KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Coimbatore – 641 021. INDIA

DEPARTMENT OF CIVIL ENGINEERING

M.E. STRUCTURAL ENGINEERING (FULL TIME)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students to excel in research and to succeed in Structural engineering profession through global, rigorous post graduate education

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve structural engineering problems

III. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real-life problems

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate structural engineering issues to broader social context.

V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

a. Graduates will demonstrate knowledge of mathematics, science and engineering.

b. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.

c. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.

d. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

e. Graduates will demonstrate knowledge of professional and ethical responsibilities.

f. Graduate will be able to communicate effectively in both verbal and written form.

g. Graduate will develop confidence for self education and ability for life-long learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

h. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.

i. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.

j. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

MAPPING:

PEOs	a	b	c	d	e	f	g	h	i	j
I	√			√			√	√	√	
II		√			√				√	√
III			√		√	√		√	√	
IV	√			√			√			√
V		√	√			√			√	√

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DEPARTMENT OF CIVIL ENGINEERING

M.E. STRUCTURAL ENGINEERING (FULL TIME)
COURSE OF STUDY AND SCHEME OF EXAMINATIONS
(2019 BATCH ONWARDS)

SUB CODE	TITLE OF THE COURSE	OBJECTIVES AND OUT COMES		INSTRUCTION HOURS/WEEK			CREDITS	MAXIMUM MARKS		
		PEO's	PO's	L	T	P		CIA	ESE	TOTAL
								40	60	100
SEMESTER - I										
20MEST101	Advanced Structural Analysis	I,II,III	a,b,h	3	0	0	3	40	60	100
20MEST102	Advanced Solid Mechanics	I,II,III	a,b,d,h,j	3	0	0	3	40	60	100
20MEST103	Research Methodology and IPR	IV,V	e,f,g,h	2	0	0	2	40	60	100
20MEST1E0-	1. Theory of Thin Plates and Shells 2. Theory and Applications of Concrete Composites 3. Theory of Structural Stability	I,II,III	a,b,f,h,j	3	0	0	3	40	60	100
20MEST1E0-	4. Analytical and Numerical Methods for Structural Engineering 5. Structural Health Monitoring 6. Structural Optimization	I,II,IV	a,b,c, h,i	3	0	0	3	40	60	100
20MEST111	Structural Design Lab	I,II	b,c,d,g,j	0	0	2	2	40	60	100
20MEST112	Advanced Concrete Lab	I,II	b,c,d,g,j	0	0	2	2	40	60	100
Total				**14**	**0**	**4**	**18**	**280**	**420**	**700**
SEMESTER - II										
20MEST201	FEM in Structural Engineering	I,II,III	c,d	3	0	0	3	40	60	100
20MEST202	Structural Dynamics	II,III	e,f,i	3	0	0	3	40	60	100
20MEST2E0	1. Advanced Steel Design 2. Design of Formwork 3. Design of High-Rise Structures 4. Design of Masonry Structures	II,III,IV	b,f,i,j	3	0	0	3	40	60	100
20MEST2E0	5. Design of Advanced Concrete Structures	II,III,IV	a,f,j	3	0	0	3	40	60	100

	6. Advanced Design of Foundations 7. Soil Structure Interaction 8. Design of Industrial Structure									
20MEST211	Model Testing Lab	II,III	b,j	0	0	2	2	40	60	100
20MEST212	Numerical Analysis Lab	II	d,e,i	0	0	2	2	40	60	100
20MEST213	Mini Project	IV	a,b,h	0	0	4	2	40	60	100*
Total				**12**	**0**	**8**	**18**	**280**	**420**	**700**
SEMESTER - III										
20MEST3E0	1. Design of Prestressed Concrete Structures 2. Analysis of Laminated Composite Plates 3. Fracture Mechanics of Concrete Structures 4. Design of Plates and Shells 5. Design of earthquake resistant structures	I,II,III,IV	a,b,f,j	3	0	0	3	40	60	100
20MESTOE0	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	IV,V	a,b,c, h	3	0	0	3	40	60	100
20MEST391	Project Work – Phase I	III	c,d,e,f, g,h	0	0	20	10	40	60	100*
Total				**6**	**0**	**20**	**16**	**120**	**180**	**300**
SEMESTER - IV										
20MEST491	Project Work – Phase II	III	c,d,e,f, g,h	0	0	32	16	120	180	300
Total				**0**	**0**	**32**	**16**	**120**	**180**	**300**

L-Lecture T-Tutorial P-Practical C-Credit
CIA – Continuous Internal Assessment
ESE – End semester Examination

Total credits = 68
Total Marks = 2000

*** To be evaluated internally by a committee of members**

Review 1& 2 – 60 marks
Final presentation and viva voce – 40 marks

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester I

20MEST101 ADVANCED STRUCTURAL ANALYSIS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. Understanding the concept of analyzing the structural members
2. To study the concept of stiffness method applied to large frames
3. To develop an understanding on applications analysis in real time approach.
4. To arrive the solution for boundary value problems
5. To study the behavior of Linear elements
6.

COURSE OUTCOMES: At the end of the course,

1. Students will be in a position to arrive structural approach for the influencing coefficients
2. Students will be able to analyze the skeleton structures using stiffness analysis code
3. students will be able to understand the applications analysis in real time approach
4. They will be able to solve boundary value problems
5. Students will know about the behavior of Linear elements

UNIT I INFLUENCE COEFFICIENTS 9

Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.

UNIT II STIFFNESS METHOD APPLIED TO LARGE FRAMES 9

Local Coordinates and Global Coordinates. Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces-Flexibility method.

UNIT III APPLICATIONS TO SIMPLE PROBLEMS 9

Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

UNIT IV BOUNDARY VALUE PROBLEMS (BVP) 9

Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

UNIT V LINEAR ELEMENT 9

Shape Functions, Solution for Poisson's Equation, General One-Dimensional Equilibrium Problem.

SUGGESTED READINGS:

1. Matrix Analysis of Framed Structures, Weaver and Gere, CBS publishers and distributors pvt ltd (April 18, 2018)
2. The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co, 2017
3. Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication, 2010
4. The Finite Element Method, Desai and Able, CBS Publication, 2005
5. nptel.ac.in/courses/105106050/
6. Advanced analysis and design of spatial structures, J.Y.Richard Liew N.M.Punniyakotty N.E.Shanmugam

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester I

20MEST102 ADVANCED SOLID MECHANICS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. To learn the principles of and relations of stress and strain
2. To understand the concept of stress and strain analysis
3. To develop an understanding on equations of elasticity
4. To study the basics in torsion of prismatic bars
5. To understand the concept of plastic deformation

COURSE OUTCOMES: At the end of the course,

1. Students will be able to understand the basic concepts of stress and strain
2. Students will be able to solve simple problems of elasticity and plasticity
3. Students will be familiar to the concept of elastic analysis of plane stress and plane strain problems
4. Students will know about the torsion of prismatic bars
5. They will also have sufficient knowledge in various theories of failure and plasticity

UNIT I INTRODUCTION TO ELASTICITY 9

Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

UNIT II STRAIN AND STRESS FIELD 9

Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

UNIT III EQUATIONS OF ELASTICITY AND TWO-DIMENSIONAL PROBLEMS OF ELASTICITY 9

Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions. Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

