



DEPARTMENT OF CIVIL ENGINEERING

R23 Course Structure And Syllabus For
M.Tech Structural Engineering

M.Tech I YEAR I – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	Professional Core - I	Advanced Structural Mechanics	3	0	0	3
2	Professional Core - II	Theory of Elasticity and Plasticity	3	0	0	3
3	Professional Elective - I	1. Theory of Plates and Shells 2. Computer Oriented Numerical Methods 3. Special Concretes	3	0	0	3
4	Professional Elective - II	1. Advanced Reinforced Concrete Design 2. Structural Health Monitoring 3. Structural Optimization	3	0	0	3
5	Lab - I	Advanced concrete Lab -I	0	1	2	2
6	Lab - II	Computed Aided Structural Design Lab -I	0	1	2	2
7		Research Methodology & IPR	2	0	0	2
8	Audit - I	Audit Course - I	2	0	0	0
		Total	16	2	4	18

M.Tech I YEAR II – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	Professional Core - III	Finite Element Analysis	3	0	0	3
2	Professional Core - IV	Structural Dynamics	3	0	0	3
3	Professional Elective - III	1. Advanced Structural Steel Design 2. Structural Reliability 3. Design of High-Rise Buildings.	3	0	0	3
4	Professional Elective - IV	1. Advanced Prestressed Concrete Design 2. Structural Stability 3. Design of Bridges	3	0	0	3
5	Lab - III	Advanced concrete Lab -II	0	1	2	2
6	Lab - IV	Computed Aided Structural Design Lab -II	0	1	2	2
7		Mini Project with Seminar	0	0	4	2
8	Audit-II	Audit Course- II	2	0	0	0
		Total	14	2	8	18

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M.Tech II YEAR I – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	Professional Elective - V	1. Earthquake Resistant Design of Structures 2. Pre-Engineered Buildings 3. Advanced Rehabilitation and Retrofitting of Structures	3	0	0	3
2.	Open Elective	Open Elective	3	0	0	3
3.	Dissertation	Dissertation Phase – I- Work Review	0	0	12	6
4.		Total	6	0	12	12

M.Tech II YEAR II – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	Dissertation	Dissertation Phase – II- Work Review	0	0	12	6
2.	Dissertation	Dissertation Viva-Voce	0	0	28	14
		Total	0	0	40	20

Open Electives Offered by the Department:

1. Green Building Technologies
2. Construction Management

Audit Course I & II:

1. English for Research Paper Writing
2. Disaster Management
3. Value Education
4. Pedagogy Studies

M.Tech I YEAR I – SEMESTER

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1	Professional Core - I	Advanced Structural Mechanics	3	0	0	3
2	Professional Core - II	Theory of Elasticity and Plasticity	3	0	0	3
3	Professional Elective - I	3. Theory of Plates and Shells 4. Computer Oriented Numerical Methods 3. Special Concretes	3	0	0	3
4	Professional Elective - II	4. Advanced Reinforced Concrete Design 5. Structural Health Monitoring 6. Structural Optimization	3	0	0	3
5	Lab - I	Advanced concrete Lab -I	0	1	2	2
6	Lab - II	Computed Aided Structural Design Lab -I	0	1	2	2
7		Research Methodology & IPR	2	0	0	2
8	Audit - I	Audit Course - I	2	0	0	0
		Total	16	2	4	18

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ADVANCED STRUCTURAL MECHANICS

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Structural Analysis I & II**Course Outcomes:** After completion of the course, students should be able to

1. Formulate the stiffness and flexibility matrices for various types of structures
2. Analyze the continuous beams, portal frames and trusses by stiffness method (structure approach)
3. Analyze the continuous beams, portal frames and trusses by flexibility method (structure approach)
4. Solve the Trusses, Continuous beams, Portal frames using element approach of stiffness method

UNIT - I**Unsymmetrical Bending:**

Definition of Shear Center in Bending - Symmetrical and Nonsymmetrical Bending - Bending Stresses in Beams Subjected to Nonsymmetrical Bending - Deflections of Straight Beams Subjected to Nonsymmetrical Bending

UNIT - II**Advanced Analysis of Beams :**

Curved Beams: Circumferential Stresses in a Curved Beam - Radial Stresses in Curved Beams - Correction of Circumferential Stresses in Curved Beams Having I-, T-, or Similar Cross Sections - Deflections of Curved Beams

Beams on Elastic Foundations - Infinite Beam Subjected to a Concentrated Load: Boundary Conditions - Infinite Beam Subjected to a Distributed Load Segment

UNIT - III**Column Buckling:**

Concept of Column Buckling - Deflection Response of Columns to Compressive Loads - Euler Buckling of Columns with General End Constraints - Local Buckling of Columns - Inelastic Buckling of Columns

UNIT - IV

Introduction to matrix methods of analysis: Static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates - Assembly of stiffness matrix from element stiffness matrix – Analysis of trusses, beams and frames by stiffness matrix methods

UNIT - V

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Direct stiffness method: General procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method -Application of direct stiffness method to trusses, simple and continuous beams and frames.

TEXT BOOKS:

1. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt Ltd.
2. Indeterminate Structural Analysis by K U. Muttu,IK International Publishing House Pvt.ltd
MatrixAnalysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications

REFERENCES:

1. Matrix Structural Analysis by Madhu B. Kanchi
2. Matrix Methods of Structural Analysis by J.Meek
3. Structural Analysis by Ghali and Neyveli

THEORY OF ELASTICITY AND PLASTICITY

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Prerequisites: Strength of Materials I & II

Course Outcomes: After completion of the course, students should be able to

1. Solve simple problems of elasticity and understanding the basic concepts
2. Apply numerical methods to solve continuum problems
3. Solve engineering problems such as thick cylinders, rotating discs
4. Solve engineering problems related to Torsion of shafts.

