Curriculum and Syllabus for M. Tech in Structural Engineering

L-Lecture; T-Tutorial; P-Practical

1st Semester							
Course Code	Subject Code	Subject Name	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PC	SE101	Advanced Structural Analysis	3	1	0	4	4
PC	SE102	Soil Structure Interaction	3	1	0	4	4
PE-1	SE103	A. Advanced Pre-Stressed Concrete B. Theory of Plates and Shells C. Theory of Structural Stability	3	1	0	4	4
PE-2	SE104	A. Repair and Rehabilitation of Structure B. Analytical and Numerical Methods for Structural Engg. C. Structural Optimization	3	1	0	4	4
IPR		Research Methodology and IPR	2	0	0	2	2
AUDIT1		Disaster Management	1	0	0	1	0
B: LABORATORY:							
Core Lab-I	SE191	Structural Lab- I	0	0	0	2	2
Core Lab-II	SE192	CADD LAB	0	0	0	2	2
Total of Theory & Practical							22

2nd Semester							
Course Code	Subject Code	Subject Name	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PC	SE201	Theory of Elasticity and Plasticity	3	1	0	4	4
PC	SE202	Structural Dynamics and Earthquake Engineering	3	1	0	4	4
PE-3	SE203	A. Advanced Structural Design B. Advance Foundation Engg. C. Composite Materials and Structures	3	1	0	4	4
PE-4	SE204	A. Advance Concrete Technology B. Theory of Elastic Stability and Behavior of Metal Structure C. Bridge Engineering	3	1	0	4	4
AUDIT2		English for Research Paper Writing	1	0	0	1	0

B: LABORATORY:							
Core Lab-III	SE291	Structural Lab-II	0	0	0	2	2
Core Lab-IV	SE292	Computational Lab in Structural Engineering	0	0	0	2	2
C: SESSIONAL							
PROJECT & SEMINAR	SE281	Mini Project with Seminar	0	0	2	2	2
Total of Theory, Practical & Sessional							22

3rd Semester							
Course Code	Subject Code	Subject Code	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PE	SE301	A. Design of Structures for Dynamic Loads B. Design of Masonry Structure C. Design of Steel-Concrete Composite Structure	3	1	0	4	4
OE	SE302	A. Industrial Safety B. Operations Research C. Cost Management of Engineering Projects D. Waste to Energy	3	1	0	4	4
C: SESSIONAL							
Thesis/ Dissertation	SE381	Dissertation – Stage I (To be continued Next Semester)	0	0	24	24	12
Total of Theory, Practical & Sessional							20

4th Semester							
Course Code	Subject Code	Subject Name	Contact Hours / Week				Credit Points
			L	T	P	Total	
C: SESSIONAL							
Thesis/ Dissertation	SE481	Dissertation- Stage II (Final) (Continued from Semester-3)	0	0	32	32	16
Thesis/ Dissertation	SE482	Comprehensive Exam (Viva-Voce)	0	0	0	0	6
Total of Theory, Practical & Sessional							22

TOTAL CREDIT = 86

Curriculum 1st Semester							
Course Code	Subject Code	Subject Name	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PC	SE101	Advanced Structural Analysis	3	1	0	4	4
PC	SE102	Soil Structure Interaction	3	1	0	4	4
PE-1	SE103	A. Advanced Pre-Stressed Concrete B. Theory of Plates and Shells C. Theory of Structural Stability	3	1	0	4	4
PE-2	SE104	A. Repair and Rehabilitation of Structure B. Analytical and Numerical Methods for Structural Engg. C. Structural Optimization	3	1	0	4	4
IPR		Research Methodology and IPR	2	0	0	2	2
AUDIT1		Disaster Management	1	0	0	1	0
B: LABORATORY:							
Core Lab-I	SE191	Structural Lab- I	0	0	0	2	2
Core Lab-II	SE192	CADD LAB	0	0	0	2	2
Total of Theory & Practical							22

Syllabus-1st Semester

ADVANCED STRUCTURAL ANALYSIS
(CODE: SE 101)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

Course Outcomes:

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

1. Analyze the skeleton structure using stiffness analysis method
2. Apply Finite Element Analysis technique for structures
3. Analyze structural system through matrix method
4. Gather knowledge of various analysis techniques for structural system.
5. Create and Apply Finite element programming for analysis.

Course Contents

Module 1: Matrix Algebra – methods for matrix inversion and solution of simultaneous equations – band and sparse matrix techniques stiffness and flexibility matrices of structural elements – various co-ordinate system and their transformation and synthesis-matrix formulation of force and displacement methods – member approach.	16L
Module 2: Finite element concept in Engineering Analysis – Displacement model shape functions and element properties. Analysis of plane stress/strain – axi-symmetric stress analysis.	12L
Module 3: Weighted residual methods and variational formulation of Finite Element Analysis. Isoparametric element — Numerical integration – assemblage of elements. Solution techniques – Finite element programming – use of package programmes.	20L

Text / Reference Books:

Sl No.	Name	Author
1	Numerical Methods for Engineers	Chopra
2	Finite element procedure	K.J.Bathe
3	Matrix analysis of frame structure	Wever/Gere
4	Structural analysis – A matrix approach	G.S.Pandit and Gupta
5	Numerical Methods for Engineers	Steven C. Chapra, Raymond P. Canale

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	3	3	3
CO3	2	1	3	2	3	2
CO4	3	2	3	3	2	2
CO5	3	2	3	3	3	3

SOIL STRUCTURE INTERACTION
(CODE: SE 102)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

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

1. Identify situations where soil-structure interaction is likely to occur and assess its impact on the behaviour of a structure
2. Analyze finite and infinite length beams and plates on isotropic elastic medium
3. Analyze Axially and Laterally Loaded Piles and Pile Groups
4. Understand analysis and design of Beam on Elastic Foundation.
5. Evaluate sub grade reaction and elastic analysis.

