees, AVL Trees, Splay Trees, B-Trees.

Unit II:
Hashing and Priority Queues: Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, d-Heaps, Leftist Heaps,Skew Heaps, Binomial Queues. Sorting: A Lower Bound for Simple Sorting Algorithms, Shellsort, Heapsort, Mergesort, Quicksort,Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting.

Unit III: The Disjoint Set Class:
Equivalence Relations, the Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case for Union-by-Rank and Path Compression, an Application. Graph Algorithms: Definitions, Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, Introduction to NP-Completeness.

Unit IV: Algorithm Design Techniques:
Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms. Amortized Analysis: An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.

Unit V: Advanced Data Structures and Implementation:
Top-Down Splay Trees, Red-Black Trees, Deterministic Skip Lists, AA-Trees, Treaps, k-d Trees, Pairing Heaps.

REFERENCE BOOKS

1. C & Data structures, N.B. Venkateswarulu, EV Prasad, S.Chand.
2. Data Structures and Algorithm Analysis in C++, 3/e, Mark Allen Weiss, PEA , 2007.
3. Data Structures Algorithms and Applications, 2/e, Sartaj Sahni, Universities Press, 2007.
4. Fundamentals of computer Algorithms, 2/e, Ellis Horowitz, Sartaj Sahni, Rajasekharan,
5. Universities Press, 2008.
6. Data Structures and Algorithms, Aho, Ullman, PEA.
7. Data Structures and Algorithms in JAVA, Adam drozdek, Cengage.
8. Data Structures with JAVATM, Hubbard, Huray, PHI,2009.
9. Data Structures, Gilberg, Forouzan, Thomson.
10. Fundamentals of Data structures algorithms and application Sartaj Sahni, University Press.

DATA MINING AND KNOWLEDGE DISCOVERY

Unit I: Introduction to Data Mining:
Types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data : Data Set, Summary Statistics, Visualization, OLAP and multi dimensional data Analysis. Classification: Basic Concepts, Decision Trees, and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: Due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier.

Unit II: Classification-Alternative techniques:
Nearest Neighborhood classifier, Bayesian Classifier, Support Vector Machines: Linear SVM, Separable and Non Separable case. Association Analysis: Problem Definition, Frequent Item-set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithms.

Unit III:
Handling categorical, continuous attributes, concept hierarchy, sequential, sub-graph patterns

Unit IV:
Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN. Cluster Evaluation: Overview, Un supervised Cluster evaluation using cohesion and separation, using the proximity matrix, Scalable clustering algorithms.

Unit V: Web Data mining:
Introduction, Web terminology and characteristics, web content mining, web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of web pages, Enterprise search.

REFERENCE BOOKS :
1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, PEA.
2. Introduction to Data Mining with Case Studies, GK Gupta , Prentice Hall.
3. Data Mining: Introductory and Advanced Topics, Margaret H Dunham, PEA, 2008.
4. Fundamentals of data warehouses, 2/e, Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer.
5. Data Mining Theory and Practice, Soman, Diwakar, Ajay, PHI, 2006.
6. Data Mining, Concepts and Techniques, 2/e, Jiawei Han , Micheline Kamber , Elsevier,2006.

DIGITAL IMAGE PROCESSING

Unit I: Digital Image fundaments:
Introduction, An image model, sampling & quantization, basic relationships between Pixels, imaging geometry. Image Transforms: Properties of 2 – D Fourier transform, FFT algorithm and other separable image transforms. Walsh transforms. Hadamard, Cosine, Haar, Slant transforms, KL transforms and their properties.

Unit II: Image Enhancement:
Background, enhancement by point processing, histogram processing, spatial filtering and enhancement in frequency domain, color image processing. Image filtering and restoration : Degradation model, diagnolisation of circulant and block circulate matrices, Algebraic approach to restoration, inverse filtering, least mean squares and interactive restoration, geometric transformations.

Unit III: Image compression:
Fundamentals, image compression modes, error free compression, lossy compression, image compression standards. Image segmentation: Detection of discontinuities, edge linking and boundary detection thresholding, region – oriented
segmentation, use of motion in segmentation.

Unit IV: Representation and description:
Various schemes for representation, boundary descriptors, and regional descriptors.

Unit V: Image Reconstruction :
Image reconstruction from Projections, Radon Transforms; Convolution/Filter back – Project Algorithms.

REFERENCE BOOKS
1. Fundamentals of Digital Image Processing, A.K.JAIN, PHI
2. Fundamentals of Digital Image Processing, Anna durai, shanmuga lakshmi, Pearson
3. Introduction to Digital Image Processing, Alasdair, McAndrew, Cengage
4. Digital Image Processing, 3/e, GONZALEX, WOODS, Addison Wesley
5. Digital Image Processing, Castleman, Pearson
6. Digital Image Processing, S Jayaraman, SEsakkirajan, T Veerakumar,TMH

NETWORK SECURITY

Unit I: 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.

