

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

अभ्यासक्रमिका
(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

Prescribed for
Post Graduate Three Year Degree Course
Master of Engineering
(Part-Time)
I to III Year Examinations
2008 - 2009 & Onwards

- Branches : 1) Civil (Geotechnical Engineering)
2) Electrical Power System
3) Thermal Power Engineering
4) Environmental Engineering
5) Computer Science & Engineering
6) Production Technology & Management
7) Digital Electronics



2008

Visit us at www.sgbau.ac.in

Price Rs. 15/-

PUBLISHED BY
Dr.K.G.Khamare
Registrar
Sant Gadge Baba
Amravati University,
Amravati 444 602

© " या अभ्यासक्रमिकेतील (Prospectus) कोणताही भाग संत गाडगे बाबा अमरावती विद्यापीठाच्या पूर्वानुमती शिवाय कोणासही पुनर्मुद्रित किंवा प्रकाशित करता येणार नाही . "

© "No part of this prospectus can be reprinted or published without specific permission of Sant Gadge Baba Amravati University.

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 extracts)
Ordinance No. 18/2001	:	An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
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. 138	:	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.

Dr.K.GKhamare

Registrar

Sant Gadge Baba Amravati University

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

**SYLLABUS
PRESCRIBED FOR
MASTER OF ENGINEERING
CIVIL ENGINEERING
(GEOTECHNICAL ENGINEERING)
PART TIME**

SEMESTER : FIRST

1 SPCGE 1 ADVANCED SOIL MECHANICS

SECTION-A

Concepts of stress, strain, principal stresses and strains, invariants octahedral stresses and strains.

Stress-strain relations, special matrices, plane stress, plane strain problems, stresses and displacements in elastic soil mass. Anisotropy governing differential equations for flow through porous media in cartesian co-ordinate and polar co-ordinates system for Laplace equations, steady state I-D flow in cartesian and polar co-ordinate system. Effective stress principles, stress paths in various drainage conditions.

SECTION-B

Development of geological model and equations of state for soils, Distribution of contact pressures for different types of soils under various loading conditions.

Yield criteria and various theories of failure, limiting equilibrium stability of soil slopes, infinite slope in ϕ and $c-\phi$ soils subjected to seepage.

Earth pressure theories, different theories, strutted excavations stability of bottom of excavation and theory of arching, limiting equilibrium equations, etc.

List of Practicals/Assignments :-

- 1) Determination of Earth pressure on retaining walls by analytical & graphical methods.
- 2) Determination of stability of slopes (Swedish circle & friction circle method)
- 3) Box shear test on gravel samples.
- 4) Triaxial tests on soil for drained & undrained conditions.
- 5) Triaxial test on rock samples.
- 6) Engg. properties of Geosynthetics & standards.
- 7) Determination of tensile strength of Geotextiles.

- 8) Determination of pull-out resistance of Geosynthetics.
- 9) Determination of % elongation of Geosynthetics.
- 10) Box shear test on Geotextile.

Books Recommended :-

- 1) Harr M.E. : Foundations of Theoretical Soil Mechanics.
- 2) Scott R.F. : Principles of Soil Mechanics.
- 3) Singh Alam : Soil Mechanics.

1 SPCGE 2 FOUNDATION ENGINEERING

SECTION-A

Planning of sub soil exploration for major civil engineering projects, sampling methods, criteria for spacing of bores, depth of bore, interpretation of field and laboratory data.

Field method : SPT, Plate Load Test, Pile Load Test, Vane Shear Test, extrapolation of tests data for actual foundations. Geophysical methods.

Mat or Raft foundations : design of G Rigid mats, modulus of subgrade reaction, effect of depth on subgrade reaction, criteria for Rigid/Flexible raft mat analysis using the modulus of sub grade reaction using finite difference method.

SECTION-B

Beams of elastic approach diff. equation of elastic curve, soil modulus and mathematical solutions, solutions for laterally loaded piles with soil modulus assumed constant, concept of Meyerhof and Ranjan's method, Reese and Matlock's method, fixity of pile heads, battered piles under lateral load-various methods, Batter pilegroup under inclined Loads-Culmann's method, Vetter's method; Hrennikoff's method, Brill approach P-V curves etc., anchored bulk heads-design methods, free and fixed earth support. Well foundation-different elements loadings, depth of well foundation. Sinking stresses, bearing capacity analysis, conditions for stability of well, lateral stability of well, different methods of analysis-Terzaghi, Pender, Banerjee and Gangopadhyay's IRC method, Well sinking, tills and shifts, stability for analysis for floating caisson.

Micro-pile-design construction criteria - various elements and field conditions, design of Pile-caps.

List of Practicals/Assignments :-

- 1) Planning of sub-soil exploration for a Civil Engineering project.
- 2) Standard Penetration Test.

- 3) North Dakota Test.
- 4) Plate Load Test.
- 5) Field Vane Shear Test.
- 6) Geophysical methods-Electrical resistivity method & sounding test.
- 7) Design of Raft foundation.
- 8) Design of Well foundation.
- 9) Design of anchored bulkheads.
- 10) Design of micro piles & pile head.

Books Recommended :

- 1) Bowles J.E. : Foundation Analysis and Design
- 2) Samsher Prakash, Gopal Rajan : Analysis and Design of Foundations and Retaining and Swami Soran
- 3) Davis and Poulos : Design and Analysis of Laterally Loaded Piles.
- 4) Kaniraj S.R.: Design Aids in Soil Mechanics and Foundations.

SEMESTER : SECOND

2SPCGE1

GROUNDIMPROVEMENT

SECTION A

Clay mineralogy - Atomic bonds, Clay minerals. Clay-water relations, Electrical effects, cation exchange, Clay mineral identification

Soil stabilization – Principle, Different methods of soil stabilization

Granular stabilization

Chemical stabilisation - Principle, Different methods, Different chemicals used, Engineering properties and behavior of chemically stabilized soils.

Cement stabilisation - Types, Mechanism, Properties, Factors influencing, Applications, Laboratory testing for stabilized soil

Lime stabilisation - Soil-lime reaction, Types and properties, Effectiveness of lime treatment, Mixture design

Ash and slag stabilisation - Fly-ash stabilisation

Bituminous stabilisation - Classification, mechanism, Laboratory testing

Thermal and electro kinetic stabilisation – Thermal, Heating and freezing, Electro-osmosis.

Construction methods for stabilized soils.

SECTION B

Deep Compaction of Granular soil – Introduction, Vibration methods – Vibration methods, Vibro compaction, Blasting, Displacement methods.

Stone-gravel and sand column, Design of stone columns, Compaction piles, Dynamic consolidation, Preloading method.

Stabilisation of soft soil – Lime columns – Bearing capacity, Principle, Bearing capacity of lime group, Total and differential settlement, Application of lime column method, Quality control methods, Design of lime column foundations. Sand drains, Granular trench stabilisation

Grouting – Grouting techniques – Permeation grouting, Hydro fracture grouting, Compaction grouting, Jet grouting, Types of grouts, Design of soil grouting program, Grouting equipment, Quality control and testing.

PRACTICAL CONTENTS :

Any eight of following study experiments / assignments

1. Compressive strength test of moulded cylinder of stabilized soil
2. Moisture-density relation of stabilized soil
3. Wetting and drying test of compacted stabilized soil
4. Freezing and thawing test of compacted stabilized soil
5. Design of stone column
6. Design of lime column
7. Assignment on preloading method of stabilisation
8. Assignment on design of sand drains for stabilisation.
9. Case histories of grouting

REFERENCES:

1. B.M. Das - Principle of Foundation Design
2. Hsai-yang Fang -Foundation Engineering Handbook
3. K.B. Woods, D.S. Berry and W.H. Goetz - Highway Engineering Handbook

2SPCGE2

SOILDYNAMICSANDMACHINE FOUNDATION

SECTION A

Theory of vibrations – Introduction to dynamic loading, Vibratory motions, Harmonic motion, Single degree of freedom system- free and forced vibrations, damped and un-damped vibrations, Systems with two degree of freedom, Un-damped dynamic vibration absorbers.

Wave propagation- vibrations in rod (infinite and finite) - Longitudinal and torsional vibrations, Wave propagation in an infinite homogeneous isotropic elastic medium, Wave propagation in elastic half space.

Dynamic soil properties- different laboratory tests and field tests, Factors affecting the modulus of soil, Dynamic bearing capacity of shallow foundation, Dynamic analysis- Triandafilidis's solution, Wallace's solution, Chummar's solution.

SECTION B

Types of machine foundations, General requirements of machine foundation, Design criteria.

Foundations of reciprocating machines- modes of vibrations, Linear elastic weightless spring method, elastic half space method, Effect of footing shape on vibration response, Dynamic response of embedded block foundation.

Foundation of impact type machines- dynamic procedure for hammer foundations, Foundation of rotary machine – design criteria, Two dimensional analysis - Resonant method, Amplitude method and combined method.

Vibration isolation- methods of isolation in machine foundations, Isolating materials and their properties
Constructional details of machine foundations

PRACTICAL CONTENTS :

Any eight of following study experiments / assignments

1. Resonant column test
2. Ultrasonic pulse test
3. Cyclic simple shear test
4. Cyclic torsional simple shear test
5. Cyclic triaxial compression test
6. Seismic bore hole test
7. Vertical block resonant test
8. Horizontal block resonant test
9. Cyclic plate load test
10. Design of machine foundation for reciprocating machine
11. Design of machine foundation for impact machine
12. Design of vibration isolators for machine foundation

REFERENCES:

1. Richart and Woods - Vibrations of Soils and Foundation
2. Srinivasulu and Vaidyanathan - Handbook of Machine Foundation
3. Swami Saran - Soil Dynamic and Machine Foundation

SEMESTER: THIRD

3SPCGE1 EARTH DAM ANALYSIS AND DESIGN SECTION A

Types of earthen dams – based on construction materials, Methods of construction, and foundation, Requirements of good dam site, Causes of failure, Design criteria for safe design, Preliminary section, Typical cross sections of earthen dams.

Seepage through earthen dam – Laplace Equation, Phreatic line and its determination for homogeneous and non-homogeneous sections under different conditions, Flow net for seepage, Various methods for constructing flow net, Seepage analysis for uniform and zoned sections, Methods of Seepage control through embankment and foundation of earthen dam, Design of impermeable blanket.

Drainage of Earthen dam – Provision of filters, Design of filter, Surface protections, Relief wells.

SECTION B

Stability analysis – Construction pore pressure and factors affecting it, Stability of slopes during construction, Pore pressure measurement – Bishop's method, Hilf's method, Approximate method.

Stability of upstream and downstream slopes – Method of slices, Bishop's method, Effective stress analysis, Stability during steady seepage and sudden drawdown

Stability of foundation against shear.

Stability analysis considering earthquake forces, Design considerations for earth dam in Seismic region..

Embankment construction procedure – Equipment, Methods of quality control, Instrumentation system for measurement of various parameters

Case studies of dam failure

Rock fill dams – Types, Characteristics, Material, foundation, design of dam section, Construction.

