

MBM 204 RESEARCH METHODOLOGY

3L-0T-0P-3C

MM 100

Module 1

Research: a) Types, Research process and steps in it, Hypothesis, Research proposals and aspects. b) Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research.c) Research Modeling: Types of Models, Model building and stages, Data consideration and testing, Heuristic and Simulation modeling.

Module 2

Report Writing: Pre writing considerations, Thesis writing, Formats of report writing, formats of publications in Research journals.

Module 3

Design of Experiments :a) Objectives, strategies, Factorial experimental design, Designing engineering experiments, basic principles-replication, randomization, blocking, Guidelines for design of experiments.b) Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, Model adequacy checking.c) Two factor Factorial Design, Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two-factor factorial design; Models-Effects, means and regression, Hypothesis testing.

Module 4

Spreadsheet Tool: Introduction to spreadsheet application, features and functions, Using formulas and functions, Data storing, Features for Statistical data analysis, Generating charts/ graph and other features. Tools used may be Microsoft Excel, Open office or similar tool.

Module 5

Presentation Tool: Introduction to presentation tool, features and functions, Creating presentation, Customizing presentation, Showing presentation. Tools used may be Microsoft Power Point, Open Office or similar tool.

Web Search: Introduction to Internet, Use of Internet and WWW, Using search engine like Google, Yahoo etc, Using advanced search techniques.

Text /Reference Books:

1. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India)
2. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers (Wiley India)
3. Kothari C.K. (2004), 2/e, Research Methodology- Methods and Techniques (New Age International, New Delhi)
4. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjana M. (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
5. The complete reference Office Xp, Stephan L. Nelson, Gujulia Kelly (TMH)
6. Basic Computer Science and Communication Engineering, R. Rajaram (SCITECH)

MSE 102 ADVANCE STRUCTURAL ANALYSIS

3L-1T-0P-4C

MM 100

Module 1

Degree of Kinematic indeterminacy and rested structure; Displacement approach of analysis-slope deflection method,

Module 2

Moment distribution method for analysis of continuous beams and rigid – jointed plane frame; Use of symmetry; Matrix method using system approach.

Module 3

Flexibility and stiffness method for analysis of pin-jointed plane frame, continuous beams and rigid –jointed plane frame;

Module 4

Introduction to Direct Stiffness method; Formation of joint stiffness matrix and vectors; Rotation of axes in two dimensions;

Module 5

Analysis and computer formulations of continuous beams, plane frames, plane trusses.

Text /Reference Books:

1 Theory of Structures - Vol 2 B.C.Punmia, Ashok KumarJain,Arun Kuamr Jain Laxmi
Publication Ltd.

2 Structural Analysis- A matrix Approach G.S. Pandit, S.P. Gupta Tata McGraw Hill

3 Advanced Structural Analysis Prof Dev Das Menon Alpha Science International, Limited, 2009

4 Structural Analysis T.S. Tandavamoorthy Oxford University Press, Incorporated, 2011

MSE 103 DESIGN OF ADVANCE CONCRETE STRUCTURE

3L-1T-0P-4C

MM 100

Module 1

Basic Philosophy Of Concrete Materials: Concrete Mix Design ,Basic philosophy of Design of concrete structure, Design of single and multi bay structures in concrete, Portal Frames, Space Frames, large span roof structures ,Bunkers and Silos ,Pressure vessels ,Chimneys ,Folded plates.

Module 2

Reinforcement Detailing For Members & Joints: Detailing Code provision, Basic philosophy of foundation design, raft foundations, pile foundations & well foundation; Pre stress of concrete structures.

Module 3

Analysis & Design: of determinate & indeterminate beams, Concordant cables, Design of end blocks ; Bunkers, silos, pressure vessels, chimneys, Folded plates, raft, pile,& well foundation, pre stress concrete.

Module 4

Design of Concrete Structures: Design and structural detailing of standard structures, like; framed structure, for residential, industrial, public utility and recreational purposes; truss, storage vessels, underground and elevated structures, etc. Development of computer programs for design of structural elements and complete structures.

Module 5

Pre-Stressed Structures: Basic philosophy of pre stressing: Various techniques of pre stressing with and without pre stressing cables, different systems of pre stressing ,material and design concepts, pre stressing of concrete structures, Analysis and design of beams, Design of end blocks, Ultimate strength in flexure and shear, Statically Indeterminate structures, Tension members, tanks, compression members, partial pre stressing ,Composite construction, precast pre stressed elements.