Unit II: Crypto Graphic Algorithms (Block Cipher):
RC2, GOST, CAST, BLOW FISH, SAFEER, RC5, NEWDES, CRAB, Theory of Block Cipher design.

Unit III: 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,E-sign, Cellular Automata.

Unit IV: 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.

Unit V: Virus es and Threats:
Intruders, Viruses, Worms and Firewalls Intruders, Viruses and Related Threats, Firewall Design Principles, Trusted Systems.

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

OBJECT ORIENTED SOFTWARE ENGINEERING

Unit I: Introduction to Classical Software Engineering :
Historical, Economic and Maintenance aspects. Introduction to OO Paradigm. Different phases in structured paradigm and OO Paradigm. Software Process and different life cycle models and corresponding strengths and weaknesses. Planning and Estimation : Estimation of Duration and Cost – COCOMO components of software. Project Management plan – one case Study.

Unit II : Tools for step wised refinement :
Cost - Benefit analysis, Introduction to software metrics and CASE tools. Taxonomy and scope of CASE tools. Introduction to testing, with focus on Utility, Reliability, Robustness, Performance, Correctness. Modules to objects: Cohesion and Coupling, Data Encapsulation and Information hiding aspects of Objects. Inheritance, polymorphism and Dynamic Binding aspects. Cohesion and coupling of objects. Reusability, Portability and Interoperability aspects.

Unit III: Requirement phase:
Rapid Prototyping method, Specification phase - Specification Document- Formal methods of developing specification document- Examples of other semi - formal methods of using Finite-State- Machines, Petrinets and E- Language. Analysis phase: Use case Modeling - Class Modeling - Dynamic Modeling, Testing during OO Analysis.

Unit IV: Design phase:
Data oriented design – Object Oriented design – Formal techniques for detailed design. One case study. Challenges in design phase.

Unit V: IIM Phases:
Implementation , Integration and maintenance phases- OOSE aspects in these phases.

REFERENCE BOOKS
1. Object oriented and Classical Software Engineering, 7/e, Stephen R. Schach, TMH
2. Object oriented and classical software Engineering, Timothy Lethbridge, Robert Laganiere, TMH.

PART-II

ELECTRONICS & COMMUNICATION ENGINEERING

MICROWAVE ANTENNAS

1. **Antenna Parameters :** Radiation Patterns, Radiation Power Density, Radiation Intensity, Gain, Antenna Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna as an Aperture, Directivity and maximum Aperture, Friis Transmission Equation, Antenna Temperature.

2. **Reflector Antennas :** Plane Reflector, Corner Reflector, 90^o Corner Reflector, Other Corner Reflectors, Parabolic Reflector, Front – Fed Parabolic Reflector, Cassegrain Reflectros, Lens Antennas, Lenses with $n>1$, Lenses with $n<1$, Lenses with variable Index of Refraction.

3. **Antenna Arrays :** Introduction, Two Element Array, N-Element Linear Array – Uniform amplitude and Spacing, Broadside Array, Ordinary End – Fire Array, Phased Array, Hansen – Woodyard End – Fire Array, N-Element Linear Array- Directivity, Nonuniform Amplitude, Binomial Array – Design equations.

4. **Microstrip Radiators :** Definition of microstrip antenna, advantages and disadvantages of microstrip antennas, applications, Radiation mechanism and Radiation fields of microstrip antennas, excitation techniques.

5. **Rectangular microstrip patch antennas :** Introduction, Analysis of Rectangular patch radiators, The vector potential approach, Dyadic Green's Function Techniques the cavity model, Model Expansion Model, the transmission line model, Bandwidth Enhancement Techniques.

Textbooks:

1. J.D. Kraus, Antennas, MC Graw – Hill, ISE, 1988.
2. Constantine A. Balanis, "Antenna theory analysis and Design", John Wiley.
3. J.J. Bahl and Bhartia, "Microstrip antennas", Artech House, 1982.

References:

1. Samuel Silver, "Microwave Antenna – Theory and Design", IEE Press, London 1984.
2. James J. Hall, P.S. Wood, Microstrip Antenna – Theory and Design, 1

VLSI TECHNOLOGY & DESIGN

UNIT – I

BASIC ELECTRICAL PROPERTIES OF MOS, CMOS & BICOMS CIRCUITS: Ids-Vds relationships, Threshold voltage Vt, Gm, Gds and Wo, Pass Transistor, MOS,CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model,Latch-up in CMOS circuits.