UNIT IV TORSION OF PRISMATIC BARS 9

Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

UNIT V PLASTIC DEFORMATION 9

Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

SUGGESTED READINGS:

1. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 2017.
2. Advanced Mechanics of Solids, SrinathL.S., Tata McGraw Hill, 2017.
3. Elasticity, Sadd M.H., Elsevier,2005.
4. Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press,2019.
5. Computational Elasticity, Ameen M., Narosa,2008.
6. Solid Mechanics, Kazimi S. M. A., Tata McGraw Hill,2001.
7. nptel.ac.in/courses/105106049
8. Vision of the Future of Solid Mechanics by Zdeněk P. Bažant

20MEST103 RESEARCH METHODOLOGY AND IPR 3H:3C

Instruction Hours/ Week: L:2 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. Understanding that when IPR would take important place in growth of individuals & nation,
2. To impart knowledge and skills required for Problem formulation, analysis and solutions.
3. To provide a thorough knowledge in Technical paper writing / presentation without violating professional ethics
4. To work on Patent drafting and filing patents.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D.
6. To educate the students on report writing.

COURSE OUTCOMES:

At the end of the course, the students have the

1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.
6. Ability to write a technical report and a thesis.

UNIT I INTRODUCTION 9

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 RESEARCH ETHICS AND PROPOSAL 9

Effective literature studies approach, analysis Plagiarism, Research ethics, 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 III NATURE OF INTELLECTUAL PROPERTY 9

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 IV PATENT RIGHTS 9

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V NEW DEVELOPMENTS IN IPR 9

Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

SUGGESTED READINGS:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007. Mayall , “Industrial Design”, McGraw Hill.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

20MEST1E01 THEORY OF THIN PLATES AND SHELLS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. To get introduced to various plate theories, governing equations for bending of plates and various boundary conditions.
2. To conceptualize Navier's solution and Levy's solution to analyze rectangular plates.
3. To study the bending of circular plates.
4. To use membrane theory to analyze the solution of shells
5. To get introduced to various plate theories, governing equations for bending of plates and shells with various boundary conditions.

COURSE OUTCOMES:

At the end of the course, students will be able to

1. At the end of the course, the students will be able to
2. Familiarize about various plate theories.
3. Analyze rectangular plates using Navier's solution, Levy's solution.
4. Analyze circular plates for the given boundary conditions.
5. Analyze the shells using membrane theory.
6. Analyze different types of plates and shells under different boundary connections by various classical methods and approximate methods.

UNIT I INTRODUCTION 9

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 STATIC ANALYSIS OF PLATES: **9**

Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

UNIT III CIRCULAR PLATES: 9

Analysis under Axis- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

UNIT IV STATIC ANALYSIS OF SHELLS: 9

Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells

UNIT V SHELLS OF REVOLUTION WITH BENDING RESISTANCE 9

Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels. Thermal Stresses in Plate/ Shell

SUGGESTED READINGS:

1. Theory of Plates and Shells, Timoshenko S. and Krieger W., McGraw Hill,2007
2. Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill,2009
3. Theory of Plates, Chandrashekhara K., Universities Press,2001
4. Design and Construction of Concrete Shells, Ramaswamy G.S, 2005
5. www.nptel.ac.in
6. Non-linear vibrations of shell-type structures: a review with bibliography, F Moussaoui, R Benamar - Journal of sound and vibration, 2002 – Elsevier

20MEST1E02 THEORY AND APPLICATIONS OF CONCRETE COMPOSITES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. Classify the composite materials.
2. Understand the behavior of materials subjected to loads.
3. Recommend cement composites as alternative to conventional materials.
4. Define the mechanical behavior under combined stresses.
5. The applications of composites.
6. The behavior of composite materials and to investigate the failure and fracture characteristics

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Formulate constitutive behavior of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behavior.
2. Classify the materials as per orthotropic and anisotropic behavior.
3. Estimate strain constants using theories applicable to composite materials.
4. Suggest cement composites as an alternative to traditional materials.
5. Explain the various failure criteria and fracture mechanics of composites
6. Explain the various types of composites and its constituents

UNIT I INTRODUCTION: 9

Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT II MECHANICAL BEHAVIOUR: 9

Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

UNIT III CEMENT COMPOSITES: 9

Types of Concrete Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT IV MECHANICAL PROPERTIES AND APPLICATION OF CEMENT COMPOSITES: 9

Behavior of Ferro cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion. FRC and Ferro cement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

UNIT V ANALYSIS AND DESIGN OF CEMENT COMPOSITE STRUCTURAL ELEMENTS 9

Ferro cement, SIFCON and Fibre Reinforced Concrete.

SUGGESTED READINGS:

1. Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis,BSP Books, 1998. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.
2. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman &Hall,1983
3. Continuum damage theory—application to concrete, J Mazars, G Pijaudier-Cabot - Journal of Engineering Mechanics, 1989
4. Concrete filled steel tubular structures from theory to practice [J], LH Han, Z Tao, W Liu - Journal of Fuzhou University
5. Micromechanics of crack bridging in fibre-reinforced concrete, VC Li, H Stang, H Krenchel - Materials and structures, 1993

Semester I

20MEST1E03 THEORY OF STRUCTURAL STABILITY 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To study the stability of columns using theoretical and numerical methods.
2. To understand the approximate methods and numerical methods of inelastic buckling.
3. To get accustomed to beam column behavior and that of frames.
4. To enumerate the lateral buckling, lateral torsional buckling and flexural torsional buckling of beams.
5. To study various numerical techniques and energy methods for buckling of thin plates.
6. To study the concept of buckling and analysis of structural element

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Analyze both static and dynamic instabilities, by both theoretical and numerical methods.
2. Analyze the inelastic buckling using various methodologies.
3. Examine the behavior of beam columns and frames with and without side sway using classical and stiffness methods.
4. Calculate lateral buckling, torsional buckling, flexural torsional buckling of various beams and non-circular sections.
5. Evaluate buckling of thin plates using energy methods and various numerical techniques.
6. Analyze the inelastic buckling of columns and plates

UNIT I CRITERIA FOR DESIGN OF STRUCTURES 9

Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavior.

UNIT II STABILITY OF COLUMNS: 9

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

UNIT III STABILITY OF FRAMES 9

Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT IV STABILITY OF BEAM AND PLATES 9

Lateral torsion buckling, axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT V INELASTIC BUCKLING 9

Introduction to Inelastic Buckling, Dynamic Stability.

SUGGESTED READINGS:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,2010
2. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York,2010
3. Structural stability: theory and implementation, WF Chen, EM Lui
4. A lemma in the theory of structural stability of differential equations, P Hartman - Proceedings of the American Mathematical Society, Structural stability on two-dimensional manifolds, MM Peixoto
5. Statistical aspects in the theory of structural stability,VV Bolotin - Dynamic stability of structures

Semester I

20MEST1E04 ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To familiarize the students in the field of differential equations to solve Initial -Boundary value problems associated with engineering applications.
2. To identify and to solve elliptic equations evolving in diverse field of engineering applications as boundary value problems.
3. To obtain solutions for functional optimization related problems.
4. To find eigenvalues by various methods.
5. To expose the various numerical integration techniques.
6. To solve the mathematical problem by using computer algorithms.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Apply the field of differential equations to solve boundary value problems associated with engineering applications using transform techniques.
2. Identify and solve elliptic equations evolving in diverse field of engineering applications as boundary value problems using Fourier Transform.
3. Gain the solutions for Functional optimization problems.
4. Explain the methods for finding eigenvalues.
5. Apply the various numerical integration techniques.
6. To write a program to solve a mathematical problem.