Course Contents

Module 1: General soil-structure interaction problems: Contact pressures and soil-structure interaction for shallow foundations, concept of sub grade modulus, effects/parameters influencing subgrade modulus.	6L
Module 2: Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models.	8L
Module 3: Beam on Elastic Foundation: Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.	10L
Module 4: Plate on Elastic Medium: Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions.	6L
Module 5: Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.	10L
Module 6: Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, Sub-grade reaction and elastic analysis, Interaction analysis.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Elastic Analysis of Soil-Foundation Interaction	Selva durai, A. P. S
2	Pile Foundation Analysis and Design	Poulos, H. G., and Davis, E. H.
3	Foundation Analysis	Scott, R. F.
4	Structure Soil Interaction - State of Art Report	State of Art Report, Institution of Structural Engineers
5	Analysis and Design Procedures for combined footings and Mats	ACI 336. (1988), American Concrete Institute, 1988

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	3
CO2	2	1	3	3	3	2
CO3	2	1	3	2	3	3
CO4	2	1	3	2	3	2
CO5	3	2	3	3	3	3

ADVANCED PRESTRESSED CONCRETE
(CODE: SE 103A)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

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

1. Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
2. Analyse prestressed concrete deck slab and beam/ girders.
3. Design prestressed concrete deck slab and beam/ girders.
4. Design of end blocks for prestressed members.

Course Contents

Module 1: Introduction to prestressed concrete: 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.	8L
Module 2: Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.	8L
Module 3: Transmission of prestress in pretensioned members; Anchorage zone stresses for posttensioned members.	6L
Module 4: Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.	8L
Module 5: 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	12L
Module 6: Analysis and design of prestressed concrete pipes, columns with moments.	6L

Text / Reference Books:

Sl No.	Name	Author
1	Design of Prestressed Concrete Structures	Lin T.Y., Asia Publishing House, 1955.
2	Prestressed Concrete	Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.
3	Limited State Design of Prestressed Concrete	GuyanY., Applied Science Publishers, 1972
4	IS: 1343- Code of Practice for Prestressed Concrete	-
5	IRC: 112	-

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	2	3	2
CO3	2	1	3	2	3	3
CO4	2	1	3	2	3	3

THEORY OF PLATES AND SHELLS
(CODE: SE 103B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

Course Outcomes:

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

1. Identify the concept of thin plates using various approaches.
2. Analyze the thin plates subjected to different loading and boundary conditions.
3. Discuss the behavior of shells and their classifications and stress-strain and force-displacement relationship.
4. Analyze different types of shells subjected to different loading criterion and boundary conditions

Course Contents

Module 1: Differential equation of plate under transverse load, series solution.	8L
Module 2: Plates with different boundary conditions and their finite difference solutions.	8L
Module 3: Stress-strain relations and finite element formulation of plate bending problem.	8L
Module 4: Classical theory of shells – membrane and bending theories; Shallow shell theory.	8L
Module 5: Cylindrical and spherical shells – membrane theory and edge disturbance	8L
Module 6: FEM & BEM formulation of shell element and application.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Analysis of plates	T.K.Varadan and K.Bhaskar , Narosa Publishing House, 1999
2	Stresses in Shells	Flugge. Blaisdell Publishing Co, 1966
3	Design and construction of concrete shell roofs	y G.S.Ramaswamy, CBS Publishers& Distributors,1986

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	2	3	2
CO3	2	1	3	2	3	2
CO4	2	1	3	2	3	3

THEORY OF STRUCTURAL STABILITY
(CODE: SE 103C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

Course Outcomes:

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

1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analyzing discrete and continuous systems
4. Approaches in evaluating stability problems, including energy and numerical methods.

Course Contents

Module 1: Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.	8L
Module 2: Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.	8L
Module 3: Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.	8L
Module 4: Stability of Beams: lateral torsion buckling.	8L
Module 5: Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.	8L
Module 6: Introduction to Inelastic Buckling and Dynamic Stability.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Theory of elastic stability	Timoshenko and Gere, Tata Mc Graw Hill,1981
2	Principles of Structural Stability Theory	Alexander Chajes, Prentice Hall, New Jersey.
3	Structural Stability of columns and plates	Iyengar, N. G. R., Eastern west press Pvt. Ltd.
4	Strength of Metal Structures	Bleich F. Bucking, Tata McGraw Hill, New York.

