DHARMSINH DESAI UNIVERSITY

FACULTY OF TECHNOLOGY

Department of Civil Engineering

COURSE STRUCTURE FOR POST GRADUATE PROGRAM: M. TECH. (CIVIL-STRUCTURAL ENGG)

w.e.from 2025-26 **TOTAL CREDIT 80**

SEM.	Sr. No.	SUBJECT	WORK LOAD			TOTAL	Credit	MARKS				
			Th	T	P			Th	Sess	TW	Pract	Total
Sem-I	1	Advanced Structural Analysis	3	2	0	**5**	**5**	60	40	25	-	**125**
	2	Advanced Foundation Engineering	3	2	0	**5**	**5**	60	40	25	-	**125**
	3	Solid Mechanics with FEA	3	2	0	**5**	**5**	60	40	25	-	**125**
	4	Structural Design Practice-I	3	0	3	**6**	**4.5**	60	40	25	25	**150**
	5	Elective Paper: 1	3	1	0	**4**	**4**	60	40	25	-	**125**
		TOTAL	**15**	**7**	**3**	**25**	**23.5**	**300**	**200**	**125**	**25**	**650**
Sem-II	1	Dynamics and EQ Engineering	3	2	0	**5**	**5**	60	40	25	-	**125**
	2	Structural Design Practice-II	3	0	3	**6**	**4.5**	60	40	25	25	**150**
	3	Elective Paper : 2	3	2	0	**5**	**5**	60	40	25	-	**125**
	4	Research Methodology	3	0	0	**3**	**3**	40	-	-	-	**40**
	5	Elective Paper : 3	3	2	0	**5**	**5**	60	40	25	-	**125**
		TOTAL	**15**	**6**	**3**	**24**	**22.5**	**220**	**120**	**75**	**25**	**565**
	Domain Specific Skill based Course Mandatory for Exit											
	1	Elastic Stability of Structures	**3**	**0**	**0**	**3**	**3**	60	-	-	-	**60**
	2	Reliability Based Structural Design	**3**	**0**	**0**	**3**	**3**	60	-	-	-	**60**

SEM.	Sr. No.	Subject	WORK LOAD			Total	Credit	MARKS				
			Th	T	P			Th	Sess	TW	Pract	Total
Sem-III	1	Dissertation based on Research Work or based on Field Data Part-1	0	0	30	**30**	**15**	-	-	100	200	**300**
	2	Seminar -1	0	0	4	**4**	**2**	-	-	50	-	**50**
		TOTAL	**0**	**0**	**34**	**20**	**17**	**0**	**0**	**150**	**200**	**350**
Sem-IV	1	Dissertation based on Research Work or based on Field Data Part-2	0	0	30	**30**	**15**	-	-	100	200	**300**
	2	Seminar -2	0	0	4	**4**	**2**	-	-	50	-	**50**
		TOTAL	**0**	**0**	**34**	**20**	**17**	**0**	**0**	**150**	**200**	**350**

List of Program Electives

Sr No	Subject
1	Prestressed Concrete
2	Bridge Engineering
3	Structural Optimization & Reliablity
4	Design of Special Structures
5	Soil Structure Interaction
6	Advanced Concrete Technology
7	Theory of Thin Plates & Shells
8	Theory of Structural Stability
9	Numerical Methods

Syllabi Book

For
Post Graduate Course of
Civil-Structural Engineering

Department of Civil Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.
http://www.ddu.ac.in

(w.e.f July - 2025)

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)

ADVANCED STRUCTURAL MECHANICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

The objective of this course is to strengthen matrix structural analysis by most versatile and advanced method of analysis.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to the structural analysis and stiffness Matrix method of analysis	04	CO1
[2]	Member stiffness approach for analysis of skeletal structures: beams, plane truss, plane frame with computer programming	12	CO2
[3]	Member stiffness approach for analysis of skeletal structures: grid, space truss, space frame with computer programming	12	CO3
[4]	Special Problems: effect of shear deformation in stiffness matrix, consideration of local load (inclusive of temperature) effects; formulation of geometric stiffness due to axial force; Introduction to Material non-linearity and Geometric non-linearity, Step by step procedure of analysis of structures.	06	CO4

C. TEXT BOOKS

1. William Weaver, James M. Gere; *Matrix Analysis of Framed Structure;* 3rd ed.; Van Nostrand Reinhold: New York
2. Dr. A. S. Meghre, S. K. Deshmukh, Matrix Methods of Structural Analysis; Charotar Publishing House