Text /Reference Books:

- 1 Advanced Reinforced Concrete Design P.C.Varghese PHI
- 2 Structural Analysis T.S. Thandavamoorthy Oxford University Press, 2011
- 3 Analysis and Behavior Of Structures Edwin C. Rossow Prentice Hall PTR, 1996

**MSE 104 TESTING, REHABILITATION & RESTORATION OF
STRUCTURES**

3L-0T-0P-3C

MM 100

Module 1

Appraisal of damage and deterioration of structures by non-destructive and other techniques, Cause of deterioration, Environmental aspects and earthquake effects

Module 2

Repair and strengthening of superstructure – structural components, load bearing wall, panel walls

Module 3

Strengthening of foundation; Grouting, Grout material, guniting, shotcreting, under pinning.

Module 4

Repair of steel structures: bridge, building, towers etc.,

Module 5

Monuments and historical structures. Prevention of water leakage in structures.

Text /Reference Books:

1. Rehabilitation of concrete structures Dr B. Vidiveli Standard Publishers Distributors, 2007
2. Rehabilitating and repairing the buildings and bridges Luis Pumarada O Neill American Society of Civil Engineers, 2002
3. Use of Geophysical Methods in Construction Soheil Nazarian, John G. Diehl American Society of Civil Engineers, 2000
4. Rehabilitation of concrete structures V.K. Raina V.K.Publisher

MSE 105 SEMINAR-I

0L-0T-8P-4C

MM 100

Students will be grouped in two to three; will have to decide final research area of thesis, download research papers from ACME, ASCE, IS-CODES, Elsevier, Springer etc. This activity may also require visiting Learning Resources Centre of other institute of national importance.

Summarizing paper: Reading abstracts and finding ideas, conclusion, highlight of their approach, the drawbacks of the papers. Generalize results from a research paper to related research problems.

Comparing the approach -identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver *presentation*, prepare a report and a review paper based on analysis.

Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

M. Tech in Structural Engineering

Semester I

MSE 106 STRUCTURE LAB.-I/ CASE STUDY-I

0L-0T-8P-4C

MM 100

Basic test for materials, Mix Design, Non-destructive and other relevant tests of concrete quality. Determination of various parameters for steel & concrete and other related parameters using computer programs.

MSE 201 MATHEMATICS (NUMERICAL METHODS)

3L-1T-0P-4C

MM 100

Module 1

Polynomial Equations in single Variable – Fixed point interactive methods – Interpolation – Various formulae and schemes, spline interpolation. Roots of Equations- Newton Raphson method, open and bracketing methods.

Module 2

Linear algebraic Equations and metrics Inversion – Gauss Elimination Interactive methods, Banded Matrix – Skyline and frontal solvers. Matrix inversions by L.U. Decomposition, Approximate methods, Inversion by partipinning.

Module 3

Eigen value and Eigenvectors of a matrix – Purer method, Jacoobe's method, Eiven's method, Householder's method.

Solution of ordinary differential equations – Range –kutta methods, multi step method – Engineering Applications. Curve fitting – Least square regression, Interpolation, Fourier approximation.

Module 4

Finite Difference Methods, Finite Differential equations – Forward, Central and backward difference- solution of beam bending, plate bending and buckling, beams on elastic foundation problems by finite difference method.

Module 5

Numerical integration – Methods – Forces and deflection in beams by numerical integration; quadrature rule.

Text /Reference Books:

1. Numerical Methods for engineers- 2000 Edition Chapra and R.P.Candale TMH
2. Numerical Algorithms -1986,E.V.Krishnamurthy & S.K. Sen Affiliated **East-** West Press
3. Numerical Methods for engineering problems Krishna Raju & K.N.Muthu Macmillan India
4. Numerical Methods in finite element Analysis -1987 Bathe & Wilson PHI
5. Numerical Methods in science & Engineering –A practical Approach-1988 Rajashekharan A.J.Wheeler