UNIT - I

Stress: Introduction to Elasticity – Definition of Kinetics and Kinematics - Notation for forces and stress - Components of stresses – Stress tensor - Differential equations of equilibrium in 2D & 3D in Cartesian coordinates and in polar coordinates - boundary conditions – Cauchy’s postulate – Stress transformation – Direction Cosines -Principal stresses – Stress invariants – Decomposition of stresses -Hydrostatic and Deviatoric stresses – Octahedral stresses – stress concentration factors

UNIT - II

Strain: Notation for strain - Components of strain – Strain tensor – Strain Components -Strain - displacement relations - Strain Compatibility Conditions - Strain transformation – Direction Cosines - Principal strains – Strain invariants - Octahedral strains – Strain Rosette

UNIT - III

Stress -Strain Relationship: Navier’s equation for stress-strain relationships – Relationship between Material constants – Stress - strain relations in 2D and 3D – Complementary conditions for shear - Material symmetry -Reduction of Material constants from anisotropic to orthotropic, monoclinic,

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isotropic and transversely isotropic – Plane stress, Plane strain and axi-symmetric idealizations - Mohr circle in 2D and 3D – Airy’s stress function – Potential function -

UNIT - IV

Solution of 2D and 3D elasticity problems: Problem solving using stress function approach: Beam bending problems – Symmetric stress distribution problems, Plane problems.

Torsion problems in Elasticity – Membrane analogy approach – Application to non- circular thin walled sections

UNIT - V

Plasticity: Introduction to plasticity – Yield criteria for pressure dependent and independent materials - – Tresca’s criterion – Von mises criterion – Mohr-Coulomb criterion -Rankine criterion -Flow rule – Associative and Non-Associative-Hardening rules and consistency conditions -Introduction to iterative and return mapping.

TEXT BOOKS:

1. Theory of Elasticity by Timoshenko, McGraw-Hill Publications
2. Theory of Elasticity by Y.C.Fung

REFERENCES:

1. Advanced Mechanics of solids by LS Srinath,
2. Elasticity and Plasticity for structural Engineers by Wang & Chen

THEORY OF PLATES AND SHELLS (Professional Elective – I)

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Theory of Elasticity, Structural Analysis

Course Outcomes: After completion of the course, students should be able to

1. Use analytical methods for the solution of thin plates and shells
2. Use analytical methods for the solution of shells and folded plates
3. Apply the numerical techniques and tools for the complex problems in thin plates
4. Apply the numerical techniques and tools for the complex problems in shells

UNIT - I

Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

UNIT - II

Small Deflection Theory of Thin Rectangular Plates : Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier solution – Application to different cases – Levy’s solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

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UNIT - III

Circular Plates: Differential Equation for symmetrical bending of Laterally loaded circular Plates – Uniformly loaded circular plates –circular plate concentrically loaded – circular plate loaded at center

UNIT - IV

Shells – functional behaviour – examples – structural behaviour of shells classification of shells – Definitions – various methods of analysis of shells – merits and demerits of each method – 2D. Membrane equation.
Equations of equilibrium: Derivation of stress resultants – cylindrical shells – Flugges simulations equations.

UNIT - V

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.
Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shell and hyperboloid of revolution cooling towers.

TEXT BOOKS:

1. Theory of Plates & Shells –Stephen, P. Timoshenko, S. Woinowsky-Krieger – Tata MC GrawHill Edition
2. Analysis and design of concrete shell roofs By G. S. Ramaswami, CBS publications.

REFERENCES:

1. Design of concrete shell roofs By Billington – Tata MC Graw Hill, New York.
2. Design of Shells and Folded Plates by P.C. Varghese, PHI Learning Pvt. Ltd

SPECIAL CONCRETES (Professional Elective – I)

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Concrete Technology

Course Outcomes:

After completion of the course, students should be able to

1. Understand the fresh and hardened properties of concrete
2. Design an appropriate economic cementitious composite based on the performance requirements of HPC and HSC
3. Determine the characteristics of concrete making materials and decide it’s suitability
4. Develop mix proportions using various methods
5. Assess the service life of an existing structure through determining the mechanical, durability and the current state of corrosion of reinforcement in concrete

UNIT - I

Fresh and Hardened Concrete: Fresh concrete - Workability tests on concrete- Workability tests on Self

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Compacting Concretes-segregation and bleeding. Hardened Concrete Abram ‘slaw-Gel-space ratio - Maturity concept - Stress Strain behavior, Creep and Shrinkage.

UNIT - II

High Performance and High Strength Concretes: High performance concrete -Requirements and properties of high-performance concrete - Design considerations – High strength concrete – Design considerations.

UNIT -III

Advanced Concrete Design: Light weight concrete - Self Compacting concrete – Polymer concrete - Fiber reinforced concrete – Reactive powder concrete - Bacterial concrete-Geo polymer concrete – Requirements and guidelines- Advantages and Applications – Porous pavement – White Topping – Roller compacted concrete.

UNIT -IV

Concrete Mix Design: Quality control - Quality assurance - Quality audit - Mix design by various methods - BIS method - DOE method - ACI method –Erntroy& Shacklock’s method.

UNIT - V

Performance Evaluation of Reinforced Concrete Structures: Durability of concrete & Corrosion tests - Resistivity of concrete - Half Cell Potential - Rapid Chloride Penetration Test - Macro cell Corrosion - Effects of concrete exposed to acidic environment – Durability Factor - Accelerated CorrosionCrackingTest-Non-destructiveevaluationofconcretestructuresUltrasonicPulseVelocity-Evaluation of Dynamic Shear & Young’s Modulus - Introduction to XRD & SEM Analysis.