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	2	3	2
CO3	2	1	3	2	3	3
CO4	2	1	3	3	3	3

REPAIR AND REHABILITATION OF STRUCTURE
(CODE: SE 104A)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

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

1. Diagonize the distress and Assess the health of structure using Non destructive tests
2. Assess and interpret the data received through Destructive field tests.
3. Understand how to prepare a report containing all details
4. Suggest repair and rehabilitation measures of the structure.
5. Knowledge about various special materials to be used for repair and rehabilitation

Course Contents

Module 1: Appraisal of damage and deterioration of structures by non-destructive and other techniques; Cause of deterioration	8L
Module 2: Environmental aspects and earthquake effects.	8L
Module 3: Repair and strengthening of superstructure – structural components, load bearing wall, panel walls.	8L
Module 4: Strengthening of foundation; Grouting; Grout material, guniting, shotcreting, under pinning.	8L
Module 5: Repair of steel structures – bridge, building, towers etc., monuments and historical structures. Prevention of water leakage in structures.	8L
Module 6: Under-water repair; Durability of repairing material; Case histories	8L

Text / Reference Books:

Sl No.	Name	Author
1	Testing of Concrete in Structure	Bungey (Surrey University Press)
2	Non Destructive Testing	Malhotra & Carino (CRC Press)
3	Corrosion of Steel in Concrete	Broomfield John P. (Taylor & Francis)

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	3
CO2	2	1	3	3	3	3
CO3	2	2	3	2	2	2
CO4	2	1	3	2	3	3
CO5	2	1	3	2	3	3

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGG.
(CODE: SE 104B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

Course Outcomes:

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

1. Solve one dimensional wave equation and one-dimensional heat conduction problems.
2. Explain functional dependency and solve Laplace and Euler's equations.
3. Apply separable kernel iterative method to solve integral equations of second kind
4. Estimate functional relationship between variables and parameters.

Course Contents

Module 1: Fundamentals of Numerical Methods: Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting; Interpolation and extrapolation.	8L
Module 2: Solution of Nonlinear Algebraic and Transcendental Equations.	8L
Module 3: Elements of Matrix Algebra: Solution of Systems of Linear Equations, Eigen Value Problems.	8L
Module 4: Numerical Differentiation & Integration: Solution of Ordinary and Partial Differential Equations.	8L
Module 5: Finite Difference scheme: Implicit & Explicit scheme.	8L
Module 6: Computer Algorithms: Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.	8L

Text / Reference Books:

Sl No.	Name	Author
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.

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	2
CO2	3	1	3	3	3	2
CO3	3	1	3	3	3	3
CO4	3	2	3	3	3	3

STRUCTURAL OPTIMIZATION
(CODE: SE 104C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT:4

Course Outcomes:

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

1. Gain knowledge to utilize through linear programming technique for optimization
2. Understand various optimization methods
3. Apply the technique for optimization of structural engineering problems
4. Apply Geometric and Dynamic Programming
5. Evaluate various structural Optimization with the help of latest software

Course Contents

Module 1: Classical methods – theory of layout – Differential calculus – simultaneous modes of failure – Fully stressed design –optimality criterial methods.	8L
Module 2: Mathematical programming and computer techniques – linear programming – Revised simplex method.	10L
Module 3: non-linear programming fundamentals – Methods for one dimensional minimization.	8L
Module 4: Direct search and gradient methods for unconstrained problems – use of penalty functions and sequential L.P. for constrained optimization problems.	12L
Module 5: Geometric programming and dynamic programming – application to structural engineering problem.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Engineering Optimization : Theory and Practice	Rao, Singireshel S.
2	Advances In Structural Optimization	J. Herskovits (Springer-Verlag New York, LLC)
3	Elements Of Structural Optimization	Raphael T. Haftka (Springer-Verlag New York, LLC)
4	Topology Optimization: Theory, methods and Applications	Springer, 2003 by M. P. Bendsoe, O. Signmund

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	2	3	2
CO3	2	1	3	2	3	3
CO4	2	1	3	2	3	3
CO5	2	1	3	3	3	3

RESEARCH METHODOLOGY AND IPR
(CODE: IPR)
L: 2 T: 0 P: 0
TOTAL CONTACT HOURS: 24
CREDIT:2

Course Outcomes:

1. Understand research problem formulation.
2. Analyze research related information, Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Contents

Module 1: 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	8L
Module 2: Effective literature studies approaches, analysis, Plagiarism, Research ethics	8L
Module 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	8L
Module 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	8L
Module 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.	8L
Module 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Research methodology: an introduction for science & engineering students	Stuart Melville and Wayne Goddard
2	Research Methodology: An Introduction	Wayne Goddard and Stuart Melville

3	Research Methodology: A Step by Step Guide for beginners	Ranjit Kumar, 2nd edition
4	Resisting Intellectual Property	Halbert, Taylor & Francis Ltd ,2007.
5	Intellectual Property in New Technological Age	Robert P. Merges, Peter S. Menell, Mark A. Lemley
6	Intellectual Property Rights Under WTO	T. Ramappa, S Chand

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2
CO2	3	2	3	2	2	2
CO3	2	2	2	2	2	2
CO4	2	2	2	2	2	2
CO5	2	2	2	2	2	2

DISASTER MANAGEMENT
(CODE: AUDIT 1)
TOTAL CONTACT HOURS: 12
L: 1 T: 0 P: 0
CREDIT: 0

Course Outcomes:

Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Contents

Module 1: Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	2L
Module 2: Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	2L

Module 3: Disaster Prone Areas In India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics	2L
Module 4: Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	2L
Module 5: Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation In Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.	2L
Module 6: Disaster Mitigation Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.	2L

Text / Reference Books:

Sl No.	Name	Author
1	Disaster Management in India: Perspectives, issues and strategies	R. Nishith, Singh AK, New Royal book Company
2	Disaster Mitigation Experiences And Reflections	Sahni, Pardeep Et.Al. (Eds.), Prentice Hall Of India, New Delhi.
3	Goel S. L. , Disaster Administration And Management Text And Case Studies	Deep &Deep Publication Pvt. Ltd., New Delhi.