- Module 1** Introduction – project attributes; project life cycle; role of managers; Management – scheduling; Gantt charts; CPM; PERT; crashing; Generation of project ideas – resource allocation; environment analysis – PEST analysis, porter’s model; analysis of strategic capabilities – value chain, BCG matrix, flexibility
- Module 2** Appraisal methods in project scanning and selection – market appraisal; technical appraisal; environmental appraisal; evaluating intangibles, social appraisal – SCBA, UNIDO, LM, CSR.
- Module 3** Total quality management: Introduction - Need for quality - Evolution of quality - Definition of quality -Basic concepts of TQM - Definition of TQM – TQM Framework -Contributions of Deming, TQM principles, The seven traditional tools of quality – New management tools – Six-sigma.
- Module 4** **Financial Appraisal:** Time value of money; cost of capital – equity, debt, preference; weighted average cost; marginal and average cost; Capital budgeting – investment appraisal techniques; NPV; IRR; Payback period; replacement decisions; selection of exact discount factor – problems, inflation, taxation;
- Module 5:** **Risk Analysis** models – single probability analysis; sensitivity analysis; break even analysis; certainty equivalent; uncertainty analysis, simulation; decision tree model; risk and utility.

Recommended Books

- Khatua Sitangshu. *Project Management and Appraisal*, Oxford University Press
- Pandey, I.M. *Financial Management*. Vikas Publishing House
- Prasanna, Chandra. *Financial Management*. Tata McGraw-Hill
- Maheshwari, S .N. &Maheshwari, S. K. *Advanced Management Accounting Vol.1 & Vol.2*. Vikas Publishing House
- Paresh Shah. *Management Accounting*. Oxford University Press

MSE 205 STRUCTURAL DYNAMICS

3L-1T-0P-4C

MM 100

Module 1

DYNAMICS OF STRUCTURES: Objectives and importance, Types of dynamic loads, Degrees of freedom, Mathematical modeling, Mass, stiffness and damping, Equivalent stiffness, Free and forced vibrations.

Module 2

SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS: Undamped free vibrations, Formulation of differential equation of motion, Newton's law of motion, D'Alembert's principle and energy approach, Natural frequency, Vibration response.

Module 3

SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS: Damped free vibrations, critically damped, under damped and over damped systems, Formulation of differential equation of motion, Natural frequency, Vibration response.

Module 4

EARTH QUACK ENGINEERING: Introduction, Cause, Earth Quack Waves Intensity, Magnitude, Earth Quack parameters, Seismographs and strong motion devices, Accelerogram Seismogram, Ground motion parameters – Amplitude and frequency content, Influence of ground conditions on earth quack ground motion.

Module 5

EARTH QUACK RESISTANT DESIGN: Planning and structural considerations, Construction of response Spectrum for elastic design, Earth quack resistant Design of structures as per codal provisions, Base Isolation – Active and passive control.

Text /Reference Books:

1. "Structural Dynamics - Theory & Computation" Mario Paz, published by CBS
2. Dynamics of Structures" by Anil K. Chopra,
3. Dynamics of structures II Edition ,1993 R.W. Clough and J. Penzin TMH
4. Structural Dynamics 1987 Mario Paz 1987 Mario Paz CBSPD
5. Dynamics of structures ,1990 J.L. Humar Printice Hall
6. Dynamics of structures - Theory and application to EQ Engineering – 1995 Anil K. Chopra , Prentice Hall India
7. Earth Queck Resistant Design ,1987 David J.Downik John Wiley and sons
8. Geotechnical Earth quack Engineering 1996 S.L.Kramer Printace Hall New York
I.S.: 1893 - 2002 : Criteria for Eathquack Resistant Design of structures, BIS ,New Delhi

MSE 206 PRE STRESSED CONCRETE STRUCTURES

3L-1T-0P-4C

MM 100

Module 1

Basic philosophy of pre stressing: Various techniques of pre stressing with and without pre stressing cables

Module 2

Different systems of pre stressing, materials and design concepts.

Module 3

Pre stressing of concrete structures, Analysis and design of beams.

Module 4

Design of end blocks, Ultimate strength in flexure and shear, Statically indeterminate structures.

Module 5

Tension members, tanks, compression members, partial pre stressing, composite construction, precast pre stressed elements.

