M.E. (FULL-TIME)/
M.TECH. (FULL-TIME)

Prospectus No. 101727

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

अभ्यासक्रमिका

(FACULTY OF ENGINEERING & TECHNOLOGY)

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SANT GADGE BABA AMRAVATI UNIVERSITY AMRAVATI

SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinances Booklet the various conditions/ provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	:	Enrolment of Students.
Ordinance No. 2	:	Admission of Students
Ordinance No. 4	:	National cadet corps
Ordinance No. 6	:	Examinations in General (relevent ex-tracts)
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Ordinance No. 9	:	Conduct of Examinations (relevent extracts)
Ordinance No. 10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission of Candidates to Degrees.
Ordinance No. 109	:	Recording of a change of name of a University student in the records of the University.

Ordinance No. 6/2008	:	For improvement of Division/Grade.
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

J.S.Deshpande
Registrar
Sant Gadge Baba
Amravati University.

SYLLABUS
PRESCRIBERD FOR
MASTER OF ENGINEERING (CIVIL)
(STRUCTURAL ENGINEERING)
(FULL TIME)
SEMESTER : FIRST

1S FSE1 ENGINEERING MATHEMATICS

SECTION A

1. Solution of algebraic and transcendental equations:
2. Bisection method, Newton's method, Newton-Raphson method, Simple iteration method, Conditions for convergence, simultaneous non linear equations.
3. Numerical solution of 1^{st} , 2^{nd} order & two simultaneous 1^{st} order differential equation by Runga Kutta method
4. Optimization Technique: Mathematical formulation of the problem, graphical presentation, slack and surplus variables, Linear programming, Simplex method, Maximization and minimization problem, dual problem, structural features, introduction to non-linear programming.
5. Calculus of variations: Functionals, Euler's equation derivation of governing differential equation from Euler-Lagrange equation.

SECTION B

6. Numerical solution of partial differential equations: Boundary value problems

   i) $\dfrac{\partial^2 \mu}{\partial x^2} + \dfrac{\partial^2 \nu}{\partial y^2} = 0$

   ii) $\dfrac{\partial^2 \mu}{\partial t^2} = \dfrac{C^2 \partial^2 \mu}{\partial x^2}$

   iii) $\dfrac{\partial \mu}{\partial t} = \dfrac{C^2 \partial^2 \mu}{\partial x^2}$

7. Numerical integration by Gauss's quadratur, Gauss points & weightages 1, 2 & 3 degree , linear simultaneous equation by Gauss & Gauss Jorden method
8. Spline interpolation : spline function, properties, boundary condition use for minimisation.

9. Introduction to reliability theory. Eigen values & Eigen vectors: standard & general Eigen values problem
10. Power iteration method, Jacobi method, use of Ritz –Vase vectors, sub space iteration method.

BOOKS:

1. Pipes: Advanced Mathematics for Physicists and Engineers
2. S. S. Rao: Optimization, Theory and Applications
3. Grewal: Higher Engineering Mathematics

1S FSE2 THEORY OF PLATES AND SHELLS

SECTION A

1 Plate: Classification- Thin and thick plates, small and large deflections, Assumptions in theory of thin plates with small deflection, Governing Differential equation in Cartesian coordinates, moment curvature relations, stress resultants.

2 Rectangular plates: Navier solution for plates with all edges simply supported, Distributes loads. Point loads, rectangular patch load, Green function.

3 Rectangular plates: Levy's method, Distributed load, line load.

4 Energy method: Minimum potential theorem Rayleigh-Ritz approach for simple cases.

5 Circular Plates: Governing Differential equation in Polar coordinates, Axi- symmetric situation, moment curvature relations, simply supported and fixes edge, distributes load, line load, linearly varying load.

SECTION B

SHELLS

6 Introduction to thin shell theory, classification on shell geometry, equation to shell surfaces, stress resultants, stress- displacement relations, compatibility Conditions, equilibrium equations.

7 Circular cylindrical shells: Membranes theory

8 Bending theory for circular-cylindrical shell, design procedure.

9 Shells of revolution: membrane theory, spherical and conical shells with axisymmetric loading.

10 Simple methods of analysis and design for conoidal and hyperbolic paraboloidal shells.

Books:

1. S. P. Timoshemkoo & W. Kriger: Theory of Plates and Shells
2. Jaeger: Theory of Plates

3. Szilard: Theory and Analysis of Plates
4. Flugge: Analysis of Shells
5. G. Ramaswami: Theory and Design of RC Shells

1S FSE3 COMPUTER METHODS OF STRUCTURAL ANALYSIS

(FORTRAN / C Language)

SECTION A

1. Finite difference method, operators for 1 & 2-D problems , application to beam & plate under static loads, different boundary conditions.

2 Memory problems in large structural systems: Incore and outcore Techniques, half band storage and solution, SK line storage and solution. Tri-diagonalisation , partial and full block elimination.Tape operations, frontal technique. Sub-structure method.

3 Flexibility method (Structure approach): - Flexibility coefficients, physics Meaning, basic determinate or released structure, choice of redundant,Geometrical compatibility conditions. Matrix formulations, Hand Solution of simple problems on truss. beams, frames, grids with loads. Settlement of supports, elastic support.

SECTION B

4 Stiffness methods (structure approach) Stiffness co-efficient, restrained structure, Unknown displacements, Joint equilibrium conditions. Hand solution of simple problems on beam, frames with out axial deformation.

5. Stiffness methods (member approach) General strategy, Large structure, Forces and displacement referred to member and structure axes, transformation member and structure stiffness matrices, assembly process, equivalent joints loads, displacement boundary condition, joint equilibrium equations, solution half band from of structure stiffness matrix. Application to pin jointed plane and space trusses, beams, frames, and grids.

6. Computer Programs: - Flow charge and computer programs for member based stiffness method-Data preparations, Various alternative, Displacement code, half band width, calculation of forces.

PRACTICAL: Practical will consist of assignments and programs based on above theory.

BOOKS:

1. John Meek: Matrix Structural Analysis
2. Beaufuit: Basic Concept Of Structural Analysis
3. Gere- Weaver: Analysis Of Framed Structures
4. Mc Crackel D D: & Dorn W. S.: Numerical Methods And FORTRAN Programming

5. Martin: Introduction To Matrix Methods Of Structural Analysis
6. R. K. Livesley: Matrix Methods Of Structural Analysis
7. J. F. Elemming: Computer Analysis Of Structural Systems
9. Dr.A.S.Meghre & S.K. Deshmukh : Matrix Method Of Structural Analysis.

1S FSE4 ADVANCED STRUCTURAL ANALYSIS

SECTION A

1. Cantilever moment distribution method, principles of multitudes, application to parallel chord Virendeel girder.Modified moment distribution method.

2. Beams on elastic foundations: Governing differential equation, solution for finite and infinite beams, energy method.

3. Approximate methods of analysis: (a) Portal method, (b) Cantilever method, (c) Factor method

4. Energy Theorems: Energy and complementary energy, revision of various energy theorems, principle of virtual displacement for elastic structures, total potential energy of structures, minimum potential enrrgy theorem

5. Rayleigh- Ritz approach, application to beams, trusses, beams on elastic foundations.

SECTION B

6. Introduction to earthquake engineering and technology. Structural response to earthquake, analysis of multistoried frames by I.S. code provision.

7. Analysis of Beams curved in plan

8. Theory of stresses & strains, basic equation of theory of elasticity, state of stress at a point, stress equilibrium equation (treatment in Cartesian co-ordinates) Differential equation of equilibrium , stresses strains & displacement in polar co-ordinates

9. Strain components, stress-strain relationship, generalized hooks law, plane stress & plane strain conditions , compatibility equations for 2-D

10. Airy's stress function, Principal planes & principal stresses in 3-D . Typical simple applications to bars in tension, bending, torsion. Plates with hole.

BOOKS:

1. J.A.L. Matheson: Hyperstatic structures
2. S. P. Timoshenkoo: Advanced Strength of materials
3. M. Heteny: Beams on elastic foundation

4. T.R.Taucher: Energy principles of structural mechanics
5. N. J. Hoff: The analysis of structure
6. Norris & Wilbar : Elementary structural analysis

1S FSE5 ADVANCED CONCRETE STRUCTURES

Note: The candidate should solve two questions out of any three from each section.

SECTION A

1 R.C.C. Structures by limit state methods IS 456-2000.
Design of portal and gable frames(Symmetric and upto two bay two storied)

2 Silos and bunkers: lateral pressure as per Johnson's and Airy's theory, design consideration for square, rectangular and circular shapes, Design of hoppers and supporting structures.

SECTION B

3 Grid and coffered floors: general features, analysis of grid floors and design.
Virendeel girders: General features, analysis of Virendeel girders. Design of members.

. Analysis and Design of Elevated reservoir with special reference to circular and intze tank and staging

Note : Candidate should use the latest IS codes

PRACTICAL: Practical will be consist of design and drawings based on above theory

BOOKS:

1. Purushothamam: Reinforced concrete structural elements
2. P. Dayaratnam: Design of reinforced concrete structures
3. A. K. Jain: Reinforced concrete (by Limit State Method)
4. N. Krishnaraju: Prestress concrete
5. N. Krishnaraju: Advanced reinforced concrete design
6. Shaha & Karve: Limit state method

SEMESTER : SECOND

2S FSE1 FINITE ELEMENT METHOD

SECTION A

1. Continuum Structures, discretisation, finite elements, nodes, variational principals, Minimum potential theorem, relation to Rayleigh- Ritz method.
2. Interpolation, Lagrangian, Hermitian shape functions, natural coordinates, area and volume coordinates, coordinate and derivative transformation.

3. 2-D Plane stress and plane strain analysis, constant strain triangle, rectangle: 3-D analysis, tetrahedral and parallelepiped elements.
4. Axi-symmetric solids with axi-symmetric loading, ring elements.
5. Plate bending elements using thin plate theory, C1 continuity, rectangle 12 dof ACM, 16 dof Bogner Fox and triangular 9 dof Brazley elements, general survey of other elements.

SECTION B

6. Thin shallow shells, rectangle elements, cylindrical shell axi-symmetric shell with axi-symmetric loading, conical frustum element.
7. Isoparametric elements, plane stress, plane strain and solids, numerical integration.
8. Plate bending elements, Co continuity, Hinton element. Ahmed shell element for general shell analysis.
9. Beam, straight with c1 and Co continuity, numerical integration to cater for membrane, bending and torsion combination, cable elements 2D and 3D.
10. Programming aspects, geometry, connectivity, code number, alternate data types, half band, data preparation, flow chart, typical sub-routines for assembly, shape functions, stiffness matrix solution of equation.

PRACTICAL: Practical will consist of assignments based on above theory.

BOOKS:

1. O. C. Zienkiewicz: Finite Element Method in Engineering Sciences (Vol I, II)
2. C. S. Desai, J. F. Abel: Introduction to the Finite Element Method
3. R. D. Cook: Concept and Applications of Finite Element Analysis
4. Bathe- Wilson: Numerical Methods of Structural Analysis
5. N. R. Patwardhan: Illustrated Finite Element Method
6. Rockey, Evans, Griffths, Nethercoat: The Finite Element Method a Basic Introduction
7. E. Hinton, DRJ Owen: Finite Element Programming, Academic Press
8. C. S. Krishnamoorthy: Finite Element Analysis Theory & Programming

2S FSE2 ADVANCED DESIGN OF STEEL STRUCTURES

Note: The candidate should solve two questions out of any three from each section.

SECTION A

1 : a) Design of Foot Bridge (N-Truss or Pratt)
b) Analysis and design for transmission tower lines

2 : a) Design for self supporting steel chimneys and its foundations
b) Design of through type truss bridge member for dead load and equivalent live load including top, bottom bracings and portal bracing

SECTION B

3 : Design of industrial buildings including gantry girder , gantry column, design of knee braces

4 : a) Design of North light trusses and Lattic girder .
b) Design of elevated rectangular, square pressed steel tanks and staging

Note : Candidate should use the latest IS codes

PRACTICAL: Practical will be consist of design and drawings based on above theory

BOOKS:

1. Ramchandra: Design of Steel Structures Vol. I & II
2. ISI Handbook
3. M. Raghupathi: Design of Steel Structures
4. S. K. Duggal: Design of steel Structures
5. Vazirani – Ratwani: Steel Structures
6. Arya Ajmani: Steel Structures
7. Punmia: Steel Structures

2S FSE3 SRTUCTURAL DYNAMICS

SECTION A

1. Single degree freedom system, free vibrations, damped free vibrations, critical damping, and response, periodic loading expressed in harmonics, dynamic load factor.
2. Single degree freedom system, response to impulsive loading, rectangular, triangular pulses, Duhamel Integral. Response to general dynamic loading, Numerical schemes such as Wilson-Theta, Newmark-Beta, constant linear acceleration, time domain and frequency domain analysis.
3. Multi-degree freedom system, stiffness and flexibility approaches, Lumped-mass matrix, free vibrations fundamental Frequencies and mode shapes, orthogonality of modes,numerical schemes to find mode shapes and frequencies.

SECTION B

4. Multi degree freedom systems, response to dynamic loading, Formulations of equations of motion, normal coordinates, mode superposition method, modal matrix, numerical scheme of Wilson and Newmark.

5. Distributed systems, free vibrations of uniform beams,,diffential equation and Solution boundary conditions, finite difference solution, finite element, Rits Approach free vibrations of simply supported plate. (Transverse vibrations)
6. Structural response to earthquake, wind and ground motion characteristics Response spectrum design earth quake, IS code provisions for multistory frames.

PRACTICAL: Practical will consist of assignments based on above theory.

BOOKS:

1. R. W. Clough:, J. Penzian: Dynamics of Structures
2. J. M. Biggs: Structural Dynamics
3. L. S. Jacobsen R. S. Arye: Engineering Vibrations
4. S. P. Timoshenkoo: Vibration Problems in Engineering
5. G. B. Warburden: The Dynamical Behaviour of Structures

2S FSE4 PRESTRESSED CONCRETE

SECTION – A

1. Analysis and design of single span Rectangular beams including shear , bond and deflection.
2. Analysis and design of end block.
3. Analysis and design of I beams and composite section.
4. Shear , bond and deflection in prestressed concrete member.
5. Analysis and design of continuous beams up to two spans linear transformation, concordant cable.

SECTION – B

6. Design and analysis of prestressed concrete pipes and circular tank.
1. Design of poles , dams and sleepers.
2. Analysis and design of portal frame, single storey and limited to two bays.
3. Design of prestressed concrete bridges for I.R.C. loading or equivalent uniformly distributed loads.
4. Grouting of beams , fire resistance of beams , special problems like stress corrosion , fatigue under dynamic loading etc.

BOOKS RECOMMENDED:-

1) N . Krishna Raju : Prestressed Concrete, CBS
2) T. Y. Lin : Prestressed Concrete, TMH

2S FSE5 ELECTIVE

(1) EXPERIMENTAL STRESS ANALYSIS

SECTION A

1. Stress Analysis by photo elasticity, Light, polorisation of light , bi-fringence poloriscope optics of poloriscope , stress optics law, isoclinics, isochromatics.
2. 2-D photoelasticity, Compensators, Compensation techniques, separation of principal stresses, analytical and experimental methods, typical model studies.
3. 3-D techniques, stress freezing and scattered light techniques.
4. Sress analysis by strain measurement, Mechanical, Optical, Acoustical strain gauges, strain gradients.
5. Electrical resistant strain gauges, various types, material mounting of gauges, Rosette and Rosette analysis, gauge factor , Wheat stone bridge , temperature compensation , strain recording instruments, bridge configuration and sensitivity

SECTION B

6. Model Analysis – Direct and indirect methods, prototypes and model similarities, dimensional analysis, Pie theorem, influence lines, Beggs and other deformeter,
7. Brittle coating method
8. By refringent coating method
9. Moire fringe method

PRACTICAL: Practical will consist of assignments based on above theory.

BOOKS:

1. Rally-Dally: Experimental Stress Analysis
2. P. H. Adam, R. C. Dove: Experimental Stress Analysis and Motion Measurements
3. M. Heteny: Hand book of Experimental Stress Analysis
4. A. W. Henry: Experimental Stress Analysis
5. H. I. Langhar: Dimensional Analysis and Theory of Models

2S FSE5 ELECTIVE

(2) STRUCTURAL STABILITY

SECTION A

1. Concept of stability: stable, unstable and neutral equilibrium, energy criteria for stability and method of stability analysis.
2. Elastic buckling of columns, uniform and varying section volumns, finite Difference method, Rayleigh-Ritz method.

3. Buckling of continuous beams.
4. Buckling of frames, neutral equilibrium method, matrix approach, moment Distribution method.

SECTION B

5. Torsional buckling of columns, pure torsion of open sections, torsion-flexure buckling of symmetric and unsymmetric columns (hinged end only)
6. Lateral backling of beams, thin rectangular and I sections, pure bending.
7. Buckling of thin plate subjected to inplane edge forces, governing equation, finite difference method.

PRACTICAL: Practical will consist of assignments based on above theory.

BOOKS:

1. S. Timoshenkoo, J. N. Gere: Theory of Elastic Stability
2. Alexander Chajes: Principles of Structural Stability

2S FSE5 ELECTIVE

(3) SOIL STRUCTURE INTERACTION

SECTION A

1 Soil-structure interacting problem: Soil behavior foundation behavior, interface behavior, idealized soil response model ,Winkler model ,elastic continuum model.

2 Beams on elastic foundation: conventional approach governing differential equation, finite difference method, energy approach.

3 Plates on elastic foundation: conventional approach, finite difference method and energy method.

SECTION B

4 Finite clement method: Interactive method, interface line and surface elements, boundary elements, infinite elements.

5 Program organization: discretisation, flow charts, data preparation, typical subroutines.

PRACTICAL: Practical will consist of assignments based on above theory.

BOOKS:

1. A.P.S. Salvadory, E. Lsevier: Elastic analysis of soil foundation interaction
2. Heteny: Beams on Elastic Foundation
3. S. Timoshenkoo: Theory of plates and shells

4. C. S. Desai, J. Y. Christian: Numerical methods in geotechnical engineering
5. Bowles: Analytical and computer methods in foundations

2S FSE5 ELECTIVE

(4) EARTHQUAKE RESISTANT STRUCTURES

SECTION A

1. Interior of earth, Engineering geology of earthquakes, plate tectonics, faults, seismic waves, quantification of earthquake, basic geography & techtonic features of India,
2. Magnitude, energy, intensity of earthquake, accelerograph, accelerogram, wave measuring instruments, recording and analysis of earthquake records, characteristics of strong ground motions, determination of magnitude, epicenter, epicentral distances, focal depth
3. Guidelines for achieving efficient seismic resistant planning & design, I. S., selection of sites, importance of architectural features in earthquake resistant building, continuity of construction, projection & suspended parts, special construction features like separation of adjoining structure, crumple section, stair case etc., geotechnical design considerations, twisting of building, seismic effect on structure, inertia forces, horizontal & vertical shaking
4. Indian seismic codes, Behaviour of masonry structure during earthquake, bands & reinforcement in masonry building, opening in walls, importance of flexible struture, principle of ductile building, capacity design concept, seismic design philosophy for building, concept of eartquake resistant building
5. .Introduction of various techniques for reduction of earthquake effect in building, base isolation seismic dampers etc

SECTION B

6. Behavior of R. C. building in earthquake, Design strategy, Strength, ductility of reinforced concrete members subjected to flexure, axial loads and shear, detailing of reinforced concrete members, beams, column,
7. Behavior of beam column joints, Design strategy, Strength, ductility of beam column joints, footing for ductile behaviour, codal provisions, short column behaviour, architectural aspect of shear wall, ductile design of shear wall
8. Special aspects in multistoried buildings, structural response to earthquake, analysis of earthquake forces on multistoried frame by I. S. 1893 P-I,
9. Behaviour and design strategy for open ground story, P-delta effect, effect of soil structure interaction on building response

10. Study of I. S 1893 Part I to V for analysis and ductile design of structure

Books:

1. I. S 1893 - 2002 Part I to V
2. I. S 13920 - 1993
3. Farzad Neaim : Handbook on Seismic Analysis & Design of Structure
4. R. L. Wiegel : Earthquake Engineering, Prentice Hall Inc
5. James L. Stratta : Manual of Seismic Design, Pearson Education Publication
6. A. K. Chopra : Dynamics of Structures.

2S FSE5 ELECTIVE

(5) DESIGN OF ENVIRONMENTAL STRUCTURE

Note: The candidate should solve two questions out of any three from each section.

SECTION A

1. Analysis and design of Intze type Elevated Service Reservoirs, Analysis and design of staging.
2. Design of underground water tanks, swimming pools, jackwell,instaction well.

SECTION B

3. Design of Water Treatment Plant unit, aeration tank, clarifloculator, flash mixers.
4. Design of water sumps, filters, analysis and design of pipes

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SEMESTER : THIRD

3S FSE1 SEMINAR I

Each student will prepare a seminar report on the topic selected in consultation with the guide. The student will present the matter before interested audience and will answer the questions raised by examiners and audience.

3S FSE2 SEMINAR II

Each student will prepare a seminar report on the topic of dissertation. The student will present the matter before interested audience and will answer the questions raised by examiners and audience.

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SEMESTER : FOURTH

4S FSE1 DISSERATION

Each student will submit a dissertation to the University on a topic selected in consultation with the guide. The student will present the matter before examiners and interested audience and will answer the questions raised by them.

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SYLLABUS
PRESCRIBERD FOR
MASTER OF ENGINEERING (FULL TIME)
MECHANICAL- (CAD/CAM)
SEMESTER-I

1MCC1 COMPUTER AIDED DESIGN

Section-A

Introduction to computer technology, Introduction to CAD systems, Computer Aided Design workstation and peripherals, Graphics input/ output devices

Design process and CAD models: Computers for design, benefits of CAD

ICG: Configuration of graphic workstations, Vector and Raster displays, Geometric modeling and transformations.

Section-B

CAD software: Graphics system and functions of a graphics package, Graphics databases structure and handling, Operating features, wireframe, solid and surface modeling, approaches to solid modeling. Computer aided drafting and documentation: Principles and concepts of automated drafting, drafting packages, Introduction to CADD packages like AutoCAD, SOLIDWORKS, CATIA. Graphics standards like GKS, PHIGS, IGES etc

Practical : Five practical based on above syllabus

References:

1) CAD/CAM by Groover and Zimmers
2) Computer Aided Design in Mechanical Engineering by V. Ramamurti
3) CAD by Krishnamoorthy and Rajiv
4) CAD Principles and Applications by Barr, Krimger and Lazaer
5) CAD/CAM Handbook by Teicholz

1MCC2 COMPUTER AIDED MANUFACTURING

Section-A

Numerical control (NC): Fundamentals of NC, merits and demerits of NC, classification of NC systems, basic components of NC systems, instructions, NC tape and coding, control units, features of machine tools and system devices.

Computer Numerical Control CNC: Problems in conventional NC, NC controller technology, computer numerical control, designing CNC systems. NC/CNC machine tools: Types and features, DDA integrator, DDA hardware interpolator, software interpolators, reference word interpolator, point to point, straight line and contouring control loops

Section-B

NC/CNC part programming: Introduction, computer-aided part programming (APT), CNC part programming

Ddirect numerical control (DNC), Types of DNC Systems. combined DNC/CNC systems,

Adaptive control: ACC and ACO systems, optimization of AC

Practical: Five practical based on above syllabus

References:

1) Yoram Koren- Computer control of manufacturing, McGraw Hill.
2) Mikell P. Groover- CAD/CAM-Prentice-Hall of India pvt. Ltd.
3) Kundar T.K., Rao P.N., Tewari N.K.-Numerical control and computer aided manufacturing; Tata McGraw Hill.
4) D. Kochan- CAM Development in computer integrated manufacturing-Springer Verlag, Berlin

1MCC3 COMPUTER ASSISTED PRODUCTION MANAGEMENT

Section-A

Computer aided process planning: Approaches to CAPP, basic part representation methods, shape producing capabilities, Process economics

Computer assisted QC: co-ordinate measuring machines-construction and types, automated dimensional gauging and in-process gauging

Capacity planning: Roll of capacity planning in manufacturing, planning and control systems, hierarchy of capacity planning decisions links to other system modules, capacity planning and control techniques.