UNIT – II

LAYOUT DESIGN AND TOOLS: Transistor structures, Wires and Vias , Scalable Design rules , Layout Design tools. Static complementary gates, switch logic, Alternative gate circuits, low power gates, Resistive and Inductive interconnect delays.

: UNIT – III

COMBINATIONAL LOGIC NETWORKS: Layouts, Simulation, Network delay, interconnect design, power optimization, Switch logic networks, Gate and Network testing.

UNIT – IV

SEQUENTIAL SYSTEMS: Memory cells and Arrays, clocking disciplines, Design ,power optimization, Design validation and testing.

UNIT – V

FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

Textbooks:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian et . al(3 authors) PHI of India Ltd.,2005
2. Modern VLSI Design, 3rd Edition, Wayne Wolf ,Pearson Education, fifth Indian Reprint, 2005.

References:

Principals of CMOS Design – N.H.E Weste, K.Eshraghian, Adison Wesley

IMAGE AND VIDEO PROCESSING

UNIT – I

Color image processing – Color models – color transformations – smoothing and sharpening – image segmentation based on color – color image compression.

UNIT – II

Video formation , perception and representation – color perception and specification – video capture and display – analog video raster – analog color television systems
Digital video – Fourier analysis of video signals and frequency response of the human visual system.

UNIT – III

Video sampling – sampling of video signals – video sampling rate conversion – video modeling, Two dimensional motion estimation

UNIT – IV

Video coding systems – waveform based video coding – content dependent video coding.
UNIT V

Video compression standards – Standardization, video telephony with H.261,H.263, Standards for visual communication systems, consumer video communications with MPEG-1, digital TV with MPEG-2, coding of audiovisual objects with MPEG -4, video bit stream syntax, multimedia content description using MPEG-7

Text Books:

1. Digital Image Processing – 3rd Editioin - Rafael C.Gonzalez, Richard E.Woods , Pearson Education, 2009. (For Unit –I only).
2. Video Processing and Communication – 1st edition - Yao Wang, J.Ostermann, Ya Zhang, Prentice Hall ,2001. (For Unit II,III and IV)

Reference Books:

1. Image processing, analysis, and machine vision, 2nd Edition,- Sonka M, Hlavac V, Boyle R. Brooks Cole publishing, 1999.
2. Multidimensional, signal, image and video processing and coding, - Woods, Elsevier, Academic press, 2006.

EMBEDDED SYSTEM DESIGN

Unit – I

An introduction to embedded systems: An embedded system, examples, current technologies, integration in system design, embedded system design flow, hardware design concepts, software development, processor in embedded system and other hardware units, introduction to processor based embedded system design concepts.

Unit – II

Devices in embedded system: I/o devices, timer and counting devices, ROM devices, serial communication devices and parallel communication devices, interrupts and their control of processors.

Programming concepts: Data types, data structures, modifiers, macros, functions, optimization of memory needs, embedded system tools – hardware and software development tools.

Unit – III

Program modeling concepts: Modeling process for software analysis, modeling of multi processor system, software algorithm concepts, software design, implementation and testing, validating and debugging, maintenance.

Unit – IV

Software design: Survey of software architecture – round robin, round robin with interrupts, function queue scheduling architecture, real time operating system architecture, selecting an architecture saving memory space, getting embedded software in target system, debugging technique.

Unit – V

Device drivers and interrupts servicing mechanism: Device drivers, parallel port and serial port drivers in a system, device drivers for internal programmable timing devices, interrupt servicing mechanism, dynamically linked libraries (DLL), context switching, latency principles.

Text Books:

a) Rajkamal, "Embedded system: Architecture, programming and design", TMH.
b) Frank Vahid, Tony D. Givargis, "Embedded system design: A unified hardware / software introduction", John wiley & sons Inc. 2002.

Reference Books:

David E Simon, " An embedded software primer".

WIRELESS COMMUNCIATIONS AND NETWORKS

UNIT I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS: Introduction to wireless communications systems, examples, comparisons & trends. Cellular concepts-frequency reuse, strategies, interference & system capacity, trucking & grade of service, improving coverage &capacity in cellular systems.

UNIT II

MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid techniques),SDMA technique(AS applicable to wireless communications).Packet radio access-protocols, CSMA protocols ,reservation protocols ,capture effect in packet radio , capacity of cellular systems .

UNIT III

WIRELESS NETWORKING: Introduction, differences in wireless & fixed telephone networks, traffic routing in wireless networks –circuit switching, packet switching X.25 protocol.