PRACTICAL CONTENTS :

Any eight of following study experiments / assignments

1. Design of earthen dam (Homogeneous section)
2. Field study of earthen dam
3. Construction of flow net for different condition of flow through body of dam and its foundation
4. Seepage analysis of earthen dam by flow net
5. Slope stability analysis of earthen dam

6. Design of impervious blanket
7. Design of filter for drainage of earthen dam
8. Seismic stability of earthen dam
9. Design of rock fill dam

REFERENCES:

1. Bharat Singh and H.D. Sharma -Earth and Rock Fill Dam
2. Bharat Singh and Varshney R.S. – engineering for Embankment Dams, *Oxford and IBH Publisher Co.*
3. J.L. Sherard et al -Earth and Earth-rock Dams , *John Wiley and sons.*
4. G.F. Sowers - Earth and Rock Fill Dam Engineering
5. U.S.B.R. - Design of Small Dams

3SPCGE2 ROCK MECHANICS
SECTION A

Introduction to Rock Mechanics and its field applications, Identification of common rocks, Physical and mechanical characteristics of rock material, Field and laboratory testing of rocks, Classification of rock masses for engineering purpose.

Rock excavation and reinforcement – Drilling, Blasting, Braking and cutting, Rock bolting, Rock anchors, Bolted and anchor supports, Rock grouting - Types of treatment, grouting material, grouting methods, Grouting design and layout

Stresses in rock mass – Types of stresses, in-situ stress determination methods – Over coning, Flat jack method, Hydraulic fracturing, Structural Geology and Ground stresses, Stresses around underground opening, stresses in tunnels and shafts, Strains and deformations around circular opening, Rheology

Rock strength and Deformability - Modes of rock failure, Stress-strain behavior in compression, Mohr-Coulomb failure criteria, Hook-Brown criteria, Griffith's crack theory, Empirical criteria for failure, Effect of size on strength, Anisotropic rocks, Plane of weakness in Rocks, Joint orientation and roughness, Deformability of rocks – Elastic and non-elastic behavior, influence of time on rock deformation, viscous behavior and creep.

SECTION B

Brittle failure of Rocks – Introduction, Fracture initiation, Fracture propagation, Rock fracture in compression, Rupture criteria for brittle rock, Factors affecting rupture behavior of rock.

Ultimate behavior of rock structures – Plasticity and resistance of rock structure, Principle of limit equilibrium method, analysis of general slip surfaces, Approximate methods for two dimensional limit equilibrium

analysis, Structural discontinuities in rock masses and progressive failure, Water pressure and resistance of rock structures.

Rock foundations - Allowable bearing pressures, Stress and deflection in rock under footing, Failure mechanisms, Subsiding and swelling rocks, Base heave and remedies, foundation anchoring

Rock slopes – Modes of failure, Factors affecting, Analysis of slopes

Underground opening - Opening in competent rock, horizontally layered rocks and rock with inclined layers, Plastic behavior around tunnels, time dependent behavior of tunnels, underground opening in blocky rocks- Block theory, Review of design methods of tunnels – Empirical and semi-empirical methods, Support and stabilisation

PRACTICAL CONTENT:

Minimum eight experiments / assignments of the following:

1. Brazilian tensile strength test
2. Point load strength test
3. Slake durability test
4. Flat jack test
5. Unconfined compression test
6. Triaxial compression test
7. Large box direct shear test
8. Field shear test
9. Hydraulic fracturing test
10. Design and testing of Rock Bolt
11. Tunnel Jacking test

REFERENCES:

1. R.E. Goodman – Rock Mechanics , *John Wiley and Sons*
2. G. Hergel – Stresses in Rocks – *A.A. Balkema Publishers*
3. J.A. Franklin and M.B. Dusseault – Rock Engineering *McGraw Hill International Editions*
4. J.A. Franklin and M.B. Dusseault – Rock Engineering Applications - *McGraw Hill Inc.*
5. K.G. Stagg and O.C. Zienkiewicz – Rock Mechanics in Engineering Practice -*John Wiley and Sons*
6. Koerner R.M. – Construction and Geotechnical Methods in Foundation Engineering, *McGraw Hill Book company.*

SEMESTER: FOURTH

4SPCGE1 ENGINEERING WITH GEOSYNTHETICS
SECTION A

Overview of Geosynthetic materials, Types of geosynthetic, Functions, Applications of geosynthetic in engineering field

Geotextiles – Types, Physical, Mechanical, Hydraulic, Constructability and durability properties, Test methods, Requirements of geotextiles as reinforcement, Applications of geotextiles.

Geogrids - Physical and mechanical properties, Test methods, Geogrid-soil interaction.

Geomembranes – Physical, Chemical, and Mechanical properties, Current uses

Erosion control – Wind erosion, Rain water erosion, Use of geotextile, Geotextile beneath rock rip-rap, Geotextile filters – Design criteria, Construction criteria, Erosion control measures using Geogrids, Erosion control mattresses, Geotextile silt fences for erosion control.

SECTION B

Bearing capacity improvement – Soil mass reinforcement geometry, Mechanism, Modes of failure (Biquet and Lee theory), Foundation on soil with geotextile reinforcement, Design procedure.

Pavement construction using Geotextile – Mode of action, design methods, Construction methods.

Reinforced retaining walls – Geotextile reinforced walls – Construction procedure, Analysis, Design, Design of gabion walls using Geotextile, Geogrid soil walls – Construction, Design

Filtration and drainage using geotextile – Geotextile chimney drains and their design.

Containment systems using geomembrane – Liquid containment, Solid containment.

Stabilisation using geogrid mattresses – Principle, Design, Construction

REFERENCES:

1. G V. Rao and Raju - "Engineering with Geosynthetics" - *GV.S.S., Tata McGraw Hill, New Delhi*
2. R. M. Koerner and Welsh J.P. - "Construction and Geotechnical Engineering using Synthetic Fabrics" - *John Willey and Sons*
3. B. M. Das – "Principle of Foundation Design"
4. R. M. Koerner – Construction and Geotechnical Methods in Foundation Engineering – *McGraw Hill Book Company.*

4SPCGE2

ELECTIVE-I

(1) GEOENVIRONMENTAL ENGINEERING

SECTION A

Identification, Characterization and regulatory requirements for disposal of hazardous, non-hazardous and domestic waste

Sources and effects of subsurface contamination, Physical, Chemical and biological characteristics of solid waste, Soil-waste interaction

Cation exchange reactions and effect of pollutants on soil properties

Erodability of soil in relation to moisture content, Containment transport, Laboratory and field evaluation of permeability, Factors affecting, Design of dewatering.

Waste management – Recycling, Composting, Insiration, and various disposal methods, Site selection, Leachet collection and detection system

SECTION B

Types of land fills – Silting criteria, Waste containment principle, Types of barrier materials, Planning and design aspects relating to waste disposal in landfills

Landfills – Ash ponds and Tailing ponds and in rocks, Environmental monitoring around landfills – Detection, Control and remediation of subsurface containment, Engineering properties and geotechnical reuse of waste, Demolition of waste etc., Reclamation of old waste dumps, Regulation, Case studies

Single and double lined landfill, Applications of Geosynthetics in waste disposal design, Landfill construction, Construction quality control and performance monitoring.

REFERENCES:

1. R. N. Fong – Geoenvironmental Engineering – Contaminated soil, Pollutant Fate and Mitigations – *CRC*
2. A.O.M. Mohamad – Geoenvironmental engineering – *Elsevier Publications*
3. Mohamad and Warkentin – Principles of Containment Transport in Soils – *Elsevier Publications*
4. R.K. Shrivastawa – Environment Geotechnique, *ISRM TT, New Delhi.*

4SPCGE2

ELECTIVE-I

(2) OFFSHORE STRUCTURE ENGINEERING

SECTION A

Design loads and forces on offshore structures – Wind forces, Wave forces, Current forces, Live loads, Impact, Nature and magnitude of loads on foundation of offshore structures, Criteria of foundation design in offshore environment.

Gravity platforms – General features, Suitability, Features of foundation, Geotechnical design of gravity platforms – General aspects, Foundation

stability, Foundation failure modes,, Bearing capacity and settlement under dynamic loads, Immediate and long term behavior.

Platforms – Catwalks, Heliports, Tender platform, Template platform, Template platforms, Tower type template platform, Production platform, Quarter platforms, Flare tower – Fabrication and installation

Manifold platforms – General features, Suitability, Constructional details

Tower platform – General features, Suitability, Caissons walls, and skirts, Caissons, Cell dome, Shafts

SECTION B

Floating structures – Tension leg platforms

Deck structures – Design loads

Construction and installation of offshore structures

Foundation of offshore structures – Soil investigation techniques

Pile foundations for offshore structures – Static analysis of axially loaded offshore pile, Analysis of pile and pile group under dynamic loads, Lateral pile load analysis, Prediction of pile behavior, Techniques of offshore piling for various structures, Pile behavior under cyclic lateral load, Development of p-y curves.

REFERENCES:

1. W.J. Graff – Introduction to Offshore Structures, *Gulf Publishing Company*.
2. *Thomas Teleford Ltd. London* : Design of Offshore Structures - Proceedings on Conference on Development in the Design and Construction of Offshore Structures , 1983

ELECTIVE-I

4SPCGE2 (3) SOIL STRUCTURE INTERACTION

SECTION A

Introduction to Soil-Foundation interaction - Idealized soil behavior, Foundation behavior, interface behavior.

Idealised soil response model for analysis of soil foundation interaction – Elastic models of soil behaviour - The Winklers model, Elastic continuum models, Two-parameter elastic models, Elastic plastic and time dependent behaviour of soil masses – elastic-plastic behaviour, time dependent behaviour

Plane-strain analysis of an infinite plate and an infinitely long beam – Bernoulli's-Euler beam theory and its modifications, Plain strain analysis of the finite plate problem, Reissner's method of analysis of the infinite plate problem, Deflection of an infinite plate on a Winkler medium.

SECTION B

The analysis of beams of finite length – Finite beams on a Winkler medium, Finite beams on a two-parameter elastic medium, Finite beams on an elastic solid medium, approximate methods, Classification of finite beams in relation to their stiffness

Analysis of finite plate – Axisymmetric loading of a circular plate, Analysis of rigid circular plate, analysis of rectangular plate, Plate resting on an elastic half space – Approximate method of analysis

Experimental investigation and field studies – Stress measurement beneath rigid footings, flexible beam and raft foundation

Limit analysis of pile groups with lateral soil reaction.

Seismic design provisions for soil structure interaction

REFERENCES:

1. Selvadurai A. P. S. – Elastic Analysis of oil Foundation Interaction, *Elsevier Scientific Publishing Company*.

ELECTIVE-II

4SPCGE3 (1) APPLICATIONS OF FEM IN GEOTECHNICAL ENGINEERING

SECTION A

Standard discrete system, Stiffness matrices, Assembly and analysis of a structure, Boundary conditions

Direct formulation, Displacement approach as a minimization of total potential energy, Relation to Rayleigh-Ritz method, Galerkin's method, Convergence criteria, Non-confirming elements and Patch test

Plane stress and plain strain analysis – Element characterization and some applications, Axi-symmetric stress analysis - Element characterization and some applications, Element shape functions – 2-D elements, Pascal triangle

Rectangular element family, Lagrange family, Serendipity family, Internal nodes and node-less variables, Triangular element family – area coordinates, shape functions, Constant strain triangles, 1-D and 3-D elements – Rectangular prism, Tetrahedral elements

Interface elements, Hierarchical shape functions, co-ordinate transformations, Generation of finite element meshes by mapping

SECTION B

Computer programming for FEM – Data input module, Flow chart, Subroutines for assemble, Shape functions, Mesh generation, Stiffness matrix, Solution of simultaneous linear algebraic equation.

Analysis of field Geotechnical Problems by Finite element solutions - Beam on elastic foundation, Mat foundation, Ring foundation, Pile foundation, Braced excavations, Sheet pile walls, Stability of slopes,

Stress and deformations in embankments, Seepage analysis, 1-D consolidation.