Section-B

Just in time: JIT in manufacturing planning and control, leveling the production, pull system introduction, product and process design, JIT applications

Computer aided inventory control: Computer aided purchasing procedure, simulation of inventory problems

Computer aided materials management: Material requirement planning, computer integrated materials management.

References:

1) Groover M.P.- Automation, Production Systems and CIM.
2) David Bedworth, M.R. Handerson & Philip Wilze- Computer Integrated Design and manufacturing

1MCC4 MECHATRONICS

Section-A

Introduction : Scope, sensors, transducers, selection, contact & non contact optical types, performance, examples. **Actuators :** Principal, types-hydraulic, pneumatic, electrical, contact speed, multispeed, step and continuous variable, actuators with stepping motors.

Computer process controls : Computer process interface, interface hardware, direct digital control, supervisory computer control.

Design of mechatronics elements: Measuring system, control software and user interface, gauging, tool monitoring system, spindle drives, feed drives, servo principles, configuration CNC systems, interfacing, monitoring, diagnostics.

Section-B

Automatic loading and unloading devices, magazines, bunkers, orientors, feeders, separators, etc.

Pneumatic systems: different control components of pneumatic systems and there conversion valves, auxiliary devices, synchronizing, clamping, declamping, application to robotics.

Hydraulic systems: different control components of hydraulic systems, valves and auxiliary devices, design and analysis of hydraulic circuits sequencing, synchronizing, pneumo-hydraulic, CNC lubrication, machine tool applications.

References:

1) Mechatronics by HMT
2) Introduction to Mechatronics and Measurment Systems by Michal B. Histand & David G. Aiciatore.
3) Industrial Automation by Turgam, Mir Publication.
4) Pneumatics and Hydraulics by Stewart.

1MCC5 ELECTIVE-I

(1) CONCURRENT ENGINEERING

Section-A

Introduction : Principles, traditional versus concurrent approach, schemes and tools of concurrent engineering, Applications of computers in practice of CE

Basic process issues : Process models, types, importance, relation between models, specifications, technology, automation and process improvement.

Concurrent engineering approach in manufacturing systems: System design procedure, features, assembly resource alternatives, tasks assignments.

Section-B

Concurrent automated fabrication systems : Introduction, methodology, preliminary and details work content analysis, human resource considerations, 'Technical Economic' performance evaluation.

Assembly work stations: Strategic issues, technical issues, economic analysis.

Case studies of concurrent engineering practice.

References:

1) David Bedwarth, M.R. Handerson & Philip Wilze- Computer integrated Design and manufacturing.
2) J.L. Nevines and D.E. Whitney-Concurrent Design of Products and Processes.
3) Procedding of the "Summer school on Application of Concurrent Engineering to Product Development" at P.S.G. College of Technology.

1MCC5 ELECTIVE-I

(2) ENGINEERING EXPERIMENTAL TECHNIQUES

Section-A

Generalized measuring systems, different transducers for measurement of different mechanical parameters such as thickness (length), temperature, pressure, force, torque, etc., their design consideration, characteristics, limitation and uses.

Intermediate stage instrumentation, Impedance matching, selection of intermediate instrumentation equipments.

Terminating stage devices- characteristics, limitations

Section-B

Dynamic response of instruments, Effect of different instruments used in the measuring system on the accuracy, sensitivity and performance of the instrument designed to measure a particular mechanical parameter.

Experimental planning, parliamentary, intermediate and final stages, a experimental investigations, selection of instruments based on static, dynamic characteristics and allowable errors, analysis of experimental data, curve fitting, report writing.

References:

1) Experimental methods for engineering by J.P. Holman
2) Measurement System, Application and Design by E.D. Doeblein

1MCC5 ELECTIVE-I

(3) MANAGEMENT INFORMATION SYSTEMS

Section-A

Objectives and cost benefits of Management Information Systems (MIS). Decision and MIS. A decision environment model, Decision strategies. Characteristics of information: Measurement and amount of Information, Information search, storage and retrieval, Information feed back systems. Planning techniques: Project proposals, reporting and controlling, Determination for information needs and sources, development of conceptual design, development of detailed design, selection of final design, design report, organization for implementation, training of operational personnel, forms and files for data collection, evaluation control and maintenance of information system.

Section-B

Computer Based Information System, MIS and CBIS family, MIS in total CBIS environment, an MIS model and dimensions of MIS model, an overview of tele-processing system(TPS):Techniques for TPS processing models, MIS and TPS, decision support system : definition : characteristics of DSS difference in DSS and development of DSS and its applications, production of sub-systems : Marketing sub-systems, finance sub-systems, personnel sub-system, office automation system : definition, importance, planning and implementation of Automated computer based office communication system.

References:

1) Essentials of MIS by K.C. Laudon, J.P. Laudon; PH
2) Strategic Management and MIS: An Integrated Approach by W. Robson; Pitman Pub.
3) Information systems for Managers by G.W.Reynolds; West Pub.
4) IT for Management by Turban E and McLean E; John Wiley Pub.
5) Foundations of Information systems by Zwass V; Irwin/ McGraw Hill

SEMESTER-II

2MCC1 FINITE ELEMENT ANALYSIS

Section-A

Introduction: Discretization, going from part to whole approach, Conventional Numerical methods- finite difference method , method of least squares Ritz method, boundary value problems, displacement method, the equilibrium method, the mix method of solid mechanics, Finite element formulation, variational methods.

Finite Elements- types: triangular, rectangular, quadrilateral, sector curved, isoparametric elements

General procedure of FEM: Discretization, element shapes, interpolation functions, shape functions, element stiffness matrix, global stiffness matrix, application of boundary conditions, solutions.

Section-B

FEA of 2-D single variable problems, application of Heat transfer, fulid mechanics, solid mechanisms, plane elasticity, analysis of structural vibrations

Applications: Free vibration of thin plates, cylindrical shells, transient heat conduction, torsion of prismatic shafts, motion of fluid in flexible container, flow of ideal fluids, viscous fluids, sheep structures.

Softwares in FEM: Introduction and study of FEM packages like ASKA, SAP, NASTRAN, ANSYS, COSMOS, NISA, ANIDA

Practical: Five practical based on above syllabus

References:

1) Introduction to Finite Element Methods by C.S. Desai & J.F. Abel.
2) Concept and application of Finite element analysis by Robert Cook.
3) Finite element analysis by C.S. Krishnamoorthy.
4) Finite element methods by J.N. Reddy.

2MCC2 SIMULATION THEORY AND APPLICATIONS

Section-A

System models and studies: Concepts of a system, system environment, stochastic activities, continuous and discrete systems, system modeling, types of models, principles used in modeling, sub-systems, types of system studies.

System simulation: The techniques of simulation, Monte Carlo method, comparison of simulation and analytical methods, Analog computers and methods, hybrid computer, simulators, continuous system simulation languages, system dynamics, growth models, logistic curves, multi-segment models, probability concepts in simulation, system simulation, events, representation of time, arrival pattern.

Section-B

Analysis of simulation output : Estimation method, simulation run statistics, replications of runs, elimination of initial bias, batch means, regenerative techniques, time series analysis, spectral analysis, auto regression.

Applications of simulation in manufacturing

Practical : Five practical based on above syllabus

References:

1) Geoffrey Gordon- System Simulation
2) Narsingh Deo- System Simulation with Digital Computers.

3) Naylor T.H. et. Al.- Computer Simulation Techniques.
4) Gottfried B.S- Elements of Stochastic Process Simulation

2MCC3 ROBOTICS AND ROBOT APPLICATIONS

Section-A

Introduction: Definition, need, robot classification, terminology and systems, benefits and limitations.

Robot system: Robot physical configuration, basic robot motions, end effectors work cell control and interlocks.

Robot sensors: Vision tactile and proximity, voice, robot control, kinetics and necessary control systems.

Section-B

Robot applications: General considerations and problems, material transfer, machine loading, welding, spray coating, processing operations, assembly, inspection, robo in FMS and automation.

Robot arm kinematics: Homogenous transformation matrix.

References:

1) Handbook of Industrial robotics.
2) Aures R.U. & Miller S.M.- Robotics applications and social implications.
3) Tanner W.R. – Industrial Robots Vol.-1 & Vol.-2.
4) Groover M.P. and Zimmer E.W.- Computer Aided Design and Manufacturing

2MCC4 INDUSTRIAL PRODUCT DESIGN

Section-A

An approach to industrial design, Technical requirements, Ergonomic requirements, Aesthetic requirements.

Ergonomic and industrial design Man- Machine relationship, Anthrometric data, Ergonomical design aspects of M/c tools testing M/cs, Instruments, automobile process equipment, etc.

Aesthetic concepts: Concepts of unity, concept of order with variety, concept of purpose, style and environment, Aesthetic continuity, proportions, rhythm, radiance.

Section-B

Design for Producibility, design for Assembly & Disassembly, Design for Maintenance

Computer aided Product Design

Industrial Design in Graphics: general design situations, Specifying design requirements, rating the importance of Industrial Design.

Design & development for Generative Manufacturing Processes.

Product Patenting.

References:

1) Industrial Design for Engineers by W.H. Mayali.
2) Design Engineering by John Diwan .
3) Problems of Product Design development by C.Hearn Bucle Pergaman Press.
4) Product Design & Manufacture by John Lindbeck , Prentice Hall International.
5) Integrated Product & Process Design by Edward Magrab, RC Press.

2MCC5 ELECTIVE-II

(1) FLEXIBLE MANUFACTURING SYSTEMS

Section-A

FMS an overview: types and configuration, concept, types of flexibility and performance measures, functions of FMS, FMS host and area controller function distribution.

Development and implementation of FMS: Planning phases, integration, system configuration, FMS layout, FMS project development steps.

Section-B

Automated material handling and storage: Functions- types- analysis of material handling equipments design on conveyors and AGV systems.

Automated Storages: Storage system performance- AS/RS- carausal storage system- WIP storage system- interfacing handling, storage with manufacturing.

Modeling and Analysis of FMS: Analytical, heuristic, queuing, simulation and petrinet modeling techniques- scope, applicability and limitations

References:

1) Groover M.P.- Automation, Production Systems and CIM.
2) Ranky P.G.- The Design and Operation of FMS.
3) Parrish D.J.- Flexible Manufacturing.

2MCC5 ELECTIVE-II

(2) VIRTUAL MANUFACTURING

Section-A

Virtual reality in engineering, rapid prototyping and near net shape manufacturing, visualization, environment construction technologies, modeling technologies, metamodeling, integrated

infrastructure and architecture, simulation, integration of ligacy data, manufacturing characterization, verification, validation and measurement, work flow, cross functional treads.

Section-B

Design centered and production centered VM, CAD data translation, manufacturing resource models for distributed manufacturing, design of production systems, Virtual manufacturing over INTERNET, IMACS (interactive manufacturability analysis and critiquing system), optimal selection of partner in Agile Manufacturing, Virtual reality modeling languages.

References:

1) Considine D.M. and Considine G.D. – Standard Handbook of Industrial Automation.
2) Kusiak A.- Intelligent Manufacturing Systems.
3) Fundamentals of Industrial Automation by Turgan.

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SEMESTER-III

3MCCS **Seminar**
Project

SEMESTER-IV

4MCCP **Project (Dissertation and viva-voce)**

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SYLLABUS
PRESCRIBERD FOR
MASTER OF ENGINEERING (FULL TIME)
DIGITAL ELECTRONICS

FIRST SEMESTER

1UMEF1/1UMEP1 MODERN ELECTRONIC DESIGN TECHNIQUES

Section - A

UNIT I : Methods of solution of network, Network equations and formulations, DC , AC and transient analysis of networks, Simulation examples using Spice or other relevant packages.

UNIT II : Types of modeling , Models of diode, BJT and FET, Design and simulation of Logic circuits and analog circuits, Sensitivity and optimization of networks and functions.

Section - B

UNIT III: Features, levels of abstraction, elements, simulation process, types of simulators, FSM modeling, test benches, generics & attributes, synthesis tools features & optimization in VHDL, Synthesis guidelines, Timing issues : terminology, flow diagram, clock, gated clock, setup & hold time, violation, metastability, static & dynamic timing analysis.

UNIT IV: CMOS & Bi-CMOS logic families & PLD architecture, Power dissipation, noise and ESD issues, clock distribution, signal connections, synchronous and asynchronous design features, and memory system design. Classification of CPLD architecture, CPLD 9500 series, Xilinx FPGA –XC4000 series, designing steps in ASIC.

Recommended Books :

1. Computer methods for circuit Analysis and Design – L. Vlach & K. Singhal
2. Computer Aided Analysis and Design of Electronic Circuits – Grimblay J.B.
3. James E. Buchanan Bicmos – CMOS System design – McGraw Hill
4. VHDL - Douglas Perry, McGraw Hill Publication
5. Using Testbenches- Janic Bergerson
6. VHDL Modeling for Digital Design Synthesis.- Yu. Chin Hsu, K. Tsai Kluwer publishers.
7. Xilinx PLD data manual

1UMEF2/1UMEP2 EMBEDDED SYSTEM DESIGN

Section - A

Unit I : **Processing & Memory Organization:** 16/32 bit embedded processors (Atmel 90SXX series/ARM make 16 series), Serial/ parallel port interfacing and drivers, DMA & high speed I/O interfacing, Memory selection for embedded systems.

Unit II : **Programming Concepts:** Assembly, C and C++ programming, Calling assembly routines in HLL, Interrupt handling in C++, Interrupt latency, Memory management, Allocation of memory to program segments and blocks, Memory maps.

Section - B

Unit III : **Multiprocessor Scheduling:** Model of multiprocessor and distributed systems, Multiprocessor priority ceiling protocol, Elements of scheduling algorithms for end-to-end periodic tasks, Schedulability of fixed priority end-to-end periodic tasks, End to end tasks in heterogeneous systems.

Unit IV : **Real Time Systems:** Characterizing real time systems & tasks, Performance measures, Estimating program runtimes, Task assignment & scheduling, Real time operating systems (RTOS), Task management, Race condition, Inter-task communication, Implementation aspects and estimation modeling in embedded systems, Validation and debugging of embedded systems, Real time communication, Hardware-software co-design in an embedded system, Applications of real time systems.

Book Recommended :

01) Real-Time Systems by Krishna & Shin (McGraw Hill International)

02) Embedded Systems by Rajkamal (Tata McGraw Hill)

03) Embedded Microcomputer Systems by Valvano (Thomson Delmar Publishing)

04) Atmel/ARM Data Books

05) Embedded Realtime Systems Programming by lyer & Gupta (Tata McGraw Hill)

06) Fundamentals of Embedded Software by Lewis Daniel (Prentice Hall India)

07) Real Time Systems by Jane Liu (Pearson India low cost edition)

1UMEF3/2UMEP1 DIGITAL COMMUNICATION TECHNIQUES

Section – A

Unit I: **Baseband and Bandpass Digital Transmission**: Baseband modulation, Correlative coding, Detection of binary signals in Gaussian Noise, ISI, Eye pattern and equalization, Bandpass modulation techniques, coherent and noncoherent detection of signals in Gaussian noise, error performance for binary and M-ary signals.

Unit II: **Error Control Coding**: Linear block codes, error detecting and correcting capability, cyclic codes, convolutional codes, properties of convolutional codes, Viterbi decoding algorithm, Turbo code concepts, Trellis codes.

Section – B

Unit III: **Synchronization, Multiplexing and Multiple Access**: Carrier and Symbol synchronization, Frequency Division Multiplexing/Multiple Access, Time Division Multiplexing/ Multiple Access, performance comparison of FDMA & TDMA, Code Division Multiple Access, capacity of multiple access methods, Access algorithms: ALOHA, Slotted ALOHA, Reservation ALOHA, Carrier sense systems and protocols.

Unit IV: **Spread Spectrum Techniques**: Model of spread spectrum digital communication system, direct sequence spread spectrum system, frequency hopped spread spectrum system, generation of PN sequences, synchronization of spread spectrum systems.

Books Recommended :

1. J. G. Proakis, "Digital Communications", Fourth Edition, McGraw Hill Inc.
2. Bernard Sklar, "Digital Communications: Fundamentals and Applications", Second Edition, Pearson Education Asia (LPE)
3. Simon Haykin, "Digital Communications", John Wiley and Sons
4. K Sam Shanmugam, "Digital Communications", John Wiley and Sons

1UMEF4/1UMEP3 DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Section - A

Unit No. I : Representation of deterministic signals, orthogonal representation of signals. Dimensionality of signals spaces, construction of orthogonal basis functions. Time bandwidth relationship : RMS duration and bandwidth, uncertainty relations.

Unit No. II : Introduction : Review of Discrete time signals and systems, Different transforms, use of DFT in linear filtering, filtering of long data sequences, Algorithm for convolution and DFT.

Section - B

Unit No. III : LS and LMS, spectral estimation, adaptive filters DSP Algorithm, Multirate Digital Signal Processing and its applications.

Unit No. IV : Issues involved in DSP processor design, Architecture and applications of TMS 320 C6XX, Multiprocessing with DSP processors, Applications of DSP to speech & radar signal processing,

Books recommended :

1) Advanced Digital Signal Processing, Proakis, McMillan
2) Discrete time Signal Processing, A.V. Oppenheim and Schafer, PHI, 1989
3) Digital Signal Processing – Principles, Algorithms and Applications, John G. Proakis, PHI, 1997
4) Digital Signal Processing, S.K. Mitra, TMH(2nd Edition)
5) Texas Instruments Application reports
6) Adaptive Filter Theory, Simon Haylein Jhon Wiley
7) Theory and Applications of Digital Signal Processing by Rabiner & Gold, Prentice -Hall.

1UMEF5/2UMEP2 DIGITAL INSTRUMENTATION

Section - A

UNIT-I : **Digital time measurement techniques :**

Vernier technique for small time interval measurement, Measurement of periodic time, Measurement of phase, capacitance, quality factor, time constant and decibel.

Digital frequency measurement techniques:

Measurement of ratio, product and difference between two frequencies, High frequency measurement, Peak frequency measurement, Fast low frequency measurement, Time reciprocating circuit.

UNIT - II : **Electronic instruments for signal analysis :**

Signal Analysers :

Spectrum analyzer, Network analyzer, Wave analyzer, Distortion analyzer,

Logic analyzer, Protocol analyzer.

Automated Measurement Systems:

Need and requirement of Automatic test equipment(ATE), Computer based & computer controlled ATE switches in ADTE, ATE for PCB, Component testing. IEEE –488 electronic instrument Bus standard, Field bus application,

Instrumentation in a Hazardous area.

Section – B

UNIT-III: **Microcontroller and PC Based Data acquisition system :**

Data acquisition system : Introduction to smart sensors, digital sensors, Case studies of real time PC based instrumentation system, Virtual instruments, Intelligent instrument and role of software.

Computer control: Hierarchy of computer control for industry, Direct digital control, Distributed computer control: System architecture and implementation concepts, buses & communication networks of DCCS, SCADA system.

UNIT-IV: **Advanced medical instrumentation Systems :**

Microprocessor interfacing and computer based instrumentation, Real time digital conditioning of monitored bio-medical signals such as EEG, ECG, EMG.

Intelligent controllers :

Programmable logic controllers, PLC programming techniques, fuzzy logic controllers, Neural network controllers.

Books recommended :

1) Electronic Instruments Handbook (3/e), 1997 by Clyde E. Coombs, McGraw Hill International
2) Applied Electronic Instrumentation and Measurement, 1992 by McLachlan & Buchla, Prentice Hall International
3) Digital Measurement Techniques, 1996 by T. S. Rathore, Narosa Publishers, New Delhi
4) Sensors & Signal Conditioning, (2/e) 1994 by Pallas Areny and Webster, J.Wiley & sons
5) Instrumentation & Process, Critis Johnson
6) Khandpur R.S., Handbook of Bio-medical Instr0umentation (3/e)

SECOND SEMESTER

2UMEF1/3UMEP1 DIGITAL IMAGE PROCESSING

Unit No. (I) : Digital Image fundamentals : Basic Image Processing steps, image acquisition, presentation of gray scale and modeling. Human visual perception, sampling and quantization, basic relationships between pixels. Histogram analysis and equalization.

Unit No.(II) : Image transforms: Fourier transforms, DFT, Properties of 2D Fourier transforms and FFT. Orthogonal and Unitary transforms, Sine, Cosine,
Hartley, Hadamard, Harr, Slant and KL transforms. Image enhancement: Basic concept, Point processing methods, Spatial filtering and frequency domain methods, Pseudo Color and full colour image processing.

Unit No. (III) : Image restoration : Degradation models, algebraic restoration techniques, Mean square error restoration, Least square error restoration, constraint least square error, Restoration by singular value decomposition. Homospheric filtering. Inverse & Wiener filtering, Geometric transformation. Image compression methods – (Lossy : Block truncation & vector quantization) (Lossless : Huffman coding, Run length coding & Block coding) Transform coding and Hybrid methods.

Unit No. (IV) : Image segmentation : Detection of discontinuities, Edge linking and boundary detection, thresholding, region oriented segmentation. Image representation Schemes. Boundary descriptors, regional descriptors.
Morphological Techniques, Object/pattern recognition and interpretation methods.

Book(s)Recommended :

1) "Digital Image Processing" : R. C. Gonzalez & Woods – Addison Wesley IIIrd Ed.
2) "Fundamentals of Digital Image Processing" by A. K. Jain – Prentice Hall Inc.
3) "Digital Image Processing & Computer vision : An introduction to theory & Implementation" by Robert Jschalkoff – John wiley & Sons Inc.
4) "Digital Image Processing" by K. R. Castleman – PHI
5) "Digital Image Processing" by W. K. Pratt.(3 Ed.) John.Wiley.
6) "Digital Image Processing & Analysis" by B. Chanda and D.Mujumdar.-PHI, New Delhi, 2000.

2UMEF2/3UMEP2 VLSI DESIGN TECHNOLOGY

Unit I : ASIC CONSTRUCTION AND CMOS DESIGN :
Physical Design; CAD Tools, System Partitioning, Estimating ASIC size, Power dissipation, FPGA partitioning methods, CMOS systems Design and Design Methods, CMOS Testing, CMOS Subsystems Design.

Unit II : Floorplanning , Placement & Routing :
Floorplanning ,Placement Physical design flow; Information Formats; global routing, detailed routing; special routing; circuit extraction and DRC

Unit – III : Analog Integrated Circuit Design Using CMOS :
Analog IC Design, Operation Amplifier, Comparator Switch Capacitor, Digital-Analog and Analog-Digital Converters

Unit – IV : The Design of CMOS R.F. Integrated Circuits:
High frequency amplifier, Mixer, R.F. Power amplifier, Phase-Locked Loops.