UNIT I FUNDAMENTALS OF NUMERICAL METHODS 9

Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting; Interpolation and extrapolation.

UNIT II NUMERICAL METHODS 9

Solution of Nonlinear Algebraic and Transcendental Equations

UNIT III ELEMENTS OF MATRIX ALGEBRA 9

Solution of Systems of Linear Equations, Eigen Value Problems.

UNIT IV NUMERICAL DIFFERENTIATION & INTEGRATION 9

Solution of Ordinary and Partial Differential Equations. Finite Difference scheme: Implicit & Explicit scheme.

UNIT V COMPUTER ALGORITHMS 9

Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

SUGGESTED READINGS:

1. An Introduction to Numerical Analysis, Atkinson K.E, J. Wiley and Sons, 1989.
2. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988.
3. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998

4. Structural stability: theory and implementation, WF Chen, EM Lui
5. Reliability-based optimization in structural engineering, I Enevoldsen, JD Sørensen
6. Two-dimensional discontinuous deformation analysis, GH Shi, RE Goodman

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester I

20MEST1E05 STRUCTURAL HEALTH MONITORING 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To access the errors in measurement and learn the principles of measurement using various electronic and physical testing machines.
2. To familiarize with vibrating measuring instruments and digital and electronic display using different sensors.
3. To access the wind flow measurement and pressure measurement and scale different models using direct model study and indirect model study.
4. To measure the distress in concrete structures using various electrical and electronic machineries.
5. To test various civil engineering structures using Non-Destructive Testing methodologies.
6. Diagnosis the distress in the structure understanding the causes and factors.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Perform force and strain measurement by selecting appropriate tools and technique.
2. Use various vibration measuring instruments and analyze the structures using digital display unit.
3. Apply model analysis as an effective experimental technique.
4. Measure distress in the structures using various electronic equipment.
5. Carry out load test on structures and perform advanced NDT methods in accessing the quality of structures
6. They will be able to analyze the structure by non-destructive testing methods and model analysis.

UNIT I STRUCTURAL HEALTH 9

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

UNIT II STRUCTURAL HEALTH MONITORING 9

Concepts, Various Measures, Structural Safety in Alteration.

UNIT III STRUCTURAL AUDIT 9

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

UNIT IV STATIC AND DYNAMIC FIELD TESTING 9

Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement. 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 9

Case Studies (Site Visits), piezo– electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

SUGGESTED READINGS:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.
5. Health monitoring of civil infrastructure, PC Chang, A Flatau, SC Liu
6. Structural health monitoring in mainland China: review and future trends, J Ou, H Li –
7. Structural Health Monitoring Vibration based condition monitoring: a review, EP Carden, P Fanning
8. nptel.ac.in/courses/114106035/36
9. nptel.ac.in/syllabus/syllabus_pdf/112104160.pdf
10. nptel.ac.in/courses/112104160/pdf_lectures/lecture13.pdf

Semester I

20MEST1E06 STRUCTURAL OPTIMIZATION 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To introduce the fundamentals of optimization concepts and their applications in the structural engineering field.
2. To study the linear programming methods of the optimization.
3. To know the constrained and unconstrained variables of the various structural engineering problems.
4. To know the various methods of optimality involving geometric and dynamic programming.
5. To have an exposure on the various advanced techniques in the structural optimization.
6. Variational principle for optimization

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Apply the basic ideas in optimization to make the structures as lightly as possible.
2. Use linear programming techniques in engineering optimization.
3. Evaluate the unconstrained and constrained optimization problems in structural design.
4. Illustrate the methods adopted in solving the problems related to geometric and dynamic Programming.
5. Apply advanced techniques of optimization such as genetic algorithm and Artificial Neural Networks in structures.
6. Apply optimization techniques to structural steel and concrete members.

UNIT I INTRODUCTION **9**

Simultaneous Failure Mode and Design, Classical External Problems.

UNIT II CALCULUS OF VARIATION: **9**

Variational Principles with Constraints

UNIT III LINEAR PROGRAMMING **9**

Integer Programming, Nonlinear Programming, Dynamic Programming, Geometric Programming and Stochastic Programming.

UNIT IV APPLICATIONS **9**

Structural Steel and Concrete Members, Trusses and Frames.

UNIT V DESIGN **9**

Frequency Constraint, Design of Layouts.

SUGGESTED READINGS:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer, 2014
2. Variational methods for Structural optimization, Cherkaev Andrej, Springer, 2012
3. Structural optimization using sensitivity analysis and a level-set method, G Allaire, F Jouve, AM Toader - Journal of computational physics

4. A new structural optimization method based on the harmony search algorithm, KS Lee, ZW Geem - Computers & structures,
5. Mixed variable structural optimization using firefly algorithm, AH Gandomi, XS Yang, AH Alavi - Computers & Structures
6. Reliability-based structural optimization using neural networks and Monte Carlo, simulation, M Papadrakakis, ND Lagaros
7. nptel.ac.in/courses/112108211/25
8. nptel.ac.in/syllabus/syllabus_pdf/112108094.pdf
9. www.nptel.ac.in/syllabus/105108127/

20MEST111 STRUCTURAL DESIGN LAB 2H:2C

Instruction Hours/ Week: L:0 T:0 P:2 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

- To understand the concept of design and detailing

COURSE OUTCOMES:

At the end of the course, students will be able to

- Design and Detail all the Structural Components of Frame Buildings.
- Design and Detail of Industrial roof system of PEB units.

LIST OF EXPERIMENTS

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

SUGGESTED READINGS:

1. Manual for Detailing of Steel Structures by S. Kanthimathinathan, 24 Nov 2014

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester II

20MEST112 ADVANCED CONCRETE LAB 2H:2C

Instruction Hours/ Week: L:0 T:0 P:2 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. To perform advanced laboratory experiments that emphasizes the structure- property relationship, statistical analysis and technical manuscript preparation.
2. Apply engineering principles to understand behavior of structural/ elements.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Illustrate the behavior of reinforced concrete and steel beam by carrying out experimental study. Explain the dynamic behavior of cantilever steel beam.
2. Proportion the concrete mix to archive desired strength and quality of concrete.
3. Design high grade concrete and study the parameters affecting its performance.
4. Conduct Non-Destructive Tests on existing concrete structures.

LIST OF EXPERIMENTS / ASSIGNMENTS:

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
2. Effect of cyclic loading on steel.
3. Non-Destructive testing of existing concrete members.
4. Behavior of Beams under flexure, Shear and Torsion.