TEXT BOOKS:

1. A. M. Neville, Properties of Concrete, Pearson Education, 2010.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.
3. A R Santhakumar; Concrete Technology , Oxford University Press

REFERENCES:

1. P. Schiessl, Corrosion of Steel in Concrete, Chapman &Hall, 1988.
2. Sandor Popovics, Concrete Making Materials, Hemisphere PublishingCorporation, 1979.
3. Mark Alexander & Sydney Mindess, Aggregates in Concrete, Taylor & Francis, 2005
4. Andrzej M. Brandt, Cement Based Composites, 2005

ADVANCED REINFORCED CONCRETE DESIGN (Professional Elective – II)

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Design of Reinforced Concrete Structures

Course Outcomes: After completion of the course, students should be able to

1. Explain the concept of limit state design
2. Understand and explain the analysis of advanced structural elements
3. Apply the codal provisions of different limit states
4. Design advanced structural elements

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UNIT - I

Limit state Analysis of R.C. Structures: Introduction- Loads – Different types of Loads and load combinations – Different methods of Design- Working Stress Method and Limit State Method – Materials - Characteristic Values – Reliability based methods of design - Partial safety factors –Stress Block Parameters - Plastic hinge, Redistribution of moments, moment rotation characteristics of RC member

UNIT - II

Limit state of Flexure: I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams, Deep Beams and Corbels

UNIT - III

Inelastic Analysis of Slabs :Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions- Reinforcement details - **Ribbed slabs :** Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements, **Flat slabs:** Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT - IV

Limit state of Shear, Bond and Torsion: Design for Shear, Bond and Torsion - Mechanism of shear and bond failure - Design of shear using limit state concept – Design for Bond –Anchorage and Development length of bars - Design of sections for torsion - Detailing of reinforcement

UNIT - V

Limit State of Compression: Design of Short and Long columns - slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns.

TEXT BOOKS:

1. “Reinforced Concrete Design” S. Unnikrishna Pillai & Devdas Menon; Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
2. “Design of Reinforced Concrete Structures” by N.Subramanian, Oxford University Press.
3. “Limit State Theory and Design of Reinforced Concrete” Dr. S. R. Karve and V.L Shah. Standard Publishers, PUNE 2004.

REFERENCES:

1. “Advanced Reinforced Concrete” P.C. Varghese Prentice Hall of INDIA Private Ltd. 2008.
2. Design of concrete structures – Arthur H. Nelson, David Darwin, and Charles W. Dolar, TataMc. Graw-Hill, 3rd Edition, 2005.
3. Reinforced Concrete design by Kenneth Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
4. “Design Reinforced Concrete Foundations” P.C. Varghese Prentice Hall of INDIA Private Ltd.

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5. IS 456- 2000 Plain and Reinforced concrete book of Practice
6. SP 16 - Design Aids for Reinforced Concrete to IS 456
7. SP 34 - Hand Book as Concrete Reinforcement and retaining

STRUCTURAL HEALTH MONITORING (Professional Elective – II)

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Concrete Technology.

Course Outcomes: At the end of the course, students will be able to

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure

UNIT – I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT – III

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT – IV

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT – V

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS:

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, JohnWiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components_Methods with Applications,

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REFERENCE BOOKS:

1. Douglas E Adams, John Wiley and Sons, 2007.
2. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
3. Structural Health Monitoring with Wafer Active Sensors, Victor Giurgutiu, Academic Press Inc, 2007.

STRUCTURAL OPTIMIZATION (Professional Elective – II)

M.Tech I Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: RCC and numerical methods

Course Outcomes: After completion of the course, students should be able to

1. Use Variational principle for optimization
2. Perform linear, non-linear, dynamic and geometric programming methods
3. Apply optimization techniques to structural steel and concrete members
4. Design using frequency constraint

UNIT – I

Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

UNIT – II

Calculus of Variation: Variational Principles with Constraints,

UNIT – III

Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,

UNIT – IV

Geometric Programming and Stochastic Programming.

UNIT – V

Applications: Structural Steel and Concrete Members, Trusses and Frames.

Design: Frequency Constraint, Design of Layouts.

TEXT BOOKS:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer

REFERENCE BOOKS:

1. Variational methods for Structural optimization, Cherkaev Andrej, Springer

ADVANCED CONCRETE LAB – I

M.Tech I Year I Semester – SE

L	T	P	C
0	1	2	2

List of Experiments:

1. Tests on cement: Consistency, Setting Time, Soundness, Compressive Strength.
2. Gradation Charts of Aggregates.
3. Bulking of Fine Aggregate.

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4. Aggregate crushing and Impact Value.
5. Air Entrainment test on Fresh concrete.
6. Marsh Cone Test.
7. Accelerated curing of Concrete.
8. Influence of W/C ratio on strength and Aggregate/Cement ratio on workability and strength.
9. Influence of Different of Chemical admixtures on concrete mixes.
10. Compressive tests on High Strength Concrete Cubes and Cylinder.

Major Equipments:

Air Entrainment meter, Accelerated Curing Tank, Aggregate Impact Testing Machine, Marsh cone Apparatus, Digital Compression Testing Machine.

COMPUTED AIDED STRUCTURAL DESIGN LAB – I

M.Tech I Year I Semester – SE

L	T	P	C
0	1	2	2

List of Experiments/Assignments:

1. Program for design of Slabs using Excel.
2. Program for design of Beams using Excel.
3. Program for design of Column using Excel.
4. Program for design of Footing using Excel.
5. Program for design of Staircase using Excel.
6. Program for design of Trusses using Excel.
7. Introduction to Analysis and design of Softwares. (Staad Pro).
8. Analysis and Design of Continous Beam

Softwares: STAAD Pro.

RESEARCH METHODOLOGY AND IPR

M.Tech I Year I Semester – SE

L	T	P	C
2	0	0	2

Course Outcomes: At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today’s world is controlled by Computer, Information Technology, but tomorrowworld will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to

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be promoted among students in general & engineering in particular.

- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT- I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT- II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT- III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT- IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT- V:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

- Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
- Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCE BOOKS:

- Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
- Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
- Mayall, “Industrial Design”, McGraw Hill, 1992.
- Niebel, “Product Design”, McGraw Hill, 1974.
- Asimov, “Introduction to Design”, Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New TechnologicalAge”, 2016.
- T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

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M.Tech I YEAR II – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	Professional Core - III	Finite Element Analysis	3	0	0	3
2	Professional Core - IV	Structural Dynamics	3	0	0	3
3	Professional Elective - III	4. Advanced Structural Steel Design 5. Structural Reliability 6. Design of High-Rise Buildings.	3	0	0	3
4	Professional Elective - IV	4. Advanced Prestressed Concrete Design 5. Structural Stability 6. Design of Bridges	3	0	0	3
5	Lab - III	Advanced concrete Lab -II	0	1	2	2
6	Lab - IV	Computed Aided Structural Design Lab -II	0	1	2	2
7		Mini Project with Seminar	0	0	4	2
8	Audit-II	Audit Course- II	2	0	0	0
		Total	14	2	8	18

FINITE ELEMENT ANALYSIS

L	T	P	C
3	0	0	3

M.Tech I Year II Semester – SE

Course Outcomes: At the end of this course, students will be able to

1. Build and analyse the FEA models for various engineering problems.
2. Identify the requirements and sources for analysis, design and evaluation.
3. Use the standard finite element software to solve the structural engineering problems.
4. Interpret the results obtained from FEA software, and arrive at the conclusions

UNIT – I

Introduction to FEM: Types of Problems – Types of Materials – Elastic / Inelastic situations – Types of forces: Body forces / Surface Traction / Point loads – Deformable bodies – Types of Deformations –Homogeneous / Non homogeneous Problems – Equations of equilibrium for elastic 2-D / 3-D continua

- Equilibrium equations for 2-D / 3-D boundary elements – Boundary conditions – Strain-displacement relation for 2-D / 3-D – Stress-strain relation for 2-D / 3-D – Plane stress / Plane strain problems.

Virtual Work Formulation: Application to problems of plane trusses with static indeterminacy not exceeding three.

UNIT – II

Variational Formulation: Approximate methods of Analysis- Weighted residual method - Rayleigh-Ritz

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Method -Strong form weak form -Variational principle - Stationarity Functional or Differential equation
Finite element formulation for 1-D problems: Minimum Potential Energy Approach, weak form approach, introduction to natural coordinates -Finite element approximations in one dimension- Lagrangian approximation-Hermitian approximations, FE formulation for Axial bar, Euler Bernoulli beam -Numerical Examples

Finite element formulation for 2-D problems: FE Approximation in 2-Dimension, Pascals triangle, Convergence criterion, Compatible and incompatible elements, FE Formulation for plane stress, plane strain and Axi-symmetrical problems, Shape functions for 2-Dimensional CST Element-4 noded quadrilateral element -Higher order triangular and rectangular elements- Consistent Nodal load vector -Numerical Examples

UNIT – III

Iso-parametric elements:

Quadrilateral elements: FE Formulation for linear and quadratic isoparametric elements- Construction of shape functions using natural coordinates/Strain-displacement matrices/Load matrices for body force and surface traction/ Expressions for stiffness matrix, load matrices for 4-noded quadrilateral elements/ Gauss Quadrature of numerical integration / Problems with rectangular elements, kinematic indeterminacy not exceeding three- Determination of shape functions for 2nd order quadrilateral elements and for elements of with serendipity / Strain-displacement matrices / Load matrices for body force and surface traction.

UNIT – IV

Finite element formulation for 3 -D elements:

FE Formulation for Tetrahedral and Hexahedral elements: Volume coordinates, Strain-displacement matrix, stiffness matrix, load matrices due to body force and surface traction/ introduction to Hexahedron(brick) elements

Galerkin’s Method of Weighted Residuals – Application to problems of mathematics / structural engineering, number of trial functions not exceeding two.

Weak form of Trial Function - Application to problems of mathematics / structural engineering, number of elements limited to two - Strain-displacement relationship/stress-strain relationship / determination of stiffness matrix for 3-noded ring element and load matrices for body force and surface traction/ Problems with kinematic indeterminacy not exceeding three for 3-noded ring elements only.

UNIT – V

Numerical examples: Simple 1-D model, 2-D model and a 3-D model/ analysis and post processing of the results using commercially available FEA software and available codes.

TEXT BOOKS:

1. Reddy, J. N, (1993). —An Introduction to the Finite Element Method, McGraw Hill, New York.
2. Cook, R. D. (1981). —Concepts and Application of Finite Element Analysis, John Wiley and Sons.
3. Zienkiewicz, O. C. And Taylor, R. L, (1989). —The Finite Element Method, Vol.1, McGraw Hill Company Limited, London.

REFERENCES:

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

1. Chandrupatla, T. R. And Belegundu, A. D, (2001). —Introduction to Finite Elements in Engineeringl, Prentice Hall of India, New Delhi.
2. Seshu. P, (2003). —Finite Element Analysisl, Prentice Hall of India Private Limited, New Delhi.
3. David V. Hutton, (2005). —Fundamentals of Finite Element Analysisl, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Bathe, K. J, (2006). —Finite Element Proceduresl, Prentice Hall of India, New Delhi

STRUCTURAL DYNAMICS

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Prerequisites: Structural Analysis I & II, Mathematics

Course Outcomes: After completion of the course, students should be able to

1. Apply the fundamental concepts and definitions used in structural dynamics
2. Calculate the natural frequency of a system using equilibrium or energy methods
3. Determine the effect of viscous damping on the response of a freely vibrating system
4. Determine the response of a system to a harmonic excitation

UNIT - I:

Theory of Vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. – Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton’s law of motion / D’Alembert’s principle, Principle of virtual work and Hamilton principle.

UNIT - II

Single Degree of Freedom Systems: Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems

– Half Power (Band-Width) Method-Harmonic excitation - Vibration Isolation – Response to support motion-Force transmitted to the foundation-Transmissibility-Dynamic magnification factor – Phase angle.