Wireless data services – cellular digital packet data (CDPD), advanced radio data information systems, RAM mobile data (RMD). Common channel signaling (CCS), ISDN-Broad band ISDN & ATM ,Signaling System no .7(SS7)-protocols, network services part, user part, signaling traffic, services & performance.

UNIT IV

MOBILE IP AND WIRELESS APPLICATION PROTOCOL: Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

UNIT V

WIRELESS LAN TECHNOLOGY: Infrared LANs, Spread spectrum LANs, Narrow bank microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer.

BLUE TOOTH : Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

Textbooks

1. Wireless Communication and Networking – William Stallings, PHI, 2003.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2nd Edn.,2002.
3. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy,Pearson Education, 2002.

References:

1. Wireless Digital Communications – Kamilo Feher, PHI, 1999

PART-II

ELECTRICAL & ELECTRONICS ENGINEERING

EE201 ANALYSIS OF POWER ELECTRONIC CONVERTERS

UNIT – I

AC to DC Converters: Single Phase Converters: Bridge type -Half controlled and Fully controlled converters –Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – power factor Improvements – Extinction angle control – symmetrical angle control – PWM – single phase sinusoidal PWM – Applications– single phase dual converters. **Three Phase Converters:** Bridge type– Half controlled and fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current– power factor Improvements – three phase dual converters – three phase - twelve pulse converters – applications.

UNIT – II

D.C. to D.C. Converters & Cycloconverters: DC to Dc Converters: Analysis of step-down and step-up dc to dc converters with resistive and Resistive inductive loads – Switched mode regulators – Analysis of Buck Regulators – Boost regulators – buck and boosts regulators. **Cycloconverters:** Single phase to single phase Cycloconverters – analysis of midpoint and bridge Configurations – Three phase to three phase Cycloconverters – analysis of Midpoint and bridge configurations – Limitations – Advantages – Applications.

UNIT – III

AC Voltage Controllers: Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive inductive- induced e.m.f. loads – ac voltage controllers with PWM Control – Effects of source and load inductances - Synchronous tap changers- Applications. Three Phase AC Voltage Controllers: phase AC voltage controllers – Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – applications.

Unit IV

Pulse Width Modulated Inverters(single phase): Principle of operation – performance parameters – single phase bridge inverter evaluation of output voltage and current with resistive, inductive and Capacitive loads – Voltage control of single phase inverters – single PWM – Multiple PWM – sinusoidal PWM – modified PWM – phase displacement Control – Advanced modulation techniques for improved performance – Trapezoidal, staircase, stepped, harmonic injection and delta modulation –Advantage – application.

Unit V

Pulse Width Modulated Inverters(three phase): Three phase inverters – analysis of 180 degree condition for output voltage and current with resistive, inductive loads – analysis of 120 degree Conduction – voltage control of three phase inverters – sinusoidal PWM – Third Harmonic PWM

– 60 degree PWM – space vector modulation – Comparison of PWM techniques – harmonic reductions – Current Source Inverter – variable d.c. link inverter.

Textbooks:

1. Power Electronics – Mohammed H. Rashid – Pearson Education –Third Edition – First Indian reprint 2004.
2. Power Electronics – Ned Mohan, Tore M. Undeland and William P. Robbins – John Wiley AND Sons – Second Edition

EE202 MODERN CONTROL SYSTEMS DESIGN

UNIT – I

A/D Conversion and the *z*-Transform, Pulse Transfer Functions of Single-Input, Single-Output Systems, Frequency Response of Single-Input, Single-Output Digital Systems, Stability of Single-Input, Single-Output Digital Systems, Performance of Single-Input, Single-Output Digital Systems

UNIT – II

Linear Optimal Control: The Optimal Control Problem, The general optimal control formulation for regulators, Optimal regulator gain matrix and the Riccati equation, Infinite-Time Linear Optimal Regulator Design, Optimal Control of Tracking Systems, Output Weighted Linear Optimal Control, Terminal Time Weighting: Solving the Matrix Riccati Equation

UNIT – III

Closed-Loop Compensation Techniques for Single-Input, Single-Output Digital Systems, State-Space Modeling of Multivariable Digital Systems, Solution of Linear Digital State-Equations, Design of Multivariable Systems.

UNIT – IV

Digital Control Systems Using Pole-Placement: Regulators, Observers, and Compensators, Linear Optimal Control of Digital Systems, Stochastic Digital Systems, Digital Kalman Filters, and Optimal Digital Compensators

UNIT – V

Advanced Topics in Modern Control: Robust, Optimal Control, Structured Singular Value Synthesis for Robust Control, Time-Optimal Control with Pre-shaped Inputs, Output-Rate Weighted Linear Optimal Control.