REFERENCES :

1. C. S. Desai and J. F. Abel – Introduction to Finite Element Method – *Sarita Prakashan, Delhi.*
2. Reddy – Introduction to Finite Element Method – *McGraw Hill Book company*
3. T.P. Chandrupatla and A. D. Belegundu - Introduction to Finite Elements in Engineering – *Prentice Hall of India Pvt. Ltd*
4. O.C. Zienkiewicz - The Finite element method – *Tata McGraw Hill Publishing Company Ltd.*
5. Hinton E. and D. R. J. Owen - An introduction to Finite Element Computation, *Swansea, Great Briton Pinneridge Press*
6. Hinton E. and D. R. J. Owen - Finite Element Programming, *London Academic 1977*
7. C.S. Krishnamurthy - Finite Element analysis Theory and programming
8. J.E. Bowles - Foundation Analysis and Design, *McGraw Hill book Company*

ELECTIVE-II

4SPCGE3 (2) GEOTECHNICAL EARTHQUAKE ENGINEERING

SECTION A

Introduction to Earthquake – Earthquake elements, Sources of earthquake, Mechanics of tectonic earthquake.

Basic earthquake principles – Focus and epicenter, Seismic waves – Origin, Wave types, Propagation, Velocity, Characteristics

Common earthquake effects – Ground motion, Detecting and recording – Seismographs, Earthquake strength measurement, Seismic risk maps, Attenuation, Amplification, Influencing factors, Ground amplification factors.

Recurrence and forecasting of earthquake – Statistical analysis and recurrence equation, Early warning indicators

Earthquake structural damage – Surface effects on geological environment, Faulting, Fault activity, Fault displacement, Rupture length, Attenuation from fault, Seismicity maps and tectonic structure

Soil behavior under cyclic strain - Soil reaction to dynamic loads, Cyclic shear related to earthquake, Characteristic shear modulus and damping ratio

SECTION B

Liquefaction – Liquefaction phenomenon, Mechanism of liquefaction, Different laboratory tests – Dynamic triaxial test, Cyclic simple shear

test, Standard curves and co-relations for liquefaction, Evaluation of zones of liquefaction in field, Vibration table studies, Field blast studies, Factors affecting liquefaction, Evaluation of liquefaction potential, Damage susceptibility, Predicting the liquefaction potential, Anti-liquefaction measures.

Bearing capacity analysis for earthquake

Earthquake induced settlement

Slope stability analyses for earthquake – Analytical methods of dynamic analysis for earth dam and embankments

Stability of earthen dam during earthquake – Types of damage, Response analysis of embankment dams – visco-elastic response analysis, Jai Krishna approach, Seed and Martin approach, Development of deformation analysis – Goodman and Seed approach, Seed approach to non-free-draining and cohesive soils, Design recommendations and precautions

Retaining wall analysis for earthquake

Site improvement methods – Grading and other soil improvement methods, Foundation alternatives to mitigate earthquake effects

REFERENCES:

1. Steven L. Kramer – Geotechnical Earthquake Engineering, *Prentice Hall*
2. Robert W. Day – Geotechnical earthquake Engineering Handbook – *McGraw Hill Professionals*
3. Swamy Saran – Soil Dynamic and Machine Foundations
4. Roy E. Hunt – Geotechnical Engineering Investigation Manual – *McGraw Hill Book Company*
5. Bharat Singh and R.S. Varshney – Engineering for Embankment Dams – *Oxford and IBH Publishing Co-op. Pvt. Ltd.*

ELECTIVE-II

4SPCGE3 (3) CONSTRUCTION METHODS IN GEOTECHNICAL ENGINEERING

SECTION A

Pile foundation - Pile driving equipment – Hammer, Pile drivers and other accessory equipment, Construction of precast and cast-in-situ piles

Cofferdams - Sheet piling in cofferdams – Setting and driving, Length and penetration, splicing, Extraction, Sealing to existing structures, Bracing systems – Circular cofferdams, Rectangular cofferdams, Setting, Bracing, Removing bracing, Excavation – Pre-dredging, Excavation inside cofferdams

Pile driving within the cofferdam – Bottom seal – Resistance to uplift, Seal construction by bucket method, Seal construction by Tremie

method, Seal construction by grout intrusion method, Dewatering – Pumping, other dewatering methods, Cofferdam difficulties – Cofferdam destroyed by surge, Cofferdam bottom blows, Improper sheet pile sections and bracing, Sheet pile stopped by boulders, Buckling of long struts, Improper procedure in unstable soil, Scour and poor Tremic-concrete procedures, problems with Tremic.Box Caissons – General considerations, Site and foundation preparation, fabrication, Launching and Towing, Setting, Concreting

SECTION B

Open Caissons – General considerations, Cutting edges, Setting, Construction of steining, sinking, Tipping and sliding, completing and installation, Construction of Pneumatic Caissons

Rock excavation – Evaluation and planning, Drilling equipment, Blast design – Criteria for design, Selection of explosive, Blast hole design, Blasting round design, Over break Control – Line drilling, Pre-splitting, Trim blasting, Loading and hauling equipment

Tunneling in solid rocks – Means of excavation in solid rocks, Full-face tunneling without support, Full-face tunneling with support

Tunneling in moderately firm rocks and ground – Classical or mining method, Single stage mining method, Multistage classical method of tunneling, Sinking caisson method, Shield tunneling method, tunneling by Tunnel boring machines, Types of TBM

REFERENCES:

1. John . Havers and Frank W. Stubbs – Handbook of Heavy Construction, *McGraw Hill Book company*
2. Karoly Szechy, Akademaiai, Kiado Budapest – The Art of Tunneling
3. Rolt Hammond – Modern Foundation Methods.

SEMESTER : FIFTH & SIXTH

5 SPCGE 1 & 6 SPCGE 1 SEMINAR AND DISSERTATION

A dissertation on recent trends in Geotechnical Engineering to be submitted.

Seminar shall be delivered on the dissertation submitted.

Marks shall be based on Seminar and Viva-Voce on dissertation.

ELECTRICAL ENGINEERING

(ELECTRICAL POWER SYSTEM) EXAMINATION (PART TIME)

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 of 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 GA and traditional methods; Unconstrained and constrained optimization using Genetic Algorithm, real coded GA, Advanced GA, global optimization using GA.
- 8) Applications to Power system:
Economic Load Dispatch in thermal and Hydro-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, Addison-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 fuels, 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 forecast - 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.

Telemetry-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 assemblers, 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, rotate and swap operations

Arithmetic Operations : 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 Embedded 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.

SECOND SEMESTER**POWER SYSTEM DYNAMICS****SECTION-A****1SEPS 4****INTRODUCTION**

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

Synchronous Machines:

Review of synchronous machine equations, parameters, Equations in a-b-c phase co-ordinates and Park's co-ordinates, Representation of external system, Low and High order state 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, Pre-calculated Swing curves and their use.

SECTION-B

System Response to Small Disturbances:

Two machine system with negligible losses, Clarke diagram for two machine series reactance system, Extension of Clarke diagram to cover any reactance network, Equation for steady State Stability limit, Two-Machine system with losses, Effect of inertia. Effect of governor, action, Conservative criterion for stability, Effect of saliency, 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 criterion, Root locus analysis of a regulated machine connected to an infinite bus. Approximate System representation, Supplementary Stabilising Signals, Linear analysis of stabilised 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.

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.

Reference 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**

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

2SEPS1**ADVANCED POWER SYSTEM PROTECTION**

SECTION-A

Review of principles of power system equipments protection, configuration 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, Corona effects, power loss & audible noise, radio interferences, electrostatic field of transmission lines, Insulation characteristics of line 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 Reference 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 governing system. Turbine governor control as affecting the power system dynamics. Transient 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 excitation control and turbine dynamics, 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 oscillations in power system and the means for control.

REFERENCES :-

- 1) V.Venkov : 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. & Fouad 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.

FOURTH SEMESTER**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 cutset matrices, primitive impedance and admittance matrices, equilibrium equations of networks. Singular and nonsingular transformation of network matrices.

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

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

SECTION-B

4. Short Circuit Studies : Three phase network, Symmetrical components. Thevenin's theorem and short circuit analysis of multinode power

systems using bus impedance matrix. Short circuit calculations for balanced and unbalanced short circuits bus impedance 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 decoupled 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 Euler method and solution of network equations by Gauss-Seidal interactive method.

REFERENCE BOOKS:

- 1) Computer Methods in Power System Analysis : G.W.Stage A.H.Elbiad, 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 (SVC), thyristor controlled series compensation (TCSC) static phase shifters (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 and 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 POWERSYSTEMLAB-II

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

FIFTH SEMESTER

3 SEPS 1 SEMINAR-I AND DISSERTATION

(As per given scheme)

SIXTH SEMESTER

4 SEPS 1 SEMINAR-II AND DISSERTATION

(As per given scheme)

**MECHANICAL ENGINEERING
(THERMAL POWER ENGINEERING)
(PART TIME)
SEMESTER : FIRST**

1S PMTE1 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 (Laplace 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-Cotes'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 Statistics by S.C.Gupta
5. Higher Engineering Mathematics by B.S.Grewal
6. Advanced Engineering Mathematics by H.K.Dass

1S PMTE 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 Exergy; Chemical Energy, Exergy from Heat and Work, Exergetic Efficiency, Generation of Entropy, Exergy. (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 NY
14. Applied Thermodynamics Babits G Allen & Bacon, Boston

1S PMTE 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

SEMESTER : SECOND

2S PMTE1 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.

2S PMTE 2 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 Montgomery, 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 Experiments 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

2S PMTE 3**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 : THIRD**3S PMTE1****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 Publications 1978
- 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.

3S PMTE 2: HEAT EXCHANGER DESIGN

Introduction, Double pipe heat exchanger, shell and tube heat exchanger, cross flow heat exchanger, design considerations, thermal design 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, Hemisphere 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

3S PMTE 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

3S PMTE 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 .

SEMESTER :FOURTH

4S PMTE 1

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)

4S PMTE 1

ELECTIVE –II

(ii) ADVANCED 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 NY)

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)

4S PMTE 2

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.

4S PMTE 2

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 N₂ O₂ 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, H₂, Ne, N₂, Air, O₂, 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 State 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 Thomas M Dekker
9. Cryogenics Bryson William E Hanser.Gardner
10. Cryogenic Refrigeration Flynn, Thomas M, Chen Gyobang
11. Applied Cryogenic Engg Vance and Duke Wiley
12. Cryogenic Processes And Equipment Leonard Wenzel, F J Kadi ASME

4S PMTE 3

LAB PRACTICE-II

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

SEMESTER: FIFTH

5S PMTE 1 : Seminar - I

5S PMTE 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.

SEMESTER : SIXTH**6S PMTE 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.

ENVIRONMENTALENGG

(PART TIME) COURSE

SEMESTER :FIRST**1 SCEE 1 ENVIRONMENTALSCIENCESANDCHEMISTRY****SECTION –A**

The Nature and scope of Environmental Problems :-

Some important definitions, Interaction of systems, Environmental disturbances, public awareness and action, Quantification of Environmental problems.

Climatology and Meteorology :-

Introduction , Basic atmospheric properties, Energy outputs and inputs, wind stability and turbulence, water in the atmosphere, climate.

Ecology :-

Introduction, Energy flow in Ecosystems, food chain and trophic levels, Nutrient cycles, elements of limnology , Eutrophication.

Global Atmospheric change :-

The green house effect and stratosphere ozone depletion, Global temperature, the green house effect, carbon dioxide, chlorofluorocarbons , the green house gases, Regional effects of green house gases, changes in stratospheric ozone, perspective on global atmospheric change.