SUGGESTED READINGS:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

20MEST201 FEM IN STRUCTURAL ENGINEERING 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To acquire knowledge on formulation of boundary value problems.
2. To gain knowledge on stress analysis.
3. To be familiar with meshing using various mesh generation methods.
4. To understand dynamic analysis.
5. To understand the behavior of plate and shell elements.
6. Use Finite Element Method for structural analysis.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Formulate boundary value problems of finite element method.
2. Discretize the structure and determine interpolation functions using various elements.
3. Apply direct stiffness method as FEA tool.
4. Analyze complex structural problems using iso - parametric and axis-symmetric formulations.
5. Perform FEA by standard software.
6. Solve continuum problems using finite element analysis

UNIT I INTRODUCTION 9

History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

UNIT II BEAM ELEMENTS 9

Flexure Element, Element Stiffness Matrix, Element Load Vector.

UNIT III METHOD OF WEIGHTED RESIDUALS 9

Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.

UNIT IV TYPES 9

Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axis-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

UNIT V APPLICATION AND COMPUTATION TECHNIQUE 9

Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi-Symmetric Stress Analysis, Strain and Stress Computations. Computer techniques of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

SUGGESTED READINGS:

1. Finite Element Analysis, Seshu P., Prentice-Hall of India,2005.
2. Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.
3. Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
4. Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000.
5. Finite Element Analysis on The Structural Behaviour Of Square CFST Beams, M.F. Javed, N.H. Ramli, S. Kashif- Ur-Rehman And N.B. Khan
6. Finite Element For Calculation Of Structures Made Of Thin-Walled Open Profile Rods, A.Tusnin
7. Finite Element Modelling Of Structures Including Piezoelectric Active Devices Jaehwan Kim ,Vasundara V. Varadan , Vijay K. Varadan

20MEST202 STRUCTURAL DYNAMICS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

To impart knowledge on

1. To understand the response of structural systems to time-varying dynamic loads and displacements.
2. To learn the behavior and response of linear and non-linear two degree of freedom structures.
3. To study the behavior and response of MDOF structures with various dynamic loading.
4. To impart knowledge on dynamic analysis of continuous systems.
5. To get introduced to advanced topics in dynamics.
6. To expose the students the principles and methods of dynamic analysis of structures and to prepare them for designing the structures for wind, earthquake and other dynamic loads.

- To enable students to Discuss the principal of dynamics. Discuss the Multi Degree of Freedom System. Discuss the Dynamic Response of Multi Degree of Freedom Systems. Discuss Continuous Systems. Discuss the Design of Structures Subjected to Dynamic Loads

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Evaluate the response of structural systems to dynamic loads and displacements.
2. Analyze the behavior of linear and non-linear SDOF and MDOF structures with various dynamic loading.
3. Analyze the response of MDOF structures with various dynamic loading.
4. Analyze the continuous system subjected to dynamic loading.
5. Analyze the dynamic effects due to wind load vibration caused by traffic, blasting and pile driving.
6. Design the structures subjected to dynamic loads

UNIT I INTRODUCTION 9

Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

UNIT II SINGLE DEGREE OF FREEDOM SYSTEM 9

Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.

UNIT III NUMERICAL SOLUTION 9

Numerical to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.

UNIT IV MDOF (LUMPED PARAMETER) 9

Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

UNIT V ADVANCED STRUCTURAL DYNAMICS (CONCEPTS ONLY) 9

Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

SUGGESTED READINGS:

1. Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw Hil, 2010
2. Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K,2016
3. Dynamics of Structures, Humar J. L., Prentice Hall, 2002
4. Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication,2004
5. Dynamics of Structures, Hart and Wong, 2000
6. nptel.ac.in/courses/105101006/
7. https://onlinecourses.nptel.ac.in/noc16_ce08

Semester II

20MEST2E01 ADVANCED STEEL DESIGN 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To be thorough with the design of industrial components such as purlins, girts, rafter, tie runner, side runner, Eaves strut, truss members and vierendeel girder.
2. To get accustomed to various connections such as welded, riveted and seated connections (Unstiffened and Stiffened connections).
3. To focus on the study and design of various steel towers and steel chimneys.
4. To study the plastic analysis of steel structures.
5. To study the design concepts of light gauge steel structures
6. To design steel structures/ components by different design processes.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Design various components of industrial structure such as purlins, girts, tie runner, side runner and vierendeel girder.
2. Design different types of steel connections and joints.
3. Design high rise steel structures subjected to wind load.
4. Apply plasticity approach in steel design.
5. Perform design of light gauge steel structures.
6. Analyze and design beams and columns for stability, strength, and drift.

UNIT I PROPERTIES OF STEEL 9

Mechanical Properties, Hysteresis, Ductility. Hot Rolled Sections**:** compactness and non-compactness, slenderness, residual stresses.

UNIT II DESIGN OF STEEL STRUCTURES 9

Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift. Stability of Beams**:** Local Buckling of Compression Flange &Web, Lateral Torsional Buckling. Stability of Columns**:** Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.

UNIT III METHOD OF DESIGNS 9

Allowable Stress Design, Plastic Design, Load and Resistance Factor Design;

UNIT IV STRENGTH CRITERIA AND DRIFT CRITERIA 9

Strength Criteria:

Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.

Drift Criteria: P Effect, Deformation Based Design

UNIT V CONNECTIONS 9

Welded, Bolted, Location Beam Column, Column Foundation, Splices.

SUGGESTED READINGS:

1. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi, 2010
2. Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee, 2014.
3. IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
4. SP – 6 - Handbook of Structural Steel Detailing, BIS,1987
5. nptel.ac.in/courses/IIT-MADRAS/Design_Steel_Structures_II/index.php
6. nptel.ac.in/downloads/105106113/
7. Advanced analysis of steel building frames, M.JClarke R.QBridge G.JHancock N.STrahair
8. Advanced analysis for structural steel building design, Wai Fah Chen
9. Steel foam for structures: A review of applications, manufacturing and material properties, B.H. Smith | S. Szyniszewski | J.F. Hajjar | B.W. Schafer | S.R. Arwade
10. Strengthening of steel structures with fiber-reinforced polymer composites, J.G. Teng | T.Yu | D. Fernando

Semester II

20MEST2E02 DESIGN OF FORMWORK 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

1. To impart knowledge on formwork materials
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

COURSE OUTCOMES:

At the end of the course, students will be able to

1. Explain materials and behavior of formwork
2. Discuss the design of foundation, wall and column formwork
3. Describe the design the formwork for beam, slab, bridges and special structures
4. Demonstrate the design of Flying Formwork slipform techniques
5. Discuss the design of formwork for supports – Scaffolds and precast concrete
6. Select proper formwork, accessories and material.
7.