Textbooks

1. Modern Control Design With MATLAB and SIMULINK, Ashish Tewari, John Wiley & Sons, Ltd, 2002
2. Nijmeijer, H. and van der Schaft, A.J. Nonlinear dynamical control systems. Springer-Verlag, New York, 1990.
3. Kirk, D.E. Optimal Control Theory. Prentice-Hall, Englewood Cliffs, NJ, 1970
4. B.C.Kuo, Automatic control systems' (5th Edition), Prentice Hall of India, 1988.
5. Moderen Control Systems Theory , M.Gopal, Wiley(2nd Edition),1993,
6. Discrete-Time **Control systems** - **K**. **Ogata**, Pearson Education/**PHI**, 2nd Edition.

EE203 AC DRIVES & SPECIAL MACHINES

UNIT – I

Control of Induction motor drives at Stator side: Scalar control – Voltage fed inverter control – Open loop volts/Hz control – speed control 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.

UNIT – II

Control of Induction motor drives at Rotor side : Slip power recovery drives – Static Kramer Drive – Phasor diagram –Torque expression - Speed control of a Kramer Drive – Static Scheribus Drive – modes of operation.

UNIT – III

Vector control of Induction Motor Drives : Principles of Vector control – Vector control methods – Direct method of vector control – Indirect method of vector control – Adaptive control principles – Self tuning regulator – Model referencing control.

UNIT – IV

Permanent Magnet Brushless DC Motors : Construction in DC Motors, Difference between Mechanical and Economic Commutators, Hall Sensors, Optical Sensors, Multiphase Brushless Motor, Square Wave Permanent Magnet Brushless Motor Drives, Torque and EMF Equation, Torque-Speed Characteristics, Microprocessors Based Controllers.

UNIT – V

Permanent Magnet Synchronous Motors : Principle of Operation, EMF, Power Input & Torque Expressions, Phasor Diagram, Power Controllers, Torque-Speed Characteristics, Self Control, Vector Control, Current Control Schemes.

Textbooks:

1. Electric Motor Drives Pearson Modeling, Analysis and Control – R.Krishnan – Publications – 1st edition – 2002
2. Modern Power Electronics and AC Drives – B.K.Bose – Pearson Publications – 1st edition
3. Power Electronic control of AC Motors – MD Murphy and FG Turn Bull Pergman Press – 1st edition
4. Power Electronics and AC Drives – B.K.Bose – Prentice Hall, Eagle wood diffs New Jersey(– 1st edition
5. Power Electronic circuits, Devices and Applications – M.H.Rashid – PHI - 1995
6. Fundamentals of Electrical Drives – G.K.Dubey – Narora publications – 1995.
7. Power Electronics and Variable frequency drives – B.K.Bose – IEEE Press – Standard publications -1st edition – 2002.
8. Miller, T. J. E. – Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, 1989
9. Kenjo, T and Naganori, S. - Permanent Magnet and Brushless DC Motors, Clarendon Press, Oxford, 1989.

EE204 POWER SYSTEM STABILITY & CONTROL

UNIT-I

SYNCHRONOUS MACHINE MODELING: Park's Transformation-Flux Linkage Equations-Voltage Equations-Formulation of State Space Equations-Current Formulation-Per Unit Conversion-Torque, Swing & Power Equations-Equivalent Circuit of a Synchronous Machine-Simplified Models of the Synchronous Machine- Simplified Linear Model- Block Diagrams-Steady State Equations and Phasor Diagrams-Machine Connected to an Infinite Bus through a Transmission Line.

UNIT-II

EXCITATION SYSTEMS: Elements of an Excitation System- Types of Excitation Systems-Modeling of Excitation Systems- Hydraulic Turbines and Governing Systems- Modeling of Steam Turbines.

UNIT-III

SMALL SIGNAL STABILITY: Small Signal Stability of A Single- Machine Infinite Bus System- Effects of Excitation System- Power System Stabilizer.

UNIT-IV

TRANSIENT STABILITY: System of one Machine against an Infinite Bus - Equal Area Criterion - Classical Model of a Multi machine System -Classical Stability Study of a Nine Bus System.

UNIT- V

VOLTAGE STABILITY:

Basic Concepts Related to Voltage Stability – Voltage Collapse – Voltage Stability Analysis – Prevention of Voltage Collapse.

Reference Books:

1. Power System Stability and Control – Prabha Kundur, TATA McGRAW – HILL.
2. Power System Control and Stability – P. M. Anderson & A.A. Fouad , Volume I, IOWA State University Press.
3. Power System Dynamics Stability & Control – K.R.Padiyar, 2nd Edition, B.S. Publication 2002.
4. Power System Stability by Kimbark, Vol- I, II & III – 1968, Dover Publication Inc, Newyork-1968.