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3
CO2	2	2	2	2	2	3
CO3	2	2	2	2	2	3
CO4	2	2	2	2	2	3

STRUCTURAL LAB- I
(CODE: SE191)
L: 0 T: 0 P: 3
TOTAL CONTACT HOURS: 36
CREDIT:2

Course Outcomes:

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

1. Design high-grade concrete and study the parameters affecting the performance
2. Conducting various tests on existing Concrete elements
3. Interpret the mechanical properties of concrete using the non-destructive testing methods.
4. Understand the behaviour of different structural components due to different loading conditions

Course Contents

Module 1. Mix design of concrete using the latest IS Codes	10P
Module 2. Physical tests on reinforcement	12P
Module 3. Tests on Compressive strength, Flexural Strength and Tensile Strength of Concrete using Compression Testing Machine, Universal Testing Machine and Tensile Testing Machine	6P
Module 4. Destructive and non-destructive tests on concrete using Rebound hammer and Ultrasonic-Pulse Velocity Tester	4P
Module 5. Detect and locate Reinforcement Steel (Rebar) embedded within concrete structure using the Rebar-locator.	4P

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	2
CO2	2	1	3	3	3	2
CO3	2	1	3	3	3	3
CO4	2	1	3	3	3	3

CADD LAB
(CODE: SE192)
L: 0 T: 0 P: 3
TOTAL CONTACT HOURS: 36
CREDIT:2

Course Outcomes:

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

1. Understand usage of different software for analysis and design
2. Apply methodology for modelling of different types of structures
3. Analyze structures with the aid of different structural software.
4. Design and detailing of RCC multi-storeyed frame and Industrial structure
5. Create detail drawing incorporating the design information

Course Contents

Module 1: Overview and important features of structural analysis and design tools.	4P
Module 2: Analysis, design, and preparation of detailed drawings for RCC structures using software.	10P
Module 3: Analysis, design, and preparation of detailed drawings for industrial steel structures using software.	8P
Module 4: Understanding the workflow for analysing multi-storeyed building frames using software.	6P
Module 5: Applying software tools to design multi-storeyed structural buildings with integration of ductile detailing.	6P
Module 6: Developing detailed and accurate structural drawings incorporating ductile detailing requirements.	4P

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	2
CO2	2	1	3	3	3	2
CO3	2	1	3	3	3	2
CO4	2	1	3	3	3	3
CO5	2	1	3	3	3	3

Curriculum 2nd Semester							
Course Code	Subject Code	Subject Name	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PC	SE201	Theory of Elasticity and Plasticity	3	1	0	4	4
PC	SE202	Structural Dynamics and Earthquake Engineering	3	1	0	4	4
PE-3	SE203	A. Advanced Structural Design B. Advance Foundation Engg. C. Composite Materials and Structures	3	1	0	4	4
PE-4	SE204	A. Advance Concrete Technology B. Theory of Elastic Stability and Behavior of Metal Structure C. Bridge Engineering	3	1	0	4	4
AUDIT2		English for Research Paper Writing	1	0	0	1	0
B: LABORATORY:							
Core Lab-III	SE291	Structural Lab-II	0	0	0	2	2
Core Lab-IV	SE292	Computational Lab.	0	0	0	2	2
C: SESSIONAL							
PROJECT & SEMINAR	SE281	Mini Project with Seminar	0	0	2	2	2
Total of Theory, Practical & Sessional							22

Syllabus-2nd Semester

THEORY OF ELASTICITY AND PLASTICITY
(CODE: SE 201)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

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

1. Understand analysis by two- and three-dimensional system
2. Solve problems using elasticity principles
3. Obtain solutions for the torsion of a straight bars of different sections
4. Gain knowledge on basic concepts on Plasticity and yield criteria
5. Apply and find solution of elasto plastic analysis of torsion and bending problems

Course Contents

Module 1: Elasticity: Introduction to tensor analysis; three dimensional stress and strain analysis. Two dimensional problems in cartesian, polar and curvilinear co-ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions. Torsion of rectangular bars including hollow sections, bending problems. Energy principles, variational methods and numerical methods.	24L
Module 2: Plasticity: basic concepts and yield criteria. Equations of plasticity, elasto-plastic analysis of torsion and bending problems, torsion of a bar of oval section (Sokoloskey's method), problems of spherical and axial symmetry, slip lines and plastic flow, strain hardening.	24L

Text / Reference Books:

Sl No.	Name	Author
1	Theory of Plasticity	Chakraborty
2	Theory of Elasticity	Timoshenko S.P. and Goodier
3	Theory of Elasticity and Plasticity	Timoshenko S.P. and Woinowsky-Kreiger
4	Plasticity Theory	Jacob Lubliner
5	Theory of Elasticity and Plasticity	Harold Malcolm Westergaard (HUP)

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	1	3	2	3	2
CO3	2	1	3	2	3	2
CO4	2	1	3	2	3	2
CO5	2	1	3	2	3	3

STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING
(CODE: SE 202)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

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

1. Apply Knowledge by developing the equation of motion for vibratory systems and solving for the free and forced response
2. Create simple models for structures using knowledge of structural dynamic
3. Interpret dynamic analysis result for design and analysis purposes.
4. Apply Structural dynamics theory to Earthquake analysis response and design of structure
5. Apply Knowledge to create mathematical modelling

Course Contents

Module 1: Introduction – Single and multi-degree freedom systems, un-damped and damped systems, numerical integration scheme, modal analysis for undamped and damped systems.	12L
Module 2: Vibration of continuous elastic media – Beam, Plates.	12L
Module 3: Characteristics of earthquake, Earthquake response of structures, Concept of earthquake resistant design.	12L
Module 4: Codal provision for design of buildings, design of liquid storage tanks, liquefaction, non-engineered construction, special topics.	12L