General Chemistry:- Law of mass action, Stoichiometry, Gas Laws

Physical Chemistry:- Types of solution, electrical conductivity and aqueous solution, ionic theory, electrical dissociation, Buffer solutions, Indicators, Solubility products, Common ion effect,

Amphoteric hydroxides, chemical equilibria and ways of shifting it.

SECTION-B

Organic Chemistry and Biochemistry :

Organic compounds of interest to environmental engineers

(Details of preparation and chemical reactions involved are not required)

General preparation of the functional groups of organic compounds.

Enzymes, classification, Enzyme catalysed reactions.

Break down and synthesis of carbohydrates, fats, protein under aerobic and anaerobic reactions.

CNP cycle under aerobic and anaerobic reactions.

Concept of B.O.D., C.O.D., T.O.C.

Colloids, Dispersion of Colloids, General and electrokinetic properties of colloids, colloidal solutions and mixtures.

Environmental Chemistry :-

Water structure and anomalous behavior of water ,
Chemistry involved in water treatment processes like coagulation, disinfection, softening, fluoridation , defluoridation, Iron and its control
Composition and characterisation of sewage, sewage sludge and gas analysis.

Chromatography :-

Principles and uses in Environmental Engg.

Text/ Reference Books :

- 1) Introduction to Environmental Engg. and Science – By Gillbert M Masters.
- 2) Environmental Science – By. Alam Singh, Vol-I,II,III.
- 3) Environmental Science & Engg.- By Henry.
- 4) Fair G M , Geyr J C , Okun D A , Water and wastewater Engineering, Vol, I & II, John Wiley & Sons, New York.
- 4) Chemistry for Environmental Engg.- By. Sawyer & M.c Carty.
- 5) Waste water Treatment, Disposal and Reuse – By MetCalf & Eddy.

ISCEE2

ENVIRONMENTAL MICROBIOLOGY

SECTION A

1. Introduction to microbiology
Classification of microorganisms, procaryotic cells, eucaryotic cells.
Characterization of microorganism, microorganism of importance.
Distribution of biological forms, interrelationship application in the field of Environmental Engineering.
- 2 Bacteria ;
Distribution, cytology, forms size, morphology and file structure of bacteria, nutritional requirements, metabolism, growth of bacteria, growth patterns, food microorganism relationship, Aerobic, Anaerobic growth.
Factor affecting growth, generation time.
- 3 Bacteriology of water :
Pathogens and indicator of pollution, method of isolation, enumeration and differentiation. Presumptive, confirmative and completed test for E-coli, most probable number, Membrane filter technique, indicators of pollution, sampling method, frequency, precautions.
Microbiology of food :
Microorganisms associated with milk and food, diseases transmitted, food poisoning,

- 4 Enzymes
Nature of enzymes, mode of actions, effect of temperature, pH, salts and heavy metal, extra cellular and intracellular enzymes classification, source of enzymes, enzymes formation.
5. Fresh water biology :
Flora and fauna in rivers, distribution, limnology, biological cycles, oxygen concentration, nutrient concentration, oxygen depletion, oxygen sag reaeration, Lake eutrophication and its prevention.

SECTION B

6. Algae, Fungi Protozoa and viruses :
General, introduction to these groups, their role in environmental Engineering and their classification, identification, observation nutrition, reproductions, their control.
Viruses :
Occurrence, special features, diseases caused by them, culturing, control of viruses.
- 7 Bacterial culture :
Isolation of microorganisms, staining procedures, pure and mix cultures, culture characteristics, different medias, selective methods, interference, gram positive and negative bacteria laboratory ulturing techniques, equipments used, microscope, autoclave, incubator, test chamber.
- 8 Microbiology of waste water treatment :
Microorganisms, fundamental theory, theory of operations, oxygen requirements and environmental factors associated with following waste treatment methods.
 - Activated sludge process
 - Trickling filter
 - Oxidation pond
 - Sludge digestion
 - Cesspools, septic tank and imhoff tank
9. Air microbiology :
Types of microorganisms, Air borne diseases, sampling of air, microbial content of air, control of airborne diseases.
10. Control of microorganisms
Death of bacteria
Pattern of death, effect of temp, pH, toxic substances on growth of bacteria, Antagonism and synergism.
Control of microorganisms by physical agents, Control of microorganisms by chemical agents.

1 SCEE 3 PRACTICALS

Determination of:-

1) Conductivity 2) pH (indicators and pH meter) 3) Turbidity 4) Hardness (Calcium and total by EDTA method) 5) Sulphate 6) Chlorides 7) Chlorine demand and Chlorine residual (Available, Break point dose) 8) Nitrogen all types 9) DO, BOD 10) COD, TOC 11) Iron and Manganese 12) Acidity and Alkalinity 13) Fluorides 14) Solids (Fixed, suspended and Volatile) (ANY TEN)

1 SCEE 4 PRACTICALS

Study of instruments, Heterotrophic plate count, preparation of differential media isolation of bacteria by various methods, staining of bacteria, enumeration of bacteria by various methods, M.F. technique, Control of microorganisms.

SECOND SEMESTER**2 SCEE 1****WATERSHED MANAGEMENT****SECTION A****1. INTRODUCTION:**

The hydrological cycle, storage, concept of storage, the watershed

2. WATER AND ENERGY:

Energy movement, quality of energy, the geometry of energy, the energy budget, Instruments and limitations, the role of water in energy sphere.

3. WATER IN THE ATMOSPHERE:

Instrumentation and limitations, Processes, Global circulation, Precipitation, sources of precipitation, forms of precipitation, Temporal and spatial distribution, Evaporation, the amount, factors affecting evaporation, Dalton's Law, Instruments, limitations.

4. WATER IN VEGETATION:

Processes, interception, Transpiration, Evapotranspiration, calculations by using water budget, Evapotranspiration, models, storage.

5. Hydrology in water resources development, statistical analysis of rainfall and runoff, different distributions methods, Estimation of Unit Hydrograph-flood flow formulae, Storm hydrograph, Storage and regulation of runoff-safe yield of streams, Estimate of storage requirements.**SECTION B****6. HYDROLOGY OF GROUND WATER:**

Common aquifers-Exploration for ground water, hydraulics of ground water flow- Measurement of permeability of formations, flownets and their constructions, Boundary conditions – Unconfined and Confined, steady and unsteady flow into wells and infiltration galleries – Evaluation of formulation constant interference, Method of images – Types, design, construction and maintenance of wells and infiltration galleries, Development of wells – well strainer – functions and selections, field tests – Hydraulics of salt water intrusions and their prevention, Ground water recharge.

7. WATERSHED DEVELOPMENT AND MANAGEMENT

Definition, Need and scope, characterization of watershed criteria survey, Basic data collection and interpretation, Establishment of watershed research stations. Watershed resource evaluation and management. Irrigation technology. Integrated farming system. Project formulation and economic analysis.

PERSPECTIVE ON WATERSHED MANAGEMENT:

Methodologies for modifying the water resource environment, watershed management and large scale changes.

PRACTICE OF WATERSHED MANAGEMENT:

Rehabilitation, Protection and Enhancement

NON POINT SOURCES OF POLLUTION:

The legal basis, the process of non point source pollution control, Best management practices principles, Best management practices on wet lands.

8. RAIN WATER HARVESTING:

Necessity, Methods of rain water harvesting, Requirements for design of project, community participation, Role of NGO's, Government and Municipal Corporation, Limitations, quality assurance of stored water.

BOOKS :-

1. Watershed Hydrology by Peter E. Black.
2. Water Resources Systems, Planning and Management by R.N.Chaturvedi.

SECTION A

Standards for raw and treated waters. Surface waters. Effects of storage on water quality. Limnology. Water ecology, Thermal stratification. Seasonal Change, lake overturns. Algae, Control measures, quality of underground Waters. Nature and source of impurities. Examination of waters.

Requirements of water treatment facilities. Process design and hydraulic design. Unit operations, Gravity systems, pumping systems. Period of design, Fluctuations in demand. Intake structures. Useful concepts from water chemistry and biology.

Principles of sedimentation and floatation. General equations for settling or discrete particulates. Hindered settling, effect of Temperature, viscosity efficiency of an ideal basin, short-circuiting. Sludge moisture content – specific gravity relationship. Up flow and sludge blanket tanks – mathematical model of the unit processes.

Theories of chemical coagulation. Nature of colloids. Zeta potential. Coagulant and their specificity. Design of mechanical flocculators. Mean velocity gradient “G”, “Gt” effect of temperature and other variables. Power consumption. Mathematical Modelling.

SECTION B

Theory of filtration. System Parameter and mathematical modeling, size and shape characteristics of granular filtering materials. Preparations of filter sand, Hydraulics of filtration through homogeneous and stratified beds. Performance of slow, rapid, high-rate multi-layer and composite filters. Upflow, two way filter, dual media filter.

Pressure filters. Diatomaceous earth filters. Micro-strainers. Filtrability Index.

Principles of disinfection. Factors affecting disinfection. Halogens: Chlorine, Iodine and Bromine.

Principles of aeration, System parameters and mathematical model. Methods of aeration. Theories of adsorption. Freundlich equation. Removal of taste and odour by adsorption. Removal of colour. Effects of fluorides. Fluoridation. Removal of fluorides.

Industrial water treatment: Boiler feed water. Softening of water. Langlier, Ryzner and other indices. Reuse of water and conservation of water in industry.

Methods of Iron and Manganese removal. Use of aeration, oxidation, ion-exchange and other methods and their control.

Theory of corrosion, and corrosion control.

BOOKS RECOMMENDED:

1. Water and Waste water Engineering by Fair Geyer and Okun, John Willy and Sons
2. Water and Waste water Technology by Mark J. Hammer, John Willy and Sons
3. Water Supply and Sewerage by E.W. Steel and McGhee, McGraw Hill Company.
4. Manual on Water Supply & Treatment, CPHEEO, New Delhi.
5. Physico-Chemical Processes for Water Quality Control by Weber, John Wiley & Sons, 1972.

2SCEE3

ADVANCED WASTEWATER TREATMENT

SECTION-A

1. INTRODUCTION: Objectives of waste water treatment, Purpose of advanced wastewater treatment, Wastewater quantity and transport and waste water characteristics. Alternative flowcharts, function and basic principles involved in different units of conventional wastewater treatment plant.
2. PROCESS ANALYSIS: Reaction and reaction kinetics, Mass balance, Reactors and their hydraulic characteristics, Practical aspects of reactor design.
3. PHYSICAL AND CHEMICAL TREATMENT: Screening, Grit removal, flow equalisations and mixing. Flocculation, sedimentation, flotation. Detailed principles and design aspects of Screening, Grit chamber and Sedimentation tank.

SECTION-B

4. PRINCIPLES OF BIOLOGICAL TREATMENT: Kinetics of biological growth, introduction to suspended and fixed film reactors. Concepts of gas transfer and solids separation, Nitrogen and Phosphorus removal from waste water. Concepts of aerobic and anaerobic treatment of waste water. Design of Activated Sludge system using biological process dynamics. Complete design details of Activated Sludge Process. Modifications of ASP. Process concepts and design aspects of Trickling Filters, Rotating Biological Contactors (RBC), Fluidized bed reactor/treatment.
5. SLUDGE TREATMENT AND DISPOSAL: Aerobic and Anaerobic digestion of sludge, sludge stabilization, dewatering, conditioning and disposal.
6. TERTIARY TREATMENT: Principles of tertiary treatment, theory of adsorption and factors affecting adsorption. Concepts and different methods of dissolved solids removal. Basic principles of Reverse Osmosis, Ultra-filtration, Electro dialysis, Desalination.