UNIT I INTRODUCTION AND FORMWORK MATERIALS 9

Requirements and Selection of Formwork, Formwork Materials-Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT II FORMWORK DESIGN 9

Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT III FORMWORK DESIGN FOR SPECIAL STRUCTURES 9

Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT IV FLYING FORMWORK 9

Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

UNIT V FORMWORK FAILURES 9

Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

SUGGESTED READINGS:

1. Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.
2. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, False workfor Concrete Structures - Guidelines, BIS.
4. nptel.ac.in/courses/105103093/pdf/concrete_uc.pdf
5. nptel.ac.in/courses/105105104/1

Semester II

20MEST2E03 DESIGN OF HIGH-RISE STRUCTURES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To introduce various aspects of planning of tall buildings and know about different types of loads.
2. To introduce various structural systems for high rise buildings with their behaviour and analysis.
3. To impart knowledge about analysis involved in tall structures.
4. To know about sectional shapes and design for differential movement, creep and shrinkage effects.
5. To impart knowledge about stability analysis of various systems and to know about advanced topics.
6. To Analyze. design and detail the tall buildings subjected to different loading conditions using relevant codes.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Identify different types of loading acting on tall buildings.
2. Interpret various structural systems used in the construction of tall structures.
3. Analyze different components of tall structures.
4. Design structural elements for secondary effects.
5. Evaluate stability analysis of frames for various secondary effects such as creep, shrinkage and temperature.
6. Analyze, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.

UNIT I DESIGN OF TRANSMISSION/ TV TOWER, MAST AND TRESTLES 9

Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT II RC CHIMNEY 9

Introduction, types, joint, analysis and design of RC Chimney, Foundation design for varied soil strata.

UNIT III STEEL CHIMNEY 9

Introduction, analysis and design of Steel Chimney, Foundation design for varied soil strata.

UNIT IV TALL BUILDINGS 9

Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Fire fighting design provisions.

UNIT V APPLICATION OF SOFTWARE 9

Application of software in analysis and design.

SUGGESTED READINGS:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi, 2002.

2. Structural Analysis and Design of Tall Buildings, Taranath B. S., Mc Graw Hill, 2011.
3. Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed), Shah V. L. & Karve S. R., Structures Publications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 2013.
5. nptel.ac.in/courses/105106113/3_multi_storey/

20MEST2E04 DESIGN OF MASONRY STRUCTURES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. Explain basic principles of design of masonry elements.
2. Apply the analysis procedures to find the member forces in connecting elements.
3. Use codal provisions to arrive strength of masonry.
4. Introduce the concepts of Prestressed masonry.
5. Apply elastic and inelastic analysis methods to predict masonry behavior under failure.
6. Analysis of Reinforced Masonry Members.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Apply the masonry design approaches.
2. Analyze Reinforced Masonry Members.
3. Determine interactions between members.
4. Determine shear strength and ductility of Reinforced Masonry members.
5. Check the stability of walls and Perform elastic and inelastic analysis of masonry walls.
6. Perform elastic and Inelastic analysis of masonry walls.

UNIT I INTRODUCTION 9

Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

UNIT II FLEXURAL STRENGTH 9

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.

UNIT III INTERACTIONS AND SHEAR STRENGTH 9

Interaction: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation. Shear Strength and Ductility of Reinforced Masonry Members.

UNIT IV PRESTRESSED MASONRY 9

Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

UNIT V ELASTIC AND INELASTIC ANALYSIS 9

Modeling Techniques, Static Push over Analysis and use of Capacity Design Spectra.

SUGGESTED READINGS:

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,2010
2. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
3. nptel.ac.in/syllabus/105102088/
4. nptel.ac.in/courses/105105110/pdf/m4l06.pdf

Semester II

20MEST2E05 DESIGN OF ADVANCED CONCRETE STRUCTURES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

To impart knowledge on

1. To understand the basic design concepts based on limit states.
2. To gain knowledge in designing special concrete structures such as grid floor, deep beam, slender column and corbel.
3. To be familiar with the design concept of yield line theory and designing flat slabs.
4. To understand plastic analysis and design of concrete structures.
5. To get familiar with the concepts like fire resistance of concrete, quality control at site and ductility
6. Explain the concepts of ductile detailing of R.C. members as per IS Codes

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Design structural elements for serviceability as per IS code.
2. Design RC special elements like slender columns, deep beams and corbels.
3. Design flat slab and apply yield line theory.
4. Adapt plastic design concept as per codal provisions.
5. Explain the practical issues in adapting detailing as a professional engineer.
6. Analyse the special structures by understanding their behaviour.

UNIT I INTRODUCTION AND DESIGN PHILOSOPHY 9

Design philosophy, Modeling of Loads, Material Characteristics.

UNIT II ADVANCE CONCRETE DESIGN IN RC BEAM 9

Stability Design, Pure, Flexural and Lateral, Design of Beam

UNIT III DEEP BEAM 9

Reinforced Concrete P-M, M-phi Relationships, Strut-and- Tie Method, Design of Deep Beam and Corbel

UNIT IV DESIGN OF RC COLUMN 9

Columns, Fatigue Resistant Design, IS code, AISC Standards and Eurocode.

UNIT V SHEAR WALL 9

Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Eurocode.

SUGGESTED READINGS:

1. Design of Steel Structures, Subramaniam N., Oxford University Press, 2008.
2. Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi,2008
3. Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.
4. nptel.ac.in/downloads/105105104/
5. https://onlinecourses.nptel.ac.in/noc17_ce23

6. Performance-based design in earthquake engineering: state of development, A Ghobarah Engineering structures
7. Developments and advanced applications of concrete-filled steel tubular (CFST) structures: Members, LH Han, W Li, R B jorhovde

Semester II

20MEST2E06 ADVANCED DESIGN OF FOUNDATIONS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

To impart knowledge on

1. Elucidate the importance of soil exploration for major construction projects.
2. Analyze and design shallow foundations.
3. Analyze the capacity of pile as single and in group.
4. Exposure to well foundations and tunnels.
5. Introduce the suitability of miscellaneous foundations like cofferdams
6. Decide the suitability of soil strata for different projects.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Decide the suitability of soil strata for different projects.
2. Design shallow foundations deciding the bearing capacity of soil.
3. Analyze and design the pile foundation.
4. Analyze well foundation and tunnels.
5. Apply theoretical concepts related to analysis of other miscellaneous foundations.
6. Understand analysis methods for well foundation.

UNIT I PLANNING OF SOIL EXPLORATION 9

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.

UNIT II SHALLOW FOUNDATIONS 9

Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

UNIT III PILE FOUNDATIONS 9

Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load-Settlement Behavior of Piles, Proportioning of Pile Foundations, Lateral and Uplift Capacity of Piles.

UNIT IV WELL FOUNDATION 9

IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods. Tunnels and Arching in Soils, Pressure Computations around Tunnels. Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.

UNIT V COFFER DAMS 9

Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

SUGGESTED READINGS:

1. Design of foundation system, N.P. Kurian, Narosa Publishing House,2001
2. Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, 2006.
3. nptel.ac.in/syllabus/105105039/
4. Structural design of isolated column footings, Fathi Abdrabbo Zaki I.Mahmoud

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester II

20MEST2E07 SOIL STRUCTURE INTERACTION 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on to

1. Make students understand soil structure.
2. Understand stress-strain characteristics of soils.
3. The mechanism of failure, the factors that affects the shear strength.
4. Structural behavior with soils.
5. Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
6. Prepare comprehensive design-oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Explain the importance of soil structure interaction.
2. Analyze the behavior of the soil under elastic and plastic condition as beam element.
3. Analyze the behavior of the soil as plate element.
4. Predict the behavior of the pile under static and dynamic loads.
5. Demonstrate the behavior of the laterally loaded piles.
6. Understand soil structure interaction concept and complexities involved.

UNIT I INTRODUCTION 9

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.