Text / Reference Books:

Sl No.	Name	Author
1	Structural dynamics theory and computation	Paz Mario
2	Seismic analysis of the Structure	T.K.Dutta
3	Introduction to Structural Dynamics	John M. Biggs (McGraw Hill)
4	Dynamics of Structures	Jagmohan L. Humar (A. A. Balkema Publisher)

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	2
CO2	2	1	3	3	3	2
CO3	2	1	3	3	3	3
CO4	2	1	3	3	3	3
CO5	2	1	3	3	3	2

ADVANCED STRUCTURAL DESIGN
(CODE: SE 203A)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

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

1. Understand the methodology of Design through latest available computing tools.
2. Analyze various types of Structures commonly required for Projects
3. Design different structural configuration using latest codes and standards.
4. Optimize the design considering the functionality and the economy.
5. Satisfy environmental sustainability

Course Contents

Module 1: Flat slab, Grid slab, Deep beam, Shear wall, Frame shear wall interaction.	16L
Module 2: Cylindrical shell, Structures for handing materials like silo and bunkers, Liquid retaining structures, Pile and Pile cap.	16L
Module 3: Design provisions as envisaged in various Indian Standards.	16L

Text / Reference Books:

Sl No.	Name	Author
1	Design of Reinforce Concrete Structures	A. K. Gupta
2	Limit State Design of RCC	A.K. Jain
3	Limit State Design of RCC Structure	Pillai & Menon

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	3	3	2
CO2	2	1	3	3	3	2
CO3	2	1	3	3	3	3
CO4	2	1	3	3	3	3
CO5	2	1	3	2	3	3

ADVANCED FOUNDATION ENGINEERING
(CODE: SE 203B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

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

1. Suggest various bearing capacity determination techniques
2. Design shallow foundation considering settlement.
3. Understand to estimate settlement
4. Design Pile foundation for Vertical and lateral load and moment and uplift load and Well foundation.
5. Understand to design foundation on expansive soil

Course Contents

Module 1: Bearing capacity: Bearing capacity of shallow foundation in layered soils, Footings on slopes, Foundation with uplift or tension forces.	8L
Module 2: Settlements: Settlement Analysis of shallow foundations in sand, clay, and layered deposits, Reliability of settlement calculations, Structural tolerances.	10L
Module 3: Design of rectangular footings, combined footings and mat foundations.	8L
Module 4: Deep foundations: Pile foundations under vertical and lateral loads, Negative skin friction of piles; Uplift capacity of piles, Well foundations.	12L
Module 5: Foundations on expansive soils; Introduction to soil dynamics and machine foundation.	10L

Text / Reference Books:

Sl No.	Name	Author
1	Foundation Analysis & Design	J.E. Bowels (Mc Graw Hill)
2	Principles of Foundation Engg.	B.M. Das (PWS Publishing)
3	Pile Foundation- Analysis & Design	Poulus & Davis
4	Constructional methods in Foundation Engineering	Koener
5	Foundation design and construction	Tomlinson .M.J.
6	Raft foundation design and analysis with practical approach	Gupta. S. C

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	2	2	2	3	2
CO3	2	1	3	2	3	2
CO4	3	2	2	2	3	3
CO5	2	1	2	2	3	3

COMPOSITE MATERIALS AND STRUCTURES
(CODE: SE 203C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

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

1. Understand composite materials.
2. Gather knowledge on advantages and drawbacks of Composite over monolithic materials
3. Gather knowledge about various types of composites
4. Know applications in various are of use

Course Contents

Module 1: FRP composites, Types, Mechanics, behavior, properties, application	16L
Module 2: Steel — Concrete composite structures, design philosophy, shear connectors, beams, girders and slabs.	16L
Module 3: Concrete — Pre-stressed concrete composite structures.	16L

Text / Reference Books:

Sl No.	Name	Author
1	Composite structure of steel and concrete	by Johnson
2	Mechanics of composite material and structure	M. Mukhopadhay (university press)
3	An Introduction to Composite Material	D. Hull (Cambridge University Press)
4	Engineering Mechanics of Composite Material	Isaac M. Daniel & Ori Ishai (OUP)
5	Steel Concrete and Composite Design of Tall Building	Bungate Taranath (McGraw Hill)

CO – PO Mapping:

	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2
CO2	3	3	2	2	3	2
CO3	2	1	3	2	3	2
CO4	3	2	1	2	3	3

ADVANCED CONCRETE TECHNOLOGY
(CODE: SE 204A)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

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

1. Know new kind of materials used and their compatibility in concrete making
2. Understand different types of concrete
3. Design High Performance concrete with various latest ingredients
4. Apply waste materials in working concrete to protect the environment
5. Understand how to vary parameters and properties of fresh and hardened concrete

Course Contents

Module 1: Microstructural aspects of cement paste; Models of hydrated Portland cement gel; Mechanism, application and specification of chemical admixtures, mineral admixtures and other cement replacement materials; Special cementitious systems, viz., phosphate cement, magnesium oxychloride cement, regulated set cement, high alumina cement etc.; concrete- environment interaction; Marine concrete; Resistance of concrete to Fire and influence of temperature; Extreme weather concreting.	28L
Module 2: Properties and mix proportioning of flyash concrete, silica fume concrete, fiber reinforced concrete, sprayed concrete, high performance concrete, self-compacting concrete and geopolymer concrete.	20L

Text / Reference Books:

Sl No.	Name	Author
1	Design of Concrete Mixes	Krishna Raju
2	Concrete Microstructure, Properties and Material	P.kumar Mehta &Paulo J. M. Monteiro
3	Concrete Technology	M.S. Shetty (S. Chand)
4	Properties of Concrete	A. M. Neviel
5	Concrete Technology	Shanta Kumar, Neviel & Brookes
6	Progress in Cement and Concrete in Series	S. N. Ghosh

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2
CO2	3	2	3	2	3	2
CO3	2	2	2	2	3	2
CO4	1	3	3	2	3	3
CO5	2	2	2	2	3	3

THEORY OF ELASTIC STABILITY AND BEHAVIOR OF METAL STRUCTURE
(CODE: SE 204B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

1. Introduce the students to the fundamentals of stability theory
2. Understand how stability theory is applied to both elastic and inelastic column buckling
3. Analyse how stability theory is applied to rigid frames and beam-columns
4. Apply the knowledge for analysis and designing of practical problem

Course Contents

Module 1: Introduction; Fundamental principles and models for elastic stability, stability of column; classification of dynamical systems, linear and nonlinear eigen value problems. Stability of plates, frames, beams and arches Lateral buckling of beams, combined bending and axial force, combined bending and torsion.	16L
Module 2: Buckling of thin elements Torsional buckling of thin walled structures and open sections Column-strength curves.	16L
Module 3: Buckling and post-buckling strength of plate elements with special references to the codal provisions. Behavior of light gauge steel structures.	16L

Text / Reference Books:

Sl No.	Name	Author
1	Fundamental of Structural Stability	Simitses
2	Stability Analysis and Design of Structures, New Delhi	Gambhir M.L
3	Stability of structure	Banzant
4	Structural Stabilty of steel- Concepts and Applications for structural engineers	Galambos Theodore V
5	Advanced Design in Structural Steel	Lothers – Prentice – Hall
6	Design of Steel Structure	S. K. Duggal (McGraw Hill)
7	Design of Steel Structure	N. Subramanian

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2
CO2	3	2	3	2	3	2
CO3	2	2	2	2	3	3
CO4	1	3	3	2	3	3

BRIDGE ENGINEERING
(CODE: SE 204C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

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

1. Understand the concept of Planning and site investigation for Bridges..
2. Analyze and Design of various types of bridges including piers and abutments.
3. Analyze and Design of Pre-tensioned as well as Post-tensioned prestressed concrete Beams.
4. Gain knowledge of scour, foundation including open well, pile and caisson .
5. Calculate and design the requirement and type of Bearings

Course Contents

Module 1: Introduction, historical review, Engineering and aesthetic requirements in bridge design, Introduction to bridge codes.	6L
Module 2: Economic evaluation of a bridge project. Site investigation and planning;. Factors affecting scour and its evaluation.	8L
Module 3: Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures.	10L
Module 4: Superstructure - analysis and design of right, skew and curved slabs. Girder bridges - types, load distribution, design.	12L
Module 5: Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges.	12L

Text / Reference Books:

Sl No.	Name	Author
1	Principle & Practice of Bridge Engineering	S.P. Bindra- Dhanpat Rai
2	Bridge Engineering	Demetrios E. Tonias, Jim J. Zhao
3	Design of Bridge Structures	Jagadish & Jayaram – Prentice Hall
4	Bridge Engineering	S. Ponnuswamy (Manohar Publishers & Distributor)

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2
CO2	3	3	3	3	2	3
CO3	2	2	2	2	3	3
CO4	2	3	3	3	3	2
CO5	2	2	2	3	2	3

ENGLISH FOR RESEARCH PAPER WRITING
(CODE: AUDIT 2)
L: 1 T: 0 P: 0
TOTAL CONTACT HOURS: 12
CREDIT: 0

Course Outcomes:

Students will be able to:

1. Understand how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
Ensure the good quality of paper at very first-time submission
4. Gain knowledge about technical writing for research purposes

Course Contents

Module 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	2L
Module 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	2L
Module 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	2L
Module 4: key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	2L
Module 5: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.	2L
Module 6: useful phrases, how to ensure paper is as good as it could possibly be the first-time Submission.	2L

Text / Reference Books:

Sl No.	Name	Author
1	Writing for Science, Yale University Press	Goldbort R (2006)
2	How to Write and Publish a Scientific Paper, Cambridge University Press	Day R (2006)
3	Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book	Highman N (1998),
4	English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011	Adrian Wallwork

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	3	2	1	1	1
CO2	2	3	2	1	1	1
CO3	2	3	2	1	1	1
CO4	2	3	2	1	1	1

STRUCTURAL LAB- II
(CODE: SE291)
L: 0 T: 0 P: 3
TOTAL CONTACT HOURS: 36
CREDIT:2

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

1. Analyse test data to assess the physical properties of Fresh and Hardened Concrete.
2. Interpret the structural performance of the concrete Beam, Column and Beam-Column Junction.
3. Apply test data to understand the behaviour of the RCC Beam and Column
4. Conduct Tests on the RCC to understand the quality of concrete.