EE205 HVDC & FACTS

UNIT I

INTRODUCTION: Comparison of AC and DC Transmission Systems, Application of DC Transmission Systems, Types of dc links, typical layout of a HVDC Converter Station. **ANALYSIS OF HVDC CONVERTERS:** Pulse number, Analysis of three phase Bridge Circuit with and without overlap, Converter Bridge Characteristics Equivalent Circuits of Rectifier and Inverter Configurations, Twelve Pulse Converters.

UNIT II

CONVERTER AND HVDC SYSTEM CONTROL: Principles of DC link Control, Converter Control Characteristics, System Control Hierarchy, Firing Angle Control, Current and Extinction Angle Control, Starting and Stopping of DC link. **HARMONICS AND FILTERS: I**ntroduction, Generation of Harmonics, Design of AC filters DC Filters.

UNIT III

HARMONICS AND FILTERS: Introduction, Generation of Harmonics, Design of AC filters DC Filters. **POWER FLOW ANALYSIS IN AC/DC SYSTEMS:** Introduction, Modeling of DC Converters Controller Equations, Solution of AC/DC load flow Simultaneous Approach and Sequential Approach.

UNIT IV

FACTS CONCEPTS: Flow of Power in AC parallel paths and Meshed Systems, Basic types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers. **STATIC SHUNT COMPENSATORS:** Objectives of Shunt Compensation, Methods of Controllable VAR generation, Static VAR Compensators- SVC and STATCOM Comparison.

UNIT V

STATIC SERIES COMPENSATORS: Objectives of Series Compensations – Variable Impedance Type - TCSC and TSSC, Switching Converter Type Series Compensators- SSSC- Power Angle Characteristics-Basic Operating Control schemes - Modeling for load studies. **COMBINED COMPENSATORS:** Introduction, UPFC – Basic operating principle, Independent real & reactive power flow controller, Control structure.

Text Books:

1. HVDC transmission by Adamson and Hingorani.
2. HVDC transmission by J.Arrillaga, Peter Peregrinus
3. HVDC power transmissions systems: Technology and system interactions by K.R.padiyar, New age Internationsl (P) Ltd.
4. Understanding FACTS Concepts and Technology of Flexible AC Transmission Systems, Narain G. Hingorani & Laszlo Gyugyi, IEEE Press, 2000.

Reference Books:

1. Direct Current transmission by E.W.Kimbark, John Wiley
2. Power Transmission by Direct Current by E.Uhlmann, Springer-Verlag
3. HVDC power converters and systems by B.J.Cory and Mc Donald
4. EHVAC and HVDC transmission engineering and practice by S.Rao
5. Facts Controllers in Power Transmission and Distribution- K. R. Padiyar, New Age International (P) Limited, Publishers, 2007.

PART-II

MECHANICAL ENGINEERING

1. FINITE ELEMENT ANALYSIS

Unit I

Stress Analysis :

Stress and Equilibrium , Boundary Conditions , Strain and Displacement Relations , Stress – Strain Relations , Plane Stress and plane strain Analysis, Temperature effects , Saint venant 's principle , Von misses Stresses

Unit II

Finite Element formulation from governing differential Equations :

Principle of Minimum Potential Energy and Rayleigh-Ritz Method.

Weighted Residual Methods: Point collocation Technique, Sub domain collocation method , Least squares Method , Galerkin's Method related Problems

Unit III

Finite Element Method :

Introduction , Objectives , Historical Background , Advantages of FEM , Engineering Applications of FEM , Finite Element Modeling , Basic procedure in FEM , Types of Elements , Discretization

Stiffness Matrix : Properties , Local Vs Global Stiffness Matrix

Shape Functions : Concept , Linear Shape Function , Quadratic Shape Function.

Unit IV

One Dimensional Problems : Introduction , Shape functions for 1D Problems , Stiffness and Force Matrices , Boundary Conditions , Temperature Effects , Problems

2D Trusses : Introduction , Derivation of Element Stiffness matrix , Stress Calculations , Temperature Effects, Problems

Beams : Introduction , Formulation, Load Vectors ,Boundary Considerations , Shear Force and Bending Moment , Simple Problems

Unit V

Dynamic Considerations :

Introduction , Spring Mass System , Formulation of Mass Matrices for 1D Bar , Truss , Beam Elements. Evaluation of Eigen values and Eigen Vectors by using Characteristic Polynomial Method. Simple Problems.

Text Books :

1. **"Introduction to Finite Elements in Engineering" ,** T.R. Chandrupatla & A.D. Belegundu , PHI , New Delhi.
2. **"Text Book of Finite Element Analysis" ,** P.Seshu , PHI , New Delhi.
3. **"Introduction to Finite Element Analysis" ,** S.Senthil , Lakshmi Publications , Chennai.