UNIT II ADVANCED APPLICATION 9

Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method. Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different

UNIT III SUBSOIL CHARACTERISTICS 9

Structure under various Conditions of Loading and Subsoil Characteristics.

UNIT IV DESIGN ORIENTED COMPUTER PROGRAMS 9

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc. Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics

UNIT V PILE FOUNDATION 9

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

SUGGESTED READINGS:

1. Analytical and Computer Methods in Foundation, Bowels J.E. Mc Graw Hill Book Co., New York, 2013.
2. Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
3. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
4. Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd,2010
5. Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing,2001
6. System identification for evaluating soil–structure interaction effects in buildings from strong motion recordings, JP Stewart, GL Fenves

20MEST2E08 DESIGN OF INDUSTRIAL STRUCTURES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

1. To impart knowledge in the area of planning and functional requirements for industrial structures.
2. To understand the basic idea about the materials and design of industry structural elements.
3. To know the design concepts of power plant structures.
4. To realize the design concepts of power transmission structures.
5. To understand the basic design concepts of chimneys, bunkers and silos and their construction techniques.
6. To study the behavior of members and connections, analysis and design of Industrial buildings and roofs, chimneys. Study the design of with cold formed steel and plastic analysis of structures.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Identify the various functional requirements of Industrial structure.
2. Design various structural elements of Industrial structure.
3. Classify and design of power plant structures.
4. Analyze and design power transmission structures.
5. Formulate the concepts in design concepts of chimneys, bunkers and silos
6. Explain the planning and functional requirements of Industrial Structures

UNIT - I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures –planning for lay out Requirements regarding Lighting, Ventilation and Fire safety- Protection against noise and vibration- guide lines from factories Act.

UNIT - II INDUSTRIAL, BUILDING 9

Roofs for Industrial Buildings- Steel and RC- folded plates and shell roofs- Gantry Girders- Design of Corbels and Nibs- Machine Foundations

UNIT - III POWER PLANT STRUCTURES 9

Bunkers and Silos - Chimney and cooling Towers – Design of steel storage tanks- Nuclear containment structures

UNIT - IV POWER TRANSMISSION STRUCTURES 9

Cables- Transmission Line Towers – Substation structures- Tower Foundations – Testing towers.

UNIT – V CURRENT DESIGN TRENDS 9

Concepts of shear walls, Walls-frames, tubular, Cores, outrigger, bundled tubes, diagonal tubes, mega tubes Environmental control structures for industries-concept of Electro static precipitators-functioning and components.

SUGGESTED READINGS:

1. Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers, 1998.
2. Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers, 2011.
3. Design of Steel Structures, Subramaniya, Oxford university Press,2008
4. nptel.ac.in/courses/105106113/3
5. https://www.springer.com/us/book/9783319908311
6. The nature and design of post-industrial organizations, GP Hube
7. Design methodologies: Industrial and educational applications, T Tomiyama, P Gu, Y Jin, D Lutters, C Kind

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester II

20MEST211 MODEL TESTING LAB 2H:2C

Instruction Hours/ Week: L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

- Understand the response of structures.
- Prepare the models.
- Understand the concept of free and forced vibrations
- To study the vibrations in different elements

COURSE OUTCOMES:

At the end of the course, students will be able to

1. Conduct model testing for static loading
2. Conduct model testing for free and forced vibrations
3. Conduct free and forced vibrations
4. Conduct vibration test on various structural elements

LIST OF EXPERIMENTS:

a. Response of structures and its elements against extreme loading events.
b. Model Testing: Static - testing of plates, shells, and frames models.
c. Free and forced vibrations, Evaluation of dynamic modulus.
d. Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain study, Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.

20MEST212 NUMERICAL ANALYSIS LAB 2H:2C

Instruction Hours/ Week : L:0 T:0 P:2 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP, BVP.
- To implement the methods using the spread sheet in Excel

COURSE OUTCOMES: At the end of the course, students will be able to

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method.
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules.
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-KuttaMethod.

CONTENTS:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations By Euler's Method.
10. Numerical Solution of Ordinary Differential Equations ByRunge- Kutta Method.

SUGGESTED READINGS:

1. Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, McGraw - Hill Pub. Co. Ltd., 2014.
2. Applied Numerical Analysis, Curtis F. Gerald and Patrick O. Wheatley, Pearson Education, South Asia, 2009.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester II

20MEST213 MINI PROJECT 4H:2C

Instruction Hours/ Week : L:0 T:0 P:4 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

1. Developing analytical skills of the students to address any specific structural related problems.
2. Select suitable experimental method to solve structural engineering problems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Use state of art technology for solving structural engineering problems
2. Carry out literature survey and narrow down the problem to solve it by experimental methods or using software
3. Identify structural engineering problems reviewing available literature.
4. Study different techniques used to analyze complex structural systems.

SYLLABUS:

Mini Project 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 highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester III

20MEST3E01 DESIGN OF PRESTRESSED CONCRETE STRUCTURES 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. To get exposed to various systems of pre-stressing.
2. To understand the design of flexural members for shear, bond and torsion and end blocks.
3. To acquire knowledge on continuous beams and their design.
4. To be familiar with the design of the tension and compression members and the process of pre-stressing.
5. To attain knowledge on design of pre-stressed concrete bridges.
6. To Design prestressed concrete deck slab and beam/ girders.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Analyze the pre-stressed concrete element using various methods.
2. Design pre-stressed concrete flexural members.
3. Design profiles for pre-stressed continuous beams.
4. Design pre-stressed tension and compression members as per codal recommendations.
5. Design pre-stressed concrete bridges as per IRC specifications.
6. Analyze prestressed concrete deck slab and beam/ girders.

UNIT- 1 INTRODUCTION TO PRESTRESSED CONCRETE 9

Types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

UNIT- 2 STATICALLY DETERMINATE PSC BEAMS 9

Design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions Analysis and design of prestressed concrete pipes, columns with moments

UNIT- 3 TRANSMISSION OF PRESTRESS 9

Transmission of prestressing pretensioned members; Anchorage zone stresses for post tensioned members.

UNIT- 4 STATICALLY INDETERMINATE STRUCTURES 9

Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

UNIT- 5 COMPOSITE CONSTRUCTION 9

Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack-width calculations

SUGGESTED READINGS:

1. Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 2010.
2. Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 2012.
3. Limited State Design of Prestressed Concrete, GuyanY., Applied Science Publishers, 1972.
4. IS: 1343- Code of Practice for Prestressed Concrete
5. www.nptel.ac.in/courses/105106117/
   Design of prestressed concrete precast road bridges with hybrid simulated annealing, JV Martí, F Gonzalez-Vidosa, V Yepes, J Alcalá

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester III

20MEST3E02 ANALYSIS OF LAMINATED COMPOSITE PLATES 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart the knowledge on fundamentals of composites.

1. To study the behavior of lamina.
2. To provide knowledge on behavior of laminate.
3. To study the effect of Hygrothermal forces on mechanical behavior of composite.
4. To get exposed to soft computing techniques.
5. To develop the computer programs for the analysis of composite plates.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Use various laminated composites.
2. Analyze the behavior of lamina.
3. Analyze the behavior of laminates.
4. Analyze the effect of Hydrothermal forces on mechanical behavior.
5. Familiarize with numerical and soft computing techniques.
6. Analyze the rectangular composite plates using the analytical methods.