Books Recommended :

1) "Application specific IC", Michael John sebastiab smith Addison Wesley publication.
2) "VLSI Digital signal processing systems Design & Implementation " K. K. Parhi; John Wiley & Sons
3) "Principles of CMOS VLSI Design " Neil Weste and Eshraghian (Second Edition) Pearson Education Asia (Addison – Wesley Publication Company
4) Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, 2nd ed. New York : Oxford University Press, 2004
5) Thomas H. Lee, The Design of CMOS Radio – Frequency Integrated Circuit, Cambridge University Press

2UMEF3 / 4UMEP1 ADVANCE COMPUTER NETWORKS AND PROGRAMMING

Unit – I : Review of computer networking concepts
Topology, LAN, WAN, MAN, Internet, OSI/ISO, TCP/IP reference models, Point to point protocols. **ARQ:** Retransmission strategies. **Functional elements :** Multiplexing, Switching , Networks Management & traffic controls. Delay models in Data Networks Switching techniques: Performance measures & architectural issues.

Unit – II : **Internetworking**

TCP/IP Internet architecture, IPV4, IPV6, IP addressing & related issues, IP address resolution techniques (ARP). IP datagram & forwarding, routing algorithms.

Unit – III : **Multiple access techniques**

ALOHA, CSMA, CSMA/CD, CSMA/CA, CDMA, OFDM, Delay throughput characteristics, WLAN-Protocols, multiple access, Ad-hoc networks, Bluetooth Specifications, WAP.

Unit – IV **Network security issues**

Ciphers, DES, Public key cryptography, RAS algorithm, Digital Watermarking, Attacks and Counter Measures , Service Authentication Proforma.

Books recommended :

1) "Data Networks" Dimitri Bertisekas & Robert Gallager, PHI
2) "Local Area Networks", Gerd E Kieser – Mc-Graw-Hill
3) "Computer Networks and Internetworking"D.E.Comer, Pearson Education
4) "Cryptography and Network Security: Principles and Practice",William Stallings, Pearson Education
5) "GSM, CDMA and 3G Systems" , Steele,, Wiely Students Edition
6) "Communication Networking" An analytical approach" Anurag kumar, D. Manjunath & Joy Kuri– Morgn – Kaufmann publishers

2UMEF4/4UMEP2 ARTIFICIAL INTELLIGENT SYSTEM

Unit No. I : Fuzzy set Theory, Introduction to Fuzzy sets, Fuzzy relation, Membership functions, fuzzification, defuzzification, fuzzy logic, fuzzy rule based system fuzzy inference system.

Unit No. II : Fuzzy Decision Making, Fuzzy modeling, Adaptive neuro fuzzy inference system, cognitive neurofuzzy modelling, Neuro fuzzy control, Application of neuro fuzzy control

Unit No. III : Fundamental of Artificial Neural Network : Artificial Neuron model. Learning process, Single layer and multilayer feed forward network, training by back propagation, Hop-field model basic concept of bidirectional associative memory, self organization map, optimization model.

Unit No. IV : Recurrent Networks, Hamming Net and MAXNET, Feature mapping, counter propagation networks, cluster discovery Network (ART), Applications of Neural Network Characters Recognition Network, Neural Network control Application, Network for Robot kinematics, Hand written Numeral recognition.

Books Recommended :

1) "Neural Networks in Computer Intelligence", Limin Fu , McGraw Hill Inc., 1994.
2) "Neural Network Fundamentals", N. K. Bose, P. Lling , McGraw Hill.
3) "Artificial Neural Networks", Zurada
4) " Fuzzy Logic with Engg. Applications", Timothy J. Ross ,McGraw Hill.
5) "Neuro Fuzzy and Soft computing", Jang, Sun, Mezutani
6) "Fuzzy Engineering", Bart Kasko, PHI
7) "Neural Networks", S. Hykin ,Pearson Education.

2UMEF5/4UMEP3 PARALLEL COMPUTING

Unit No. I : **Introduction**

Parallel Computer models, Flynn's classification, system attributes, multiprocessor and multicomputers, conditions of parallelism, program partitioning and scheduling, program flow mechanisms, performance metrics and measures, parallel processing applications, speed up performance laws.

Unit No. II : **Pipelining and superscalar Techniques**

Linear and nonlinear pipeline processors, reservation and latency analysis, collision free scheduling, instruction pipeline design, arithmetic pipeline design, super scalar and super pipeline design.

Unit No. III : **Parallel and scalable architectures**

Multiprocessor, multicomputers, multivector and SIMD computers, scalable, multithread and dataflow architecture.

Unit No. IV : **Parallel Program Development and Environment**

Programming Parallel Computers, Parallel Programming environments, Synchronization and multiprocessing modes, multitasking,. Microtasking , autotasking, shared variable program structure, semaphores and applications, message passing program development, control decomposition techniques, heterogeneous processing.

Book Recommended :

1) "Advanced Computer Architecture", Kai Hwang, Parallelism, Scalability, Programmability", McGraw Hill Inc. Ed. 1993.

2) "Elements of Parallel Computing", V. Rajaraman , PHI, 1990

3) "Computer Architecture and Parallel Processing", Kai Hwang, F. A. Briggs, McGraw Hill, 1985

4) "Computer organization & Architecture",William Stallings, PHI, New Delhi, 6th edition.

5) "Kalsuk'Advanced computer Architectures", Dezso'Sima, Terence Fountain & Peter Pearson's Edation. (2nd Edition)

6) "Parallel Processing for Supercomputers and AI", Hwang and Degroot (Eds) McGraw Hill.

2UMEF6 Lab.-III(based on 1UMEF4 & 2UMEF1)

2UMEF7 Lab.-IV (based on 2UMEF2)

THIRD SEMESTER

3UMEF1 Seminar on special topic

3UMEF2 Seminar on proposed topic of Dissertaion

FOURTH SEMESTER

4UMEF1 Seminar after completion of dissertation

4UMEF2 Dissertation & Viva voce

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SYLLABUS

PRESCRIBERD FOR

MASTER OF ENGINEERING (FULL TIME)

ELECTRICAL ENGINEERING

(ELECTRICAL POWER SYSTEM)

SEMESTER : FIRST

1 SEPS 1 POWER SYSTEM OPTIMIZATION

SECTION-A

1) Introduction to optimization and classical optimization techniques

2) Linear Programming :

Standard form, geometry of LPP, Simplex Method pf solving LPP, revised simplex method, duality, decomposition principle, and transportation problem.

3) Non-Linear Problem (NLP) :

One dimensional methods, Elimination methods, Interpolation methods

4) Non-Linear Programming(NLP):

Unconstrained optimization techniques-Direct search and Descent methods, constrained optimization techniques, direct and indirect methods

Section-B

5) Dynamic Programming:

Multistage decision processes, concept of sub-optimization and principle of optimality, conversion of final value problem into an initial value problem.

6) CPM and PERT

7) Genetic Algorithm:

Introduction to genetic Algorithm, working principle, coding of variables, fitness function. GA operators; Similarities and differences between Gas and traditional methods; Unconstrained and constrained optimization using Genetic Algorithm, real coded gas, Advanced Gas, global optimization using GA.

8) Applications to Power system:

Economic Load Dispatch in thermal and Hudro-thermal system using GA and classical optimization techniques, Unit commitment problem, reactive power optimization. optimal power flow, LPP and NLP techniques to Optimal flow problems.

References:

1. "Optimization - Theory and Applications", S.S.Rao, Wiley-Eastern Limited
2. "Introduction of Linear and Non-Linear Programming ", David G. Luenberger, Wesley Publishing Company
3. "Computational methods in Optimization ", Polak, Academic Press
4. "Optimization Theory with Applications" Pierre D.A., Wiley Publications
5. "Optimization for Engineering Design: Algorithms and Examples", Kalyanmoy deb, PHI Publication
6. "Genetic Algorithm in Search Optimization and Machine Learning ", D.E. Goldberg, Addision-Wesley Publication, 1989
7. "Advanced Power System Analysis and Dynamics " L.P. Singh, Wiley Eastern Limited.
8. "Power System Analysis ", Hadi Saadat, TMH Publication.
9. " Electrical Energy System : An Introduction ". Olle I.Elewgerd, TMH Publication, New Delhi.

1 SEPS 2 GENERATION PLANNING AND LOAD DISPATCH

SECTION - A

Generation- Fossil fules, Hydropower and Nuclear power generation systems. Chronological Load Curves, Power duration curve, Integrated duration curve, Hydrography, Flow duration curve, Mass curve for Hydro Power generations. Co-ordination of steam, Hydro and Nuclear power stations. Optimum Generation allocation-Line losses neglected and including the effect of transmission losses for thermal power generations. Long range and short range Hydro generation scheduling. The short term and long term Hydro-thermal scheduling of generation.

Load Forecasting & Generation Planning - Classification of loads -Load forecasting methodology-Energy forecasting-peak demand forecasting-Weather sensitive and Non-weather sensitive forecasting - Total forcast - Annual and Monthly peak demand forecast.

SECTION-B

Generation system cost analysis:

Cost analysis -capacity cost, production cost.

Production analysis-production costing, production analysis involving nuclear unit, production analysis involving hydro unit.

Fuel inventories-energy transaction and off-peak energy utilization.

Generation System Reliability Analysis - probabilistic generating Unit-Model and Load model, effective load-Reliability analysis for isolated system-Interconnected system-Reliability analysis of interconnected system.

Load dispatch & System Communication - Consideration for centralized control of system operations. Requirements of the central load dispatch centre.

Telementry-Remote control and data transmission, etc.

Power system reforms, deregulation of electric utilities, energy management & conservation.

REFERENCES:

1) Power System Planning - R.L. Sullivan, McGraw Hill.
2) Economic Control of Interconnected System -Kirchmayers, L.K.,John Wiley and Sons, New York.
3) Generation of Electrical Energy - B.R. Gupta, Euresia Publishing House Pvt., Ltd., New Delhi.
4) Power System Restructing and Deregulation - by Loi Lei Lai
5) Restructed Electrical Power Systems - by Mohammad Shahidehopur, Muwaffaq Alomoush.
6) Privatization, Restructing, and Regulation of Network Utilities (Walras-Pareto Lectures) : by David M. Newbery.
7) Power to the People : Electric Power Deregulation : An Expose : Jack Duckworth
8) Understanding Electric Utilities and De-Regulation (Power Engineering) : by Lorrin Philipson, et al
9) Power Generation, Opearion and Control : A.J. Wood and B.F. Wollenberg:, John Wiley 1996
10) Understanding Electric Utilities and De-Regulation (Power Engineering) : by Lorrin Philipson, H. Lee Willis, Lorrion Philipson
11) The End of a Natural Monopoly : Deregulation and Competition in the Electric Power Industry : by P.Z.Grossman, D.H. Cole, P.Z. Grossman, D.H. Cole

1SEPS 3 MICROPROCESSOR AND MICROCONTROLLER

SECTION - A

Overview of Intel 8085 microprocessor.

8086 : Architecture, instruction including I/O instructions, bus timing diagram, interrupt structure, ISR minimum and maximum mode, Assembly Language Programming.

Hardware and Software debugging aids: 1 Pass and 2 Pass assemblers, cross assemplers, circuit emulators, simulators, linkers, loaders, compiler, cross compiler, logic analyzers.

Types of interfacing devices

SECTION B

8051 Architecture : 8051 Microcontroller Hardware, Input/ Output Pins, ports, and circuits, External Memory, Counter and Timers, Serial Data input/output, Interrupts

Assembly language programming concepts : The mechanics of programming, The assembly language programming process, PAL instructions, Programming tools and techniques, Programming the 8051

Moving Data : Addressing modes, external data moves, code memory read only data moves, push and pop -op codes, data exchanges

Logical Operations : Byte level logical operations, bit level logical operations, rorate and swap operations

Arithmetic Opearions : Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic

Jumps and Call Instructions : The jump and call program range, jumps, calls and subroutines, interrupts and returns

8051 Microcontroller Design : Microcontroller specification, microcontroller design, testing the design, timing subroutines, look up tables for the 8051, serial data transmission

Applications : Keyboard, displays, pulse measurement, D/A and A/D conversion, multiple interrupts

Serial Data Communication : Network Configuration, 8051 Data Communication

Books Recommended :

1. Kenneth J.Ayala, The 8051 Micro Controller : Architecture, Programming, Penram International, Mumbai.

2. Intel Embeded Micro Controller Data Book, Intel Corporation.
3. D.V.Hall, Microprocessor and Digital Systems, ELBS Publication, London.
4. B.P.Singh, Advance Microprocessors and Micro Controllers, New Age International, New Delhi.
5. D.V.Hall, Microprocessors and Interfacing, Tata McGraw Hill Publication, New Delhi.
6. Y.C.Liu, Gibson, Microcomputer Systems: the 8086/8088 Family, Architecture, Programming and Design, Prentice Hall of India Publications, New Delhi.
7. Lance A. Leventhal, Introduction to Microprocessor, Software, Hardware and Programming.
8. Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International, Mumbai.

1SEPS 4 POWER SYSTEM DYNAMICS

SECTION-A

INTRODUCTION

Reliable electrical power service, Stability of Synchronous machines, Tie-line oscillations, Method of simulation.

Synchronous Machines:

Review od synchronous machine equations, parameters, Equations in a-b-c phase co-ordinates and Park's co-ordinates, Representation of external system, Low and High orderstate models, Choice of state variables. Initial state equivalent circuit, Phasor diagram p.u. reactances.

System Response to Large Disturbances:

System of one machine against infinite bus, Classical Model, Mechanical and electrical torques, Critical clearing angle and time, Automatic reclosing, Precalculated Swing curves and their use.

SECTION-B

System Response to Small Disturbances:

Two machine system with negligibe losses, Clarke diagram for two machine series reactance system, Extention of Clarke diagram to cover any reactance network, Equation for steady State Stability limit, Two-Machinesystem with losses, Effect of inertia. Effect of governor, action, Conservative criterion for stability, Effect of sallency, saturation and short circuit ratio on steady state power limits.

Regulated Synchronous Machines:

Demagnetising effect of armature reaction and effect of small speed changes, Modes of oscillations of unregulated multimachine system. Voltage regulator and governor coach with delay Distribution of power impacts.

Effect of Excitation on Stability:

Effect of excitation on generator power limits, transients and dynamic stability, Examination of dynamic stability by Routh's criterian, Root locus analysis of a regulated machine connected to an infinite bus. Approximate System representation, Supplementary Stabilising Signals, Linear analysis of stabillised generator.

REFERENCES:

1. Synchronous Machines by C.Concordia, John Wiley & Sons.
2. Power System Stability by E.W.Kimbark, Dover Publication, Vol.-3
3. Power System Control & Stability by Anderson, Galgotia Publ.
4. Power System Stability by S.B. Crary, John Wiley & Sons.

1SEPS 5 DIGITAL SIGNAL PROCESSING

SECTION-A

Digital Signal Processing

Characterization & Classification of Digital Signals. Digital Signal Processing of continuous signals. Discrete time signals - sequences, representation of signals on orthogonal basis, sampling, aliasing, quantization & reconstruction of signals.

Discrete systems-attributes, z-transform, analysis of LTI system. Frequency analysis, inverse systems, Discrete Fourier transform, Fast Fourier implementation of discrete time system.

Digital filters - structures, sampling, recursive, non-recursive A to D & D to A conversion. FIR, IIR & lattice filter structures, Design of FIR digital filters. Window method, Park-McCellan's method. Design of IIR digital filters. Butterworth, Chebyshev.

SECTION-B

Elliptic approximations, low-pass, band-pass, band-stop & high-pass filters. Effect of finite register length in FIR filter design.

Multirate signal processing-motivation-application, decimation & interpolation, sample rate conversion, polyphase implementation of sampling rate conversion, Filter bank theory-DFT filter banks, Adaptive filtering theory.

DSP Processors and Applications - DSP Microprocessor architectures, fixed point, floating point precision, algorithm design, mathematical, structural and numerical constraints, DSP programming, filtering, data conversion; communication applications. Real time processing considerations including interrupts.

Refernce Books :

1. J.G.Proakis and D.G.Manolakis 'Digital Signal Processing Principles, Algorithm and Applications' Prentice Hall 1997
2. A.V.Oppenheim, R.W.Schafer, 'Discrete Time Signal Processing' John Wiley.
3. J.R. Johnson, ' Introduction to Digital Signal Processing Prentice Hall 1992
4. D.J.Defatta, J.G.Dulas. Hodgekiss, 'Digital Signal Processing' J. Wiley and Sons Singapore, 1988
5. L.R.Rabiner & B. Gold - 'Theory & Applications of Digital Signal Processing', Prentice Hall, 1992

1 SEPS 6 POWER SYSTEM LAB.-I

Indentify and perform minimum 16 (sixteen) experiments based on syllabus of subjects form Semester-I.

SECOND SEMESTER

2SEPS1 ADVANCED POWER SYSTEM PROTECTION

SECTION-A

Review of principles of power system equipments protection, cinfiguration of various solid state protection scheme, evaluation of digital relays from electromechanical relays, performance & operational characteristics of digital protection, Basic elements of digital filtering, analog multiplexers, conversions of system: the sampling theorem, signal aliasing error, sample & hold circuit, multiplexers, analog to digital conversion, digital filtering concepts, A digital relay. Hardware & Software.

SECTION - B

Mathematical background to protectional algorithm, first derivative (Mann & Morrison) algorithm, Fourier algorithm-full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm, least square based algorithm, differential equation based algorithm, travelling wave based

technique. Digital differential protection of transformer, digital line differential protection, recent advances in digital protection of power system.

Books Recommended :

1) Digital Protection for Power System : A.T.Johns and S.K.Salman, Peter, Published by Peter Peregrinus Ltd. on behalf of the IEE, London, U.K.
2) Power System Protection and Switchgear : Badri Ram and D.N.Vishvakarma, Tata McGraw Hill, New Delhi.
3) Transmission Network Protection : Theory and Practice, Y.G.Paithankar, Marcel Dekker, New York, U.S.A.
4) Fundamentals of Power System Protection : Y.G.Paithankar and S.R. Bhide, Prentice Hall of India, New Delhi.

2 SEPS 2 HIGH VOLTAGE TRANSMISSION

SECTION-A

Introduction of EHV-AC transmission, Tower configuration, Thermal ratings of lines & cables, circuit breakers, insulators for A.C. transmission, Voltage gradients of conductors, Cuona effects, power loss & audible noise, radio interferences, electrostatic field of transmission lines, Insulation characteristics of ling air gaps. Design of EHV lines based upon steady state limits, transient overvoltages & voltage stability, series shunt compensation, active & reactive power flow control, basics of static VAR compensators.

SECTION-B

H.V.D.C. Transmission:

General aspects of comparison between HVDC & HVDC transmission schemes and terminal station layout.

Operation of converters as rectifier and as an inverter. Equivalent circuit and operating chart of converter.

Control of the converters (ccc & cca) Harmonics and its control, faults protection of line and terminal equipment.

Parallel operation of HVDC and AC, Multiterminal HVDC Systems

REFERENCE BOOKS :

1. Weedy, B.M. : Electric Power Systems, John Wiley & Sons.
2. EHV Transmission Line Refernce Book : Edison Electric Inst.
3. Adamson, C & Hingorani N.G. . HVDC Power Transmission, Garraway Publications.

4. Kimbark, E.W. : Direct Current Transmission, Vol.I, John Wiley & Sons.
5. Uhlman, E. : Transmission by D.C.
6. Rakosh Das Beganudre : Extra High Voltage AC Transmission Engineering.

2 SEPS 3 POWER SYSTEM MODELLING & CONTROL

SECTION-A

Transient response and concept of stability in Electrical Power System. Modelling of Power System.

Control of voltage, frequency and tie-line power flows, Q-v and P-f control loops, mechanism of real and reactive power control.

Mathematical model of speed govening system. Turbine governor contrate as affecting the power system dynamics. Transion and steady state response in the interconnected power systems. (multimedia systems).

Excitation systems. Transformation model of exciter system. Analysis using block diagrams. Power systems stabilizers.

Dynamic stability (small disturbances), effect of exitation control and turbine dyanmics, characteristic equation, method of analysis of the stability of power system.

Multimachine systems, Flux decay effects.

Multimachine systems with constant impedance loads, matrix representation of a passive network in the transient state, converting to a common reference frame. Converting machine co-ordinates to system reference, relation between machine current and voltages, system order, machine represented by classical methods, multimachines systems study.

SECTION-B

Net interchange tie-line bias control. Optimal, sub-optimal and decentralised controllers. Discrete mode AGC. Time - error and inadvertent interchange correction techniques. On-line computer control. Distributed digital control. Data acquisition systems. Emergency control, preventive control, system, system wide optimization, SCADA.

Self excited electro-mechanical osillations in power system and the means for control.

REFERENCES :-

1) V.Venlkov : Transient Processes in Electrical Power System, Mir Publication, Moscow.
2) Olle I.Elgard : Electric Energy Systems Theory, Tata McGraw Hill Pub. Co., New Delhi.

3) Anderson P.M. & Foaud A.A. : Power System Control and Stability, Galgotia Pub.
4) Nagrath I.J., Kothari D.P. : Modern Power System Analysis, Tata McGraw Hill Pub. Co., New Delhi.

2SEPS 4 COMPUTER METHODS IN POWER SYSTEM ANALYSIS

SECTION - A

1. Representation of power systems for computerised analysis: Mathematical models of synchronous generator for steady state and transient analysis, Transformer with tap changer, transmission line, phase shifter and loads.

2. Topology of Electric Power System-Network Graphs, Incidence matrices, fundamental loop and cutest matrices,primitive impedance and admittance matrices, equillibrium equations of networks. Singular and nonsingular transformation of network matrices.

3. Formation of bus impedence and admittance matrices by algorithm - Modification of bus impedence and admittance matrix to account for change in networks. Derivation of loop impedance matrix.

   Three phase network elements-transformation matrix - incidance and network matrices for three phase network. Algorithm for formulation of 3 - phase bus impedence matrix.

SECTION-B

4. Short Circuit Studies : Three phase network, Symmetrical components. Thevenin's theorem and short circuit analysis of multinode ower systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced short circuits bus impedenace and look impedance matrices.

5. Load flow studies : Sleek bus, loop buses, voltage control buses, Load flow equations, Power flow model using bus admittance matrix, Power flow solution through Gauss-Seidal and N-R methods - sensitivity analysis, Second order N-R method, fast mecouple load flow method - Sparsity of matrix. Multiarea power flow analysis with the line control.

6. Stability studies of Power System - Development of mathematical model for multimachine system stability analysis-Formation of equations and method of solution. Transient stability analysis including synchronous machines,

system network and loads.

Solution of state equation by modified Eular method and solution of network equations by Gauss-Seidal interactive method.

REFERNCE BOOKS :

1) Computer Methods in Power System Analysis : G.W.Stage A.H.Elabiad, McGraw Hill Book Co.
2) Computer Techniques in Power System Analysis : M.A. Pai, Tata McGraw Hill Publication.
3) Electric Energy System Theory : O.I.Elgard, Tata McGraw Hill Publication.
4) Computer Aided Power System Operation and Analysis: R.N.Dhar, Tata McGraw Hill Publication.
5) Modern Power System Analysis : I.J.Nagrath, D.E.Kothar, Tata McGraw Hill, New Delhi.

2SEPS 5 FACTS AND POWER QUALITY

SECTION-A

Steady state and dynamic problems in AC systems, Flexible AC transmission systems (FACTS), principles of series shunt compensation, description of static var compensation (SAC), thyristor controlled series compensation (TCSC) static phase shitters (SPS), static condenser (STATCON), static synchronous series compensator (SSSC) and unified power flow controller (UPFC), modelling and analysis of FACTS controllers, control strategies to improve system stability.

SECTION-B

Power quality problems in distribution systems, Harmonics, Harmonics creating loads, modelling, harmonic propagation,series and parallel resonance, harmonic power flow, mitigation of harmonics, filters,passive filters, active filters,shunt and series hybrid filters, voltage sag ans swells, voltage flicker, mitigation of power quality problems using power electronics conditioners, IEEE standards.