Response to General Dynamic Loading – Duhamel’s Integral-Constant Force, Rectangular load, Triangular load, Response to Periodic loading- Fourier series expression of periodic loading- Response to Fourier series loading

UNIT - III

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Modesuperposition procedure.

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

UNIT - IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

UNIT - V

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions.

TEXT BOOKS:

1. Dynamics of Structures by Ray W. Clough & Joseph Penzien, Second Edition, CBS Publishers & Distributors
2. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.

REFERENCES:

1. Structural Dynamics by Mario Paz and William Leigh, Fifth Edition, Springer.
2. Theory of Vibrations by W.T. Thomson, Pearson
3. Fundamentals of Structural Dynamics by Roy. R. Craig, John Wiley & Sons

ADVANCED STRUCTURAL STEEL DESIGN (Professional Elective – III)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Design of Steel Structures & Structural Analysis

Course Outcomes: After completion of the course, students should be able to

1. Design the eccentric and moment connections
2. Design the truss members subjected to tension, compression
3. Determine the collapse loads for continuous beams and portal frames
4. Estimate the various types of loads such as Dead, Live and Wind loads on PEB's

UNIT - I

Simple Connections – Bolted Pinned And Welded Connections: Bolted Connections – Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

UNIT - II

Plastic Analysis:

Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.

UNIT - III

Eccentric and Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections – Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

UNIT - IV

Analysis and Design of Industrial Buildings:

Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform, Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions, Design of bracings.

UNIT - V

Design of Steel Truss Girder Bridges:

Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

TEXT BOOKS:

1. Limitstate Design of Steel Structures by N. Subramanian
2. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. NewDelhi.
3. Design of Steel Structures. P.Dayaratnam, Publisher : S. Chand, Edition 2011-12.

REFERENCES:

1. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientific Publishes Journals Department.
2. Design of Steel Structures Galyord & Gaylord, Publisher: Tata Mc Graw Hill, Education. Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III – 2015

STRUCTURAL RELIABILITY (Professional Elective – III)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Course Outcomes: After completion of the course, students should be able to

1. Understand Basics of Statistics and explain Probability Theory
2. Characterize the dimensional variations of materials
3. Explain and apply Monte Carlo method
4. Develop reliability-based designs

UNIT - I

Concepts of Structural Safety: General - Design methods- Basic Statistics: Introduction -Data reduction – Histograms - Sample correlation - Probability Theory: Introduction, Random events - Random variables - Functions of random variables - Moments and expectation - common probabilitydistribution - Extremal distribution.

UNIT - II

Resistance Distributions and Parameters: Introduction - Statistics of properties of concrete, steel, strength of bricks and mortar - dimensional variations - characterization of variables - Allowable stresses based on specified reliability.

UNIT - III

Basic Structural Reliability: Introduction - Computation of Structural reliability- Monte Carlo Study of Structural Safety: General- Monte Carlo method - Applications.

UNIT - IV

Reliability Methods: Introduction - Basic variables and failure surface - First-order second-momentmethods (FOSM)

UNIT - V

Reliability Based Design: Introduction - Determination of partial safety factors - Safety checking formats - Development of reliability-based design criteria - Optimal safety factors -Summary of results of study for Indian standard – RCC Design. - Case Studies.

TEXT BOOKS:

1. R. Ranganathan, Structural Reliability Analysis and Design, Jaico Publishing House, 2006.
2. R.E. Melchers, Structural Reliability – Analysis & Prediction, 2/e, Wiley – Blackwell, 1999.

REFERENCES:

1. Maurice Lemaire, Structural Reliability, Wiley (2009).
2. Dan M. Frangopol, Mitsuo Kawatani & Chul-Woo Kim, Reliability and Optimization ofStructural Systems, Taylor & Francis (2006)

DESIGN OF HIGH-RISE BUILDINGS (Professional Elective – III)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Structural analysis I and II

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Course Outcomes: After completion of the course, students should be able to

1. Analyze and Design Transmission Line Towers and Masts
2. Analyze and Design Steel Chimney
3. Analyze and Design RC Chimney
4. Understand various loadings and structural forms of Tall Buildings and perform modal analysis

UNIT - I

Loading and Design Principles: Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, – Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design.

UNIT - II

Behaviour of Various Structural Systems: Factors affecting growth, height and structural form. Highrise behaviour, Rigid Frames, braced frames, In filled frames, shear walls, coupled shear walls, wall- frames, tubulars, cores, outrigger - braced and hybrid mega systems.

UNIT - III

Analysis and Design: Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist - Computerized three dimensional analysis – Assumptions in 3D analysis – Simplified 2D analysis.

UNIT - IV

Structural Elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

UNIT - V

Stability of Tall Buildings: Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation - Case Studies.

TEXT BOOKS:

1. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988.
2. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.
3. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 2005.

REFERENCES:

1. Gupta.Y.P.(Editor), Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, New

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Delhi,1995.

- Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.

ADVANCED PRESTRESSED CONCRETE DESIGN (Professional Elective – IV)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Course Outcomes: After completion of the course, students should be able to

- Realize the importance of pre-stressing the long span structures and heavily loaded members
- Acquire the knowledge of various pre-stressing techniques; their merits and demerits
- Develop skills in planning, analysis and design of pre-stressed concrete beams, and slabs
- Develop skills to satisfy the serviceability and strength provisions of the Indian Standards(IS:1343-2012)

Pre requisites : Reinforced Concrete Design & Structural Analysis

UNIT I:

Introduction – Prestressing Systems – Pretensioning Systems – Post-tensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Linear Thrust Line – Concept of Load Balancing .

Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II:

Deflections of prestressed concrete members: Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.

Ultimate Flexural Strength of Beams: Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned Steel.

UNIT III:

Composite constructions: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shear strength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV:

Prestressed concrete slabs: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs.

Prestressed Concrete Pipes: Circular prestressing- Types of Prestressed Concrete Pipes- Design of Prestressed Concrete Pipes.