2. THERMAL ENGINEERING

Unit – I : **I.C. Engines and Gas Turbines**

Classification- comparison between Otto & Diesel cycles- combustion in SI and CI engines- Fuel supply systems in SI and CI engines- Reciprocating compressors, effect of multi-staging-Rotary compressors, types, working, work input, stalling- Gas turbines, Brayton cycle and its modifications, efficiencies and work output.

Unit – II : **Refrigeration & Air Conditioning**

Bell-Coleman cycle - Vapour compression cycle, applications, effect of various modification-Vapour absorption cycle-Properties of moist air, methods of air conditioning – Heat load calculations – winter and summer air conditioning.

Unit – III : **Heat Transfer**

One dimensional steady state heat conduction in slabs, pipes, composite walls, insulated pipes and fins - heat transfer in laminar and turbulent flows over flat plates and in pipes -natural convection - principle of radiant heat transfer, radiant heat transfer between black bodies and grey bodies – design of heat exchangers.

Unit – IV : **Nuclear Power Plants**

Controlled chain reactions - fissile and fertile fuels - components of nuclear reactors,-principle and working of BWR, PWR and FBR - nuclear waste disposal

Unit – V : **Alternate Energy Sources**

Solar Energy – collectors, solar pond - storage of solar energy - applications of solar energy - PV cells, advantages and disadvantages.
Fuel cells – principle of operation, types, constructional features.
Wind Power – Principle, types, advantages and disadvantages.
Hydrogen and Bio-Diesels – suitability for IC Engines, types, sources, effect on environment.

Textbooks :

1. Thermal Engineering by R.K.Rajput – Laxmi publications
2. An Introduction to Power plant technology by G.D. Rai - Khanna publications
3. Heat transfer by Y.A.Cengel – Tata McGrahill
4. Non-Conventional Energy resources by Dubey & Bhargava – Dhanpath Rai

3. MANUFACTURING ENGINEERING

UNIT-I **Metal Casting**: Casting terms, Sand Mould making Procedure, Pattern Allowances, Types of Pattern. Composition, Properties and Testing of Moulding Sand Properties. Elements of Gating System. Defects in Casting. Special Casting Processes like Shell moulding, Precision Investment Casting, Die Casting, Centrifugal Casting and Continuous Casting.

UNIT-II **Metal Forming**:- Advantages and disadvantages of hot and cold working processes. Rolling principle, rolling stand arrangement. Forging principle, types of forging. Extrusion principle, types of extrusion. Sheet metal operations – Classification of Presses and Press operations; shearing operations; different types of dies; Clearance, Cutting Force, Methods of reducing Cutting force; Scrap Strip Layout.

UNIT-III **Metal joining processes**:- Welding terms, Welding joints and types of welding. Edge preparations; Principle of gas welding, Resistance welding and electric Arc welding. Principle and set up of TIG, MIG, SAW, AHW, PAW.

UNIT-IV **Machining processes**:- Mechanics of machining(Chip Formation), tool geometry, tool life and tool wear, Principal elements of Metal Machining and their selection. Heat generation and temperature distribution in metal cutting. Required characteristics of cutting fluid. Principles of work holding, principles of design of jigs and fixtures. unconventional machining process – EDM, ECM, WJM – mechanism of metal removal, characteristic features and application in each case. Rapid Prototyping-Principle, methodology, equipment and applications.

UNIT-V **Automation and computer aided manufacturing**:- Automation in production systems, manufacturing operations – processing, assembly and other factory operations. Basic components of NC system, classification of NC system, features of CNC & DNC. Applications, advantages and disadvantages of NC. Group technology – part families, parts classification and coding, features of parts classification and coding system. Flexible manufacturing systems – types, layout configurations, applications and benefits of FMS. Advanced manufacturing technique -

Text Books:

1. Manufacturing science by AMITABHA GHOSH AND MALLICK, Allied pub.
2. Machining and manufacturing process by P.N.RAO, TMH.
3. Automation, production systems and computer integrated manufacturing – M.P.GROVER, Pearson's education, PHI.
4. CAD/CAM by M.P.GROVER, AND E.W.ZIMMIERS, Pearson's education, PHI.
5. CAD/CAM by P.N.RAO, TMH.
6. PRODUCTION TECHNOLOGY by P.C.SHARMA, S.Chand & Company.