Books Recommended :

1) G.T.Heydt : Power Quality, Stars in a Circle Publication, Indiana, 1991.
2) E.J.E.Miller : Static Reactive Power Compensation, John Wiley & Sons, New York, 1982.
3) Recent Publications on Power Systems and Power Delivery.

2 SEPS 6 POWER SYSTEM LAB.-II

Identify and perform minimum 16 (sixteen) experiments based on syllabus of subjects form Semester-II.

THIRD SEMESTER

3 SEPS 1 SEMINAR-I AND DISSERTATION

(As per given scheme)

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FOURTH SEMESTER

4 SEPS 1 SEMINAR-II AND DISSERTATION

(As per given scheme)

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SYLLABUS
PRESCRIBERD FOR
MASTER OF TECHNOLOGY (FULL TIME)
CHEMICAL TECHNOLOGY
(MEMBRANE & SEPARATION TECHNOLOGY)

FIRST SEMESTER

1 MST 1 ADVANCES IN ABSORPTION AND ADSORPTION SEPARATION TECHNOLOGIES

Absorption, fundamentals, applications, multicomponent absorption, Non-isothermal absorption, mass transfer in packed towers for gas absorption, capacity, height of tower, plate towers, absorption equipments & recent developments.

Adsorption isotherm models, break through curve, steady state & unsteady state adsorption, adsorption equipments, structure of adsorbents, kinetic effects, equilibrium, non-equilibrium isothermal and non isothermal operation, regeneration of adsorbent.

PRACTICALS : based on above syllabus.

BOOKS :

1) Chemical Engineering, Vol.I & II : Coulson & Richardson.

2) Handbook of Separation Techniques for Chemical Engineers : P.A.Schweitzer.

3) Mass Transfer Operations : R.E.Treybal.

4) Absorption, Fundamentals and Applications : Zarzycki R.,Chacuk A.

5) Gas Separation by Adsorption Process : R.T.Yang.

1 MST 2 MEMBRANE SEPARATION PROCESS

Membrane transport and separation mechanism, Basic transport equations, solute transport parameters, surface force-pore flow model, prediction of membrane performance, physico-chemical criteria of membrane process, material science of RO/UF membranes, aqueous & non-aqueous solution systems, module design and analysis, membrane process design and systems, membrane process in water, waste water, biotechnology process, food industries etc., membrane bioreactor, pervaporation techniques in alcohol concentration, gas separation application, by permeation under pressure through membrane, membrane fouling and compaction, liquid membranes, pollution control by membrane process. RO treatment of non-aqueous solutions in liquid phase.

PRACTICALS : based on above syllabus.

BOOKS :

1) RO/UF Principles and Applications : S.Sourirajan, R.Matsscera, Canada.
2) UF Applications Handbook : Munir Cheryon.
3) Membrane Separation Process : Stratumann, Germany.
4) Filtration and Separation : J.Wakeman, Elsevier.
5) Handbook of Separation Process Technology : Koros W.J., Rousseau R.W., Wiley, New York.

1 MST 3 CHEMICAL ENGINEERING ANALYSIS

Chromatographic techniques for chemical analysis for measuring thermodynamic, kinetic & physico-chemical properties, process chromatography, production chromatography, laboratory or preparative chromatography, gas chromatography, liquid chromatography, Elution chromatography, Gas-Liquid chromatography, chromatographic equipments, process design & optimization, counter current techniques, HPLC, ion exchange chromatography, electrophorasis, electrodialysis, lypholisation, equipment, recent advances. Basic principles of mass spectrometry, its application for molecular structure determination, magnetic rosonance spectroscopy, NMR chemical shift, Fourier transfer IR, Coulometric analysis, basic of electronic circuitvy for chemical instruments, computer applications and programming in chemical analysis and instrumentation.

BOOKS :

1) Chromatographic Methods : Braithwaite A., Smith F.J., Chapman & Hall.
2) New Developments in Gas Chromatogrphy : Purnell J.H., Wiley Production Scale GC.
3) Preparative Liquid Chromatography : Bidlingmeyer R.A., Elsevier.
4) High Performance Liquid Chromatography : Brown P.R., Hartwick R.A., Wiley.
5) Chemical Engineering, Vol. I to IV : Coulsion V. Richardsons.
6) Separation Techniques : Schoew H.M., New Chemical Engg., Intersciences Pub.
7) Separation Processes : C.J.King, Tata McGraw Hill.
8) Instrumental Methods of Chemical Analysis : Willard H.N., East West Press.
9) Instrumental Methods of Chemical Analysis : Ewing G.W., McGraw Hill.

1 MST 4 ADVANCED ENERGY TECHNOLOGIES

Energy intensive chemical process, energy balances, energy consumption & audit, recovery of energy, energy recovery units related to gas-gas, gas-liquid, liquid-liquid systems, waste heat recovery units, Energy planning, energy conservation.

Energy resources - conventional, non-conventional, renewable / alternate sources of energy, using water, wind, tide, solar, biomass, geothermal, etc. and their applications, energy related pollution control technologies, combustion process, removal of Nitrogen, Sulphur containing gases, acid gas removal.

BOOKS :

1) Chemical Technology, I to IV : Venkateshwaralu D.
2) Energy Conservation in Petrochemical Industries : S.B.Pandya, Tata McGraw Hill.
3) Conventional Energy Technology : S.B.Pandya, Tata McGraw Hill.
4) Practical Techniques of Saving Energy in Chemical Industry : Sitting M., Noyes Data Corp, USA.
5) Fuels & Fuel Technology : Francis W., M.C.Peter, Pergamon Press.
6) Fuel Combustion Energy Technology : S.N.Saha, Dhanpat Rai Pub. Co, New Delhi.

1 MST 5 SEMINAR-I

Presentation of critical apprisal of literature survey on the topic related to recent development, advances, reserach work in the field of membrane and separation technologies.

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SECOND SEMESTER

2 MST 1 ADVANCED DOWNSTREAM TECHNOLOGY FOR CHEMICAL RECOVERY AND WASTE UTILIZATION

Centrifugal separation - theory, application, equipments, power requirement, chemical separation for Gas-Liquid system, Gas-Solid system. Super critical fluids extraction in food, pharmaceutical, environmental and petroleum applications, water treatment, desalination, Bio separation, dialysis, industrial dialysis.

Cryogenic distillation for refinery, petrochemical off gases, natural gases, gas recovery-Olefin, Helium, Nitrogen, Desulfurization - coal, flue gases, Azeotropic & extractive distillation - residue curve maps, homogeneous azeotropic distillation, pressure swing distillation,

Column sequences, hetro geneous azeotropic distillation.

Energy conservation in separation processes - energy balance, molecular sieves - zeolights, adsorption, catalytic properties, manufacturing processes, hydrogel process, application, New trends.

Separations process synthesis for nonazeotropic mixtures, non ideal liquid mixtures, separation synthesis algorithm, Ion exchange - manufacture of resins, physical & chemical properties, capacity, selectivity, application, regeneration, equipment, catalysis use.

PRACTICALS : based on above syllabus.

BOOKS :

1) Perry's Chemical Engg. Handbook : McGraw Hill Pub.
2) Conceptual Design of Chemical Processes : Douglus J.M., McGraw Hill
3) Recent Developments in Chemical Process & Plant Design : Liu Y.A., John Wiley & Sons Inc.
4) Cryogenic Process Engg. : Timmerhaus K.D., Plenum Press.
5) Encyclopedia of Separation Technology, Vol I & II : Kirk Othmer, Wiley Interscience.

2 MST 2 INDUSTRIAL BIOTECHNOLOGY

Advanced termentation process for industrial production, Fermentation products, Biochemistry and bio chemical engineering aspects, kinetics of growth & model of fermentation process, industrial microbiology, fermentation types and mechanism, recent development in fermentation design, measu rement and control devices, instrumentation in fermentar, liquid media and air sterilization techniques, heat load of fermentation, enzyme engineering, industrial production and applications of enzymes, immobilization of enzymes of whole cells, bioenergy utilization, bioconvertion of renewable resources to organic chemicals, application of bio technology in petroleum, oil, paper, food & chemical industries, production of high value products using biotechnology, production of antibiotics, vaccine, vitamins, surfuctants, polysaccharides by microbial fermentation, their isolation, purification.

PRACTICALS : based on above syllabus.

BOOKS :

1) A Comprehensive Practise in Biotechnology : Rehrn H.J. & Reed S., Vevlacs Chemie, Weinheim.

2) Biochemical Engineering & Biotechnology Handbook : Atkinson B., Mavituna F., The Nature Press, New York.
3) Pollution Control in Process Industries : Mahajan S.P., Tata McGraw Hill.

2 MST 3 ADVANCED MATERIAL TECHNOLOGY

Packings in crystals, ceramic structure, silicate materials, refractory material, structure sensitive materials, polymeric materials, structure, rheology, mechanical properties, instruments used for determination of structure, detects, advances in polymeric materials, metals like carbon, steel, alloy steel, effect of cooling & heating on structure of metal structure, strengthening mechanism, rubber and composite materials.

Stress characteristics, reinforced material, plastics in packaging, containers for pharmaceutical, beverage, food, oil, detergent, etc. industries, BOPP film in food packaging, laminated, heat seable, flame proof polyester fibers, flame retardant polyolefin fibers, polymer alloys and their applications, nylon, pc, pvc, polysulphur etc., alloys, materials of construction for handling specific chemicals, Lining of equipment, inspection & testing, corrosion, fatigue, protection & testing, nanomaterials.

BOOKS :

1) Process Design of Equipments, Vol. I & II : Dawande S.D., Central Techno Pub., Nagpur.
2) Hydrocarbon Processing- Journal
3) Corrosion Engineering : Fontana M.G., McGraw Hill.
4) Chemical Engg. - World Journal.
5) Chemical Age of India.

2 MST 4 ADVANCED REACTOR DESIGN

Basic concept of design of reactors, types, optimisation techniques, multiphase reactors, multiphase reactions, hetrogeneous catalytic reactions, isothermal, non isothermal, adiabatic, non adiabatic, fluidised catalytic reactor, slurry reactor, characterisation of catalysis, chemical kinetics & rate equation for homogeneous and hetrogeneous reactions, chemical reaction kinetics for reactions with heat and mass transfer simulteneously, non ideal flow, fixed bed reactor - adiabatic, non isothermal, non adiabatic fixed bed, comparision of fixed, moving & fluid beds, optimization - formulation of reactor problems, use of linear programming, differential calculus, non linear programming in reactor optimization, instrumentation & control devices in chemical reactor.

BOOKS :

1) Chemical Reaction Engg. : Levenspiel O., John Wiley.
2) Chemical & Catalytic Reaction Engg. : James J. Carberry, McGraw Hill.
3) Chemical Engg. Kinetics : Smith J.M., McGraw Hill.
4) Chemical Reactor Design & Analysis : Bischott K.B. & Forment G.F.
5) Optimization of Process : Edgar T.F., Himmelbloan D.M., McGraw Hill.
6) Elements of Chemical Reaction Engg. : Scot Fogler H.C., Prentice Hall.

2 MST 5 SEMINAR-II

A collection of literature on a topic related to recent developments in process technology, etc., critical apprisal of literature collected, preparation of report and presentation of Seminar.

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THIRD SEMESTER

3 MST 1 SEMINAR-III

Preparation of detail report based on collection of data, experimental work, published reviews, etc. on a topic related to Project / Dissertation and presentation as Seminar.

3 MST 2 PROJECT / DISSERTATION

Literature survey on Project / Dissertation topic, planning of work, finalising materials and methodology, etc.

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FOURTH SEMESTER

4 MST 1 PROJECT / DISSERTATION

Review of Project / Dissertation data generated, experimentation, conclusion drawn, recommendations given, preparation of report, calculation, designing, etc.

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SYLLABUS
PRESCRIBERD FOR
MASTER OF TECHNOLOGY (FULL TIME)
MECHANICAL ENGINEERING
THERMAL ENGINEERING
SEMESTER : FIRST

1S FMTE1 ADVANCED MATHEMATICS

1. PARTIAL DIFFERENTIAL EQUATIONS: -

Formation of partial differential equations, solution of Lagrange's form Pp + Qq =R; Linear partial differential equations with constant coefficients and its solution, complimentary function and particular integral.

2. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of variables, solution of wave equation, one dimensional and two dimensional heat flow equation in steady state (Lap lace equation) and its solution.

3. STATISTICS: -

Method of least squares, curve fitting by graphical method. Co-relation. Regression, Probability distribution. Binomial, Poisson's and Normal Distribution.

4. INTERPOLATION: -

Newton's interpolation formulae, Newton's and Gauss's forward and backward interpolation formulae, Interpolation with unequal intervals, Lagrange's formula for unequal intervals. Newton's divided difference formula. Inverse interpolation

5. NUMERICAL METHODS

Numerical integration:- Newton-Cote's formula, Trapezoidal rule, Simpson's one third and three eighth rule, Waddle's rule. Numerical solution of ordinary differential equations. Taylor's series, Runge-Kutta and Euler's method. Milne's corrector method.

6. OPTIMIZATION TECHNIQUES.

Linear programming, formulation of problem, simplex method, Duality concept and principle, dual simplex method.

NOTE:- Tutorials to be prepared on each unit using MATLAB programming.

Books recommended:-

1. Advance Engineering Mathematics (VII and VIII edition) by Erwin Kreyszig

2. Operation Research by Premkumar Gupta and D.S.Hira
3. A Text Book on Engineering Mathematics by Bali.Saxena,Iyenger
4 Fundamentals of Statestics by S.C.Gupta
5. Higher Engineering Mathematics by B.S.Grewal
6. Advanced Engineering Mathematics by H.K.Dass

1S FMTE 2 ADVANCED THERMODYNAMICS

Introduction and Overview: Introductory Concepts and Preliminaries; Properties of Pure Substances; Energy and the First Law of Thermodynamics, Energy Transfer by Heat, Work, and Mass; Second Law of thermodynamics, Entropy: A Measure of Disorder.

Exergy: A Measure of Work Potential. Exergy Analysis: Frame of reference; Ambient State, Dead state; Convertible energy and Maximum work; Derivation of Exergy and Exalpy; Chemical Energy, Exergy from Heat and Work, Exergetic Efficiency, Generation of Entropy, Anergy. (Standard- Terminology- Reference: Paper on Exergy Analysis by G Lucca in Hand Book Acc. No. 18243 "A future for Energy: Flower' 90")

The two Laws combined: Review on some consequences of first Law, Limitations of first Law, Thermodynamic Temperature Scale, Practical Temperature Measurement, Clausius Clapeyron Equation, Stefan's Law. Helmholtz and Gibbs Functions, Availability in Steady Flow, Irreversibility and Effectiveness, Combined First and Second Laws, Isothermal and Adiabatic Compressibility; Joule-Kelvin Coefficient Maxwell Equation, Vander wall's Gas Equation; Equilibrium among Phases of a Pure Substances.

Multi Phase Systems: General considerations, Dalton & Amagat Model, Mixture of gases and vapors. Changes in Molal Properties upon Mixing, Gibbs entropy Equation and Gibbs -Duhem Equation.

Chemically Reactive systems: Thermodynamics of reactive Systems and Criterion of Equilibrium, Phase rule. Combustion Process, Enthalpy of formation; First Law Analysis of Reacting Systems; Second Law analysis of Reacting Systems, Equilibrium Constant and its temperature Dependence.

Thermodynamic Optimization: Exergy analysis of Vapor and Gas Power Cycles, Guideline for improving Thermodynamic Effectiveness; Exergy analysis of Simple Power Plant (Steam Plant) or Energy efficiency of Industrial Production Schemes (e.g. Helium Liquefaction System);

Introduction to: Irreversible Thermodynamics and Thermodynamics of High-Speed Gas Flow.

BOOKS:

1. Advanced Engineering Thermodynamics Adrian Bejan Wiley N Y 2nd Ed. ISBN 0471148806
2. Advanced Engineering Thermodynamics Benson R S Pergamon, Oxford
3. Methods Of Thermodynamics, by Reiss H, Pub. Blaisdell N Y
4. CRC handbook of Thermal Engg Kreith; Frank CRC ISBN 084939581x
5. Analysis of Energy Efficiency of Industrial Processes Stepanov, Vladimir S. Springer Verlag ISBN 038754080
6. An introduction to statistical thermodynamics Terrel L Hill
7. Fundamentals of classical Thermodynamics,Van Wylen, Sonntag, Borgnakke, John Wiley
8. Thermodynamics , K E Wark, McGH
9. Thermodynamics for Engrs, B V Karlekar, Prentice Hall
10. Cycles And Performance Estimation Hodge J Butterworth London
11. Availability Analysis Moran M J Prentice Hall
12. The Exergy Method of System Analysis J E Ahern Wiely-Interscience NY
13. Technical Thermodynamics Bosnjakovic ; Pub Blacksher N Y
14. Applied Thermodynamics Babits G Allen & Bacon , Boston

1S FMTE 3 FLUID DYNAMICS

1. Fluid flow concepts, Euler's equations of motion, Navier stoke equation, equation of continuity, Rotational irrotational flows, potential and stream functions, and flow nets circulations. Velocity.
2. Basic function- Uniform stream, sink, vertex doublet superposition of functions, flow over half bodies, Rankine bodies, circular cylinder, Magnus effect.
3. Conformation Mapping – Simple transformation and inverse transformations.
4. Boundary layer, theory for laminar and Turbulent flow, Blasius solution for flat plate, approximate methods, boundary layer separation and control, effect of roughness.
5. Turbulent flow, Semi empirical theories of turbulence, eddy viscosity, Prandtl's mixing length theory, Kerman's similarity hypothesis, Taylor's Verticity transfer theory.

6. Review of one dimensional compressible flow, approximation to two and three dimensional such as sonic, supersonic flows, small perturbation Theory, Shock Waves, Prandtl Mayors equation.

Books recommended:

1) Foundation of Fluid Dynamics –YUAN
2) Advanced Fluid Dynamics – BINDER
3) Dynamics and Thermodynamics –SHAPIROO.
   (For compressible flow Vol. I +II)
4) Boundary Layer Theory – SCHLICHTING.
5) Fluid Dynamics – PAO.
6) Fluid Dynamics – SHAMES
7) Recent Advances in Fluid Mechanics Editors P L Sachdev, M Venkatchalappa.(Gordon & Breach science Publishers)
8) Physical fluid Dynamics, D J Trinton, Oxford Science Pub
9) An Introduction to Fluid Dynamics, By G K Batchelor, Cambridge Mathematical Library

1S FMTE4 ADVANCED HEAT TRANSFER

Introduction to basic fundamentals, two dimensional heat conduction, graphical and numerical analysis, unsteady state heat conduction, Transient numerical methods.

Convection heat transfer, free and forced convection co-relations, combined free and forced convection.

Radiation processes and properties, radiation exchange between surfaces, gas radiation, radiation network.

Condensation and boiling heat transfer, transpiration cooling, ablation. Heat pipe- classification, construction and application

Books:-

1. Heat Transfer by J.P. Holman, Tata MacGraw Hill Publication
2. Heat Transfer by S.P. Sukhatme, Tata MacGraw Hill Publication
3. Heat and Mass Transfer by Eckert and Drake, Tata MacGraw Hill Publication
4. Principles of Heat Transfer by Kreith and Bohn, P.W.S. Publishing Company.
5. Convective heat & mass transfer by Kays and Crawford, Tata MacGraw Hill Publication.
6. Radiation Heat Transfer by E.M. Sparrow and R.D. Cess, Tata MacGraw Hill Publication.
7. Heat Transfer by Karlekar, P.H.I. Publication

8. Computer aided heat transfer analysis by Adams J.A. & Roger D.F. Tata MacGraw Hill Publication.
9. Introduction to Convective Heat Transfer analysis by Patrick Oosthuizen, Queens University, Tata MacGraw Hill Publication.
10. Heat transfer handbook, Nichola P. Chereminioff, Jaico Publishing House.
11. Heat pipe theory application by S. W. Chi
12. Advances in Heat Pipe Technology by Reay.

1S FMTE 5 RESEARCH METHODOLOGY

1. **Research Concept:** Concept, meaning, objectives, motivation; Types of research, approaches (descriptive research, conceptual, theoretical, applied, and experimental research)

2. **Formulation of Research Task:** Literature Review: importance & methods, sources, qualification of cause effect relations, discussions, field study, laboratory experiments, critical analysis of already generated facts, hypothetical proposal for future development and testing, selection of research task, prioritization of research.

3. **Mathematical Modeling and Simulation:** concept of modeling, classification of mathematical models, modeling with ordinary differential equations, differential equations, partial differential equations, graphs. Simulation concept, types (quantitative, experimental, computer, fuzzy theory, statistical), process of formulation of model based on simulation.

4. **Experimental Modeling:**

   a. Definition of experimental design, examples, single factor experiments, blocking and nuisance factors, guidelines for designing experiments.
   b. General model of process: Input factors/variables, Output parameters/variables, controllable/ uncontrollable variables, dependent/ independent variables, compounding variables, extraneous variables; experimental validity.
   c. Process optimization, designed experiments: methods for study of response surface, First order design. Determining optimum combination of factors, determination of steepest ascent, Taguchi approach to parameter design.

5. **Analysis of results** (Parametric and Non parametric, Descriptive and Inferential Data): types of data, collection of data (normal distribution, calculation of correlation coefficient), processing analysis, error

analysis, meaning, and different methods; analysis of variance, significance of variance, analysis of co- variance, multiple regression, testing linearity/ non linearity of model, testing adequacy of model, testing model/hypothesis.

6. **Report writing**: types of report, layout of research report, interpretation of results, style manuals, layout and format, style of writing, typing, references, pagination, tables, figures, conclusions, appendices.

7. **Landscape of Creativity**: Convergent Vs. divergent thinking, creativity, creativity Vs. intelligence, creativity abilities, creativity and madness, determination of creativity, increasing creativity, creative achievement, techniques of creativity, collective creativity.

(Term work: Ten Assignments based on above.)

Books:

1. Willkinson k, P L Bhandarkar, "Formulation of Hypothesis" Himalaya Pub Mumbai
2. Schank Fr, "Theories of Engg Experiments", TMcGH
3. Douglas Montgomary, Design of experiments"
4. Introduction to SQC, John Wielly & Sons
5. John W Besr & James V Kahn, "Research in Education", PHI Pub
6. Adler and Granovky, " Optimization of Engg Experints Mir Pub
7. Cochran & Cocks, "Experimental design", John Wielly & sons.
8. S S Rao" Optimization Theory & Applications", Wiely Eastern N Delhi
9. C R Kothari, "Research Methodology", Wiley Eastern ND

1S FMTE6 LAB PRACTICE - I

Lab Practice will constitute laboratory experimentation, design / simulation / programming assignments, industrial visits etc under Advanced Engineering Mathematics, Advanced Thermodynamics, Advanced Heat Transfer, and Research Methodology.

SEMESTER : SECOND

2S FMTE1 MODERN ENERGY SOURCES & POWER PLANT ECONOMICS

1. **SOLAR ENERGY: -**
   Fundamentals of heat transfer. Flat plate and concentrating collectors- design, analysis and performance, applications. Photovoltaic power.
2. **WIND, TIDAL, OCEAN, GEOTHERMAL ENERGY**: -
   Applications, Design aspects, Power generation methods, various cycles and analysis.
3. **MAGNETO-HYDRODYNAMICS**: -
   Design of various components, analysis, performance and methods of power generation.
4. **POWER PLANT ENGINEERING: -**
   Power plant economics, Advance trends in Thermal, Nuclear, and Hydel power generation.