UNIT V:

Continuous beams: Advantage of Continuous Members – Effect of Prestressing Indeterminate

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon’s Theorem, Redistribution of moments in a continuous beam.

Anchorage Zone Stresses in Beams: Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel’s method- Guyon’s Method - Anchorage zone Reinforcement as per IS1343-2012.

TEXT BOOKS:

1. Prestressed concrete, krishnanraju N., Tata Mc Graw Hill, New Delhi.
2. Prestressed concrete by K. U. Muthu, PHI Learning Pvt. Ltd

REFERENCES:

1. Design of prestressed concrete structure, Lin T. Yand Burns, Asia Publication house, 1995.
2. Limit state design of prestressed concrete, Gutan Y, Applied science publishers, 1972.
3. IS:1343-2012-code of practice for Prestressed concrete

STRUCTURAL STABILITY (Professional Elective -IV)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: RCC Design and Analysis

Course Outcomes: After completion of the course, students should be able to

1. Apply the approximate methods based on energy to determine the stability of simple systems
2. Differentiate how the tangent modulus and double modulus theories of inelastic buckling led to the column paradox, thereby preventing further difficulties for a general theory of structures
3. Analyze elastic and in-elastic buckling of bars and frames
4. Analyze the beams for lateral torsional buckling

UNIT – I

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior.

UNIT – II

Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT – III

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT – IV

Stability of Beams: lateral torsion buckling.

Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

UNIT – V

Introduction to Inelastic Buckling and Dynamic Stability.

TEXT BOOKS:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.

REFERENCES:

1. Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt. Ltd.
2. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

DESIGN OF BRIDGES (Professional Elective – IV)

M.Tech I Year II Semester – SE

L	T	P	C
3	0	0	3

Prerequisites: Structural Analysis I &II, Reinforced Concrete Design

Course Outcomes: After completion of the course, students should be able to

1. Determine flood discharge, waterway, economic span
2. Select type of super structure, sub structure and the bearings
3. Calculate the various types of loads acting on the bridges
4. Design the Slab bridges, Girder bridges and Prestressed Concrete bridges

UNIT - I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads-Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT - II

RCC Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy

UNIT - III

Box Culverts: - Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT - IV

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT - V

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments. - Case Studies.

TEXT BOOKS:

1. Design of Concrete Bridges by M. G. Aswani, V. N. Vazirani and M. M. Ratwani.
2. Bridge Deck Behaviour by E. C. Hambly.

REFERENCES:

1. Concrete Bridge Design and Practice by V. K. Raina.
2. 2.Essentials of Bridge Engineering by Johnson Victor, Oxford & IBH.
3. 3.Design of Bridges by V. V. Sastry, Dhanpat Rai & Co.

ADVANCED CONCRETE LAB – II

M.Tech I Year II Semester – SE

L	T	P	C
0	1	2	2

LIST OF EXPERIMENTS:

1. Mixed Design for Self Compacting Concrete.
2. Workability tests for Self Compacting Concrete.
 - a. J-Ring
 - b. U-box
3. Workability tests for Self Compacting Concrete.
 - a. L-box
 - b. Slump Cone
 - c. V-Funnel
4. Permeability of concrete.
5. Rapid Chloride Permeability Test.
6. Carbonation Test.
7. Non Destructive Testing of concrete using Rebound Hammer and Ultra sonic pulse velocity.
8. Flexural tests on Normal and High strength concrete.
9. Study on Stress Strain behavior of concrete and determining the Young’s Modulus.

Major Equipments:

Workability Test Apparatus, Rebound Hammer, Ultrasonic pulse Velocity, Flexural Testing Machine, RCPT.

COMPUTER AIDED STRUCTURAL DESIGN LAB –II

M.Tech I Year II Semester – SE

L	T	P	C
0	1	2	2

List of Experiments:

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

1. Analysis and Design of Single Storey Frame using STAAD pro.
2. Analysis and Design of Multi Storey Building using STAAD pro.
3. Wind load Analysis on RCC building using STAAD pro.
4. Analysis and Design of Steel Truss using STAAD pro.
5. Analysis and Design of Isolated footing using STAAD pro.
6. Analysis and Design of Combined footing using STAAD pro.
7. Analysis and Design of Bridge Deck using STAAD pro.
8. Analysis and Design of Circular water tank using STAAD pro.

Softwares: STAAD Pro.

M.Tech II YEAR I – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	Professional Elective - V	4. Earthquake Resistant Design of Structures 5. Pre-Engineered Buildings 6. Advanced Rehabilitation and Retrofitting of Structures	3	0	0	3
2.	Open Elective	Open Elective	3	0	0	3
3.	Dissertation	Dissertation Phase – I- Work Review	0	0	12	6
4.		Total	6	0	12	12

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (Professional Elective –V)

M.Tech II Year I Semester – SE

L	T	P	C
3	0	0	3

Pre-requisites: Structural Dynamics, Reinforced Concrete Design

Course Outcomes: After completion of the course, students should be able to:

1. Predict the sources of earthquakes understanding seismology and conceptually design the buildings
2. Apply the Response Spectrum Analysis Method and static equivalent method for the determination of lateral loads on the buildings
3. Apply ductility requirements for the design of structural components
4. Assess seismic performance of non-structural components and structural components and identify effective measures to mitigate potential damage

UNIT - I

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics-

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.

Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basicassumptions.

UNIT - II

Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures.

Twisting of Buildings – Flexible Building and Rigid Building Systems.

Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete - Design Earthquake Loads – Basic Load Combinations – Permissible Stresses.

Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method.

UNIT - III

Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods.

RC Buildings – IS Code based Method.- Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands

– Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

UNIT - IV

Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – Behaviour of Coupled Shear Wall.

UNIT - V

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquake.

Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

TEXT BOOKS:

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Hall of India Pvt. Ltd.