4. OPTIMIZATION AND INDUSTRIAL ENGINEERING

UNIT – I : OPTIMIZATION METHODS

Engineering applications of optimization, statement of optimization problems, classification of optimization problems. Classical Optimization: Lagrange Multipliers, Kuhn-Tucker conditions. Linear programming: Simplex method, Artificial starting solution, M-Technique, Two-Phase technique, Dual simplex method. Dynamic programming: Characteristics of a Dynamic Programming problem, Deterministic Dynamic Programming. Integer Programming: Branch and Bound Technique. Non-Linear Programming: Fibonacci method, Golden Section method, Quadratic Interpolation Method.

UNIT-II: DEMAND MANAGEMENT AND PRODUCTION PLANNING AND CONTROL

Basic categories of forecasting methods, Extrapolative methods, Components of Demand, Moving average method, Exponential smoothing method, Regression and Correlation. Forecasting errors.
Operations Decision making: Break – Even analysis, Decision theory and expected value criteria. Decision trees. Statistical models , equations for continuous and discrete data.
Product Life cycle, Intermittent and continuous productions systems. Aggregate production planning.

UNIT – III: INVENTORY AND SUPPLY CHAIN MANAGEMENT

Make-or-buy decisions. Dependent and independent demand. Inventory costs. Economic Order Quantity(EOQ). Quantity discounts. Stochastic inventory models.
Definition of supply chain, Supply chain integration, demand forecasting in supply chain, Inventory management in supply chain, Managing demand and supply in a supply chain, Measuring supply chain performance, Information Technology in supply chain.

UNIT IV: JOB DESIGN AND WORK MEASUREMENT

Overview. Specialization an Engineering d automation. Approaches to job design, human concerns in work systems, compensation, Legal and ethical considerations. Work Methods and Motion Economy. Work measurement objectives. Time-study equations. Statistical sample size. Adjustments,allowances and standard times. PMTS, Work Sampling, Sample size for work sampling.

UNIT V: ADVANCED TOPICS IN OPTIMIZATION AND INDUSTRIAL ENGINEERING

Introduction. Basics of Artificial Neural Networks. Activation and Synaptic Dynamics. Functional Units of ANN for Pattern Recognition Tasks. Feed forward Neural Networks. Feedback Neural Networks. Competitive Learning Neural Networks. Architectures for Complex Pattern Recognition Tasks. Applications of ANN.
Genetic algorithms: Working Principles, GAs for Constrained Optimization
Simulated Annealing: Introduction, Methodology and Applications

Text Books:

1. Modern Production Operations Management, Elwood Spencer Buffa, Eighth Edition, John Wiley & Sons, Australia
2. Schaum's Outlines "Operations Management", Joseph G Monks, Second Edition, McGraw Hill
3. Engineering Optimization Theory and practice, S.S. Rao, New Age International Limited.
4. Introduction to Operations Research, Hilloer & Lieberman, Seventh Edition, TMH.
5. Operations Research, Hamdy A Taha, Pearson Education
6. Artificial Neural Networks, Yagananarayana B, PHI
7. Optimization for Engineering Design: Algorithms and Examples,Kalyanamoy Deb, PHI

5. ADVANCED MATERIALS AND PROCESSING

UNIT I

Crystallography: Classification of crystals – Bravi's lattices – Miller Indices – Packing factor in cubic systems – coordination number – crystal imperfections – crystal deformation – Slip and Twinning – Fracture Mechanisms

Phase Diagrams: Binary phase diagrams – Phase rule – one component system, two component system, isomorphism, eutectic, eutectoid, peritectic and peritectoid systems, concept of Ternary diagrams.

UNIT II

Heat Treatment of Steels: Iron–Iron carbide equilibrium diagram, TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformation.

Heat Treatment Processes: Annealing, normalizing, hardening, tempering, surface hardening, age hardening, austempering, martempering and hardenability concept and experimental determination.

UNIT III

Ferrous and Non Ferrous Alloys: Composition, properties and application of ferrous and non ferrous metals and their alloys. Study of cast iron, steels and copper, aluminum and titanium alloys, Nano materials – Introduction and Applications

UNIT – IV

Polymers and polymerization: Structure and properties of thermoplastics and thermosets – engineering applications – property modifications – mechanical, thermal behavior – composites with polymer matrix- ceramics – glasses – glass ceramics – fabrication methods – metal matrix and ceramic matrix composites.

UNIT – V

Processing of polymers: Fabrication of composites- processing of ceramics – thermal spraying – ion beam machining – laser and electron beam processing – super plastic forming – thin films and their deposition- diamond coating techniques – tribological applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Avner, McGrawHill
2. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI.
3. Material s for Engineers and Technicians – Reymond and Higgins, Elsevier publications
4. Analysis and performance of Fiber Composites – B.D. Agarwal & L.J. Broutman, John willey & Sons Inc.
5. Manufacturing Engineering & Technology – Kalpukjain & Schmid,

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