Books :

1) Principles of Solar Thermal Engineering by F.Kreith & J.F.Kreider, McGraw Hill Publications1978
2) Solar Engines of thermal Processes by J.A.Duffie and W.A.Beckman, John Wiley & Sons publication 1999.
3) Applied Solar Energy by A.B.Meinal & F.P.Meinal, Addison Wesley 1976 publication.
4) Power Plant Technology by El-Wakil, Tata McGraw Hill publication
5) Power Plant Engineering by Morse.

2S FMTE 2 HEAT EXCHANGER DESIGN

Introduction, Double pipe heat exchanger, shell and tube heat exchanger, cross flow heat exchanger, design considerations, thermal deign of heat exchanger, various designing methods, performance calculations.

Mechanical design of various components like shell, tube sheet, nozzles. Selection of material for various components.

Books:-

1. Process Heat Transfer by D.Q. Kern, Tata MacGraw Hill Publication
2. Heat Exchanger Design by Frass & Ozisik, John Wiley and Sons, Newyork
3. Convective Heat transfer by Kays and London, Tata MacGraw Hill Publication

4. ANSI Standards for pipe and nozzle selection – 1996
5. ASME Section VIII Division for pressure Vessel and Boiler Design Code – 1995
6. Approximate sizing of shell and tube heat exchanger, Heat exchanger Design Handbook, by Kenneth J. Bell, Hemi sphere Publishing Corporation
7. ASME section II, Material Specifications – 1995
8. Mechanical design of hear exchanger design & Pressure vessel component, by Sing K.P. & Soler A. I.; Arcturus Publishers Cherry Hill
9. Process Heat Exchange by Robert Kern, Tata MacGraw Hill Publication
10. Heat exchanger Design handbook, Saunders E A.D., Hemisphere Publishing Corporation 1986
11. Tubular Exchange Manufacturer Association (TEMA) 7th Edition — 1988

2S FMTE 3 ELECTIVE –I

(i) S.I. ENGINES

Fuels: Suitability of fuels for S.I. Engines, Fuel ratings, fuel additives.

Alternative fuels: Alcohols, hydrogen, LPG, CNG, Gaseous fuels.

Fuel supply systems, Carburetion, fuel supply system, Design for low emissions, MPFI, electronic controls,

Theory of combustion: Working process, stages of combustion, heat release rates calculations, flame front propagation, rate of pressure rise, p-q diagram, abnormal combustions, S.I. engine cycle calculations,

Combustion Chambers: Requirement of C.C. for S.I. engines. and combustion chambers for MPFI.

Emissions: Theory of emission formation, causes and control, emission norms, emissions control by engine modifications, emission after treatment, exhaust system devices, catalytic converters, thermal reactors.

Performance Characteristics: Variables affecting performance of S.I. engines, methods of performance improvement, effect of altitude and ambient conditions on engine performance parameters. Analytical method of performance estimation, supercharging.

Modern engine technologies, mean value S.I. Engine modeling, Variable cam timing engine.

References

1. Fundamentals of Internal combustion engines by John. B.Heywood. McGraw hill Publications
2. I.C.Engines by Maleev

3. Internal combustion engines by Benson R. S. Vol I and Vol II
4. I.C. Engines by Taylor and Taylor

2S FMTE 3 ELECTIVE -I

(ii)ADVANCED REFRIGERATION

Review Of Basic Refrigeration Cycles, Reverse Carnot Cycle, Second Law Of Thermodynamics. Vapor Compression Refrigeration. Standard And Actual Compression Cycle.

Multi Pressure Systems, Refrigeration Component Matching And System Integration, Thermodynamics of Vapor Absorption Refrigeration, Non Conventional Refrigeration Systems with elementary analysis.

Properties Of Refrigerants, Green House Effect, Numbering And Color Coding Of Refrigerants, Recent Trends In Refrigerants. Air as refrigerant and air refrigeration cycles

Refrigerant Component Matching And Designing Refrigeration Components Like Compressor, Condenser, Capillary, Condenser Etc.

Reference:

Thermal Environmental Engineering, Therlkeld J.L., Prentice Hall, NY, 1970.

Refrigeration & Air Conditioning, Stoecker W.E. & Jones J.W., Tata Mcgraw Hill , Refrigeration And Air Conditioning,
C.P.Arora, Tata Mcgraw Hill, 1996.

Modern Refrigeration and Air conditioning (2004) By Andrew Daniel Althouse. Carl Harold Turnquist (Hardcover
Text)

Ashrae Hand Books, 1994,1995,1996,1997 .

2S FMTE 4 ELECTIVE –II

(i) C. I. ENGINES

Fuels: Suitability of fuels for C.I. engines; rating of fuels, fuel additives. Alternative fuels: Alternative fuels such as alcohols, CNG, LPG, Bio-diesel, and biomass fuels. Dual-fuel engines.

Fuel supply Systems: Injection, injection equipment design and injection process, and common Rail Fuel injection.

Theory of Combustion: Stages of Combustion, factors affecting delay period, abnormal combustion, cycle simulation, models for C.I. Engine combustion calculation.

Combustion Chambers: Chamber design, matching with fuel injection, selection criteria of combustion chambers, induction and exhaust systems.

Emissions: Mechanism of formation, Emission norms, strategies of emission control, EGR; Adverse effects of emissions on human health and Environment.

Performance Characteristics: Variables affecting performance of CI engines, methods of performance improvement, Analytical method of performance estimation.

Turbocharging: Types, methods and effects, other waste heat utilization practices. EGR, VGT systems. Mathematical model of a turbo-charged diesel engine.

Advance Engine Technologies: VCT, Microprocessor controls in engines, low heat rejection engines.

List of books recommended

1. Fundamentals of IC Engines - J.B. Heywood, McGH
2. I.C. Engines - Maleev
3. Internal Combustion Engines- R. S. Benson (Vol. I & Vol.II)
4. IC Engines- Taylor (I & II)

2S FMTE 4 ELECTIVE –II

(ii) ADVACNCED AIR CONDITIONING

Properties Of Air Water Mixture, Psychometric Air Conditioning Processes, Dehumidification Processes, Comfort Air Conditioning, Parameters Affects Comfort Conditions, Cooling Load Calculations, Design Of Air Delivery Systems To Hospital, Auditorium, Hotels Etc., Noise And Vibration Control In Air Conditioning Hall.

Air Conditioning Component Selection (Component Matching), Designing Air Ducts, Window Air Conditioner / Split Air Conditioner Performance Testing, Energy calculations- Degree-Day procedure, Bin Method , Comprehensive Simulation methods method, Flow- Pump – and piping Design.

Electrical Circuits And Components In Air Conditioner Like Olp, Capacitor, Performance Study Of Motors Used For Fan, Blower, Compressor,

Reference:

Air Conditioning Engineering , Jones W.P., Arnold Publication Ltd. London, 1984.

Control Systems For Heating, Haines R.W.

Air Conditioning And Ventilation Of Building, Croome- Gole D.J. And Roberts B.M.

Thermal Environmental Engineering, Therlkeld J.L.,Prentice Hall, Ny, 1970.

Refrigeration & Air Conditioning, Stoecker W.E. & Jones J.W., Tata Mcgraw Hill , Refrigeration And Air Conditioning, C.P.Arora, Tata Mcgraw Hill, 1996.

Ashrae Hand Books, 1994,1995,1996,1997 .

Heating, Ventilating, and Airconditioning Analysis and design By F.C.Mcquiston , J.D.Parker, J.D.Spitler, John Wiley & Sons, Inc.

Modern A/C, Heating & Ventilation by Carrier, Cherne, Grant, Roberts (Pitman N Y)

Modern Refrigeration and Air conditioning (2004) By Andrew Daniel Althouse. Carl Harold Turnquist (hardcover Text)

Refrigeration, Air conditioning and cold storage By Gnumner Reynold (Clifton Books Co)

2S FMTE 5 ELECTIVE -III

(i) GAS TURBINES

General Concepts related to Turbo machinery: Classification; Euler's Equation for Turbo machinery; Velocity triangle; Cascade analysis & nomenclature. Shaft Power & Aircraft Propulsion Cycles.

Centrifugal Compressors: Work done and pressure rise; Slip; Compressibility effects; Compressor characteristics. Axial Flow Compressors: Stage pressure rise; Blockage in compressor annulus; Degree of reaction; 3- D flow; Stage performance; h-s diagram & efficiency; Off design performance; Performance characteristics; Design process. Combustion System.

Axial Flow Turbines: Stage performance; Degree of reaction; h-s diagram & efficiency; Vortex theory; Overall turbine performance; Performance characteristics; Blade cooling; Design process. Prediction of performance of simple gas turbines; Off Design performance; Gas turbine blade materials; Matching procedure.

Recommended Texts

1. H. Cohen, Gas Turbine Theory, 4th Edition, Longman, 1998.
2. S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbo machinery, 4th Edition, Pergamon Press, 1998.
3. Jack D. Mattingly, Elements of Gas Turbine Propulsion, McGraw Hill, Inc., 1996.
4. Budugur Lakshminarayana, Fluid Dynamics and Heat Transfer of Turbomachinery, John Wiley & Sons, Inc,1996.
5. Wilson, D. G. The Design of High efficiency turbomachinery and gas turbine, MIT press, 1984.
6. Horlocks, J.H. Axial Flow Compressors, Krieger Publishing, 1982.

2S FMTE 5 ELECTIVE-III

(ii) CRYOGENICS

Introduction: Historical review and present application areas. Review of thermodynamic relationships, Joule Thomson effect, conductive, convective and radiative heat transfer.

Cryogenic Fluids: PVT behavior of a pure substance, Inversion curve, T-S diagram for He N_2 O_2 air etc, Molecular forms of Hydrogen, Properties and principal uses of cryogenic fluids. Minimum work required liquefying 1 kg?mole of some of the several common cryogens (He, H_2. Ne, N_2, Air, O_2, Methane, Ethane, Ammonia).

Cryogenic Refrigeration & Gas Liquefaction Systems: Liquefaction systems for (I) gases other than Neon, Hydrogen and Helium (II) for Neon, Hydrogen and Helium.

Refrigeration methods (i) Evaporation of volatile liquid- VC (ii) Cascade, mixed refrigerant cascade (iii) Isenthalpic expansion (Joule Thomson/ Linde apparatus) (iv) An adiabatic (isentropic) expansion, Combination of Isenthalpic and Isentropic expansion (Claude, Modified Claude & Heylandt cycles) (v) Stirling cycle / Phillips refrigerator, (vi) Gifford-McMohan, (vii) Magnetic, (viii) He-He dilution refrigerator.

Applications: Air separation, liquefaction of natural gas, superconductivity and its application, storage dewars, vacuum technology, low T insulation categories, high vacuum with/without shields, powders, rigid foams, low conductivity solids. Materials for cryogenic service: metals polymers, glass.

BOOKS:

1. MacKinnon, Lachlan, Experimental Physics at Low Temperatures, Wayne Statte University Press, Detroit
2. Lounasmaa, O. V., Experimental Principles and Methods Below 1 K, New York, Academic Press,
3. Pobell, Frank, Matter and Methods at Low Temperatures, second edition, Berlin, Springer
4. White, Guy K., Experimental Techniques in Low-Temperature Physics Third Edition, Oxford Uni. Press,
5. Cryogenic Process Engineering Timmerhaus K D, Flynn T M Pub.:Plenum
6. Cryogenic Fundamentals Haselden G Academic Press
7. Cryogenic Systems Randall F Barron McGH
8. Cryogenic Engineering Flynn Thomos M Dekker

9. Cryogenics Bryson William E Hanser.Gardner
10. Cryogenic Refrigeration Flynn, Thomos M, Chen Gyobang
11. Applied Cryogenic Engg Vance and Duke Wiley
12. Cryogenic Processes And Equipment Leonard Wenzel, F J Kadi ASME

2S FMTE 6 LAB PRACTICE-II

Lab Practice will constitute laboratory experimentation, design / simulation / programming assignments on electives of a Group I or Group II

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SEMESTER : THIRD

3S FMTE 1 : Seminar - I

3S FMTE 2 : PROJECT

Seminars:

Seminar 1 - General (non- dissertation) topic from the advances in thermal engineering.

Seminar 2 - Related to candidate's probable topic for dissertation.

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SEMESTER : FOURTH

4S FMTE 1: DISSERTATION & VIVA-VOCE

Substantiation of the topic / title of *dissertation* shall undergo 2 stages: Endorsement and Registration.

Approval (endorsement) by the PG Committee shall be done before / during the commencement of the third semester, and approved topic will be sent without delay to university for registration.

After confirmation of registration will follow Project presentation (candidate portraying his own scheme in respect of tools / techniques / software and tasks performed through seminar). External and internal examiners will make assessment of each seminar jointly.

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SYLLABUS PRESCRIBED FOR
TWO YEAR POST GRADUATE DEGREE COURSE
MASTER OF TECHNOLOGY
(CHEMICAL ENGINEERING)
(FULL TIME)

FIRST SEMESTER

1CE 1 TRANSPORT PHENOMENA

Viscosity and Mechanisms of Momentum Transport, Shell momentum balances and velocity distribution in Laminar flow., Equation of continuity, Mechanical energy, and equation of motion, velocity distribution in Turbulent flow, Polymeric liquids, Non Newtonian Viscosity and Models, Molecular theory of Polymeric Liquids. Boundary layer flow and hydrodynamic boundary layer.

Thermal conductivity and the mechanism of Energy transport, Shell energy balance and temperature distributions in laminar and turbulent flow, convective transport of energy, Thermal boundary layer theory, Heat transfer coefficients for different situations.

Diffusivity and the mechanisms of Mass Transport. Mass transport by convection, concentration distributions in laminar and turbulent flow. concentration boundary layer, Mass transfer with chemical reaction.

Simultaneous heat, mass and momentum transfer, analogy, dimensional analysis, Scale up.

Recent Developments in the fields and future challanges.

Books and References :

1. Transport Phenomena, R.B.Bird, W.E. Stewart and E.W. Lightfoot. John Wiley, 2nd Ed
2. Fundamentals of Momentum, Heat and Mass Transfer, J.R. Wilty, et. Al. John Wiley, 4th Ed.
3. Transport Processes and Separation process Principles, Christie J. Geankopolis 4th Ed. Prantice Hall.

Practical based on above syllabus.

1 CE 2 ADVANCED BIOCHEMICAL ENGINEERING

Kinetics of Microbial Growth And Product Formation

Phases of cell growth in batch cultures; simple unstructured kinetic models for microbial growth; growth associated product formation kinetics; Monod and Leudeking-Piret models; etc.,

Introduction to structured models for growth and product formation.

Stoichiometry of cell growth and product formation-elemental balances, available electron balances, degrees of reduction; yield coefficients of biomass and product formation; maintenance coefficients; oxygen consumption and heat evolution in aerobic cultures.

Techniques in Fermentation :-

Sterilization

Sterilization methods; Thermal death kinetics; Design criterion; Batch and continuous Heat- Sterilization of liquid media; Membrane Filter Sterilization of liquid media and Air.

(Death kinetics and design criteria to be elaborated)

Transport Phenomena In Bioreactors

Mass Transfer in heterogeneous biochemical reaction systems; oxygen transfer in submerged fermentation processes; oxygen uptake transfer coefficients (k1.a); relation OUR and OTR, role of aeration and agitation in oxygen transfer. Heat transfer processes in biological systems.

Process Design and Construction Of Bioreactors

Materials of construction, vessel geometry, Bearing assemblies, motor drives; Aseptic Seals; Flow measuring Devices, valves; Agitator and Sparger Design ; sensors and its ancillaries. Operational modes of reactors-Batch, continuous, Fed batch, repetitive batch, recycles and continuous cultivation; novel bioreactors; stirred tank, air lift & loop reactors, packed-bed and hollow-Fiber membrane Bio-reactors; reactors for waste-treatment processes; scale up criteria for bioreactors.

Books and References:

1. Bailey J.E and Ollis, D.F.Biochemical Engineering fundamentals, McGraw Hill(1986).
2. James M.Lee, Biochemical Engineering, Prentice Hall, Englewood Cliffs, New Jersey
3. Michael L. Shuler and Fikret Kargi, Bioprocess Engineering: Basic Concepts, Second Edition, Prentice Hall.
4. S. Aiba et al, Biochemical Engineering, Academic Press, London, 1965.

Practical based on above syllabus.

1 CE 3 PROCESS CONTROL

Dynamic modeling of complex processes by applying fundamental laws, Empirical modeling

Graphical methods for first order plus dead time and second order (over & under) damped Processes. Computer based process parameter estimation techniques.

Introduction to non linear , open loop unstable, dead time, integrating processes and their control.

Advanced control strategies, controller design for cascade control, feed forward control and interfacial Control.
Adaptive control, MRAC and STR, control configuration, Analysis and Applications
Model based control: Internal model control, Dynamic matrix control, model predictive control.
Multivariable control, Transfer function Matrix, Stability and interaction analysis.
Digital control : Hardware & Software requirement, Introduction of DDC, DCS, supervisory (optimizing) and hierarchical, z-and modified z-transformation and their inverse. Controller design and implementation.
Case studies.

Recent Developments in the fields and future challanges.

Books & References :

1. George Stephanopoules, "Chemical Process Control, An Introduction to Theory and Practical", Prentice Hall, New Delhi, 1998
2. Smith C A and Corripio A B "Principles and Practice of Automotive Process Control", John Wiley, New York, 1976.
3. Coughnowr D R, "Process System Analysis and Control" 2nd edn., McGraw Hill, New York, 1991.
4. Luyben" Process Modelling, Simulation and Control for Chemical Engineers", 2nd edn, McGraw Hill, 1990.

1 CE 4 MATHEMATICAL MODELING AND OPTIMIZATION

Introduction to process engineering and optimization, formulation of various process optimization problems and their classification, basic concept of optimization, convex and concave function, necessary and sufficient conditions for stationary points, optimization of one dimensional problems

Unconstrained multi variable optimization, direct search methods, indirect first and second order methods, linear Programming and its application : Simplex and Big M & two phase methods.Constrained multi level optimization, necessary and sufficient conditions for optimum, quadratic programming, Dynamic programming, integer and mixed integer programming.

Neural Network : Fundamentals, basic propagation network, use of neural networking in industries, fundamentals of genetic algorithm, genetic modeling.

Books & References:

1. T.F.Edgar and D.M Himmelblau "Optimization of Chemical Processes" McGraw Hill Edition.

2. Rao S.S "Engineering Optimization" New Age
3. Sharma J.K. "Operations Research"
4. Rajasekaran R, & Vijayalakshmi G.A. " Neural Network, Fussy Systems and Genetic Algorithm.

1 CE 5 ELECTIVE-I (Any one of the following topics)

1) ADVANCED CHEMICAL ANALYSIS

Introduction to Spectroscopical Methods Of Analysis
Molecular Spectroscopy, Atomic Spectroscopy, Polarimetry And Refractometry, Electrometric Methods Of Analysis, XRD Analysis
Thermal Methods, Chromatographic Methods
QUANTITATIVE SPECTROSCOPY: Beer-Lambert's Law, Limitations, Deviations (Real, Chemical, Instrumental). Nesslerimetry, Duboscq colourimetry, Estimation of inorganic ions such as Fe, Ni and estimation of Nitrite using Beer-Lambert's Law. Various electronic transitions in organic and inorganic compounds effected by UV, Visible and infra red radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds), Effects of auxochromes and effects of conjugation on the absorption maxima, Instrumentation for UV, VISIBLE and IR spectroscopies (Source, Optical parts and Detectors), Multicomponent analysis,
Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixure of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

Books & References:

1. Parikh V.M., " Absorption Spectroscopy of Organic Molecules ", Addison - Wesley Publishing Company, 1974.
2. Willard, H.H., Merritt. I.I., Dean J.A., and Settle, F.A., " Instrumental Methods of Analysis", Sixth edition, CBS publishers, 1986.
3. Skoog D.A. and West D.M., " Fundamentals of Analytical Chemistry", Saunders-College Publishing, 1982.
4. Banwell, G.C., " Fundamentals of Molecular Spectroscopy", TMH, 1992.

1 CE 5 ELECTIVE-I
2) MATERALSCIENCE

Packings in crystals, ceramic structure, silicate materials, refractory material, structure sensitive materials, polymeric materials, structure, rheology, mechanical properties, instruments used for determination of structure, detects, advances in polymeric materials, metals like carbon, steel, alloy steel, effect of cooling & heating on structure of metal structure, strengthening mechanism, rubber and composite materials.

Stress characteristics, reinforced material, plastics in packaging, containers for pharmaceutical, beverage, food, oil, detergent, etc. industries, BOPP film in food packaging, laminated, heat seable, flame proof polyester fibers, flame retardant polyolefin fibers, polymer alloys and their applications, nylon, pc, pvc, polysulphur etc., alloys, materials of construction for handling specific chemicals, Lining of equipment, inspection & testing, corrosion, fatigue, protection & testing, nanomaterials.

Books & References:

1) Process Design of Equipments, Vol. I & II : Dawande S.D., Central Techno Pub., Nagpur.
2) Hydrocarbon Processing- Journal
3) Corrosion Engineering : Fontana M.G., McGraw Hill.
4) Chemical Engg. - World Journal.
5) Chemical Age of India.

1 CE 5 ELECTIVE-I
3) PULP& PAPER TECHNOLOGY

Raw materials for making pulp & Paper. Different pulping processes, pulp washing, recovery of spent chemicals, pulp bleaching, stock preparation: beating, refining, internal sizing filling & loading, coloring, wet end additives.

Fourdrinier and cylinder mold paper making machines, sheet formation, Pressing, sheet drying, external sizing, winding, Hand made paper production.

Environmental aspect of Pulp & Paper Industry.

Recent Development of subject.

Books & References:

1. Pulp & Paper, Chemistry & Chemical Technology Casey, J.P.Wiley Interscience, New York
2. Pulp & Paper Manufacture , MacDonald R.G, McGraw Hill
3. Pulping Processes, Rydhlom S.A Interscience, New York
4. Pulp & Paper, Science and Technology, Libby, C.E McGraw Hill
5. Handbook of Pulp & Paper Technology, Britt, K.W. Reinhold Publishing Corporation, NY.

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SECOND SEMESTER

2 CE 1 CHEMICAL REACTION ENGINEERING

Basic concept of design of reactors, types, optimisation techniques, multiphase reactors, multiphase reactions, hetrogeneous catalytic reactions, isothermal, non isothermal, adiabatic, non adiabatic, fluidised catalytic reactor, slurry reactor, characterisation of catalysis, chemical kinetics & rate equation for homogeneous and hetrogeneous reactions, chemical reaction kinetics for reactions with heat and mass transfer simulteneously, non ideal flow, fixed bed reactor - adiabatic, non isothermal, non adiabatic fixed bed, comparision of fixed, moving & fluid beds, optimization - formulation of reactor problems, use of linear programming, differential calculus, non linear programming in reactor optimization, instrumentation & control devices in chemical reactor.

Books & References:

1) Chemical Reaction Engg. : Levenspiel O., John Wiley.
2) Chemical & Catalytic Reaction Engg. : James J. Carberry, McGraw Hill.
3) Chemical Engg. Kinetics : Smith J.M., McGraw Hill.
4) Chemical Reactor Design & Analysis : Bischott K.B. & Forment G.F.
5) Optimization of Process : Edgar T.F., Himmelbloan D.M., McGraw Hill.
6) Elements of Chemical Reaction Engg. : Scot Fogler H.C., Prentice Hall.

Practical based on above syllabus.

2CE2 ADVANCED SEPARATION PROCESS

Membrane transport and separation mechanism, basic transport Equations solute transport parameters, surface force-pore model, prediction of membrane performance, physico-chemical criteria of membrane process, material science of RO/UF membranes, aqueous & non aqueous solution systems, module design and analysis, membrane process design and systems, membrane process in water, waste water, biotechnology process, food industries etc., membrane bio reactor, pervaporation techniques in alcohol concentration, gas separation application, permeation under pressure through membrane, membrane fouling and compaction, liquid membranes, pollution control by membrane process RO treatment of non-aqueous solutions in liquid phase.