REFERENCE BOOKS:

1. Wastewater Engineering: Treatment, Disposal & Reuse, By Metcalf & Eddy Inc. Sixth Ed. 2002, McGraw Hill.
2. Introduction to Environmental Engg., By. P.A. Veslind, PWS, Publishing Compony, Boston, 1997.
3. Wastewater Treatment and disposal, By S.J. Arceivalla, Marcel Dekker, 1981.
4. Wastewater Treatment Plant Planning, Design and Operation, By S.R. Quasim, Holt, Rinehart & Winston N.Y.
5. Activated Sludge Process: Theory and Practices, By N.F Grey, Oxford University Press, 1990.

THIRD SEMESTER**3 SCEE1 ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT****SECTION A**

1. Development and Environment, need for EIA, concept of EIA, elements of EIA, environmental attributes, nature of impacts – primary, secondary, tertiary, short-term, long-term, local and regional, reversible & irreversible impacts
2. Overview of impacts – directly & indirectly measurable impacts w.r. to air, noise, water, land, biological & socio-economic environment
3. Screening and scoping in EIA, terms of reference for conducting EIA, methodologies of EIA-checklists, matrices, overlays, cost benefit analysis, & adaptive environment and management, networks
4. Framework of EIA – scope of EIA, baseline data collection, prediction of impacts, evaluation of impacts, battelle environmental evaluation system, environmental management plan, greenbelt development, environmental quality monitoring, budgetary provisions for implementing control measures
5. Environmental appraisal of projects, MoEF questionnaire for environmental clearance, element of public participation & hearing, case studies on EIA of industrial, mining, highway and water resources projects, critical environmental issues and formulation of strategies for EMP for these projects

SECTION B

1. Environmental legislation – basic concepts, critical issues, civil liability, various enactment and their provisions – Water Act (1974, 1988), Forest Conservation Act (1980), Air Act (1981, 1988), Water (Cess) Act 1977, Environmental Protection Act 1986, Public Liability & Insurance Act, Motor Vehicle Act 1989, Rules for Hazardous waste

handling, storage & disposal, environmental tribunal & its functions. Implementation mechanism of environmental legislation. Role of State & Central boards of pollution control, local Govt., social action groups, Environmental policies.

2. Environmental Audit – definition, concept of EA, types of environmental audit, benefits of environmental audit, scope & objectives, environmental statement, procedural aspects of conducting environmental audit, pre-audit phase, on-site audit phase & post-audit phase, water audit, raw material audit & energy audit, health & safety audit, conservation of energy and water, waste minimization, economic benefits of environmental audit
3. Sustainable development & environmental management, carrying capacity based developmental planning process, regional EIA and preparation of regional EMP, concept of carrying capacity, assimilative and supportive capacity, development of action plans for critical environmental areas, training needs in environmental management and environmental education programmes. Environmental Management in India.
4. Resource Management
Types of resources - terrestrial (soil) resources, minerals, plants & animals (biotic) resources, marine, fresh water, air & bioenergy resources, resource utilization-renewable and non-renewable resources, optimal use of resources, depletion of resources – causes & effects.
Human Resources – importance of socio-economic studies in developmental projects.

BOOKS :-

- 1) Environmental Impact Assessment : Rau & Woofes.
- 2) Environmental Impact Assessment : W.F. Canter, McGraw Hill.
- 3) Proceedings of Indo-British Workshop on EIA of Petrochemical Industries and Environmental Audit, Jan. 1994, IAEM, Nagpur.
- 4) Handbook on Pollution Control Acts, Central Pollution Control Board, New Delhi.
- 5) The New Environmental Age by R.K.Sapra, S.Bhardwaj, Ashish Pub. House, New Delhi.

3 SCEE 2 AIR POLLUTION & CONTROL**SECTION A**

- I General principles, Biosphere, Air Environment, Air pollution, Primary and Secondary pollutants, Removal processes, sources of pollution, Averging time air quality.

- II Particulate matter : Natural & manmade, viable & nonviable, effects & removal mechanism, particle size distribution.
- III Gaseous pollutants : CO, CO₂, Ozone, SO₂, H₂S, Sources and effects on vegetation materials and Humans, photo-chemical smog, secondary pollutants : NO_x, Atmospheric reactions & Scavenging process.
- IV Meteorology : Solar radiation, Heat balance, green house effect, Wind velocity, wind rose, turbulence, wind profile, humidity, temperature.
- V Atmospheric Stability : Lapse rate, inversion : flume shape, Max mixing depth. Transport of air pollutants.

SECTION B

- VI Air pollution monitoring : Sampling, monitoring equipments, stack monitoring, quality surveillance, source monitoring, Ambient air quality.
- VII Air pollution control : Various methods of control of particulate matter in industries and design of gravity separator, cyclone separator, filters, electrostatic precipitator, absorption devices, scrubbers, combustion devices, control of gaseous emission and process emission controls.
- VIII Air quality modeling : Modelling, Air quality mathematical models, Gaussian Dispersion model, plume rise, application of models.
- IX Pollution from mobile sources, problems, effects, testing and control, preventive measures.
- X Other types of pollutions:
1) Noise pollution 2) Radioactive pollution 3) Thermal pollution, Nature, sources, effects and control measures.

BOOKS RECOMMENDED :-

- 1) Air Pollution, Vol. I To IV – A. C. Stern.
- 2) Fundamentals Of Air Pollution – Stern, Wohlers, Bouble, Lower.
- 3) Air Pollution & Control – P. P. Mowli & N. Venkata Subbayya.
- 4) Air Pollution – Rao & Rao.
- 5) Air Pollution Sienfeld J. H.
- 6) Air Pollution – Perkins.
- 7) Air Quality Monitoring – A Course Manual By Neeri, 19981.
- 8) Mechanical handbook
- 9) Mechanical Handling - Jolley, F. Raby, & H. Walder.
- 10) Material Handling Engineering – Sayre, Haward S.

3 SCEE 3

PRACTICALS

- 1) To measure CO % & NO % of the exhaust gases from vehicles or gasoline engine.
- 2) Determination of SPM, RSPM, SO₂
- 3) Statistical Calculations of observed air pollution data.
- 4) Design of Bag filter for controlling dust pollution in particular industry – case study.
- 5) Design of cyclone separator.
- 6) Study of Air Quality Monitoring Instruments & Equipments.
- 7) Determination of wind velocity, wind direction, temperature, cloud cover, humidity & preparation of windrose diagram.

3 SCEE 4

DESIGN PROBLEM

A project report on Design of Complete Water Treatment Plant or Sewage Treatment Plant or Industrial Waste Water Treatment Plant including detailed drawing and cost economics will be prepared by a group of not more than 3 Students.

Examination will be based on Viva-Voce on report submitted.

FOURTH SEMESTER

4 SCEE 1

INDUSTRIAL WASTE WATER TREATMENT

SECTION A

Problem of Industrial Waste Water:

Variation in quality and quantity of industrial waste water. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Indian standards for discharge of treated waste water on land, into municipal sewer and natural water courses.

Sampling procedure. Experimental evaluation of physico-chemical or biological treatment methods for treatment of the wastewater.

Approaches to minimization of problem of industrial waste water, Good house-keeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal. Cleaner Technologies of production for waste minimization.

SECTION B

Different aspects and choices of various alternatives such as:

- 1) Treating different effluent streams separately.
- 2) Treating different streams jointly after mixing them partly or fully.
- 3) Including/excluding domestic waste along with the industrial waste.

General approach for handling and treatment of industrial waste water with following special characteristics.

Shock loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Experimental evaluation of physico-chemical or biological treatment processes for treatment of the waste water.

Process line diagrams, characteristics and treatment of industrial waste of: -

Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical, electroplating etc. industries.

BOOKS RECOMMENDED:

- 1) Waste Water Treatment, Disposal and Reuse-Metcalf and Eddy.
- 2) Pollution Control in Process Industries – S.P.Mahajan.
- 3) Liquid Waste of Industry – Theory, Practices and Treatment Nemcrow.
- 4) Industrial Water Pollution Control- W.W.Eckenfelder.
- 5) Natural Systems for Waste Management and Treatment – S.C. Reed, E.J. Middlebrooks, R.W.Crites.
- 6) The Treatment of Industrial Waste – Purse lievre E.B.
- 7) Water Quality Management by W.W. Eckenfelder
- 8) Biological Treatment of Waste Waters : W.W. Enkenfelder

**4SCEE 2 ENVIRONMENTAL SANITATION
AND SOLID WASTE MANAGEMENT**

SECTION – A

1. Concept of environment and scope of sanitation in rural areas. Principles involved in the protection of public health by engineering measures to control the environment Rural water supply – Selection and development of preferred sources of water, sanitary

considerations for location and construction of wells, springs, infiltration wells, radial wells and infiltration galleries, bacterial travel in soils.

2. Improvised methods and compact systems of treatment of surface and groundwater. Specific problems in rural water supply and treatment e.g. iron, manganese, fluorides etc.
3. Treatment and disposal of wastewater / sullage, Various methods of collection and disposal of nightsoil , On-site sanitation system and community latrines. Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits etc.
4. Swimming Pool sanitation – quality standards, algae control
Fly and Mosquito Control – destruction of adult flies and prevention of fly breeding.
Drainage filling, digging, dewatering, chemical measures.
5. Food Sanitation – Public consideration, Causes of food poisoning, food storage,
Restaurant sanitation, Slaughter house sanitation, Milk plant sanitation, Sanitation of Hospital.

SECTION – B

6. Problems and impacts of solid waste in developing countries; Sources, types and composition of Municipal solid waste, quantity estimation and forecast, Management systems and planning.
7. Characteristics of solid waste – Sampling – physical , chemical and biological analysis. Sources , types and composition of industrial hazardous and toxic wastes, Treatment and disposal methods.
8. Collection of solid waste: On site handling and processing; Collection systems and service; Analysis of collection systems, collection routes; Management issues and concerns.
Transfer and transport, design requirements.
9. Composting – Process microbiology, Aerobic and anaerobic composting, parameters affecting, Design considerations, compost control, engineering design and operations.
Sanitary Landfill – Process mechanism, Classification, types, siting considerations, engineering design and operations.
10. Incineration - Process details, classification, types, siting considerations, Energy recovery, Pyrolysis, engineering design and operations.

Biogas from solid wastes, conversion of solid wastes to protein, Legislation and byelaws in solid waste management, Solid Waste (Management & Handling) Rules, 2001.

Reference / Text Books:

- Ehlers and Steel; Municipal and Rural Sanitation.
- Wagner E. G. & Lanoik J.N; Water supply for rural areas and small communities, Geneva : WHO,
- Manual for rural Water Supply, Helvetas Swiss Corporation, Divyajyoti Prakashan, Jodhpur.
- G. Techbanoglous, Elliasen; Solid waste Engineering, Principles and management issues, Mc-Graw Hill Book Co.
- Bhide A.D and Sudaesan B.B; Solid waste Management in developing Countries, INSDOC, New Delhi.
- D. Joseph Hagerty, Joseph L. Pavoni & John E. Heer Jr.; Solid Waste Management, Van Norstrand Reinhold Environmental Engineering Science..
- Frank Kreith; Handbook of solid waste Management, Mc-Graw Hill Inc.
- Frank Flintoff; Management of solid waste in developing countries, WHO publication.