D. REFERENCE BOOKS

1. Ghali, Amin Neville, Structural Analysis _ A Unified Classical and Matrix Approach; Seventh Edition, Taylor And Francis, 2017
2. John F. Fleming, Computer Analysis of Structural Systems; McGraw-Hill Companies
3. K. I. Majid, Non-Linear Structures; Butterworths
4. William McGuire, Richard H. Gallagher, Ronald D. Ziemian, Matrix Structural Analysis, 2nd Edition, Faculty Books.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Evaluate	Understand stiffness method for analysis
CO2	Analysis	To handle member stiffness matrix analysis for basic structures.
CO3	Analysis	To analyses member stiffness matrix analysis for special structures.
CO4	Application	The course will give basic knowledge of nonlinear analysis. And use of commercial software for the purpose of analysis

F. COURSE MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	3	1	2	1	2	2	1	3	1
CO2	1	3	1	3	1	3	3	1	3	2	2	3	1	3
CO3	2	2	3	2	3	2	3	2	1	1	3	2	3	2
CO4	2	2	2	1	2	1	2	3	2	3	1	1	2	2
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: ADVANCED FOUNDATION ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	0	3	3	40	0	0	0	40

A. COURSE OVERVIEW

The course is designed for to build the necessary theoretical background for design and construction of foundation systems.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**Shallow Foundations** Bearing capacity theories (Shear criteria): Prandtl's, Rankine's, Meyerhof's, Skempton's, Bearing capacity from Plate Load Test.	3	CO1
[2]	**Bearing Capacity of Combined Footings** Rectangular combined footings, trapezoidal combined footings	2	CO1
[3]	Bearing Capacity of Raft or Mat Foundation Introduction, Common types of Mat foundation, Bearing Capacity calculation.	2	CO1
[4]	**Pile Foundations** Methods of determining axial load carrying capacity of single pile: Dynamic formulae (Engineering News Formula and Modified Hiley's Formula), Pile Load Test on sand, clay and layered soil, Efficiency of Pile group, Axial load carrying capacity of pile group in clay and sand, Negative skin friction, Ultimate lateral resistance of single pile: Brom's theory, Concept of Free head and Fixed head pile, Lateral load carrying capacity of single pile as per IS-2911 in cohesive and cohesionless soil, Dimensional analysis of elastic pile theory (Reese and Matlock) in cohesionless soil, Reese's approach in cohesive soil, design of pile cap.	11	CO2
[5]	**Under-reamed Pile** Introduction, Installation method, Bearing capacity of under-reamed pile.	3	CO2
[6]	**Well Foundations** Types of wells, components of well foundation, requirement of shape of wells, Forces acting on wells, Lateral stability of well foundation	5	CO3
[7]	**Free and fixed cantilever sheet pile walls, anchored bulkheads** Cantilever sheet pile wall in sand and clay, Anchored sheet pile wall, Free earth support method and Fixed earth support method.	6	CO4
[8]	**Foundations on difficult subsoil** Collapse potential and settlement, Computation of collapse settlement, treatment method, General characteristics of swelling soils, Design of foundation in swelling soils	2	CO5
[9]	**Ground Improvement Techniques** Improvement techniques, Surface compaction, Drainage method, Vibration Method, Pre-compression and consolidation, Grouting, Chemical stabilization	2	CO5

C. TEXT BOOKS

1. Das, B. M. (2020). Advanced Soil Mechanics, Fifth Edition. United Kingdom: Taylor Francis Group
2. Punmia B. C. Soil Mechanics and Foundations; Laxmi Publications

D. REFERENCE BOOKS

1. Murthy V. N. S, Soil Mechanics and Foundation Engineering; UBS Publisher
2. Arora K. R. Soil Mechanics and Foundation Engineering; Standard Publishers Distributors
3. Das B. M. Principles of Geotechnical Engineering; Tata McGraw Hill.
4. Bowles J. E. Physical and Geotechnical Properties of soils; McGraw Hill Book Company
5. Saran, S. (2018). Analysis and Design of Substructures: Limit State Design. India: CBS Publishers & Distributors.
6. Coduto, D. P. (2001). Foundation Design: Principles and Practices (2nd Edition). United Kingdom: Prentice Hall.
7. Kaniraj, S. R., Kaniraj, A. (1988). Design Aids in Soil Mechanics and Foundation Engineering. India: Tata McGraw-Hill

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Design of shallow footings like isolated and mat footings.
CO2	Apply	Design of Deep foundation like pile and under-reamed pile.
CO3	Understand	Understand types of well and analyse Lateral stability of well foundation.
CO4	Analyze	Analyse anchored and cantilever sheet pile wall.
CO5	Remember	Identify expansive soil and suggest suitable types of ground improvement techniques.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	3	2	3	2	3	3	3
CO2	3	3	3	3	3	3	2	3	2	3	2	3	3	3
CO3	3	3	3	3	3	3	2	3	2	3	2	3	3	3
CO4	3	3	3	3	3	3	2	3	2	3	2	3	3	3
CO5	2	2	1	2	1	2	1	3	2	3	1	3	2	1
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)