Books and References:

1. RO/UF Principles and Applications; S.Sourirajan, R. Matsscera, Canada
2. UF Applications Hand book; Munir Cheryon
3. Membrane Separation Process : Stratumann, Germany
4. Handbook of Separation Process Technology: Koros W.J, Rousseau R.W., Wiley, New York.

Practical based on above syllabus

2 CE 3 PROCESS DESIGN AND PLANT UTILITIES

Process Design and development. General design considerations, Hierarchy of chemical process design.
Nature of process synthesis and analysis. Developing a conceptual design and flow sheet synthesis.
Synthesis of reaction-separation systems, Distillation sequencing, Energy targets, heat integration of
Reactors, distillation columns, evaporators and driers. Process change for improved heat integration.
Heat and mass exchange networks and network design. CHEM CAD/CAM ASPHEN Essential utilities of chemical process plants such as Water sources, steam, compressors & vacuum pumps, refrigeration systems, inert gases etc.

Recent Developments in the fields and future challanges.

Books & References:

1. Jack Broughton; Process Utility Systems; Institution of Chem. Engineers U.K.
2. Reid, Prausnitz poling; The Properties of Gases & Liquids, IV ed. McGraw Hill International ed.
3. S.C.Arora & S.Domkumdwar; A Course in Refrigeration and Air Conditioning; Dhanpat Rai & Co.(P) ltd.

2CE4 ENERGY TECHNOLOGY AND CONSERVATION

Sources of energy, different forms and conversion , solid, liquid and gaseous fuels, composition Analysis, heating values, combustion of fuels, furnaces and furnace streams, material and energy Balance, consumption and heat transfer efficiency, furnace design, oxidation of sulfur and sulfur compounds, alternate sources of energy, energy auditing, case studies, principle of renewable energy, technical and social implications.
Solar radiation, measurement and estimation, solar heating devices, solar water heaters, sheltered and unsheltered heaters, systems with separate storage, selective surfaces, solar ponds, solar concentrators and other devices, Bio fuels: classification, combustion and pyrolysis, production of alcohol and bio gas. Bio diesel, fundamentals, transesterification of vegetable oils for bio diesel production, characterization of bio diesel, economics, current trends, future prospects.
Hydrogen energy,: system and analysis, hydrogen infrastructure, safety, codes and standards.
Hydrogen production: Electrolysis, thermochemical, hydrogen from fossil fuels, biomass a renewable sources of energy. Hydrogen storage, carbon storage materials, metal and chemical hydrides, cryogenic hydrogen storage, hydrogen fuel cells.

Recent Developments in the fields and future challanges.

Books & References:

1. Fuels & Fuel Technology : Francis W; Peter M.C Pergmon Press
2. Fuel Combustion Energy Technology : S.N.Saha, Dhanpat Rai Pub. Co. New Delhi
3. Conventional Energy Technology : S.B.Pandya, Tata McGraw Hill
4. Practical Techniques of Saving Energy in Chemical Industries : Sitting M, Noyes Data Corp. USA.
5. Brame J. S. S. and King J. G. Edward Arnold, " Fuel, Solid, Liquid and Gases"
6. Sukhatme S.P., "Solar Energy"

2CE5 ELECTIVE-II (Any one of the following)

1) ENVIRONMENTAL ENGINEERING & WASTE MANAGEMENT

Ecology and environment, sources of air waster, solid wastes, Air pollution, Micrometeorology and dispersion of pollutants in environment, Fate of pollutants, Air pollution control techniques, centrifugal collectors,electrostatics, precipitator, bag filter, wet scrubbers, Design & efficiencies, Combustion generated pollution, vehicle emission control, case studies, Water pollution, water quality modeling of streams, Characterization of effluents, effluent standards, treatment methods, Primary, secondary and tertiary methods, solid waste collection, treatment and disposals, waste recovery systems.

Books & References:

1. Environmental Impact Assessment L.Canter, McGraw Hill
2. Fundamentals of Ecology, E.P.Odum, V.B.Sounders & CO
3. Physici-Chemical Process for water quality control, Wiley International
4. Water & Water Pollution Handbook, L.L.Gaccio, Marcel Dekkar, New York.

2CE5 ELECTIVE-II
2) NANOTECHNOLOGY

Introduction to Nanotechnology – History of nano-revolution, nano scale materials and their applications, Carbon nano tubes, organic and inorganic nano structures.
Future of the nanotechnology.
Materials used in Nanotechnology – An overview of the physical (mechanical, electrical) and chemical properties of different classes of solid materials such as metals, semiconductors, insulators and polymers.

Examples of size effects of properties observed in thin films, colloids and nanocrystals.

Conventional Fabrication Techniques – Topdown and bottom up process, techniques used in conventional microfabrication including thin film deposition (e.g. CVD, PVD(, lithography, chemical etching and electrodeposition.

Analytical Techniques – Analytical techniques such as Scanning Electron Microscopy (SEM), Electron and X-ray Diffraction, Ellipsometry, Photoelectron, Optical and Ion spectroscopy and Probe Microscopy. Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM)

Applications – Examples of applications in Micro and Nano technology including, Micro fluidics, Micro Electron Mechanical Systems (MEMS) membrane technology, and catyalyst and coatings

Books & References :

1. M. Wilson, K. K. G. Smith, M. Simmons and B, Raguse; Nanotechnology, Chapman & Hall/CRC press 2002
2. M. Meyyappan; Carbon Nanotubes, Science and application; CRC Press, 2005
3. Alexei Nabok; Organic and Inorganic Nanostructures; Publisher Artech House, London, 2005
4. H. Watarai, N. Teramae and T Sawada; Interfacial Nanochemistry; Kluwer Academic/Plenum Press, 2005

2CE5 ELECTIVE-II
3) CHEMOINFORMATICS

Definition; in-vivo, in-vitro, in-silico synthesis of molecules
Representation of molecules in computers; WLN, SMILES, InChi etc.; Graph theory; Property Calculations; QSAR, QSPR
Molecular surfaces; data mining, data modeling; 2D and 3D structural databases; Database search tools (ANN, GA, Fuzzy etc.)
Virtual reactions, reaction prediction; bond energies; reaction databases; drug design; CML
Introduction to packages such as ACDLABS, Chemsk8, Chemaxon, JME, Molchem

Books & References:

1. J. Gasteiger, T. Engel, "Cheminformatics," Wiley-VCH, Weinheim, Germany, 2003 A. Leach, V. Gillet, "An Introduction to Cheminformatics," Springer, 2003.
2. J. Bajorath, "Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery (Methods in Molecular Biology)," Humana Press, 2004

3. Gasteiger, Johann J., ed. Handbook of Chemoinformatics: From Data to Knowledge. 4 v. Wiley-VCH, 2003.

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THIRD SEMESTER

3CE1 DISSERTATION / SEMINAR : Preparation of detailed report based on collection of data, experimental work, published review, etc, on a topic related to the Project / Dissertation and presentation as seminar.

Literature survey on Project / Dissertation topic, planning of work, finalising materials and methodology, etc.

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FOURTH SEMESTER

4CE1 DISSERTATION / SEMINAR : Review of Project / Dissertation data generated, experimentation, conclusion drawn, recommendations given, preparation of report, calculation, designing, etc.

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SYLLABUS
PRESCRIBED FOR
TWO YEAR POST GRADUATE
DEGREE COURSE
MASTER OF ENGINEERING
(FULL TIME)
COMPUTER SCIENCE & ENGINEERING
SEMESTER : FIRST

1RMEF1/1RME1 ADVANCED COMPUTER ARCHITECTURE

I. Fundamentals : Technology & Computer usage trends, costs, Performance measurements. Quantitative principles of Computer design. Concepts of memory hierarchy. Instruction set architectures. Memory addressing. Operations in the instruction set. Encoding. Role of compilers. DLX architecture.

II. Pipelining : Basic principles & DLX. Various hazards : Pipelines, data, control hazards. Implementation issues. Multicycle operations. Crosscutting issues. Instruction set design and piplelining. MIPS R4000 pipeline architecture.

III. Advanced pipeline and instruction - level parallelism : concepts & challenges. Data hazards & dynamic scheduling. Dynamic Hardware prediction. Compiler support for ILP. Hardware support for parallelism. Studies of ILP. Power PC620.

IV. Memory- hierarchy design : Basics of caches, Reducing cache miss & hit time. Main memory. Virtual memory. Protections Examples of virtual memory. Issues in the design of memory hierarchies. Alpha APX 21064 Memory hierarchy.

V. Storage Systems : Types of storage devices, Buses & their types, performance I/O performance measures. Reliability, Availability and RAID. Interfacing to an Operating system. Designing an I/O system. Unix file system performance.

VI. Interconnection networks : Introduction & basic concepts, Computer connection to interconnection network. Interconnection network media. Practical issues. Examples of interconnection networks. Issues for interconnection networks. Internet working. An ATM network of workstation.

Books :

1. Hennessy J.L. & Patterson D.A."Computer Architecture : A Quantitative Approach" 2/e (Harcourt Asia)
2. Hayes J.P. "Introduction to Computer Architecture" (McGraw Hill))
3. Hwang K."Advanced Computer Architecture & Parallel Programming"

(McGraw Hill)
4. Hamacher V.C."Computer Organization (McGraw Hill)

1RMEF2/1RME2 ALGORITHMICS

I. Introduction : Mathematical Notations, Proof techniques, Elementary algorithmics, Efficiency of algorithms : Examples. Asymptomatic notations : conditional asymptomatic notations. Notation with several parameters. Operations on asymptomatic notations.

II. Algorithm analysis : Analysing control structures. Examples. Average-case analysis. Amortized analysis. Solving recurrences. Review of data structures : Arrays, Stacks, Queries, Records & Pointers, Lists, Graphs, Trees, Associative tables, Heaps.

III. Greedy Algorithms : Some characteristics, Graphs : Minimum spanning trees, Shortest paths. The knapsack problem, Scheduling, Divide & Conques : Introduction - general template, Binary search, sorting, median finding & matrix multiplication. Exponentiation. Cryptograph.

IV. Dynamic programming : Examples, Principle of optimality, Knapsack problem & shortest paths. Chained matrix multiplication, Recursion,Memory function. Graphs : Travarsing trees. Depth-first-search : Directed & undirected graphs : Breadth-first-search. Back tracking. Branch-and-Bound. Minimax principle.

V. Probability algorithms : Introduction, pseudorandom generation. Numerical probabilistic algorithms. Monte Carlo algorithms. Las Vegas algorithms. Parallel algorithms : Basic techniques. Work & efficiency. Examples. Parallel evaluations of expressions. Parallel sorting networks & parallel sorting.

VI. Computational complexity.Introduction.Information-theoretic arguments. Adversary arguments. Linear reduction, Introduction to NP-completeness. Heuristic algorithms. Approximate algorithms. NP-hard approximation problems. Approximation schemes.

Books :

1. G. Brassard, P.Bratley "Fundamentals of Algorithmics" (PHI)
2. Horowitz & Sahni "Fundamentals of Algorithms" (Galgotia)
3. Aho, Ullman "Analysis & Design of Computer Algorithms" (Addison-Wesley)
4. Donald E.Knuth "The Art of Computer Programming" Vol.I, Vol.II, Vol.III (Addison-Wesley)

1RMEF3/1RME3 OPERATING SYSTEM DESIGN

I. General overview of the Unix System, Kernel : Architecture of Unix OS, Kernel data structures, system administration. The buffer cache; advantages & disadvantages.

II. Internal representation of files, inodes, structures, directories, super block, allocation of disk blocks, System Calls for the file system in Unix.

III. Processes : States & transitions, Layout of system memory. Context Sleep. Process Control, Process Scheduling and Time.

IV. Memory management policies in Unix. Swapping, demand paging hybrid system. I/O subsystem : drivers & streams.

V. Interprocess Communication : Process tracing, System V IPC Network communications, Sockets.

VI. Multiprocessor Systems : Problems & solutions with master slave processors. Distributed Unix System.

Books :

1. M.J.Bach : The Design of Unix Operating System (PHI)
2. A.S.Tanenbaum : Operating System Design & Implementation (PHI)
3. D.Comen : Operating System Design (Prentice Hall)

1RMEF4/3RME1 DIGIAL IMAGE PROCESSING

I) Introduction, Origin and application of DIP. Fundamental steps and components of an IP system. Elements of visual perception. Light and EM spectrum. Image sensing, acquisition, sampling and quantization. Basic relationships between pixels.

II) Spatial domain image enhancement : gray level transformations. Histogram processing. Enhancement using arithmetic/logic operations. Basics of spatial filtering. Smoothing spatial filters. Sharpening spatial filters. Combined methods.

III) Frequency domain image enhancement : Fourier transform and the frequency domain. Smoothing frequency domain filters. Sharpening frequency domain filters. Homomorphic filtering. Implementation of 2-D Fourier transform, the FFT.

IV) Image restoration : Noise models. Restoration in the presence of noise-only- spatial filtering. Periodic noise reduction by frequency domain filtering. Linear, Position Invariant degradation. Estimation of degradation function. Inverse filtering. Wiener filtering. Constrained LS filtering. Geometric

transformations : spatial & gray level interpolation.

V) Color image processing : color fundamentals. Color models. Pseudo color image processing. Full color image processing. Color transformations. Smoothing & sharpening. Color segmentation. Noise in color image. Color image compression.

VI) Image compression : fundamentals, image compression models. Error-free compression methods. Lossy predictive coding. Transform coding. Image segmentation : point, line & edge detection. Edge linking and boundary detection. Thresholding.

TEXT BOOK : Gonzalez R.C. & Woods R.E. : "Digital Image Processing" (2/e) (Pearson Education)

REFERENCES :

1) Pratt W.K. : "Digital Image Processing" (3/e) (John Wiley)
2) Chanda B. & Majumdar D. :"Digital Image Processing & Analysis" (2000) (PHI)
3) Schalkoff R.J. : "Digital Image Processing & Computer Vision" (John Wiley & Sons)
4) Umbaugh S.E. : "Computer Vision and Image Processing" (Prentice Hall)"

Lab : At least eight experiments must be performed which will include at least one experiments on each Unit.

1RMEF5/3RME2 DATABASE MODELING & DESIGN

I. INTRODUCTION : Introduction to Database Processing. Introduction to Database Development. DATA MODELING. The Entity-Relationship Model. The Semantic Object Model.

II. DATABASE DESIGN : The Relational Model and Normalization. Database Design Using Entity-Relationship Models. Database Design with Semantic Object Models.

III. DATABASE IMPLEMENTATION WITH THE RELATIONAL MODEL

Foundations of Relational Implementation. Structured Query Language. Database Application Design.

IV. USING INTERNET TECHNOLOGY : Using Database Applications. Managing Multi User Databases. Accessing the Database Server : ODBC, OLE DB, and ADO.

V. ENTERPRISE DATABASES : Sharing Enterprise Data. Relational Implementation with DB2, the Hierarchical and Network Data Models.

VI. OBJECT-ORIENTED DATABASE PROCESSING

Basic Concepts, Data, Objects & Class concepts. Object-Oriented Database Processing.

Book :

David Kroenke : Database Processing
Fundamentals, Design and Implementation (7/e) (Macmillan)

References :

1. C.J.Date : Database Processing (Addison - Wesley)
2. R. Ramakrishnan : Database Management Systems (McGraw Hill)

3RME 2 LAB

At least eight experiments must be performed which will include at least one experiement on each Unit.

SEMESTER : SECOND

2RMEF1/2 RME 1 COMUPTER COMMUNICATION NETWORKS

Unit I : The need for speed and quality of service. Advanced TCP/IP and ATM Networks. The need for a protocol architecture. The TCP/IP protocol architecture. The OSI model. Internetworking, TCP, UDP, Ipv6.

Unit II : Pacekt-switching networks. Frame relay networks. ATM protocol architecture. ATM logical connections. ATM cells. ATM service categories. ATM Adaptation Layer (AAL). The emergence of high-speed LANs. Ethernet. Fibre channel. Wireless LANs.

Unit III: Overview of probability and Stochastic processes. Probability. Random variables. Stochastic processes. Queuing analysis. Why queuing analysis. Queuing models. Single-server queus. Multiserver queues. Queues with priorities. Networks of queues. Other queuing models. Estimating model parameters. Self-similarity. Self-similar data traffic. Examples of self-similar data traffic. Performance implications of self-similarity.

Unit IV: Congestion control in data networks and internets. Effects of congestion. Congestion and control. Traffic management. Congestion control in Packet-Switching networks. Frame relay congestion control. The need for flow and error control. Link control mechanisms. ARQ performance. TCP flow control. TCP congestion control performance of TCP over ATM.

Unit V : Overview of graph theory and least-cost paths. Elementary concepts of graph theory. Shortest path length determination. Internet routing principles. Distance-Vector protocol. RIP. Link-State protocol. OSPF. Path-Vector protocols. BGP and IDRP. Multicasting.

Unit VI: Integrated Services Architecture (ISA). Queuing discipline. Random early detection. Differentiated services. Real-Time traffic. Resource Reservation : RSVP. Multiprotocol label switching. Real-Time Transport Protocol (RTP).

References :

1. Willam Stallings - High Speed Networks and Internets - Performance and Quality of Service, 2nd Ed., (Pearson Education)
2. Andrew S. Tanenbaum - Computer Networks, 4th Ed., Pearson Education.
3. James F. Kurose, Keith W. Ross - Computer Networking : A Top-Down Approach Featuring the Internet.
4. William Stallings - Data and Computer Communications, 7th Ed., Pearson Education.
5. Andrew S. Tanenbaum - Computer Networks, 4th Ed., Pearson Education.

2RMEF2/2RME2 ARTIFICIAL NEURAL NETWORKS TECHNIQUES

I. Introduction: Brief overview of neural computing. Engineering approaches to neural computing. ANNS : mapping and structure viewpoints. ANN learning approaches. Mathematical fundamentals for ANH: Vectors, Matrix, State-space visualization. Optimization. Graph & Digraphs.

II. Elementary ANNS : Biological vs. Artificial neural units. Units net activation to output characteristics. Artificial unit model extensions. Linear separability. Techniques to directly obtain linear unit parameters. Perceptrons, Adaline/Madaline units. Multilayers perceptrons. Gradients Decent training.

III. Neural network based pattern associaters. Influence of psychology on PA design linear associative mappings, Training & examples. Hebbian Learning. Multilayer feedforward network structures. Delta Rule, Generalized delta rule. Architecture & tracing extensions.Hiden Units. MLFF network mapping. Example of FF N/W design.

IV. FF PA design, Weight space, Error surfaces & search. Generalization. Output error norms, High-order derivative based training. Stochastic optimization. Network architecture determination problem. Genetic algorithm for n/w training. Correlation n/w/, N/W minimization & inversion.

V. Recurrent Networks : Introduction. Basic parameters & Recurrent network design, weight storage perception and n/w capacity. Network synthesis procedures & examples. Energy function characterization.

BAM Self-organizing feature maps. Adaptive resonance architectures.

VI. RBF networks : Structure, Characteristics, Design, Training & Application examples. Introduction to Neuro-fuzzy systems. Fuzzy sets & Logic overview. Fuzzy system design procedures. Fuzzy/ANN design and implementation. Practical ANN implementation. Related elements of Computer architecture. Hardware realization.

Books :

1. Schalk off Robert J. "Artificial Neural Networks" (McGraw Hill ISE)
2. Simon Haykin "Neural Networks" (Pearson Education) 2/e
3. Kosko, B. "Neural Networks & Fuzzy Systems" (PHI)
4. Fu Li Min "Neural Networks in Computer Intelligence" (McGraw Hill)

Lab : At least eight experiments must be performed which will include at least one experiments on each Unit.

2RMEF3/4 RME 1 COMPUTER VISION

Unit I : Image formation and image models, cameras, geometric camera models, geometric camera calibration, Radiometry - measuring light, sources, shadows and shading, color.

Unit II : Early vision : just one image : linear filters, edge detection, noise estimation derivatives, detecting edges, texture : representation analysis and synthesis, application, shape from texture.

Unit III: Early vision : multiple images, the geometry of multiple views : two views, three views, more views, stereopsis, reconstruction, human stereopsis, binocular, fusion, more cameras, affine structure from motion : elements of affine geometry, affine structure from motion : from two and multiple images, Euclidean images, segmentation, projective structure from motion.

Unit IV : Mid-level vision : segmentation by clustering : introduction, human vision application, pixels, graph theoretic clustering, segmentation by fitting a model : Hough transforms, fitting lines and curves, robustness, examples.

Unit V : Segmentation and fitting using probabilistic methods : missing data problems, EM algorithm and its application in practice, model selection. Tracking with linear dynamic models : abstract inference problem, linear dynamic model, Kalman filtering data association, application and examples.

Unit VI : High-level vision : geometric methods, model-based vision : assumptions, Pose consistency, Pose clustering, hypothesis using invariance, verification, application, aspect graphs : visual events, coputing the aspects graph, aspects graphs and object localization.

TEXT BOOK :

Forsyth, Ponce : Computer Vision - A Modern Approach (PHI / Pearson Edu.)

REFERENCES :

1) M.Sonka, et.el : Image Processing, Analysis and Machine Vision, II edition (Thomson/Vikas Pub.)
2) R.Jain et.el : Machine Vision, McGraw Hill, New York, 1995.
3) H. Wechsler : Computational Vision (Academic Press, London 90)
4) Schalkoff : Image Processing and Computer Vision (Wiley)

Lab : At least eight experiments must be performed which will include at least one experiments on each Unit.

2RMEF4/4RME2 ELECTIVE

(I) EXPERT SYSTEM DESIGN

I. Introduction : Definitions & importance. DP,MIS & DSS. Artificial Intelligence : Overview. Evolution of Expert Systems. Early expert systems : their characteristics, features & applications. Recent Expert Systems; Future Expert Systems.

II. Components of Knowledge in ES. Knowledge representation methods. Representation via Rule-based systems. Knowledge acquisition & domain expert. Example. Knowledge acquisition via Rule Induction. Software rule induction.

III. Inference engine : Role, Search strategies, Forward chaining algorithm. Backward chaining algorithm. Mix modes. ES Modularity. Enhancements : Uncertainty concepts & approaches to uncertainty. Bridges in ES. Explanation.

IV. Validation : ES justification, Rule-based validation. Performance verification. Case Study. Hybrid ES : Definition, importance. Examples of Hybrid ES. An overview of permutation search.

V. ES departments: Overview, Development Languages. ES shells. ES environments. ES hardware. Implementation: Overview Milestone chart, Software & Hardware considerations. Monitoring, Maintenance & Documentation.

VI Staffing & Training : Overview, Essential & Supplemental tools. Justification, Organizational considerations. Oversight & evaluation. ES & Heuristic programming. Future trends in expert systems. ES development flow diagram.

Books :

1. Ignizio James P."Introduction to Expert Systems" (McGraw Hill)
2. Rolston "Expert System Design" (McGraw Hill)
3. Hayes Roth "Hardbook of Expert System Design" (Addison-Wesley)
4. Patterson "Artificial Intelligence & Expert Systems" (PHI)

2RMEF4/4RME2 ELECTIVE

(II) REAL TIME SYSTEMS

I. Introduction to real-time systems; comparison of control flow and data flow, methods for description of parallel systems; design methodologies.

II. Real-time Operating Systems : multi-tasking, systems protection, task descriptions, task scheduling;

III. Interprocess Communication : basic concepts,standard software, semaphores, deadlock; primitive model of operating system.