4 CEE 3

ELECTIVE

(I) HAZARDOUS WASTE MANAGEMENT

SECTION – A

1. Introduction to Hazardous Waste :-
Definition, Problems, general awareness, Industry and Government's perspective. Risk Assessments, Environmental legislation.
2. Hazardous waste characterization and site Treatment.
Introduction, study of characterization, Assessment of Hazardous sites, waste minimization and Resource Recovery, chemical , physical and biological treatment to Hazardous waste. Thermal process.
3. Transportation of Hazardous wastes :-
Introduction of Hazardous wastes :-
Hazardous Wastes (Handling, Storage & Management) Rules, 1989 of MoEF.
Introduction, container for Hazardous waste, bulk transport, Non bulk transport.

4. Groundwater contamination :-
Effect on human health, Historical uses and abuses, hydrology, Detection , Control and Mitigation of groundwater contamination.
5. Process Techniques and Disposal :-
Selecting the process, siting the facility, integrated land fill system as Disposal sites, Developing a new facility, operating a landfill.

SECTION – B

6. Basic Disaster Management Aspects.:-
The significance of Disaster, the Disaster threat, National Disaster Management policy, major Requirement for coping with Disaster Management cycle, Disaster and National Development, Disaster legislation, counter disaster resources. International Disaster Organisation, utilisation of Resources.
7. Long-Term Measures :-
Prevention, Mitigation.
8. Major factors for occurrence of Disaster impact :-
9. Response to Disaster impact :-
10. Major post impact factors, Disaster management support requirements.

BOOKS RECOMMENDED :-

1. Hazardous waste management : Charles A. Wentz.
2. Hazardous waste minimization : Harry M. Preeman.
3. Hazardous waste Chemistry, Toxicology and treatment : Stanly E. Manahan.
4. Disaster Management : W. Nick Carter.

4 SCEE 3

ELECTIVE

(ii) NOISE POLLUTION AND CONTROL

SECTION A

- I Introduction, Noise pollution, Nature of noise, Characteristics of noise, NEI, Sound pressure levels, and propagation of noise.
- II Source of noise, Types of sources of noise, (mobile and non mobile) comparison of noise and Air pollution standards. Assessment and measurement of sound control facilities, Monitoring procedures.
- III Effects of noise on people and various protective equipments Like earplugs, earmuffs, etc. Basic principles of noise control, general noise control factors sources of vibrations.

SECTION B

- IV Noise in Home & its control, control of Existing noise outside the home, Noise from construction and Civil Engineering works and its control. Noise from industry and its control.
- V Road traffic noise and its control subjective rating of Automotive vehicles noise characteristics of vehicle guidelines for vehicular noise, relation between noise and engine combustion system Aircraft and Airport noise.
- VI Legal Aspects of noise pollution, prediction and Assessment of Impacts on the noise Environment due to stationery and mobile noise sources. Existing legal provisions for controlling noise, International noise level standards.

BOOKS RECOMMENDED

- 1) Noise Pollution - P. R. Trivedi, Gurdeep Raj
- 2) Environmental Noise Pollution and its Controls - G. R. Chatwal, M. C. Mehra, M. Satake

4SCEE3**ELECTIVE****(III) ENVIRONMENTAL BIOTECHNOLOGY**

Basic concepts of Microbial Biochemistry of carbohydrates, proteins and lipids; structure of nucleic acids.

Biodegradation, biotransformation, microbial associations, significance of monitoring bacterial, viral and protozoan pathogens, gene probes, biosensors, immunoassay.

Basic concepts of genetic engineering, chromosomal DNA, plasmid DNA, replication of DNA, genetic code.

Transformation, transduction, conjugation, mutation, recombinant DNA techniques, biotransformation of biomass/organic waste into value added chemicals and energy.

Single cell proteins, microorganisms involved and biochemical changes of different pollutants present in liquid wastes. Types of reactors.

Books Recommended :

1. Concepts in Biotechnology- Edited by Balsubramanian et. al.
2. Text book of Biotechnology- Dubey.

ELECTIVE**4SCEE3****(IV) REMOTE SENSING AND GIS IN ENV. ENGG.**

Fundamental principles of Remote Sensing; Electromagnetic energy and its atmospheric interactions ; Remote sensing systems.

Elements of Remote sensing systems; Indian remote sensing program.

Data products and types; Interpretation techniques; Digital image processing; Image rectification, enhancement and classification.

Geographical information system, concept and characteristics.

Raster and Vector data, attribute generation and analysis.

Integrated applications of Remote Sensing and GIS in Environmental engineering, Viz. Resources management, monitoring and evaluation, modeling.

Books Recommended :

1. Sabnis F.- Remote Sensing, Principles and interpretation -WH & Freeman & Co. NY.
2. Gupta R. P.- Remote Sensing
3. Jensen J. R.- Introductory Digital Image Processing -Pentice Hall NZ.

5 SCEE 1 & 6 SCEE 1**SEMINAR AND DISSERTATION**

A Dissertation on Recent Trends in Environmental Engineering to be submitted.

Seminar shall be delivered on the dissertation submitted.

Marks shall be based on Seminar and Viva-Voce on dissertation.

IRME1 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 pipelining. 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)

IRME2 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 & Conquer : 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 : Traversing 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)

IRME3 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)

SEMESTER : SECOND**2 RME 1 COMUPTERCOMMUNICATIONNETWORKS**

- 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 :** Packet-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.

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. Hidden 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.

2RME3

SEMINAR

SEMESTER: THIRD

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.

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 experiment on each Unit.

SEMESTER: FOURTH

4RME 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, computing 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.

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)

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)

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)

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 functions. Raster display hardware.
- IV. Realism in three-dimensional graphics, Curves & Surfaces, Shapes description requirements, Parametric functions, B-spline method, B-Sphere method, Displaying Curves & surfaces.
- V. Three-dimensional transformations & perspective : Modeling, Viewing, Clipping. Perspective transformation. Screen Coordinate system : Properties, Projective transformations.
- VI. Hidden-surface elimination, Depth-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)

4RME3**SEMINAR****SEMESTER: FIFTH****5RME1****SEMINAR**

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

SEMESTER: SIXTH**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.

PRODUCTION TECHNOLOGY & MANAGEMENT**(PART-TIME) FIRST SEMESTER****1SPTM1 ADVANCED METAL CUTTING AND WELDING TECH.**

Metal cutting theory, nomenclature system, Developments in tool mat Composites.

Design of metal cutting tools, single and multiple point cutting tools.

Tooling for NC/CNC M/c -consideration and requirements.

Non traditional metal shaping processes.

Design of drills jigs and fixtures for milling, broaching, turning, welding and assembly.

JOINING OF METALS

Welding-weldability of metals, pre and post treatments of joints, welding defects

Advance welding tech., soldering and brazing.

TERM WORK : Practicals based on above syllabus.

BOOKS RECOMMENDED:

1. Metal cutting theory and cutting tool design-Arshinov(MIR Publications)
2. Mat. and Process in manufacturing-8e, Degarmo E. Paul, J.T. Black (PHI)
3. Processes and mat. of manufacture-ROY A.Lindberg, 4e (PHI)
4. Fundamentals of metal cutting and m/c tools-Juneja (WEL)
5. Metal cutting theory and practice-A.Battacharya (Central book publisher)
6. Tool design - Donaldson, Cyril Donaldson, G.H.Lecain, Tata Mc Graw Hill.
7. Jigs and fixtures - Kemptser
8. Jigs and fixtures - Grantt
9. Welding Tech. - Little
10. Welding Tech. - O.P.Khanna, S.Chand & Co.

1SPTM2 ADVANCED METAL FORMING &**CASTING TECHNOLOGY**

Sheet metal working-Shear action in die cutting, Different die cutting operation, die types & applications. Metal flow in forming & drawing dies, Different forming, bending & drawing operations die types & applications

Design of press working tools

Roll pass design, roll forming, process & design of forging dies, high velocity rate forming, High energy forming, Powder metallurgical technique & powder forming, selection of metal forming process with reference to products & their desired properties

Casting processes, classification & comparison based on different criteria, study of recent developments. Solidification of metal in casting, Metallurgical changes, study & analysis as a heat transfer problem. Feeding of casting under gravitational & external forces, design of feeding system.

Defects & testing of castings

TERMWORK

Practicals based on above syllabus

BOOKS RECOMMENDED:

- 1) Technique of Press Working Sheet Metal- Eary & Reed(PHI)
- 2) Tool Design Donaldson(TMh)
- 3) Tool Design Astmf(PHI)
- 4) Principles of Rolling Burtsev(MIR)
- 5) Forging Die Design Sharan
- 6) Fundamentals of Casting R.A.Flymn
- 7) Principals of Metal Casting Heine Resenthal
- 8) Die Casting Deohler
- 9) Solidification of Casting
- 10) Process & Materials of Manufacture Roy A. Lindberg, 4e (PHI)

SECOND SEMESTER

2SPTM1

PRODUCTION MANAGEMENT

Generalised model of prod. System, design optimisation and control of prod. System Forecasting types, demand pattern, qualitative and quantitative forecasting models and applications Aggregate prod. And capacity planning. Master planning scheduling and Rough cut capacity planning Prod. Control functions, loading charts sequencing and scheduling models,expediting functions and short term capacity control.

High volume prod. systems-analysis of automated flow lines, assembly systems and line balancing. Mat. Management functions-standardization, simplification and diversification, purchasing functions, inventory control-static and dynamic models, objective control, inventory control under constraints, stores functions and records, spare parts and in-process inventory.

BOOKS RECOMMENDED

1. Prod. and operations management-Dilworth
2. Prod. and operations management-Adam and Ebert
3. Prod. and operations management-Buffer
4. Automation prod. system and CIM-M.P. Groover, (PHI)
5. Hand book of mat. management-Gopalkrishnan
6. Mat. Management.-procedures, text and cases-A.K.Dutta
7. Prod./Operations management. Roger W.Schmenner
8. P.P.C.-Samuel Eilon

2SPTM2 PRODUCTIVITY AND QUALITY MANAGEMENT

Industrial Inspection I-Design considerations for gauges and measuring instruments. Tolerances for linear dimensions and dimensional chains. Limits Fits and tolerances as per I.S., inspection of threads and gears. Measurement of surface texture etc.

Industrial inspection II-Pneumatic gauging, in-process gauging, geometrical and positional tolerances, geometrical and physical limitations in metrology, automated inspection principle and methods, sensor technologies for automated inspections, CMM, flexible inspection systems, inspection probs, machine vision etc

Quality management-Quality of products: meaning of quality, evaluation of total quality control, fundamental factors affecting quality, modern quality problems, total quality systems, quality information feedback, quality training, orientation and work force

Development Quality costs: introduction, identifying quality cost items, analysis of quality costs S.Q.C., ISO 9000.

Modern approach to productivity improvement: Quality management. Tech, QFD, Taguchi method, Poka Yoke tech., quality philosophies of quality Gurus; Deming Juran, Ishikawa, Croshy, Cmway, total quality management. Self assessment (QMS/A), Kaizen and innovation, Kanban, TPM, SMED,5S.

Total factor and partial factor productivity, measurement of productivity, qualitative tech. For improving productivity.

BOOKS RECOMMENDED:

1. Engineering M.Q.C.-I.C. Gupta
2. Quality planning and analysis-Juran, Tata Mc Graw Hill.
3. S.Q.C.-Grant
4. S.Q.C.-Juran
5. Introduction to total quality-David Goetsch and Stanley Devis

6. Automation prod. Systems-Mikell P.Groover, (PHI)
7. Total quality control-A.V.Feigenbann, Mc Graw Hill, 3e
8. Productivity Engineering and Management.-D.J.Sumanth
9. KAIZEN-M.Imai
10. Prod. and operation management-Dilworth
11. Managing for total quality-N.Logothetis
12. Profile of ISO 9000-Bureau of business practice

2SPTM3 OPERATIONS RESEARCH TECHNIQUES

Linear programming: Formulation of O.R. problems. Simplex method, duality on linear programming, sensitivity analysis, revised simplex method.1

Integer programming, goal programming.