UNIT 1 INTRODUCTION 9

Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

UNIT 2 EQUATIONS 9

Governing Equations. Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary

UNIT 3 SOLUTIONS 9

Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

UNIT 4 FINITE ELEMENT SOLUTIONS 9

Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT. Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses. Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT. Finite Element Model, C^0Element Formulation, Post Computation of Stresses.

UNIT 5 ANALYTICAL METHODS 9

Analysis of Rectangular Composite Plates using Analytical Methods.

SUGGESTED READINGS:

1. Mechanics of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.
2. nptel.ac.in/courses/105108124/pdf/Lecture Notes/LNm5.pdf
3. nptel.ac.in/courses/112104168/
4. Mechanics of laminated composite plates and shells: theory and analysis, JN Reddy
5. Analysis of laminated composite plates using a higher-order shear deformation theory, ND Phan, JN Reddy

20MEST3E03 FRACTURE MECHANICS OF CONCRETE STRUCTURES 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

To impart knowledge on

1. Gain knowledge in fracture mechanics principles.
2. Understand the effect of scale in fracture mechanics.
3. Exposed to numerical methods for analysis of concrete elements.
4. Understand the importance of numerical modeling.
5. Introduce steel fracture.
6. Apply fracture mechanics models to high strength concrete and FRC structures.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Apply the fundamentals of fracture mechanics to concrete structures.
2. Demonstrate scale effects in crack analysis of concrete elements.
3. Use FEM concepts to analyze cracked concrete members.
4. Model the pre cracked element
5. Explain the fracture of steel.
6. Identify and classify cracking of concrete structures based on fracture mechanics.

UNIT 1 INTRODUCTION 9

Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

UNIT 2 STRESS AT CRACK TIP 9

Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone,

UNIT 3 CORRECTION TO CRACK TIP 9

Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

UNIT 4 MATERIAL MODELS: 9

General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics.

UNIT 5 APPLICATIONS OF MODELING 9

Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

SUGGESTED READINGS:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Elementary Engineering Fracture Mechanics, Broek David, 3rd Rev. Ed. Springer, 1982.
3. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEM Report, Chapman and Hall, 1989.

4. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989.
5. nptel.ac.in/courses/105106053/17

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

Semester III

20MEST3E04 DESIGN OF PLATES AND SHELLS 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

Design Doubly Curved Shells using Approximate Solutions.

COURSE OUTCOMES: At the end of the course, the student will be able to:

1. Analyse and design prismatic folded plate systems.
2. Analyse and design shells using approximate solutions
3. Analyse and Design Cylindrical Shells
4. Analyse bending of long rectangular plates using thin plate theory Evaluate
5. CO2 Analyse circular plates with various loading conditions Evaluate CO3 Analyse rectangular plates using classical approach and methods Evaluate CO4 Analyse bending of Anisotropic plates Evaluate

SYLLABUS:

UNIT- I	Prismatic folded	9
UNIT- II	Plate Systems Shell Equations	9
UNIT- III	Approximate Solutions	9
UNIT- IV	Analyses and Design of Cylindrical Shells	9
UNIT- V	Approximate Design methods for Doubly Curved Shells.	9

SUGGESTED READINGS:

1. Theory of Plates and Shells, Timoshenko and Woinowsky-Krieger S., Tata McGraw Hill Edition, 2010.
2. Design and Construction of Concrete Shell Roofs, Ramaswamy G. S., 1st Edition, 2005.
3. Design of Reinforced Concrete Shells & Folded Plate, Varghese P. C., 2010
4. Design of Plate and Shell Structures, JawadMaan H., Springer Science.
5. https://onlinecourses.nptel.ac.in/noc18_me65
6. https://ocw.mit.edu/courses/mechanical.../2-081j-plates-and-shells

20MEST3E05 DESIGN OF EARTHQUAKE RESISTANT STRUCTURES 3 0 0 3 100

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40, External–60; Total-100
End Sem. Exam–3 Hrs.

COURSE OBJECTIVE:

1. To understand the seismic hazard parameters
2. To understand the Indian codal provisions and interprets the suitable application of codal provisions
3. To apply earthquake forces and response of the structure
4. To create capacity design of RC structures
5. To impart knowledge in analyze and design of structures by using software

COURSE OUTCOME:

On the successful completion of the course, students will be able to

1. Determine the seismic hazard parameters
2. Calculate the effect of EQ forces and response of the structure
3. Compresence the Indian codal provisions and interprets the suitable application of codal provisions.
4. Suggest capacity design of RC structures
5. Identify suitable configuration, Loads and perform push over analysis for Steel structures.
6. Analyse and design of structures by using software

UNIT I INTRODUCTION: 9

Elements of engineering seismology-causes of earthquakes, seismic waves, magnitude, intensity and energy release-Indian seismology-Earthquake History-Seismic zone Map of India-seismographs-seismogram-accelerograph-strong motion characteristics-initiation into vibration of structures.

UNIT II IS CODE PROVISIONS: 9

Modal response contribution-modal participation factor-response history-spectral analysis-approximate methods for lateral load analysis-IS 1893-2002 provisions-IS 4326 provisions-behavior and design of masonry structures-discussion of codes IS 13827 and 13828. Ductile detailing of reinforcement in RC Building as per IS 13920.

UNIT III SEISMIC ANALYSIS OF BUILDINGS: 9

Introduction to methods of seismic analysis-Equivalent static analysis IS 1893 provisions-Design horizontal seismic coefficient-design base shear-distribution-idealization of building frames-seismic analysis and modeling-determination of lateral forces-equivalent static lateral force method-response spectrum method-time history method-push over analysis-mathematical modeling of multistory RC Building.

UNIT IV SEISMIC DESIGN CONCEPTS: 9

Concept of earthquake resistant design-concept of ductility-lateral force resisting systems-strong column weak beam concept-guidelines for seismic resistant construction-beam column joints-effect of structural irregularities-Earthquake Resistant Design for multi storey RC frames, shear wall, braced frames and their combinations-capacity based design

UNIT V MODERN CONCEPTS: 9

Soil performance-Liquefaction-Modern concepts-base isolation-adaptive system-seismic evaluation-retrofiting and strengthening of structures-seismic retrofitting strategies.

COMPUTER AIDED ANALYSIS AND DESIGN: (For internal assessment only-not for theory examination) Computer aided analysis and design of building systems for earthquake loads-response spectrum-time history analysis-capacity based design-hands on session using computer software.