IV. Building on Semaphores : queues, circular and multiple buffers; Other communication Mechanisms : monitors, and the rendezvous; multi-processor considerations;

V. Real-time Languages : Ada; basic concepts of Ada : Data abstraction, packages and private types, generics, managing the name space;

VI. Real time system design : Design methodologies for real-time systems; example real-time system design.

Text Book :

Raymond Buhr, Donald Bailey :

Introduction to Real-Time Systems :

From Design to Networking with C/C++ (Addison Wesley)

2RMEF4/4RME2 ELECTIVE

(III) SYSTEM SIMULATION

I. Introduction : Basic Simulation Modeling, discrete event Simulation, Single server queuing system, simulation of an inventory system. Distributed simulation, Other types, Monte Carlo simulation.

II. Complex System Modeling : List processing in simulation. Introduction to SIMLIB, and its use to simulate, Single-server queuing. Time-shared computer model, Multiteller bank, Job-shop Model. Event-List manipulation.

III. Review of basic probability and statistics, Building valid & credible simulation models : basic principles. Verification & validation of simulation programs. A 3- step procedure. Statistical procedures for comparing real world observations & simulation output data.

IV. Input probability distributions selection : Introduction, useful probability distributions. Techniques to assessing sample independence. Various activities. Shifted & truncated distributions. Models of arrival process.

V. Random number generators : Introduction, various types & testing of random number generator. General approaches to generate random variates. Generating continuous & discrete random variates correlated random variates. Arrival processes generation.

VI. Output data analysis; transient & steady state behavior, Statistical analysis for terminating simulation & for steady state. Multiple measures of performance. Comparing alternative system configurations.

Text book;

A.M.Law & W.D.Kelton "Simulation, Modeling & Analysis" 2/e (McGraw Hill)

References :

4. Geoffrey Gordon : System Simulation (PHI)
5. N.Deo : System Simulation with Digital Computers : (PHI)
6. J.A.Payne : Introduction to Simulation : (McGraw Hill)

2RMEF4/4RME2 ELECTIVE

(IV) COMPUTER GRAPHICS

I. Review of Basic Concepts : Line-drawing algorithms & display. Two dimensional transformations. Clipping and Windowing.

II. Raster Graphics fundamentals. Frame buffer display, Scan conversion, Natural images, Solid-area scan conversion, Algorithm & their properties.

III. Interactive raster graphics : Painting model, feedback images, Raster graphics systems representations, manipulation functinos. Raster display hardware.

IV. Realism in three-dimensional graphics, Curves & Surfaces, Shapes description requirements, Parametric unctions, Bexic method, B-Sphire method, Displaying Curves & surfaces.

V. Three-dimensional transformations & perspective : Modeling, Viewing, Clipping. Perspective transformation. Screen Coordinate system : Properties, Projective transformations.

VI. Hidden-surface elimination, Depty-buffer algorithm, Scan-line coherence, Area Coherence algorithms, Sorting & Coherence. Shading model, Special effects.

Books :

1. W.M.Newman & R.F.Sproul : Principles of Interactive Computer Graphics, 2/e, (McGraw Hill)
2. F.S.Hill : Computer Graphics(McMillan)
3. D.Hearn & M.P.Baker : Computer Graphics (Prentice-Hall)
4. Hamington : Computer Graphics (McGraw Hill)

2RMEF5 SEMINAR

Each candidate shall deliver a Seminar on selected topic (related to recent trends in Computer Science & Engg.) and submit a report.

2RMEF6 TECHNICAL PAPER WRITING

Each candidate shall select a topic (related to recent trends in Computer Science & Engg.), carry out the literature review, write a research paper for the selected topic according to IEEE/ACM technical paper format and submit the paper , Present (deliver) the paper.

SEMESTER : THIRD

3RMEF1/5RME1 SEMINAR

Seminar to be delivered on work completed during Third Semester.

SEMESTER : FOURTH

4RMEF1/6RME1 SEMINAR AND DISSERTATION

Each candidate shall submit project thesis and appear for project defence. The thesis shall mainly contain introduction Literature survey, Design/Analysis and implementation, testing conclusion, Reference and Resume.

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SYLLABUS
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MASTER OF ENGINEERING
(FULL TIME)
INFORMATION TECHNOLOGY

SEMESTER : FIRST

1 NMEF 1 OPERATING SYSTEM CONFIGURATION

Unit I : Introduction to Operating Systems Internals OS concepts : Process management, memory management, file management, I/O management, study and comparison of different operating system architectures : Windows, Linux

Unit II : Process Management Windows : System mechanisms, management mechanisms, strartup and shutdown, Process, Threads and Jobs.

Linux : Peocess descriptor and task structure, Process creation, implementation of threads, process termination, process scheduling

Unit III: Memory Management Windows : Memory manager & its services, system memory pools, virtual address space layout, address translation, page fault handling.

Linux : Pages, zones, kmalloc, vmalloc, slab layer, slab layer allocator, statically allocating on the stack, high memory mapping.

Unit IV : File Management Windows : Windows file system formats, FS driver architecture, troubleshooting FS problems, NTFS design goal and features, NTFS drivers, NTFS on disk structure.

Linux : Common file system interface, file abstraction layer, Unix file system, VFS, Dentry object, super block object, inode object, file object, data structures associated with file systems.

Unit V : Communication in Distributed Systems Distributed computer, systems, issues in designing, distributed operating systems, Group communication, RPC model, implementing RPC, stub generation, RPC messages, communication protocol for RPC, client-server binding, RPC in heterogeneous environment, lightweight RPC.

Unit VI: Synchronization & Resource Management in Distributed Systems Clock synchronization, Event ordering, mutual exclusion, deadlock, election algorithms, Global scheduling algorithm, Task assignment approach, load balancing approach, load sharing approach.

TEXT BOOKS :

1) Andrew S. Tanenbaum & Maarten Van Steen, Distributed Systems "Principles and Paradigms", PHI, 1st Indian Edition, 2002.
2) Robert Love , "Linux Kernel Development", Pearson Education, 2nd edition, 2005.

REFERENCE BOOKS :

1) Mark Russinovich, David Solomon, "Windows Internals", Microsoft Press, 4th edition, 2005.
2) Pradeep K. Sinha, "Distributed Operating Systems Concepts and Design", PHI, 1st edition, 1997.
3) Daniel Bovet, "Understanding the Linux Kernel", O'Reilly Publications, 2nd editioni, 2003.

1 NMEF 2 DATABASE SYSTEM DESIGN

Unit I : The extended entity relationship model and object model, the ER model revisited, complex data types, user defined abstract data types and structured types, Subclasses, Superclasses, Inheritance, Specializationand generalization, Relationship types of degree higher than two.

Unit II : Object-Oriented Databases, overview of object-oriented concepts, object identity, object structure and type constructors, Encapsulation of operations, methods and persistence, type hierarchies and inheritance, type extents and persistent programming languages, OODBMS architecture and storage issues, transactions and concurrency control, examples of ODBMS.

Unit III: Object Relational and Extended Relational Databases, database design for an ORDBMS, nested relations and collections, storage and access methods; Query processing and optimization, an overview of SQL3, implementation issues for extended type, systems comparison of RDBMS, OODBMS, ORDBMS.

Unit IV: Parallel and Distributed Databases and Client-Server Architecture, architecture for parallel databases, parallel query evaluation, parallelizing individual operations, sorting joins, distributed database concepts, data fragmentationi, replication and allocation, techniques for distributed database

design, query processing in distributed databases Concurrency control and recovery in distributed databases, An overview of client-server architecture.

Unit V : Databases on the Web and Semi-Structured Data, Web interfaces to the web, overview of XML, structure of XML data, document schema, querying, XML data, storage of XML data, XML applications, The semi-structured data model, implementation issues Indexes for text data.

Unit VI : Enhanced Data Models for Advanced Applications, active database concepts, temporal database concepts, Spatial databases : concept and architecture, deductive databases and query processing, mobile databases, geographic information systems.

TEXT BOOKS :

1) Elmsari and Navathe, "Fundamentals of Database Systems"
2) Ramakrishnan and Gehrke, "Database Management Systems"
3) Korth, Silberschatz, Sudarshan, "Database System Concepts"

REFERENCE BOOKS :

1) Rob and Coronel, "Database Systems : Design, Implementation and Management"
2) Date and Longman, "Introduction to Database Systems".

1 NMEF 3 NET - CENTRIC COMPUTING

Unit I : Network Technology : Introduction, media issues, data link protocols, the OSI model, networking topologies, types of networks, protocols capabilities, NetBIOS, IPX, TCP/IP, CSMA/CD, token passing, frame relay, networking devices, repeaters, bridges, routers, switches, gateways, network design issues, data in support of network design, network design tools, protocols and architecture.

Unit II: Network performance, Modeling and Estimation : Issues related with optimizing network performance, probability, stochastic processes, modeling and performance evaluation, queuing theory, queuing models, estimating model parameters, throughput utilization, modeling network as graph external and internal representation, complexity issues, network traffic controls.

Unit III: Network Administration : Function and responsibilities, network issues : planning, implementation, fault diagnosis and recovery, network design : problem definition, multipoint line layout heuristics, CMST algorithms, ESAU-Willam's

algorithm, Shannon's algorithm, unified algorithm, Bin packing algorithm, Terminal assignments and concentrator location.

Unit IV: High Speed Networks : Need, characteristics, challenges, applications, frame relay, ATM, ISDN, High speed LANs : Ethernet, fiber channel, DQDB, SMDS, B-ISDN, STM, DSL, and DWDM, architecture transport, switching and routing in optical domain, optical network management, internetworking.

Unit V: Network Security : basic cryptographic techniques, security in OSI architecture, internet and networked computing, Kerberos, firewalls, proxy, etc. Security applications in commerce and banking. IP Telephony : VOIP system architecture, protocol hierarchy, structure of a voice endpoint, protocols for the transport of voice media over IP networks, Providing IP quality of service for voice, signaling protocols for VOIP, PSTN gateways, VOIP applications.

Unit VI: Strorage Networks : introduction, challenges, SCSI protocols and architecture : RAID, backup and mirroring, fiber channel attached storage, network attached storage including NFS, CIFS, and DAFS, management of network storage architectures. New storage protocols, architectures and enabling technologies.

REFERENCE BOOKS :

1) Stallings W., "High Speed Networks and Internets : Performance and Quality of Service", Prentice Hall, 2002.
2) Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill.
3) Ramaswami R., Shivrajan K., "Optical Networks", Morgan Kaufmann.
4) Douskalis B., "IP Telephony : The Integration of Robust VOIP Service", Pearson Edu. Asia.
5) Douglas E. Comer, "Computer Networks and Internet", Pearson Edu. Asia.
6) Stallings W., "High Speed Networks :TCP/IP and ATM Design Principles", Prentice Hall, 1998.
7) Andrew Tanenbaum, "Computer Network", PHI.

1 NMEF 4 REAL TIME EMBEDDED SYSTEM DESIGN

UNIT I: Process and Operating system

The process abstraction, Switching context, Embedded system project Management, Intercrosses communication and power consumption.

Introduction to Real time systems, Embedded systems , Perceive computing application areas, Overview of Embedded system architecture, Recent Treads in Embedded system.

UNIT II: RTOS

Features Characteristics of RTOS,. Task Scheduling , Signals, Events, Queues, Mail Boxes. Creation of Threads and Inter Thread Communication

UNIT III: Fault techniques

Introduction, Fault causes, Types , detections, fault and Error containment, Reducancy, Hardware, software, time, Integrated failure Handling

UNIT IV: Embedded Hardware:

ARM Processor, PIC Microchip 16 Bit Processor, Detailed study of 16F877A,Atmel 89c51 Microcontroller development board.

UNIT V: Chip Design and Programming

Target Devices Different type of ASICS , FPGA , CPLD Architectures and programming

UNIT VI: Case Study

Study of any Two RTOS, eg. VxWorks, RTLinux, micro c/OS-II : Memory Management, task state diagram , preemptive priority, context switches.

TEXT BOOKS:

1. Dr. K.V. K. K. Prasad "Embedded / Real Time System : Concepts, Design, & Programming -Black Book" Dreamtech Press Publication
2. Frank Vahid, Tony Givargis, "Embedded System Design", Willey
3. Smith M., "Application Specific Integrated Circuits"
4. Raj Kamal, "Embedded Systems", Tata McGraw-Hill

REFERENCE BOOKS:

1. Sriram lyer, Pankaj Gupta, "Embedded Real time Systems Programming", Tata M. Hill.
2. Tammy Nergaard "Embedded Systems Architecture - A Comprehensive Guide For Engineering & Programming", Elsevier Publication
3. Barr M., "RTOS"
4. Jane W.S. "Real Time Systems", Pearson Education
5. C.M. Krishana, Kang G., Shin, "Real Time System" –M.G. Hill
6. Vx Works Programming Guide

1 NMEF 5 ELECTIVE-I

i) SOFTWARE ENGINEERING METHODOLOGIES

Unit I: Software Process Models : Software Process Framework, Process Patterns, Personal and Team Process Models, Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Process Assessment, CMMI, Impact of Processes and Outcomes, Process Selection and applicability.

Unit II: Requirements Engineering : Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain, Requirements Characteristics and Characterization, Requirement qualities, Requirement Specification, Requirement Traceability, System Analysis Model Generation, Requirement Prioritization.

Unit III: UML Concepts : Programming In Small Versus Programming In Large, UML 2.0 History/ New Features MDA/ MOF/ XMI/ CORBA, Introduction to UML Metamodel, Extensibility Mechanisms and its usage, Introduction to OCL, Specification techniques of diagrams in UML.

Unit IV: Behavioral Model : Use Cases, Use Case Diagram Components, Use Case Diagram, Actor Generalization, Include and Extend, Template for Use Case Narrative, Using Use Cases Data Dictionary : Finding the Objects, Responsibilities, Collaborators, and Attributes, CRC Cards, Dynamic Behavior : Sequence diagrams, object lifelines and message types, Activity Diagrams : Decisions and Merges, Synchronization.

Unit V: Design Engineering : Design quality, Design Concepts, The Design Model, Introduction to Pattern-Based Software Design, Architecture styles : Main program with sub program style, Abstract data type style, Repository, Layered. Architectural Design: Software Architecture, Data Design and Architectural Design.

Unit VI: Object Oriented Design : Design of Objects, Design and Factoring, Design of Software Objects, Features and Methods, Cohesion of Objects , Coupling between Objects , Coupling and Visibility, Inheritance, Establishing The Object Model, Refining classes and associations, Analysis model vs. design model classes, Categorizing classes: entity, boundary and control, Modeling associations and collections, Achieving reusability, Reuse through delegation, Identifying and using service packages.

REFERENCE BOOKS:

1. Ian Sommerville, "Software Engineering", 7th Edition, Addison-Wesley, 2004
2. Grady Booch, James Rambaugh, Ivar Jacobson, "Unified Modeling Language Users Guide", 2nd Edition, Addison-Wesley,.
3. Jim Arlow, Ila Neustadt, "UML 2 and Unified Process: Practical Object Oriented Analysis and Design. ", 2nd Edition, Addison-Wesley,
4. Tom Pender, "UML Bible", John Wiley & Sons,.
5. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education,

1 NMEF 5 ELECTIVE-I

ii) INTELLIGENT SYSTEM

Unit I : Artificial Intelligence : Intelligence, Artificial intelligence, intelligent systems. Knowledge representation : Reasoning, issue and acquisition : propositional calculus, predicate calculus, Rule-based knowledge representation, symbolic reasoning under uncertainty.

Unit II: Expert Systems : introduction, expert systems, stages in the development of expert system, probability-based expert systems, expert system tools, difficulties in developing expert systems, applications of expert systems.

Unit III: Fuzzy Systems : introduction, foundation of fuzzy systems, fuzzy relations, arithmetic operations of fuzzy numbers, linguistic descriptions and their analytical forms, defuzzification methods, fuzzy logic in control and decision-making applications, hardware realization of the analog fuzzy controller.

Unit IV : Artificial Neural Networks : introduction, Neuron physiology, artificial neurons, artificial neural networks, features of artificial neural networks, backpropagation training algorithms, functional link neural networks, cascasde correlation neural networks.

Unit V : Genetic Algorithms and Evolutionary Programming : introduction, genetic algorithms, procedures of genetic algorithms, the working of genetic algorithms, the logic behind genetic algorithms, evolutionary programming, the working of evolutionary programming, genetic-algorithm-based machine learning classifier system.

Unit VI : Swarm Intelligent Systems : introduction, background of Ant intelligent systems, importance of the ant colony paradigm, ant colony systems, development of the ant colony systems, application of ant colony intelligence, the working of ant colony systems, particle Swarm intelligent systems, engineering applications of PSIS and future research.

TEXT BOOK :

1) N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford.

REFERENCE BOOKS :

1) Hakin, Simon 2003, "Neural Networks : A Comprehensive Foundation", PHI, New Delhi.
2) Kosko B. 1997, "Neural Networks and Fuzzy Systems", PHI, New Delhi.
3) Rajasekaran S. and G.A.Vijayalakshmi Pai, 2003, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, New Delhi.
4) Sriram, Ram D. 1977, "Intelligent Systems for Engineering - A Knowledge-Based Approach", Springer, London.

1 NMEF 5 ELECTIVE-I

(iii) LEGAL AND PROFESSIONAL ETHICS

Unit-I Technical communication: Oral presentations Technical writing, System documentation, Technical requirements Team Work Culture: Collaboration, Group dynamics, Leadership styles, Personality types, Collaboration tools.

Unit-II Social informatics, Social impact of IT on society, Online communities & social implications, Philosophical context, Diversity issues, Gender-related issues, Cultural issues, Accessibility issues, Globalization issues, Economic issues in computing, Digital divide.

Unit-III Foundations of intellectual property, Ownership of information, Plagiarism, Software piracy, Fair use, Digital Millennium Copyright Act (DMCA), Copyrights, patents, trademarks and trade secrets, NDAs,
International differences.

Unit-IV Legal Issues: Compliance to Cyber laws, Hackers/crackers, Computer crime, Viruses, System use policies & monitoring, Risks and liabilities of computer-based systems, Accountability, responsibility, liability.

Unit-V Organizational context: Business processes, IT environment, Organizational culture, Professionalism, Relationships with professional societies., Codes of professional conduct, such as IEEE, ACM, BCS, ITAA, AITP. Ethics and history of ethics,

Whistle-blowing, Workplace issues (harassment, discrimination), Identify theft, Ethical hacking,

Unit-VI Implications of: History of computer hardware, software, History of the Internet History of Telecommunications, The IT profession, IT education. Privacy and civil liberties.

BOOKS RECOMMENDED:

1. Meenakshi Raman, Sangeeta Sharma,"Technical Communication – English Skills for Engineers" Oxford Higher Education
2. George Reynolds, "Ethics in Information Technology", Thomson Course Technology, 2003
3. Sara Baase,"A Gift of Fire: Social, Legal and Ethical Issues for Computing and the Internet ", PHI publications
4. Richard A.Spinello, " Case Studies in Information Technology Ethics", Second Edition, PHI

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ORDINANCE NO. 14 OF 2007

Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time), Ordinance, 2007

Whereas it is expedient to make an Ordinance in respect of Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time) for the purposes hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time), Ordinance, 2007".
2. This Ordinance shall come into force w.e.f. the date of its approval by the Management Council.
3. Following shall be the Examinations leading to the Degree of Master of Engineering (Full Time)/ Master of Technology (Full Time) courses :-
   i) M.E./M.Tech. Semester-I Examination
   ii) M.E./M.Tech. Semester-II Examination
   iii) M.E./M.Tech. Semester-III Examination
   iv) M.E./M.Tech. Semester-IV Examination
4. Examinations of IIIrd & IVth semesters shall be held at the end of IVth semester seperately.
5. An applicant for admission to the Degree of Master of Engineering (Full Time) / Master of Technology (Full-Time) courses shall have passed the Degree Examination in Bachelor of Engineering/Bachelor of Technology in the branches mentioned under column No.2 of the following table against respective course :-

TABLE

M.E./M.Tech.	B.E./B.Tech. of this University or any other statutory University
1.	2.
a) M.E. Civil (Structural Engg.)	Civil /Construction Engg., Water Management
b) M.E. Mechanical (CAD/CAM)	Mechanical/Automobile/Production/Industrial Engineering
c) M.E. Electronics	Electronics & Telecommunication, Electronics Engg., Industrial Electronics, Instrumentation & Information Tech.
d) M.E. Digital Electronics	Electronics & Telecommunication, Electronics Engg., Industrial Electronics, Instrumentation & Information Tech.
e) M.E. Electrical (Electrical Power System)	Electrical / Electrical Power System / Electronics & Power
f) M.Tech. Chemical Technology (Membrane & Separation Technology)	Chemical Engineering/Chemical Technology
g) M.Tech. Mechanical (Thermal Engineering)	Mechanical/Automobile Engineering

6. The Degree of Master of Engineering (Full-Time) / Master of Technology (Full-Time) shall be awarded to an examinee who in accordance qualifies himself/herself in any one of the following subjects :-
   1) M.E. Civil (Structural Engineering)
   2) M.E. Mechanical (CAD/CAM)
   3) M.E. Electronics
   4) M.E. Digital Electronics
   5) M.E. Electrical (Electrical Power System)
   6) M.Tech. Chemical Technology (Membrane & Separation Technology)
   7) M.Tech. Mechanical (Thermal Engineering)
7. (i) University shall hold Main Examinations of Semester-I of above mentioned Full Time Degree Courses in Winter every year and Supplementary Examinations in Summer every year at the end of the Second Semester .
   (ii) University shall hold Main Examinations of Semesters-II, III & IV in Summer every year and Supplementary Examinations in Winter every year.
   (iii) The period of Academic session shall be such as may be notified in Academic Calender of the concerned academic session.
   (iv) Examinations shall be held at such places and on such dates as may be notified by Board of Examinations.
8. For the purposes of Instructions and Examinations, students shall study sequentially.
9. Subject to his/her compliance with the provisions of Ordinance relating to Examinations in General, the applicant for admission to an examination at the end of the course of study of a particular semester shall be eligible to appear at it, if;
   (i) He/She has satisfied the conditions mentioned in the following table and the provisions thereunder.

TABLE

Sr. No.	Name of Exam.	The student should have completed the term satisfactorily of	The student should have passed the subjects of examination of
1.	M.E./M.Tech. Semester-I	Semester-I	----
2.	M.E./M.Tech. Semester-II	Semester-II	----
3.	M.E./M.Tech. Semester-III	Semester-III	2/3 heads of passing of Semester- I & II taken together
4.	M.E./M.Tech. Semester-IV	Semester-IV	- do -

(Explanation :- The Theory or Practical part of the subject shall be treated as separate head of Passing.)

(ii) He/She shall not be allowed to submit the dissertation till he/she has passed in all subjects of I & II Semester.

10. The schemes of teaching and examinations shall be regulated by the Regulation.
11. Examination fees for the examination shall be as prescribed by the University time to time.
12 Examinees who are successful in all Semester-I, Semester-II, Semester-III and Semester-IV Examinations and who obtained 75% or more marks in all the Four Examinations shall be placed in First Division with Distinction, those obtaining 60% or more, but less than 75% shall be placed in First Division, and all other successful Examinees shall be placed in Second Division. There shall be no classification of successful examinees at Semesters I, II, & III Examinations.
13. (i) The scope of the subject shall be as indicated in the syllabus.
    (ii) The medium of instructions and examination shall be English.
14. Provisions of Ordinance No. 18 of 2001 relating to condonation of deficiency of marks for passing an examination and of Ordinance No. 10 relating to exemptions and compartments shall apply to each examination under this Ordinance.
15. An examinee, who does not pass or who fails to present himself/ herself for the examination, shall be eligible for readmission to the said examination on payment of fresh fees, and such other fees as may be prescribed by the University.
16. As soon as possible after the examination, the Board of Examinations shall publish a result of the examinees. The result of all examinations shall be classified as above and branchwise merit list shall be notified as provided under Original Ordinance No.6.
17. Notwithstanding anything to the contrary, no one shall be admitted to an examination, if he/she has already passed the said examination or an equivalent examination of any Statutory University.
18. (i) Examinees who have passed in all the subjects prescribed for all the examinations of the particular branch shall be eligible for award of the Degree of Master of Engineering/Master of Technology in that branch including specilization.
    (ii) The Degree Certificate in the prescribed form shall be signed by the Vice-Chancellor.
19. Ordinance No. 19 of 1998 relating to Examinations leading to the degree of Master of Engineering-Electrical (Electrical Power System), Ordinance, 1997 and Ordinance No. 16 of 2002 relating to Examinations leading to the degree of Master of Engineering, Ordinance, 2002 shall stand repealed from the date of commencement of this Ordinance in force.