Dynamic programming: Characteristics of dynamic programming, stagecoach Problem, capital budgeting problem, salesman problem, production smoothing problem, forward & backward recursion

Decision theory: Decision making under uncertainty, Decision making under risk, decision trees, utility theory.

Game theory: two person Zero sum games, pure & mixed strategies, dominance, algebraic & graphical methods of solution, linear programming methods to solve mixed strategy games.

Simulation: Introduction, formulating & implementing a simulation model, role of random number in simulation, application of simulation to inventory control problems, queuing problems, investment problems, & projecting network problems, role of computers in simulation.

Waiting line models Multiple server models (M/M/S)

BOOKS RECOMMENDED:

- 1) Askhedkar R.D. & Kulkarni R.V. : Operations Research, Dhanpat Rai & Sons.
- 2) Shenoy G.V. : Linear Programming Methods and Applications, Wiley Eastern Ltd.
- 3) Sharma J.K. : Operations Research Theory & Applications, Macmillan India Ltd.
- 4) Shenoy G.V., Srivastava U.K., Sharma S.C.: Operations Research & management, Wiley Eastern.
- 5) Hamdy A. Taha : Operations Research, An Introduction, Prentics Hall of India Pvt. Ltd., New Delhi.

- 6) Wagner Harvey M. : Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., New Delhi. 110 001.
7. Hiller and Liberman : Operations Research.
- 8) Budnick Frank S., Dennis McLeavey, Richard Mojena : Principles of Operations Research for Management, Richard D. Irwin Inc., Homewood Illinois 60430, All India Traveller Bookseller, Delhi. 110 051
- 9) Ravindran, Phillips, Solberg: Operations Research Principles and Practice, John Wiley & Sons Inc.
- 10) Nair N.G. : Operations Research, Dhanpat Rai & Sons.
- 11) Verma A.P. : Operations Research with Numeric Analysis & Statistical Methods., S.K.Katariya & Sons, Delhi. 110 006
- 12) Gupta Premkumar, Hira D.S. : Operations Research, S.Chand & Co. Ltd., Ram Nagar, New Delhi. 55
- 13) Goel B.S., Mithal S.K. : Operations Research, Pragati Prakashan, Meerut, U.P. (India)

THIRD SEMESTER

3SPTM 1 ERGONOMICS

Introduction : ergonomics and man machine systems. Basic ergonomics, Work psychology and method of measurement of work, Paced & Unpaced performance. Design & selection of displays and controls. Application of anthropometric data and design of work place. Layouts, Environmental studies, industrial safety & training, case studies.

PRACTICALS : Practicals/ case studies based on above syllabus.

BOOKS RECOMMENDED :

- 1) Ergonomics Design for People at Work, Vol.I & II : Eastman Kodak Co.
- 2) A Guide to the Ergonomics of Manufacturing : Martin Heylander, East West Press, Teylor & Fransis.
- 3) Ergonomics : Man in his Working Environment : K.F.H. Murrel, Chhapman & Hall Ltd., U.S.A.
- 4) Ergonomics at Work : David J.Oborn, John Wiley & Sons, New York.
- 5) Motion & Time Studies : Ralph M.Barnes, John Wiley & Sons.
- 6) Motion & Time Studies : Martin E. Muldel, PHI.
- 7) Hand Book of Industrial Engg. : Gavriel Salvendy, John Wiley & Sons.

3SPTM2 COMPUTER INTEGRATED DESIGN & MANUFACTURING

Evaluation of CAD/CAM, integrated CAD/CAM concept, CAD applications, scope of CIM, geometric modeling, CAD process, concept of concurrent engineering.

Numerical control: introduction to NC, CNC, DNC, adaptive control system, constructional and operational features, CNC part programming, and economics of CNC.

Introduction to GT,FMS, scope and applications, types and elements of FMS, FMS Layouts.

Robotics:Robot characteristics, motions, work space description, Robot applications in CIM.

Manufacturing system integration requirements for integrating manufacturing. Systems, CAPP, CAQC and automated mat. Handling systems.

PRACTICALS:

A case study and practicals based on above syllabus.

BOOKS RECOMMENDED:

1. Computer integrated design and Manufacturing- David D. Bedworth, M.R. Henderson, Mc Graw Hill International Edition.
2. CAD/CAM Mickell P. Groover, (PHI)
3. Automation prod. Systems and CIM-Mickell P. Groover, (PHI)
4. CAD/CAM-Ibrahim Zeid
5. Computer control and management. Systems-Yoren Koren.

FOURTH SEMESTER**4SPTM 1 PROCESS ENGINEERING**

Process planning/engineering functions, preliminary part print analysis, approaches to process planning, Dimensional analysis, “Theory of dimension chains” Tolerances analysis, Tolerance chart, purpose utilisation.

Workpiece control-Equilibrium theories, gauging, classifying operations

Selecting and planning manufacturing process; determining manufacturing sequence

Selection of equipments, standard and special equipments, classification of tooling

Process picture, operation routing, computer aided process planning, structure of CAPP, limitations, process planning system and their selection criteria

Computer aided process planning-structure of CAPP system, limitations of cad based process planning, forward and backward planning, implementation, criteria consideration, process planning system and their selection criteria.

BOOKS RECOMMENDED

1. Process Engineering. for Manufacturing - Eary and Johnson (PHI)
2. Computer Integrated Design and Manufacturing - David D. Bedworth (TMH)
3. Dimensional Control in Precision Manufacturing - Gadzala I.L.
4. Tolerance Control in Design and Manufacturing - Wade O.R.

4 SPTM 2 RESEARCH METHODOLOGY

- 1) Research concept : process of growth of knowledge, generation/realization of new facts, establishing logic for the generated facts, scope of quantification of cause effect relationship, evolution of hypothesis.
- 2) Approach of formulation of the research task : literature review, sources discussions, field studies; critical analysis of generated facts, hypothetical proposals for future development, constraints for proposal selection, prioritization.
- 3) Research approaches : conceptual reserach, theoretical research, applied research,
Experimental research : experimental validation of proposed logic, experimentation to generate design data.
- 4) Modeling & Simulation : concept of modeling, concept of simulation, types of simulation (quantitative, experimental, computer, fuzzy based, statistical), process of formulation of models based on selected type of simulation.
- 5) Model Optimization.
- 6) Formulation of hypothesis.

REFERENCES:

- 1) T.S.Wilkinson & P.L.Bhandarkar : Methods & Techniques of Social Research, Himalaya Pub., Mumbai.
- 2) Averill M. Law & W.David Kelton : Simulation, Modeling & Analysis.
- 3) H.Schenck Jr. : Theories of Engg. Experimentation, McGraw Hill.
- 4) Montgomery : Design of Experiments.
- 5) Bart Kasko & Klir : Neural Network & Fuzzy Systems, Prentice Hall.
- 6) T.J.Roff : Fuzzy Logic with Engg. Application, Tata McGraw Hill.
- 7) Fuzzy Sets, Uncertainties & Information, Prentice Hall.
- 8) S.S.Rao : Optimization Theory & Applications, Wiley Eastern.
- 9) Back Volumes of Journal : Modeling & Simulation, AMSE Press, France.

4SPTM3**ELECTIVE****(1) FACILITY PLANNING**

Plant location-major factor influencing the location of an industry choice of site. The big city and small town plant location. Localisation of industries, social and governmental factors in plant location. Decentralisation of industries and self-sufficiency. Industrial housing, discussion on the location of some major plants in India.

Plant layout-factors influencing plant layout, balance in departments and operations, production or centers and the work places layout, product or line layout, layout by process or functions, work in progress bank, service centers, tools and techniques used in making layouts, flow diagram, process charts, machine layout, data cards, visual aids such as templates and three dimensional models, layout drawings and lot plans or model of plant, illustrative examples of representative plants in selected industries, factors indicating poor layout, means of securing more floor space. Computer aided layout-planning.

Plant building and services sizes and types of factory building and their construction, latest trends in factory building and industrial architecture, building costs of alternate types, scope for expansion lighting, poor ventilation, air-conditioning, dust removal, water, steam, compressed air, industrial waste disposal.

Industrial safety engineering-accident prevention, machinery safe guards (mechanical and electrical)- precautions against fire, explosions and health hazards-ventilation and personal protective gear, factories and allied Acts.

Material Handling:- importance of proper materials handling in increasing productivity and affecting saving, factors determine the nature of material handling equipment's, the material and its container building characteristics, equipment operating costs, volume of handling activity and annual cost analysis equipment decision, types of handling equipment, maintenance of handling equipment, illustrative examples, design of conveyors, their uses and typical applications, internal and external transportation.

REFERENCES:-

- 1 Materials Handling- Therodore H.Allegri Sr.
- 2 Material Handling System Design-James M.Apple
- 3 Plant Layout & Mat.Handling-Eastman
- 4 Plant Layout- J.M.Maore
- 5 Accident Prevention-Henrich
- 6 Industrial Safety-Black

4SPTM3**ELECTIVE****(2) MAINTENANCE & RELIABILITY ENGINEERING**

Elements of pneumatic, hydraulic, electrical & electronic control systems.

Maintenance of electrical, mechanical drives & systems, std. Maintenance practice & procedures, machine diagnostics, machine condition monitoring and signature analysis.

System reliability, availability and maintainability, reliability testing, prediction & improvement, maintenance cost, evaluation of maintenance performance, FMEA, economics of replacement.

Maintenance types, work standards, logistic support, organisation for maintenance.

BOOKS RECOMMENDED :

1. Maintenance Engineering. Handbook-Higgins
2. Maintenance planning and control-Anthony Kelly
3. Industrial maintenance -H.P.Garg
4. Reliability Engineering - L.S.Srinath
5. Reliability of Engineering Systems -L.Ryabinin
6. Practical Reliability Engineering -Patric D.T. O'Connor
7. The Assurance Science -Halpern.

4SPTM3**ELECTIVE****(3) COMPUTERS IN PRODUCTION MANAGEMENT**

Basic concept of data base system, Relational DBMS data structures, normalization, SQL, SQL forms, reports and loader, DBTG, subschema and schemas

Concept of DSS, architechure and application.

Expert systems development in design and manufacturing, expert system tools.

Industrial applications of AI and expert systems

BOOKS RECOMMENDED:

1. Database System Concepts, H.F.Korth, S. Sudarshan, McGraw Hill International Edition.
2. Principles of Data Base Management - Martin, (PHI)
3. Expert system - Shashikumar
4. An Introduction to Database Systems, C.J.Date, Pearson Education.
5. Introduction to Expert System - James P. Nizio
6. Artificial Intelligence - Enaine Rich & Kevin Knight
7. DSS - Spragne (Prentice Hall)
8. DSS - Jayshankar

4SPTM3**ELECTIVE****(4) PLASTIC TECHNOLOGY**

New tech. for alloying of polymers, speciality FRP's & composites, Introduction to some advanced plastic alloys & speciality plastics, standard test procedures, testing devices & set-ups for plastics, Recent development in mould processes & equipments.

Parameter setting in processing of plastics, achieving quality & productivity in moulding process using techniques such as QMC, Intelligent process control etc.

Defect cause analysis & trouble shooting in plastic processing. Computer applications in moulding process.

Plastic part design: Part design for various moulding processes. Mat selection, Ribs & undercut design, parting line location, design for service requirements, aesthetics, part design for Thermoforming.