TOTAL HOURS:45

TEXT BOOKS

Name of the Book	Author Name	Publisher	Year
Dynamics of Structures-Theory and Applications to earthquake Engineering	Chopra A.K	Prentice-Hall of India Pvt. Ltd., New Delhi	2011
Earthquake Resistant Design of Structures	Pankaj Agarwal and Manish Shrikhande	Prentice-Hall of India Pvt. Ltd., NewDelhi	2006

REFERENCES:

Name of the Book	Author Name	Publisher	Year
Dynamics of Structures	Clough R.W., and Penzien J	McGraw Hill, INC	2011
Wind and Earthquake Resistant Buildings-structural Analysis & Design	Taranath B.S., , Marcell Decker	NewYork	2005
Earthquake Engineering Hand book	Chen W.F., & Scawthorn	CRC Press	2003
Earthquake Resistant Design of Structures	. Duggal	Oxford University Press	2007

WEB SITES:

1. www.springer.com
2. www.nptel.com
3. www.wikipedia.com
4. www.aboutcivil.com

OPEN ELECTIVES **Semester III**

20MESTOE01 BUSINESS ANALYTICS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

- Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Demonstrate the ability to translate data into clear, actionable insights.

COURSE OUTCOMES:

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.

UNIT- 1 BUSINESS ANALYTICS **9**

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics, Statistical Tools- Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview

UNIT- II TRENDINESS AND REGRESSION ANALYSIS **9**

Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III ORGANIZATIONAL SETUP: **9**

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes.

UNIT- IV DESCRIPTIVE ANALYSIS: **9**

Descriptive Analytics, predictive analytics, predicative modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive modeling, nonlinear Optimization

UNIT- V FORECASTING TECHNIQUES **9**

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression

SUGGESTED READINGS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021
OPEN ELECTIVES Semester III
20MESTOE02 INDUSTRIAL SAFETY 3H:3C

Instruction Hours/ Week: L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100
End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

To impart knowledge on

1. To provide comprehensive knowledge on the cause of accident and construction industry related laws.
2. To know in detail about the safety in various aspects of construction.
3. To have a knowledge about the preparation of accident report by analyzing the key factors.
4. To have a practical knowledge about the safety implementation by case studies.
5. Possess a mastery of Health safety and environment knowledge and safety management skills, to reach higher levels in their profession.
6. Knowledgeable safety Engineer rendering professional expertise to the industrial and societal needs at national and global level subject to legal requirements.

COURSE OUTCOME:

At the end of the course, the students will be able to

1. Understand the basic mandatory procedures to be followed in the construction industry.
2. Practice safety measures in construction sites.
3. Analyze accident causation, reporting and Investigation.
4. Do safety management in construction.
5. Understand the importance of agencies involved in rescue operation by various case studies.
6. Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to occupation health and safety practices.

UNIT-I: INDUSTRIAL SAFETY 9

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II: FUNDAMENTALS OF MAINTENANCE ENGINEERING 9

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III WEAR AND CORROSION AND THEIR PREVENTION: 9

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV: FAULT TRACING: **9**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V PERIODIC AND PREVENTIVE MAINTENANCE: **9**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

SUGGESTED READINGS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall Londo

OPEN ELECTIVES

Semester III

20MESTOE03 OPERATIONS RESEARCH 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.

COURSE OUTCOMES: At the end of the course, the student should be able to

1. Students should able to apply the concept of non-linear programming
2. Students should able to carry out sensitivity analysis
3. Student should able to model the real world problem and simulate it.

UNIT 1 MODEL FORMULATION: 9

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II SIMPLEX METHODS: 9

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III NONLINEAR PROGRAMMING 9

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV SCHEDULING AND SEQUENCING 9

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V PROGRAMMING: 9

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

SUGGESTED READINGS:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2.H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021
OPEN ELECTIVES Semester III
20MESTOE04 COST MANAGEMENT OF ENGINEERING PROJECTS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100
End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

- Cost engineering is concerned with the application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science, profitability analysis, project management, and planning and scheduling.

COURSE OUTCOMES:

1. Students should be able to understand and apply several major areas of knowledge and skills in Cost Engineering

UNIT 1- INTRODUCTION 9

Introduction and Overview of the Strategic Cost Management Process. Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT 2-PROJECT 9

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT 3- COST BEHAVIOR AND PROFIT PLANNING 9

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning,

UNIT 4 TOTAL QUALITY MANAGEMENT 9

Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT 5- QUANTITATIVE TECHNIQUES 9

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

SUGGESTED READINGS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021
OPEN ELECTIVES Semester III
20MESTOE05 COMPOSITE MATERIALS 3H:3C

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100
End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

- The Students Learn About The Benefits Gained When Combining Different Materials Into A Composite.

COURSE OUTCOME:

1. The Motive Is To Make The Students To Understand Different Processing Methods, Issues, Properties And Testing Methods Of Different Composite Materials.

UNIT–I INTRODUCTION 9

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II REINFORCEMENTS 9

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III MANUFACTURING OF METAL MATRIX COMPOSITES 9

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV MANUFACTURING OF POLYMER MATRIX COMPOSITES: 9

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V STRENGTH: 9

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

SUGGESTED READINGS:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

ME – STRUCTURAL ENGINEERING (FULL TIME) **2020-2021**

OPEN ELECTIVES **Semester III**

20MESTOE06 **WASTE TO ENERGY** **3H:3C**

Instruction Hours/ Week : L:3 T:0 P:0 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVES:

- To prepare student to excel in research or to succeed in Energy engineering profession through global, rigorous post graduate education.
- To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve energy engineering problems.

COURSE OUTCOME:

1. Graduates will demonstrate an ability a system, component or process as per needs and specifications.
2. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
3. Graduates will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
4. Graduates will demonstrate knowledge of professional and ethical responsibilities.
5. Graduate will be able to communicate effectively in both verbal and written form.
6.

UNIT-I INTRODUCTION TO ENERGY FROM WASTE **9**

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II BIOMASS PYROLYSIS **9**

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III: BIOMASS GASIFICATION: **9**

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV BIOMASS COMBUSTION: **9**

Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V BIOGAS: **9**

Properties of biogas (Calorific value and composition) - Biogas plant technologyand status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

SUGGESTED READINGS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021

OPEN ELECTIVES Semester III

20MEST391 PROJECT WORK – PHASE –I 20H:10C

Instruction Hours/ Week :L:0 T:0 P:20 Marks: Internal–40 , External–60; Total-100

End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

- To take up any research and challenging practical problem for finding better solutions.
- To provide a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

COURSE OUTCOMES:

At the end of the course, students will demonstrate the ability to

1. Identify a topic for study and carry out literature survey
2. Write a technical report related to selected topic
3. Present outcome of the study with the help of ppt.
4. Manage any type of design and construction projects.

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

ME – STRUCTURAL ENGINEERING (FULL TIME) 2020-2021
OPEN ELECTIVES Semester IV
20MEST491 PROJECT WORK – PHASE –II 32H:16C

Instruction Hours/ Week : L:0 T:0 P:32 Marks: Internal–120 , External–180; Total-300
End Sem. Exam–3 Hrs.

COURSE OBJECTIVESS:

To impart knowledge on

1. Developing analytical skills of the students to address any specific structural related problems.
2. Select suitable experimental method to solve the structural engineering problems.
3. Execution of the project using suitable techniques
4. On completion of the project work students will be in a position to take up any research and challenging practical problem for finding better solutions.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Identify the problem by analyzing the gap through literature survey
2. Conduct the experimental work to solve structural engineering problems
3. Validate the experimental results using simulation models
4. Write a technical report related to selected topic
5. Present outcome of the study with the help of ppt.
6. Manage any type of design and construction projects.

SYLLABUS:

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.