Course Contents

Module 1. Casting and testing of RCC Beam and Column	14P
Module 2. Permeability Test on Concrete specimen	6P
Module 3. Workability test on fresh concrete	8P
Module 4. Testing of the RCC Beam–column junction.	8P

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	2	3	3	2
CO2	2	2	3	2	3	3
CO3	3	2	3	3	2	3
CO4	2	1	2	3	3	2

COMPUTATIONAL LAB IN STRUCTURAL ENGINEERING
(CODE: SE292)
L: 0 T: 0 P: 3
TOTAL CONTACT HOURS: 36
CREDIT:2

Course Outcomes:
Students will be able to:
CO1: Apply working knowledge about computer aided design methods and procedures
CO2: Analyze structural problem using standard software
CO3: Create higher end 3D model for analysis and designing of structures
CO4: Prepare detail drawing incorporating the design information

Course Contents

Module 1. Modelling and assembly techniques of various structures.	6P
Module 2. Create higher end 3D solid models.	8P
Module 3. Application of finite element method in regular structures.	8P
Module 4. Application of finite element method in irregular structures.	6P
Module 5. Application of finite element method in special structures.	8P

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2
CO2	3	2	3	3	2	2
CO3	2	1	3	2	3	3
CO4	2	2	3	3	2	3

MINI PROJECT WITH SEMINAR
(CODE: SE281)
L: 0 T: 0 P: 2
TOTAL CONTACT HOURS: 24
CREDIT: 2

Course Outcomes:

At the end of the course:

1. Students will get an opportunity to work in actual industrial environment if they opt for internship.
2. In case of mini project, they will solve a live problem using software/analytical/computational tools.
3. Students will learn to write technical reports.
4. Students will develop skills to present and defend their work in front of technically qualified audience.

Course Contents

Module 1: Problem identification in design engineering.	2P
Module 2: Solution development for identified engineering problems.	2P
Module 3: Verification and analysis of available experimental data.	2P
Module 4: Conducting experiments in various engineering subjects.	2P
Module 5: Material characterization and property evaluation.	2P
Module 6: Application of software tools for engineering problem solving.	2P

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	2	3	2
CO2	3	1	3	3	3	3
CO3	2	3	2	1	2	1
CO4	2	3	2	1	2	1

Curriculum 3rd Semester							
Course Code	Subject Code	Subject Code	Contact Hours / Week				Credit Points
			L	T	P	Total	
A: THEORY:							
PE	SE301	A. Design of Structures for Dynamic Loads B. Design of Masonry Structure C. Design of Steel-Concrete Composite Structure	3	1	0	4	4
OE	SE302	D. Industrial Safety E. Operations Research F. Cost Management of Engineering Projects G. Waste to Energy	3	1	0	4	4
C: SESSIONAL							
Thesis/ Dissertation	SE381	Dissertation – Stage I (To be continued Next Semester)	0	0	24	24	12
Total of Theory, Practical & Sessional							20

Syllabus-3rd Semester

DESIGN OF STRUCTURES FOR DYNAMIC LOADS
(CODE: SE 301A)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 52
CREDIT: 4

Course Outcomes:

1. Understand the fundamental dynamic parameters of civil structures and their influence on response under various dynamic loads
2. Students will identify the most appropriate method and solve the equation of motion for a discrete multiple degree-of-freedom structural system.
3. Compute seismic and wind load combinations on structural systems.
4. Solve a multiple degree-of-freedom structural system using a nonlinear analysis platform under various dynamic loads.
5. Analyse probabilistic response evaluation and performance based design.

Course Contents

Module 1: Review on Multiple Degree-of-Freedom (MDOF) Systems, Approximate Methods for MDOF Systems, Modal Participation and Combinations

Module 2: Seismic Response of MDOF Systems, Introduction to Seismic Hazard, Design for Seismic Loads

Module 3:. Introduction for Wind Loads, Design for Wind Loads, Codal provisions

Module 4: Introduction to Nonlinear Systems, Introduction to Nonlinear Modelling Platforms, Calibration and Evaluation

Text / Reference Books:

Sl No.	Name	Author
1	Structural dynamics theory and computation	Paz Mario
2	Seismic analysis of the Structure	T.K.Dutta
3	Introduction to Structural Dynamics	John M. Biggs (McGraw Hill)
4	Dynamics of Structures	Jagmohan L. Humar (A. A. Balkema Publisher)

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	3	2	3	3	3	2
CO3	3	1	3	3	3	3
CO4	2	2	2	3	3	3
CO5	2	1	3	3	3	3

DESIGN OF MASANORY STRUCTURES
(CODE: SE 301B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 52
CREDIT: 4

Course Outcomes:

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

1. Understand the masonry design approaches.
2. Analyse 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.

Course Contents

Module 1: Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces	8L
Module 2: Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.	8L
Module 3: Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.	8L
Module 4: Shear Strength and Ductility of Reinforced Masonry Members.	8L
Module 5: Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns.	10L
Module 6: Elastic and Inelastic Analysis, Modeling Techniques, Static Pushover Analysis and use of Capacity Design Spectra.	10L

Text / Reference Books:

Sl No.	Name	Author
1	Design of Reinforced Masonry Structures,	Narendra Taly, ICC, 2nd Edn,
2	Masonry Structures: Behavior and Design	Hamid Ahmad A. and Drysdale Robert G., 1994.
3	Mechanics of Masonry Structures,	Editor: Maurizio Angelillo, 2014.
4	Earthquake-resistant Design of Masonry Buildings,	Toma_evi_Miha, Imperial College Press, 1999

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	2	2	3	2
CO2	3	2	3	2	3	2
CO3	2	2	3	2	3	3
CO4	2	1	3	2	3	3
CO5	2	1	2	2	3	3

DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURE
(CODE: SE 301C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

1. Students will able to analyse composite beams, columns, trusses and box-girder bridges including the related connections.
2. Students will gain knowledge to design different composite civil structures
3. Students can apply knowledge to solve practical problems related to composite structure
4. They will get exposure on case studies related to steel-concrete constructions of buildings.