Mould design & building: mould/ die design in view of polymer melt flow behavior, mat. Shrinkage property, cooling/heating system design, gutes & flow channel design, parting line layout for split mould collapsible cores, ejector system design, design for QMC/SMED, stack mould design.

Computer aided mould design: Introduction to mould design software packages, electronic catalogues.

Mould materials, mould building methods, requirements of tool room & shop facilities for in house mould making.

Plastic packaging: unit & bulk packaging, outstanding features of plastic packaging, Globally & Nationally major emerging areas of use of plastics-medical, automobile, agriculture, Information tech. etc.

Joining of plastics: Various welding techniques for plastics, Boss, weld & seal design, adhesive selection for joining plastic parts.

Recycling of plastics: various tech., biodegradable plastics, environment protection through plastics, guidelines for processing & use of plastics.

BOOKS RECOMMENDED :

1. Plastic mat. Hand book - Brydson
2. Plastic mat. Hand book, Vol. I & II -A.S.Athaley
3. Plastics-Harry Duboise
4. Simple methods for identification of plastics-Beann(Hanser)
5. Polymer science-Birley/Haworth (Hanser)
6. Designing with plastics-Ethrenstein/Erhard (Hanser)
7. Plastic failure guide-Myer Ezrin (Hanser)
8. Injection moulding-A.S.Athley
9. How To Make Injection Moulds-Menges/Mohren (Hanser)
10. Extrusion dies for plastic & rubber-Michaeli (Hanser)
11. Technology of Thermoforming-James L. Throne (Hanser)
12. Plastics Recyling - Ebric (Henser)

4SPTM3**ELECTIVE****(5) PRODUCT DESIGN**

Finite element analysis (FEA)- Introduction, physical problems, mathematical models & use of finite element solution. Finite element analysis an integral part of computer aided design.

Rapid prototyping tech- Stereo- lithography, solid grounded curing, selective laser sintering, fused deposition modeling, 3-dimensional printing, laminated object manufacturing Virtual prototyping physical prototyping v/s. virtual prototyping.

Taguchi's concept of product design & quality-Robust design testing, design and analysis of experiments using statistical techniques.

An integrated approach for product and process design-Concurrent engineering.Strategies, cost impact of design decision, concurrent

engineering. Tools and methods, application of new tools, CIM & concurrent engineering.

Quality function deployment(QFD) approach for product design.

Virtual manufacturing Introduction to latest product design packages viz Pro-engineer, mechanical desktop, solid works etc.

BOOKS RECOMMENDED

1. Maynards Industrial engineering. Handbook 4th edition-William K Hodson (McGraw Hill)
2. Finite element producers-Klaus-Jurgen Bathe (PHI)
3. Managing for total quality-N. Logothesis (PHI)
4. Product design for manufacturing-A.K.Chitale & R.C.Gupta (PHI)
5. Product design and manufacture-John R Lindbeck
6. Stereo Lithography & other rapid prototyping & manufacturing technologies-Paul F Jacobs (PHI)
7. Assembly automation:The Virtual & Physical manufacturing engineering-Charles J. Cohrad
8. Quality engineering. Using robust design - M.S.Phadake (Prentice Hall)
9. Taguchi system of experiment design-Ed Don Clansing (UNIPUB-KRAUS int.pub.)

FIFTH SEMESTER

5 SPTM 1 SEMINAR AND DISSERTATION

SIXTH SEMESTER

6 SPTM 1 MINAR AND DISSERTATION

DIGITAL ELECTRONICS (PART TIME)

FIRST SEMESTER

1 UMEP1/1 UMEF1 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 Bicos – 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

1UMEP2/1UMEF2 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 Iyer & 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)

1UMEP3/1UMEF4 DIGITAL SIGNAL PROCESSING AND APPLICATIONS**Section - A**

Unit 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 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 III : LS and LMS, spectral estimation, adaptive filters DSP Algorithm, Multirate Digital Signal Processing and its applications.

Unit 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 Schaffer, 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 Haykin Jhon Wiley
- 7) Theory and Applications of Digital Signal Processing by Rabiner & Gold, Prentice -Hall.

SECOND SEMESTER**2UMEP1/1UMEF3****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

2UMEP2/1UMEF5

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 Instrumentation (3/e)

(DIGITALELECTRONICS)PARTTIME**THIRDSEMESTER****3UMEP1/2UMEF1 DIGITAL IMAGE PROCESSING**

- Unit 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 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 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 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.

3UMEP2/2UMEF2 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

3UMEP3 Lab.-III(based on 1UMEP3 & 3UMEP1)

3UMEP4 Lab.-IV (based on 3UMEP2)

FOURTH SEMESTER

4UMEP1/2UMEF3 ADVANCE COMPUTERNETWORKS 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 Bertsekas & 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

4UMEP2/2UMEF4 ARTIFICIAL INTELLIGENT SYSTEM

Unit I: Fuzzy set Theory, Introduction to Fuzzy sets, Fuzzy relation, Membership functions, fuzzification, defuzzification, fuzzy logic, fuzzy rule based system fuzzy inference system.

Unit II: Fuzzy Decision Making, Fuzzy modeling, Adaptive neuro fuzzy inference system, cognitive neurofuzzy modelling, Neuro fuzzy control, Application of neuro fuzzy control

Unit 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 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.

4UMEP3/2UMEF5 PARALLEL COMPUTING

Unit 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 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 III : Parallel and scalable architectures

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

Unit 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.

FIFTH SEMESTER

5UMEP1 Seminar on special topic

5UMEP2 Seminar on proposed topic of Dissertaion

SIXTH SEMESTER

6UMEP1 Seminar after completion of dissertation

6UMEP2 Dissertation & Viva voce

AMRAVATI UNIVERSITY, AMRAVATI

*** % ORDINANCE NO. 2 OF 1987**

Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time) Ordinance, 1986

Whereas it is expedient to make an Ordinance in respect of Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time) for the purposes hereinafter appearing, the Executive Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time) Ordinance, 1986.
2. This Ordinance shall come into force w.e.f. the session 1986-87.
3. Following shall be the Examinations leading to the Degree of Master of Engineering (M.E.) (Part-Time)
 - (i) M.E. Semester-I Examination,
 - (ii) M.E. Semester-II Examination,
 - (iii) M.E. Semester-III Examination,
 - (iv) M.E. Semester-IV Examination,
 - (v) M.E. Semester-V Examination } Exam. of V & VI Semesters
 - (vi) M.E. Semester-VI Examination } shall be taken together
 } at the end of VI Sem.
4. Subject to compliance with the provisions of this Ordinance and of other Ordinances in force from time to time an applicant for admission to the Degree of Master of Engineering (M.E.) (Part-Time) shall have;

Passed the Degree Examination with atleast 55 % marks Bachelor of Engineering in a branch as given below of the University or any other examination recognised by the University equivalent thereto for the part time M.E. course they must have a full time work experience of minimum 2 years in a registered firm/ company/industry/education and research institution/ govt. depts./ govt. autonomous organization in the relevant field in which admission is being sought.

Entry level qualification for various subject of Part Time M.E.

* As approved by the Executive Council, dated 24-4-1987.
 % As amended by Ordinance Nos. 21 of 1992, 19 of 1994, 15 of 1996, 15 of 2000, 1 of 2001, 29 of 2001, 12 of 2002, 8 of 2005 & 11 of 2007

M.E. Branch	Entry Level Qualification B.E. / B.Tech. of any statutory University in following branches.
1.	2.
a) M.E. Structural Engg.	Civil / Construction Engg.
b) M.E. Geo-Technical Engg.	Water Management
c) M.E. Thermal Power Engg.	Mechanical Automobile
d) M.E. Electrical Power System	Electrical / E.P.S.
e) M.E. Electronic Engg.	Electronics Engineering Electronics & Power System Electronics & Telecommunication Industrial Electronics Instrumentation Electronics & Communications
f) M.E. Environmental	Graduate of any Engg./Tech. branch
g) M.E. Computer Science & Engineering	Computer Science & Engg. Computer Technology Computer Engineering Electronics Engg. Electronics & Telecommunication Information Technology
h) M.E. Production Tech. & Management	Production Mechanical Industrial Engineering Automobile

5. The Degree of Master of Engineering (Part-Time) shall be awarded to an examinee who in accordance with the provisions of this Ordinance qualifies himself/herself in any one of the following subjects :-

(1) M.E. Civil (Structural Engg.) (2) M.E. Civil (Geo Technical Engg.)
 (3) M.E. Electrical Power System (4) M.E. Thermal Power System (5) M.E. Electronics (6) M.E. Environmental Engg. (7) M.E. Computer Science & Engineering (8) M.E. Production Technology & Management (9) M.E. Digital Electronics.

6. i) University shall hold Main examinations of the Part Time course for Semester-I & III in Winter every year at the end of First & Third Semesters and Supplementary examinations in Summer every year at the end of Second & Fourth Semesters.

ii) University shall hold Main examinations of the Part Time course for Semester-II, IV, V & VI in Summer every year at the end of Second, Fourth & Sixth Semesters and Supplementary examinations in Winter every year at the end of First, Third & Fifth Semesters.

(iii) Period of Academic Term shall be such as may be notified by the University.

(iv) The examinations will be held at such places and on such dates as may be notified by the University.

7. For purposes of Instruction and Examinations students shall study sequentially.

8. Subject to his/her compliance with the provisions of this Ordinance and other Ordinances (Pertaining to Examinations in General) in force from time to time the applicant for admission to an examination at the end of the course of study of a particular part shall be eligible to appear at it, if;

(i) He/She satisfies the condition in the tabel and the provisions thereunder.

TABLE

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

(Note:-Subjects prescribed and numbered in the scheme of Examination shall be treated as separate subjects, however, the Theory, and Practical, if any, of the subject shall be treated as separate head of Passing.)

(ii) He/She has complied with the provisions of Ordinance pertaining to Examinations in general.

(iii) He/She has prosecuted a regular course of study in college affiliated to the university.

(iv) He/She has in the opinion of the Principal, shown satisfactory progress in his/her studies.

9. Papers and the practicals in which as examinee is to be examined, maximum marks for these and the minimum pass marks which an examinee must obtain in order to pass in the subjects and the examination are detailed in the Examination scheme.

10. Examination fees for each part of the examination and also for the practical examination shall be as prescribed by the University from time to time.

11. An examinees who is successful in all the First M.E. Part-I, First M.E. Part-II, and Second M.E. part-I, Second M.E. Part-II Examinations under this Ordinance and who obtains 75% or more marks in aggregate of 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 will be no classification of successful examinees at any part of the Examination.

12. (i) Scope of the subject shall be as indicated in the syllabus.
(ii) Medium of instructions and examination shall be English.
13. Provisions of Ordinance No. 7-A relating to condonation of deficiency of marks for passing and examination shall apply to the examinations under this Ordinance.
14. An examinee, who does not pass or who fails to present himself/herself for the examination shall be eligible for readmission to the same examination on payment of fresh fees, and such other fees as may be prescribed.
15. As soon as possible after the examinations, the Executive Council shall publish a result of the examinees. The result of all examinations shall be classified as above and subjectwise merit list shall be notified as per Ordinance No.6.
16. Notwithstanding anything to the contrary in this Ordinance no one shall be admitted to an examination under this Ordinance, if he/she has already passed the same examination or an equivalent examination of any Statutory University.
17. i) Examinees who have passed in all the subjects prescribed for all the examinations of the particular subject shall be eligible for award of the Degree of Master of Engineering (Part-Time) in that subject concerned.
(ii) The Degree Certificate in the prescribed form shall be signed by the Vice-Chancellor.