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* Regulation No. 5 of 2005

Examinations leading to the Degree of Master of Engineering /Master of Technology (Full Time) Regulation, 2005.

Whereas it is expedient to frame the Regulation in respect of Examinations leading to the Degree of Master of Engineering/Master of Technology (Full Time) Regulation, 2005for the purposes hereinafter appearing the Management Council is hereby pleased to make a following Regulation.

1. This regulation may be called "Examinations leading to the Degree of Master of Engineering / Master of Technology (Full Time) Regulation, 2005.
2. This Regulation shall come into force w.e.f. the date of its approval by the Management Council.
3. The Schemes of Teachings and Examinations for First & Second in respect of Examinations leading to the Degree of Master of Engineering / Master of Technology (Full Time) Regulation, 2005 shall be as per Appendices-A, B, C, D, E, F, G, H & I appended with this Regulation respectively.

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* As amended vide Regulation Nos. 37 of 2005, 25 of 2007 and 13 of 2009.

DIRECTION

No.11/2009 Date : 4/6/2009

Subject : Eligibility Criteria for admission to the Degree of Master of Engineering (Full Time) (Computer Science & Engineering) and (Information Technology) courses

Whereas Ordinance No. 14 of 2007 in respect of Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) /तंत्रशास्त्र पारंगत (Master of Technology) (Full Time), Ordinance, 2007 is in existence in the University,

AND

Whereas the schemes of teaching & examinations and syllabi alongwith eligibility criteria for admission to Master of Engineering (Full Time) (Computer Science & Engineering) and (Information Technology) were accepted by the Academic Council vide Item Nos. 87(6) D) R-2 and H) R-1 in its meeting held on 14-01-2009,

AND

Whereas Regulation No. 13 of 2009 in respect of Examinations leading to the Degree of Master of Engineering (Full Time) / Master of Technology (Full Time) (Amendment) Regulation, 2009 is in existence in the University,

AND

Whereas eligibility for admission to the above courses is the matter which is required to be regulated by the Ordinance,

AND

Whereas the matter regarding making of amendments in the existing Ordinance is likely to take some time,

AND

Whereas two year Master of Engineering (Full Time) (Computer Science & Engineering) and (Information Technology) courses are to be implemented from the academic session 2009-2010,

AND

Whereas syllabi for the above two courses are to be sent for printing.

Now, therefore, I, Dr.Ku.Kamal Singh, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :-

1) This Direction shall be called "Examinations leading to the Degree of अभियांत्रिकी पारंगत (Master of Engineering) (Full Time) / तंत्रशास्त्र पारंगत (Master of Technology) (Full Time), Direction, 2009"

2) This Direction shall come into force from the date of its issuance.

3) An applicant for admission to the Degree of Master of Engineering (Full Time) (Computer Science & Engineering) and (Information Technology) courses shall have passed the Degree Examination in Bachelor of Engineering / Bachelor of Technology in the following branches :-

i)	M.E. (Computer Science & Engineering)	Computer Science & Engineering, Computer Technology, Computer Engineering, Electronics Engg., Electronics & Telecommunication, Information Technology
ii)	M.E. (Information Technology)	Information Technology, Computer Science & Engineering, Computer Technology, Computer Engineering, Electronics & Telecommunication, Electronics Engineering

4) The Degree of Master of Engineering (Full Time)shall be awarded to an examinee who accordance qualifies himself / herself in the following subjects :-

i) M.E. (Computer Science & Engineering)
ii) M.E. (Information Technology)

Sd/-
Dr. Kamal Singh
Vice-Chancellor

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Appendix-A

Two Year Post Graduate Degree Course in Electrical Engineering (**Electrical Power System**)
Master of Engineering (Full-Time)

FIRST SEMESTER

Sr. No.		Name of the Subject	Hours / Week			Examination Scheme									
						THEORY						**PRACTICAL**			
			L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	**Min. Pass Marks** Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1SEPS1	Power System Optimization	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	1SEPS2	Generation Planning and Load Dispatch	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	1SEPS3	Microprocessor & Microcontroller	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	1SEPS4	Power System Dynamics	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	1SEPS5	Digital Signal Processing	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	1SEPS6	Power System Lab.-I	-	-	4	-	—	—		—	—	50	50	100	50
		TOTAL	20	-	4				500					100	
												TOTAL : 600			

SECOND SEMESTER

1.	2SEPS1	Advanced Power System Protection	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	2SEPS2	High Voltage Transmission	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	2SEPS3	Power System Modeling & Control	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	2SEPS4	Computer Methods in Power System Analysis	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2SEPS5	FACTS and Power Quality	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	2SEPS6	Power System Lab.-II	-	-	4	-	—	—		—	—	50	50	100	50
		TOTAL	20	-	4	-	—	—	500					100	
												TOTAL : 600			

THIRD SEMESTER

Sr. No.	Name of the Subject		Hours / Week			Examination Scheme		
			L	T	P	Internal marks	Total	Min Pass Marks
1.	3SEPS1	Dissertation and Seminar	-	-	6	100	100	50
		TOTAL	-	-	6		100	

TOTAL : 100

FOURTH SEMESTER

						External marks	Internal marks	Total	Min. pass marks
1.	4SEPS1	Dissertation and Seminar	-	-	6	200	100	300	150
		TOTAL	-	-	6			300	

TOTAL : 300

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-B

Two Year Post Graduate Degree Course in **Digital Electronics**
Master of Engineering (Full-Time)
FIRST SEMESTER

Sr. No.	Name of the Subject		Hours / Week			Examination Scheme									
						THEORY						**PRACTICAL**			
			L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	**Min. Pass Marks** Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1UMEF1	Modern Electronic Design Techniques	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	1UMEF2	Embedded System Design	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	1UMEF3	Digital Communication Techniques	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	1UMEF4	Digital Signal Processing and Applications	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	1UMEF5	Digital Instrumentation	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	1UMEF6	Lab.-I(based on1UMEF1 & 1UMEF2)	-	-	2	-	—	—		—	—	25	25	50	25
7.	1UMEF7	Lab.-II(based on 1UMEF3 & 1UMEF5)	-	-	2	-	—	—		—	—	25	25	50	25
		TOTAL	20	-	4				500					100	
														TOTAL : 600	

SECOND SEMESTER

1.	2UMEF1	Digital Image Processing	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	2UMEF2	VLSI Design Technology	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	2UMEF3	Advanced Computer Networks and Programming	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	2UMEF4	Artificial Intelligent Systems	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2UMEF5	Parallel Computing	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	2UMEF6	Lab.-III(based on 1UMEF4 & 2UMEF1)	-	-	2	-	—	—		—	—	25	25	50	25
7.	2UMEF7	Lab.-IV (based on 2UMEF2)	-	-	2	-	—	—		—	—	25	25	50	25
		TOTAL	20	-	4				500					100	
														TOTAL : 600	

THIRD SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme		
		L	T	P	Internal marks	Total	Min Pass Marks
1.	3UMEF1 Dissertation and Seminar	-	-	6	100	100	50
	TOTAL	-	-	6		100	

TOTAL : 100

FOURTH SEMESTER

					External marks	Internal marks	Total	Min. pass marks
1.	4UMEF1 Dissertation and Seminar	-	-	6	200	100	300	150
	TOTAL	-	-	6			300	

TOTAL : 300

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-C

Two Year Post Graduate Degree Course in Mechanical Engineering
Master of Engineering (**CAD/CAM**)
(Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
					THEORY						**PRACTICAL**			
		L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	**Min. Pass Marks** Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1MCC1 Computer Aided Design	4	-	2	3	80	20	100	40	50	25	25	50	25
2.	1MCC2 Computer Aided Manufacturing	4	-	2	3	80	20	100	40	50	25	25	50	25
3.	1MCC3 Computer Assisted Production Management	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	1MCC4 Mechatronics	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	1MCC5 Elective-I	4	-	-	3	80	20	100	40	50	—	—	—	—
	TOTAL	20	-	4				500					100	
													TOTAL : 600	

SECOND SEMESTER

1.	2MCC1 Finite Element Analysis	4	-	2	3	80	20	100	40	50	25	25	50	25
2.	2MCC2 Simulation Theory and Applications	4	-	2	3	80	20	100	40	50	25	25	50	25
3.	2MCC3 Robotics and Robot Applications	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	2MCC4 Industrial Product Design	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2MCC5 Elective-II	4	-	-	3	80	20	100	40	50	—	—	—	—
	TOTAL	20	-	4				500					100	
													TOTAL : 600	

THIRD SEMESTER

Sr. No.	Name of the Subject		Hours / Week			Examination Scheme		
			L	T	P	Internal marks	Total	Min Pass Marks
1.	3MCC1	Dissertation and Seminar	-	-	6	100	100	50
		TOTAL	-	-	6		100	

TOTAL : 100

FOURTH SEMESTER

						External marks	Internal marks	Total	Min. pass marks
1.	4MCC1	Dissertation and Seminar	-	-	6	200	100	300	150
		TOTAL	-	-	6			300	

TOTAL : 300

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-D

Two Year Post Graduate Degree Course in Civil Engineering (**Structural Engineering**)
Master of Engineering (Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
					THEORY						PRACTICAL			
		L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	Min. Pass Marks Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1. 1SFSE1	Engineering Mathematics	4	-	-	3	80	20	100	40	50	—	—	—	—
2. 1SFSE2	Theory of Plates & Shells	4	-	-	3	80	20	100	40	50	—	—	—	—
3. 1SFSE3	Computer Methods of	4	-	2	3	80	20	100	40	50	25	25	50	25
4. 1SFSE4	Advanced Structural Analysis	4	-	-	3	80	20	100	40	50	—	—	—	—
5. 1SFSE5	Advanced Concrete Structures	4	-	2	4	80	20	100	40	50	25	25	50	25
	TOTAL	20	-	4				500					100	
											TOTAL : 600			

SECOND SEMESTER

1. 2SFSE1	Finite Element Method	4	-	-	3	80	20	100	40	50	—	—	—	—
2. 2SFSE2	Advanced Design of Steel Structures	4	-	2	4	80	20	100	40	50	25	25	50	25
3. 2SFSE3	Structural Dynamics	4	-	-	3	80	20	100	40	50	—	—	—	—
4. 2SFSE4	Prestress Concrete	4	-	2	3	80	20	100	40	50	25	25	50	25
5. 2SFSE5	Elective	4	-	-	3	80	20	100	40	50	—	—	—	—
	TOTAL	20	-	4				500					100	
											TOTAL : 600			

Elective : 1) Experimental Stress Analysis 2) Structural Stability 3) Soil Structure Interaction
4) Earthquake Resistant Structures 5) Design of Environmental Structures

THIRD SEMESTER

Sr. No.	Name of the Subject		Hours / Week			Examination Scheme		
			L	T	P	Internal marks	Total	Min Pass Marks
1.	3SFSE1	Dissertation and Seminar	-	-	6	100	100	50
		TOTAL	-	-	6		100	

TOTAL : 100

FOURTH SEMESTER

						External marks	Internal marks	Total	Min. pass marks
1.	4SFSE1	Dissertation and Seminar	-	-	6	200	100	300	150
		TOTAL	-	-	6			300	

TOTAL : 300

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-E

Two Year Post Graduate Degree Course in Mechanical Engineering (**Thermal Engineering**)

Master of Technology (Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
					THEORY						PRACTICAL			
		L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	Min. Pass Marks Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1SFMTE1 Advanced Mathematics	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	1SFMTE2 Advanced Thermodynamics	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	1SFMTE3 Fluid Dynamics	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	1SFMTE4 Advanced Heat Transfer	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	1SFMTE5 Research Methodology	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	1SFMTE6 Lab. Practice-I	-	-	4	-	—	—		—	—	50	50	100	50
	TOTAL	20	-	4				500					100	
											TOTAL : 600			

SECOND SEMESTER

1.	2SFMTE1 Modern Energy Sources& Power Plant Economics	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	2SFMTE2 Heat Exchanger Design	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	2SFMTE3 Elective-I	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	2SFMTE4 Elective-II	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2SFMTE5 Elective-III	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	2SFMTE6 Lab. Practice-II	-	-	4	-	—	—	---	—	—	50	50	100	50
	TOTAL	20		4				500					100	
											TOTAL : 600			

THIRD SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme		
		L	T	P	Internal marks	Total	Min Pass Marks
1.	3SFMTE1 Dissertation and Seminar	-	-	6	100	100	50
	TOTAL	-	-	6		100	
						TOTAL : 100	

FOURTH SEMESTER

					External marks	Internal marks	Total	Min. pass marks
1.	4SFMTE1 Dissertation and Seminar	-	-	6	200	100	300	150
	TOTAL	-	-	6			300	
							TOTAL : 300	

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-F

Two Year Post Graduate Degree Course in Chemical Technology
Master of Technology (**Membrane & Separation Technology**)
(Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
					THEORY					PRACTICAL				
		L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	Min. Pass Marks Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1. 1MST1	Advances in Absorption & Adsorption Sepration Technologies	4	-	2	3	80	20	100	40	50	25	25	50	25
2. 1MST2	Membrane Separation Process	4	-	2	3	80	20	100	40	50	25	25	50	25
3. 1MST3	Chemical Engineering Analysis	4	-	-	3	80	20	100	40	50	—	—	—	—
4. 1MST4	Advanced Energy Technologies	4	-	-	3	80	20	100	40	50	—	—	—	—
5. 1MST5	Seminar-I	-	-	2	-	—	—	—	—	--	50	50	100	50
	TOTAL	16	-	6	-	—	—	400					200	
										TOTAL : 600				

SECOND SEMESTER

1. 2MST1	Advanced Downstream Technology for Chemical Recovery & Waste Utilization	4	-	2	3	80	20	100	40	50	25	25	50	25
2. 2MST2	Industrial Biotechnology	4	-	2	3	80	20	100	40	50	25	25	50	25
3. 2MST3	Advanced Material Technology	4	-	-	3	80	20	100	40	50	—	—	—	—
4. 2MST4	Advanced Reactor Design	4	-	-	3	80	20	100	40	50	—	—	—	—
5. 2MST5	Seminar-II	-	-	2	-	--	--	---	--	--	50	50	100	50
	TOTAL	16	-	6	-	—	—	400					200	
										TOTAL : 600				

THIRD SEMESTER

Sr. No.	Name of the Subject		Hours / Week			Examination Scheme		
			L	T	P	Internal marks	Total	Min Pass Marks
1.	3MST1	Dissertation and Seminar	-	-	6	100	100	50
		TOTAL	-	-	6		100	

TOTAL : 100

FOURTH SEMESTER

						External marks	Internal marks	Total	Min. pass marks
1.	4MST1	Dissertation and Seminar	-	-	6	200	100	300	150
		TOTAL	-	-	6			300	

TOTAL : 300

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. 50 internal marks out of 100 will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-G

Two Year Post Graduate Degree Course in Chemical Engineering
Master of Technology (**Chemical Engineering**)
(Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
		L	T	P	**THEORY**					**PRACTICAL**				
					Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	**Min. Pass Marks** Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1. 1CE1	Transport Phenomena	4	-	2	3	80	20	100	40	50	25	25	50	25
2. 1CE2	Advanced Biochemical Engineering	4	-	2	3	80	20	100	40	50	25	25	50	25
3. 1CE3	Process Control	4	-	-	3	80	20	100	40	50	—	—	—	—
4. 1CE4	Mathematical Modelling & Organisation	4	-	-	3	80	20	100	40	50	—	—	—	—
5. 1CE5	Elective-I *	4	-	-	3	80	20	100	40	50	—	—	—	—
	TOTAL	20	-	4	-	—	—	500					100	

TOTAL : 600

*Elective-I 1) Advanced Chemical Analysis 2) Material Science 3) Pulp & Paper Technology

SECOND SEMESTER

1. 2CE1	Chemical Reaction Engineering	4	-	2	3	80	20	100	40	50	25	25	50	25
2. 2CE2	Advanced Separation Techniques	4	-	2	3	80	20	100	40	50	25	25	50	25
3. 2CE3	Process Design & Plant Utilities	4	-	-	3	80	20	100	40	50	—	—	—	—
4. 2CE4	Energy Technology & Conservation	4	-	-	3	80	20	100	40	50	—	—	—	—
5. 2CE5	Elective-II *	4	-	-	3	80	20	100	40	50	—	—	—	—
	TOTAL	20	-	4		—	—	500					100	

TOTAL : 600

*Elective-II 1) Environmental Engineering & Waste Management 2) Nanotechnology 3) Chemoinformatics

THIRD SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme		
		L	T	P	Internal marks	Total	Min Pass Marks
1. 3CE1	Dissertation and Seminar	-	-	6	100	100	50
	TOTAL	-	-	6		100	
						TOTAL : 100	

FOURTH SEMESTER

						External marks	Internal marks	Total	Min. pass marks
1.	4CE1	Dissertation and Seminar	-	-	6	200	100	300	150
		TOTAL	-	-	6			300	
								TOTAL : 300	

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.
Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.
Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.
2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-H

Two Year Post Graduate Degree Course in **Computer Science & Engineering**
Master of Engineering (Full-Time)

FIRST SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme									
					THEORY						PRACTICAL			
		L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	Min. Pass Marks Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1RMEF1/1RME1 Advanced Computer Architecture	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	1RMEF2/1RME2 Algorithmics	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	1RMEF3/1RME3 Operating System Design	4	-	-	3	80	20	100	40	50	—	—	—	
4.	1RMEF4/3RME1 Digital Image Processing	4	-	2	3	80	20	100	40	50	25	25	50	25
5.	1RMEF5/3RME2 DataBase Modeling & Design	4	-	2	3	80	20	100	40	50	25	25	50	25
	TOTAL	20		4				500						100
									TOTAL : 600					

SECOND SEMESTER

1.	2RMEF1/2RME1 Computer Communication Network	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	2RMEF2/2RME2 Artificial Neural Network Techniques	4	-	2	3	80	20	100	40	50	25	25	50	25
3.	2RMEF3/4RME1 Computer Vision	4	-	2	3	80	20	100	40	50	25	25	50	25
4.	2RMEF4/4RME2 Elective *	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2RMEF5 Technical Paper Writing	-	1	-	-	—	—	—	—	—	—	50	50	25
6.	2RMEF6 Seminar	-	1	-	-	—	—	—	—	—	—	50	50	25
	TOTAL	8	1	2				400					200	
												TOTAL : 600		

Elective * : 1) Expert System Design 2) Real Time System 3) System Simulation 4) Computer Graphics

THIRD SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme		
		L	T	P	Internal marks	Total	Min Pass Marks
1.	3RMEF1/5RME1 Dissertation and Seminar	-	-	6	100	100	50
	TOTAL	-	-	6		100	
						TOTAL : 100	

FOURTH SEMESTER

					External marks	Internal marks	Total	Min. pass marks
1.	4RMEF1/6RME1Dissertation and Seminar	-	-	6	200	100	300	150
	TOTAL	-	-	6			300	
							TOTAL : 300	

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.

Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.

2. Single marksheet for 3rd & 4th semesters together will be given to the student.

Appendix-I

Two Year Post Graduate Degree Course in **Information Technology**
Master of Engineering (Full-Time)

FIRST SEMESTER

Sr. No.		Name of the Subject	Hours / Week			Examination Scheme								
						THEORY					**PRACTICAL**			
			L	T	P	Duration of Papers (Hrs)	Max. Marks Theory Papers	Max. Marks College Assessment.	Total	**Min. Pass Marks** Theory Papers		Max. Marks	Max. Marks College Assessment	Total	Min. Pass Marks
1.	1NMEF1	Operating System Configuration	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	1NMEF2	Database System Design	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	1NMEF3	Net Centric Computing	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	1NMEF4	Real Time Embedded System Design	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	1NMEF5	Elective-I *	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	1NMEF6	Lab.-I (based on1NMEF1 & 1NMEF2)	-	-	2	-	—	—		—	—	25	25	50	25
7.	1NMEF7	Lab.-II (based on 1NMEF3 & 1NMEF4)	-	-	2	-	—	—		—	—	25	25	50	25
		TOTAL	20	-	4				500					100	

TOTAL : 600

Elective-I * i) Software Engineering Methodologies ii) Intelligent Systems iii) Legal and Professional Ethics

SECOND SEMESTER

1.	2NMEF1	Integrative Programming	4	-	-	3	80	20	100	40	50	—	—	—	—
2.	2NMEF2	Digital Media Development	4	-	-	3	80	20	100	40	50	—	—	—	—
3.	2NMEF3	Information Technology Management	4	-	-	3	80	20	100	40	50	—	—	—	—
4.	2NMEF4	Systems Security	4	-	-	3	80	20	100	40	50	—	—	—	—
5.	2NMEF5	Elective-II *	4	-	-	3	80	20	100	40	50	—	—	—	—
6.	2NMEF6	Lab.-III (based on 2NMEF1)	-	-	2	-	—	—		—	—	25	25	50	25
7.	2NMEF7	Lab.-IV (based on 2NMEF2 & 2NMEF4)	-	-	2	-	—	—		—	—	25	25	50	25
		TOTAL	20	-	4				500					100	

TOTAL : 600

Elective-II * i) Software Testing ii) Wireless Networks and Communication iii) Data Warehousing and Data Mining

THIRD SEMESTER

Sr. No.	Name of the Subject	Hours / Week			Examination Scheme		
		L	T	P	Internal marks	Total	Min Pass Marks
1.	3NMEF1 Dissertation and Seminar	-	-	6	100	100	50
	TOTAL	-	-	6		100	
						TOTAL : 100	

FOURTH SEMESTER

					External marks	Internal marks	Total	Min. pass marks
1.	4NMEF1 Dissertation and Seminar	-	-	6	200	100	300	150
	TOTAL	-	-	6			300	
							TOTAL : 300	

GRAND TOTAL : 1600

Semester III

Seminar : Seminar to be delivered on work completed during third semester. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.
Dissertation : Title of the dissertation work to be submitted to the University on or before 15th Sept. (for regular examination) and 15th of February (for supplementary exam.). Title accepted/modified /rejected by the sanctioning authority of University to be conveyed to the concern within a month.

Semester IV

Seminar : to be delivered on the complete work of dissertation. Out of 100, 50 internal marks will be assessed by a Committee consisting of Head of Department, dissertation guide and subject expert appointed by Principal of the College / Head of University Department. Remaining 50 internal marks will be given by guide based on performance.
Note : Thesis of dissertation work must be submitted to the University on or before 30th April (for regular exam.) and 30th November (for supplementary exam.). Thesis of Dissertation work be submitted with late fee to the University upto 31 May (for regular exam.) and 31st December (for supplementary exam.). The late fee shall be charged as in case of Examination form.

Notes : 1. Student should fill the examination form in the begining of 3rd semester jointly for 3rd & 4th semesters.
2. Single marksheet for 3rd & 4th semesters together will be given to the student.