Course Contents

Module 1: Introduction to steel - concrete composite construction – COEs – Composite action – Serviceability and - Construction issues.	10L
Module 2: DESIGN OF CONNECTIONS: Shear connectors – Types – Design of connections in composite structures – Degree of shear connection – Partial shear interaction	10L
Module 3: DESIGN OF COMPOSITE MEMBERS: Design of composite beams, slabs, columns, beam – columns - design of composite trusses.	10L
Module 4: COMPOSITE BOX GIRDER BRIDGES: Introduction - behaviour of box girder bridges - design concepts.	10L
Module 5: CASE STUDIES: Case studies on steel - concrete composite construction in buildings - seismic behaviour of composite structures.	8L

Text / Reference Books:

Sl No.	Name	Author
1	"Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol.I	Johnson R.P, Blackwell Scientific Publications, 2004.
2	"Composite Steel and Concrete Structural Members, Fundamental behaviour"	Oehlers D.J. and Bradford M.A, Pergamon press, Oxford, 1995
3	"Steel Designers Manual", Steel Concrete Institute(UK)	Owens.G.W and Knowles.P, Oxford Blackwell Scientific Publications, 1992.

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	3	2	3	2	3	3
CO3	3	2	3	2	3	3
CO4	2	1	3	2	3	3

INDUSTRIAL SAFETY **(CODE: SE 302A)** **L: 3 T: 1 P: 0** **TOTAL CONTACT HOURS: 48** **CREDIT: 4**	
Course Outcomes: **CO1:** To develop knowledge about the safety rules and regulations, standards and codes applicable for engineering industry. **CO2:** To understand various mechanical machines and their safety importance. **CO3:** To understand the principles of machine guarding and operation of protective devices. **CO4:** To analyse the working principle of engineering processes such as metal forming and joining process and their safety risks. **CO5:** Developing the knowledge related to health and welfare measures in engineering industry.	
Course Contents	
Module 1: Industrial safety: 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.	8L
Module 2: Fundamentals of maintenance engineering: 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.	8L
Module 3: Wear and Corrosion and their prevention: 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.	8L
Module 4: Fault tracing: 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.	12L
Module 5: Periodic and preventive maintenance: 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	12L

Text / Reference Books:

Sl No.	Name	Author
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 London.

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3
CO2	2	1	2	2	2	2
CO3	2	1	2	2	2	2
CO4	2	1	2	2	2	2
CO5	2	2	2	2	2	3

OPERATIONS RESEARCH
(CODE: SE 302B)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

At the end of the course, the student should be able to

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

Course Contents

Module 1: Optimization Techniques, Model Formulation, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	10L
Module 2: Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method - sensitivity analysis - parametric programming	8L
Module 3: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT	8L
Module 4: Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	12L
Module 5: Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	10L

Text / Reference Books:

Sl No.	Name	Author
1	Operations Research, An Introduction,	H.A Taha, PHI, 2008
2	Principles of Operations Research,	H.M. Wangner, PHI, Delhi 1982
3	Introduction to Optimisation: Operations Research,	J.C. Pant, Jain Brothers, Delhi, 2008
4	Operations Research	Hitler Libermann, McGraw Hill Pub. 2009

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	3	2	3	2
CO2	2	2	2	2	3	2
CO3	2	1	3	2	3	3
CO4	2	1	3	3	3	3

COST MANAGEMENT OF ENGINEERING PROJECTS
(CODE: SE 302C)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Course Outcomes:

The objectives of this course are to:

CO1. To make them understand the concepts of Project Management for planning to execution of projects.

CO2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.

CO3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.

CO4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

Course Contents

Module 1: Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost.	8L
Module2: Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making. 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 nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents	8L

Module3: 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	8L
Module4: 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.	8L
Module5: Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, 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.	8L
Module 6: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	8L

Text / Reference Books:

Sl No.	Name	Author
1	Cost Accounting A Managerial Emphasis	Prentice Hall of India, New Delhi
2	Advanced Management Accounting	Charles T. Horngren and George Foster,
3	Management & Cost Accounting	Robert S Kaplan Anthony A. Alkinson,
4	Principles & Practices of Cost Accounting	Ashish K. Bhattacharya, A. H. Wheeler publisher

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	3
CO2	2	1	2	2	2	3
CO3	2	1	2	2	2	3
CO4	2	2	2	2	2	3

WASTE TO ENERGY
(CODE: SE 302D)
L: 3 T: 1 P: 0
TOTAL CONTACT HOURS: 52
CREDIT: 4

Course Outcomes:

CO1: To enable students to understand of the concept of Waste to Energy.
CO2: To link legal, technical and management principles for production of energy form waste.
CO3: To learn about the best available technologies for waste to energy.
CO4: To analyze of case studies for understanding success and failures.
CO5: To facilitate the students in developing skills in the decision-making process.

Course Contents

Module 1: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	10L
Module 2: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	10L
Module 3: Biomass Gasification: 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.	10L
Module 4: Biomass Combustion: 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	10L
Module 5: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and 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.	12L

Text / Reference Books:

Sl No.	Name	Author
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	Biomass Conversion and Technology	C. Y. Were Ko-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

CO – PO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	1	2	3	2	3
CO2	2	2	2	3	2	3
CO3	2	2	2	2	3	2
CO4	3	1	2	2	2	3
CO5	3	1	2	2	3	3