Text /Reference Books:

- 1 Pre Stressed Structures, Krishna Raju, TMH
- 2 Pre Stressed Structures, T.Y. Lin, A.P. Burns, Wiley Publication
- 3 Pre Stressed Structures, S.R. Pillai & Mennon, TMH

Module 1

Concept of simulation: Introduction, The system, Continuous and discrete systems, System simulation, Real time simulation, When to use simulation, Types of simulation model, Steps in simulation study, Phases of simulation study, Advantages of simulation, Limitations of the simulation Technique, Areas of applications.

Module 2

Monte Carlo Method: Monte Carlo Method, Normally distribution random number, Monte Carlo Method V/S stochastic Simulation

Simulation of Continuous systems: A pure Pursuit Problem, Queuing system, Markov chains

Module 3

Random Number: Random Numbers, Random Number Tables, Pseudo Random Numbers, Generation of Random Numbers, Mid square Random Number generator, Qualities of an efficient Random Number generator, Testing Numbers for Randomness.

Module 4

Analysis of simulation output: Estimation Methods, Simulation run statistics, Replication of runs, Elimination of internal bias

Module 5

Simulation Language: Basic concept of Simulation tool, discrete systems modeling and simulation, Continuous systems modeling & simulation, Structural, data and control statements hybrid simulation

Text /Reference Books:

1. Theory of Modeling and Simulation Bernard P.Zeigler, Herbert Prashofer ,Academic Press
2. System Modeling & Simulation V.P.Singh New age International
3. Simulation Modeling Method Harrington Addison-Wesley
4. Simulation Seldon M. Ross Macmillan
5. Modeling Rome Harre publishers weekly

MSE 208 PLATES & SHELLS

3L-1T-0P-4C

MM 100

Module 1

Plate equation and behaviour of thin plates in Cartesian, polar and skew coordinates; Curvilinear coordinates and coordinate transformation

Module 2

Isotropic and orthotropic plates, bending and twisting of plates

Module 3

Navier and Levy solutions and energy methods; rectangular, circular plates and plates with variable rigidity in Cartesian and polar coordinates; Numerical solutions.

Module 4

Shell behaviour, shell surfaces and characteristics, classifications of shells, equilibrium equations in curvilinear coordinates, force displacement relations.

Module 5

Membrane analysis of shells of revolution and cylindrical shells under different loads, shallow shells, concept of pseudo stresses, membrane solution of elliptic paraboloids and hyperboloids, solutions of typical problems.

Text /Reference Books:

- 1 Theory and Analysis of Elastic Plates and Shells J. N. Reddy CRC Press
- 2 Stress in Plates and Shells A. C. Ugural TMH
- 3 Stresses in Beams, Plates and Shells Taylor and Francis

MSE 209 ADVANCE FOUNDATION DESIGN

3L-1T-0P-4C

MM 100

Module 1

Critical study of conventional methods of foundation design, analysis of settlement of soil and foundations, foundations of in-expensive and swelling soils

Module 2

Raft foundations, well foundations, pile foundations.

Module 3

Theory of vibrations, liquefaction of soils

Module 4

Coffer dams, types and design principles, underpinning of foundations, design of bridge abutments

Module 5

Three dimensional consolidation and theory of sand drains, reinforced earth and its applications.

Text /Reference Books:

- 1 Theory and Practice of Foundation Design M.N. Son ,S.C. Das Eastern Economy Edition
- 2 Principles of Foundation Engineering Braja Das Cenage Learning
- 3 The Foundation Engineering Handbook Manjrikar Gunaratne CRC Publication

MSE 210 RELIABILITY BASED CIVIL ENGINEERING DESIGN

3L-1T-0P-4C

MM 100

Module 1

Concepts of structural safety; Basic statics and probability;

Module 2

Resistance parameters and distributions; Probabilistic analysis of loads, live load and wind load; Basic structural reliability.

Module 3

Monte Carlo study of Structural safety; Level 2 reliability methods; Reliability analysis of components.

Module 4

Reliability based design determination of partial safety factors, code calibration; Reliability of structural systems; Fatigue reliability – S-N curve approach.

Module 5

Applications to steel and concrete structures; Offshore structures etc.