REFERENCES:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
2. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nemchand & Bros
3. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial college Press.
4. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
5. Earthquake Tips – Learning Earthquake Design and Construction C. V. R. Murty

REFERENCE CODES:

1. IS: 1893 (Part-1) -2016. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., NewDelhi.
2. IS:4326-1993, “Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.
3. IS:13920-2016, “Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.

PRE-ENGINEERED BUILDINGS (Professional Elective – V)**M.Tech II Year I Semester – SE**

L	T	P	C
3	0	0	3

Pre-requisites: Design of Steel Structures & Structural Analysis**Course Outcomes:** After completion of the course, students should be able to

1. Understand the functions of Primary system, Secondary system and Bracing system of PEB components.
2. Calculate the Dead, Live, Wind and Seismic loads acting on PEB’s
3. Check the structural stability of PEB’s
4. Analyze and Design the PEB’s

UNIT - I:

Introduction to Pre-Engineered Buildings: Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered buildings.

UNIT - II:

Pre-Engineered Building Components: Primary System: Main frames, Gable End Frame - Secondary frame system: Sizes and Properties of Purlins & Girts – Bracing System: Rod, angle, Portal, Pipe bracing – Sheeting and Cladding: Roof Sheeting and Wall sheeting – Accessories: Turbo Ventilators, Ridge vents, Sky Lights, Louvers, Insulation, Stair cases, Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads. Serviceability Limits as per code.,

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Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/t_w , b_f/t_f ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations, Analysis and Design of Rigid Frames.

UNIT - III:

Peb Frame Connection Design Methodology: Rigid Frame Moment Connection, Shear Connection, High strength bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, Selection of governing forces for connection design.

UNIT - IV:

Mezzanine Floor Systems: Design of Mezzanine Beams, Columns and joists – Mezzanine decking, Different types of Mezzanine Floor systems – Grating, Chequered plate and Rigid floor System, Types of base plate Pinned , Fixed, strength bolts, different types of bolts & grades, Lever arm, bolt Patten its effect on connection design, thickness of connection plate, base plate size, Selection of governing forces for base connection design & Anchor bolt.

UNIT - V:

Analysis and Design Of Pre-Engineered Buildings: 2D and 3D Modelling of Portal Frames, Optimization Techniques, Comparison of software output with manual calculations. Design of Cold Formed Sections i.e., Purlins and Girts, Design of Roof Sheeting, trapezoidal , Standing seam sheeting, Welding technology, Manufacturing process , Erection Procedures.

TEXT BOOKS:

1. Pre-Engineered Steel Building, K.S. Vivek and P.Vyshnavi, LAP Lamdert Academic Publishing.

REFERENCES:

1. Metal building systems: Design and Specifications, Third edition, Alexander Newman, McGraw-Hill Education.
2. Pre-Engineered Metal Building Systems, Labsori

ADVANCED REHABILITATION AND RETROFITTING OF STRUCTURES (Professional Elective – V)

M.Tech II Year I Semester – SE

L	T	P	C
3	0	0	3

Prerequisites: Reinforced Concrete Design, Steel Design, Concrete Technology

Course Outcomes: After studying this course, students will be able to:

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique

UNIT – I

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Introduction – Definition of Repair, Retrofitting, Strengthening and rehabilitation, Deterioration of Structures – Distress in Structures – Causes and Prevention, Mechanism of Damage – Types of Damage, Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation, Damage Assessment -, Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems - Influence on Serviceability and Durability- Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

UNIT – III

Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post- tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building, Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shot Create – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

Seismic Retrofitting: Seismic strengthening of existing RC structures, Use of FRP for retrofitting of damaged structures

UNIT – V

Specialized Repairs: Electro chemical repair using re-alkalization and chloride extraction techniques, Specialized repairs for chemical disruption, fire, marine exposure etc, Repair of damaged structures of water retaining structures, hydraulic structures, Pavements and Runways, Tunnels, Bridges, Piers and Flyovers, Parking Garages, Underwater repair, Masonary Repair, Repair and Restoration of Heritage Structures

Post-Repair Maintenance of Structures: Protection & Maintenance schedule against environmental distress to all those structures

TEXTBOOKS:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press.

REFERENCES:

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

1. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
2. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
3. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).
4. “Deterioration, Maintenance and Repair of Structures “, Sidney, M. Johnson
5. “Concrete Structures – Materials, Maintenance and Repair”- Denison Campbell, Allen & Harold Roper, Longman Scientific and Technical.
6. “Learning for failure from Deficiencies in Design, Construction and Service” R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons Raiker R.N., - R&D Center (SDCPL).

DISSERTATION PHASE – I

M.Tech II Year I Semester – SE

L	T	P	C
0	0	12	6

Course Outcomes: At the end of the course, the student will be able to:

1. Identify structural engineering problems reviewing available literature.
2. Identify appropriate techniques to analyze complex structural systems.
3. Apply engineering and management principles through efficient handling of project

Syllabus Contents:

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

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M.Tech II YEAR II – SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1.	Dissertation	Dissertation Phase – II- Work Review	0	0	12	6
2.	Dissertation	Dissertation Viva-Voce	0	0	28	14
		Total	0	0	40	20

DISSERTATION PHASE – II**M.Tech II Year II Semester – SE**

L	T	P	C
0	0	12	6

Course Outcomes: At the end of the course, the student will be able to:

1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to the engineering community and society.
3. Demonstrate professional ethics and work culture.

Syllabus Contents:

Dissertation – II will be extension of the work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre-submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along

GREEN BUILDING TECHNOLOGIES (OE)**M.Tech II Year I Semester – SE**

L	T	P	C
3	0	0	3

Course Outcomes

After completion of this course students will be able to

1. Understand the Green building concept and focus on approaches that make building sustainable.
2. Illustrate Green building assessment and accreditation system.
3. Able to apply low energy building strategies.
4. Design green building to improve sustainability of infrastructure.
5. Classify the economic benefits of green buildings.

UNIT – I

Introduction: The shifting landscape of green buildings, The driving forces for sustainable construction, Ethics and sustainability, Basic Concepts and Vocabulary, Major Environmental and resource concerns. International Building Assessment systems.

UNIT – II

The green building assessment system: Structure of the LEED suite of Building rating systems, LEED Credentials, LEED Building Design and construction Rating system, Green Globes Building Rating Tools, Structure of Green Globes for New Construction, Green Globes Assessment and Certification Process, Green

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Globes Professional Credentials, IGBC Building design, Rating system and Professional credentials, Green Building Documentation Requirements

UNIT – III

Green building design: Conventional versus Green Building Systems, green materials, material selection criteria, Executing the Green Building Project, Integrated Design Process, Role of the charrette in the design process,.

UNIT – IV

Low – energy building strategies: Building Energy Issues, High – Performance Building Energy Design Strategy, Passive Design Strategy, Building Envelope, Internal Load Reduction, Smart Buildings and Energy Management Systems.

UNIT – V

Green building economics and sustainable construction: General approach, The Business Case for High – Performance Green Buildings, Economics of Green Building, Quantifying Green Building Benefits, Articulating Performance Goals for Future Green Buildings

Text Books:

1. Sustainable Construction, CHARLES J. KIBERT, John Wiley & sons, 4th Edition, 2016.
2. Sun, Wind & Light- Architectural design strategies, Mark Dekay & G.Z Brown, John Wiley & sons, 3rd Edition, 2014

Reference Books:

1. IGBC Reference manual (2016)

CONSTRUCTION MANAGEMENT (OE)

M.Tech II Year I Semester – SE

L	T	P	C
3	0	0	3

Course Outcomes:

After completion of this course students will be able to

1. Understand the construction management skills as a member of a multi- disciplinary team.
2. Apply to construction planning techniques.
3. Analyse construction documents for planning and management of construction processes.
4. Apply knowledge, techniques, skills, and tools of the construction industry in construction activities.
5. Understand the legal implications of contract, common, and regulatory law to manage a construction project

UNIT-I

CONSTRUCTION PLANNING AND MANAGEMENT: Significance of Construction Management, Objectives and Functions of Construction Management, Types of Construction, Resources for Construction Industry, Various stages in Construction, Construction Management Team & Types of Organization.

UNIT-II

PROJECT PLANNING: Project Planning Techniques, Planning of Manpower, Materials, Equipment and

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Finance, Scheduling by Bar Charts, Limitations of Bar Charts.

PERT&CPM: Significance of CPM&PERT Techniques in Construction Management, Project Scheduling, Network Analysis, Cost-Time Analysis in Network Planning, Float; Total float & free float.

UNIT- III

CONTRACT MANAGEMENT: Types of contracts, contract document, specification, important conditions of contract–tender and tender document–Deposits by the contractor

BIDDING: Definition and Process, Various steps in Bidding, M Book- MusterRoll

UNIT-IV

CLAIM MANAGEMENT: Construction claims, Source of claim, Claim Management, Disputes and Dispute resolution, Arbitration and its advantages, project closure, Construction closure, Contract closure.

UNIT-V

REGULATIONS AND SAFETY: Labour Regulations, Social Security – welfare legislation – Laws relating to Wages – Workmen’s Compensation Act – Safety in Construction, legal and financial aspects of accidents in construction.

Text Books:

1. Construction Planning and Management, P.S. Gahlot & B.M. Dhir, Wiley Eastern Limited, 2nd Edition,2018.
2. Construction Project Management, Chitkara K.K, Tata McGraw Hill Publishing Co, 4th Edition, 2019.

Reference Books:

1. Fundamentals of Management, Stephen A. Robbins & DavidA. Decenzo & Mary Coulter, 14th Edition, 2016.

DISASTER MANAGEMENT (Audit Course)

M.Tech I Year I Semester – SE

L	T	P	C
2	0	0	0

Course Outcomes:

After completion of this course students will be able to

1. Understanding the various types of disaster and its effect.
2. Illustrate the aspects of Environmental impacts assessment (EIA).
3. Demonstrate assessment of risk mitigation.
4. Assess the functional impacts of disaster management.
5. Integrate the management cycle and risk reduction.

UNIT-I

Introduction To The Different Types Of Disasters:

Dr. Pallavi Badry	Dr. K.M. Lakshmana Rao	Dr. N. Darga Kumar	Dr. Prabhakar Singh	Dr. S. Suriya Prakash	Er. N. Srinivas Rao	Dr. S. Srihari	Dr. N. Sudharsan,	Mrs. V. Swathi

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, Is, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozonedepletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT-II

Environment and Disasters:

Environment, ecosystem and disasters. Climate change – issues and concerns. Industrial hazards and safety measures. Post disaster impact on environment. Impact of developmental projects on disaster risk. Aspects of environmental management for disaster risk reduction. Environmental Impact Assessment (EIA).

UNIT-III

Disaster Risk Mitigation:

Disaster risk assessment (Hazard-Vulnerability-Capacity analysis), Hazard mapping and forecasting. Principles and aspects of Disaster prevention Disaster mitigation Preparedness for damage mitigation and coping with disasters. Capacity building for disaster/damage mitigation (structural and non-structural measures). Contingency planning for damage mitigation of different hazards.

UNIT-IV

Disaster Management:

Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community – based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster responses; Police and other organizations.

UNIT-V

Planning For Disaster Rescue and Risk Reduction:

Community-hazard profile of the disaster site. DM cycle, Different phases of Disaster Management :Predisaster stage, Emergency stage, Post disaster stage. Implementation of different disaster management phase and Relief mechanism during different disaster stages including cyclones, earthquakes, fire accidents, Tsunami, landslides etc. Disaster Management Act (2005); Disaster Management Policy (2009);

Text Books:

1. Disaster Mitigation: Experiences And Reflections, Pradeep Sahni, 1st Edition 2013.
2. Natural Hazards & Disasters, Donald Hyndman & David Hyndman, Cengage Learning, 1st Edition, 2009.

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