Text/ Reference Books:

- 1 Limit State Design of reinforced Concrete Dr .B. C. Poonmia Firewall
- 2 Reliability Based Design in Civil Engineering Milton Edward Harr Dover Publications, Incorporated, 1987
- 3 Reliability Based design S.S. Rao TMH
- 4 Quality Engineering using Robust Design Phadke Madhav S. Pearson Education India,

MSE 211 BRIDGE ENGINEERING

3L-1T-0P-4C

MM 100

Module 1

Types of Bridges, choice of bridge type, criteria for selection of bridge site

Module 2

Economic span, bridge loadings, slab bridges, effect of skew, load distribution theories for multi beam bridges,

Module 3

Design of R.C. and pre stressed T beam bridges

Module 4

Behavior and structural action of box girder bridge, bridge bearings

Module 5

Methods of construction, inspection and maintenance procedures, rehabilitation of bridges.

Text /Reference Books:

1 Bridge Engineering S. Ponnuswamy TMH

2 Design of Bridges N. Krishna Raju Oxford

3 Bridge Engineering Handbook Wai-Fah Chen Lean Duen CRC Press

MSE 212 FINITE ELEMENT METHODS

3L-1T-0P-4C

MM 100

Module 1

Principles of discretisation; Element stiffness mass formulation based on direct, variational and weighted residual techniques, Displacements.

Module 2

Hybrid stress and mixed approaches; Shape functions and numerical integration, convergence, Displacement, hybrid stress and mixed formulations

Module 3

Shape functions, isoperimetric formulation, numerical integration and convergence.

Module 4

Formulations for elements for two dimensional and axisymmetric shells, Semi analytical formulations.

Module 5

Application to layered composite plate/shells, Hybrid stress and mixed formulations for plates.

Text /Reference Books:

1 Finite Element Method Y.M.Desai Pearson

2 The Finite Element Methods in Engineering Singiresu S. Rao Elsevier

3 An Introduction to Finite Element Method Junuthula Narasimha Reddy TMH

MSE 213 TALL BUILDING

3L-1T-0P-4C

MM 100

Module 1

Structural systems of tall buildings

Module 2

Moment resistant frames, braced frames, eccentrically braced frames, shear walls frames, Tubular Structures.

Module 3

Shear walls, coupled shear walls, frame shear wall interaction, tubular structures.

Module 4

Approximate and matrix oriented methods of design of tall buildings

Module 5

Design of pile and raft foundation for tall buildings.

Text /Reference Books:

- 1 Structural analysis and Design of Tall Building Bungale S.Taranath CRC Press
- 2 Tall Building Systems and Concepts Fazlur R. Khan American Society Of Civil Engineers
- 3 The future of the city :Tall Buildings and Urban Design M.M. Ali WIT Press

MSE 203: SEMINAR-II

0L-0T-8P-4C

MM 100

Students will be grouped in two to three; will have to decide final research area of thesis, download research papers from ACME, ASCE, IS-CODES, Elsevier, Springer etc. This activity may also require visiting Learning Resources Centre of other institute of national importance.

Summarizing paper – Reading abstracts and finding ideas, conclusion, highlight of their approach, and the drawbacks of the papers. Generalize results from a research paper to related research problems.

Comparing the approach -identify weaknesses and strengths in recent research articles in the subject. Practice sessions on how to read, analyze and summarize research papers. Students in group will have to deliver *presentation*, prepare a report and a review paper based on analysis.

Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

1. Tensile Strength of Concrete by Cylinder Split Strength Test (Brazilian Test)
2. Chemical Composition of Cement.
3. Strain Measurement of Concrete by Mechanical & Electrical Strain Gauges.
4. Case Study of Structural Failure of Any Building in the Region.

MSE 302 SEMINAR-III

0L-0T-4P-2C

MM 100

Objective: To assess the debating capability of the student to present a technical topic. Also to impart training to students to face audience and present their ideas and thus creating in them self esteem and courage that are essential for engineers.

Individual students are required to choose a topic of their interest from Structural Engineering related topics preferably from outside the M. Tech syllabus and give a seminar on that topic about 30 minutes. A committee consisting of at least three faculty members shall assess the presentation of the seminar and award marks to the students. Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

MSE 302 DISSERTATION PART-I**0L-0T-10P-5C****MM 100**

Objective: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4th semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members. The technical paper is to be submitted along with the thesis

MSE 401 DISSERTATION PART - II**0L-0T-24P-12C****MM 100**

Objective: To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4th semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members. The technical paper is to be submitted along with the thesis