SUBJECT: SOLID MECHANICS WITH FINITE ELEMENT APPLICATIONS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

To Understand the use of FEM to a range of Engineering Problems and the application of the FEM technique to solve linear 2D structural beams and Continuum problems

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to the Solid mechanics and finite element method, Steps in finite element analysis.	04	CO1
[2]	Introduction: State of stress and strain at a point in two and three dimensions, stress and strain invariants, Hooke's law, plane stress and plane strain	04	CO2
[3]	Formulation of shape functions and element stiffness matrix derivation line, truss and beam elements	10	CO3 CO4
[4]	Formulation of shape functions and element stiffness matrix derivation triangular and rectangular elements.	10	CO3 CO4
[5]	Isoperimetric element Analysis	08	CO5

C. TEXT BOOKS

1. Cook R.D; *Concepts and Applications of Finite Element Analysis*, 1st Edition; Wiley, John & Sons 2006

D. REFERENCE BOOKS

1. K J Bathe; Finite Element procedures in engineering analysis, Prentice- Hall India Pvt. Ltd, 1982
2. J. N. Reddy; An Introduction to Finite Element Methods, 3rd edition; John Wiley and sons, 2005
3. Tirupathi K., Chandrapatla, Ashok D. Belagundu, "Introduction to Finite Elements in Engineering", 1st edition, 2013.
4. S. S. Rao, "The Finite Element Methods in Engineering", Elsevier, 4th Edition, 2013
5. Krishnamoorthy C.S; Finite Element Analysis; McGraw-Hill India: New Delhi, 2019

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Evaluate	Understand the Solid mechanics
CO2	Comprehension	Learning the basics of Theory of Elasticity
CO3	Analysis	Formulate stiffness matrices for Bar, truss, beam, plane stress problems.
CO4	Analysis	Analyse 1D and 2D problems using Finite element method
CO5	Application	Apply the concept isoparmetric element in the FEM

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	1	1	3	2	1	2	3	3
CO2	1	2	3	1	2	2	1	1	3	2	1	3	2	2
CO3	2	3	2	2	2	1	1	1	2	1	2	2	2	2
CO4	3	2	3	3	3	2	1	1	3	2	1	2	3	2
CO5	2	3	2	3	3	1	1	1	3	1	2	3	2	3

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: STRUCTURAL DESIGN PRACTICE-I

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	3	6	4.5	60	40	25	25	150

A. COURSE OVERVIEW

This course is to introduce the basic design philosophy and principles of concrete structure design. The course combines basic structural fundamentals and analysis methods into a single unified treatment and provides a background to understand the structural design methods in the design field.

This course provides the concepts of design the various structural RCC elements and special structures using different design methods with application to structural engineering problems as per relevant Indian Standards.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Introduction to various design methods i.e. Working Stress Method, Ultimate Load Method and Limit State Method.	2	CO1
[2]	• Design of Singly Reinforced and Doubly Reinforced Rectangular Beams for Limit State of Collapse for Flexure. Design of Flanged Beams for Limit State of Collapse for Flexure • Design of Rectangular Beams for Limit State of Collapse for Shear and Torsion.	6	CO2, CO3
[3]	Design of One-way and Two-way simply supported and continuous Slabs.	6	CO3, CO4
[4]	Design of Short and Slender Columns subjected to Axial Load and Uniaxial or Biaxial Bending. Development of non-linear P-M-M relationship.	6	CO4, CO3
[5]	Design of Isolated and Combined Footings. Preparation and use of excel sheets for RCC element design	7	CO5, CO4
[6]	Multistory buildings, Earthquake Resistant Design, machine foundation, Complete design and structural detailing of structures as per IS Standards, Design of material retaining structures.	9	CO5

C. TEXT BOOKS

1. H. J. Shah, *Reinforced Concrete, Vol. I and II*, Charotar Publishing.
2. S Unnikrishna Pillai & Devdas Menon, *Reinforced Concrete Design*, Tata McGraw Hill Publication

D. REFERENCE BOOKS

1. N. Krishna Raju, R. N. Pranesh, *Reinforced Concrete Design*, New Age International Publishers.
2. P. C. Varghese, *Design of RCC Structures*, PHI Publications

3. Punmia B.C "Advanced RCC Design" Laxmi Publications Pvt. Ltd". 2006.
4. Varghese A. V., Advanced Reinforced Concrete, Varghese, Prentice Hall of India.
5. Sinha S. N., Reinforced Concrete Design, Tata Mc-Graw Hill, Delhi.
6. Indian standard Code: 456 2000, *Code of Practice for plan & reinforced concrete.*
7. Special Publications -16, *Design Aids for Reinforced Concrete to IS: 456*, 1987

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	To understand various design methods of structures and brief history.
CO2	Design	Design of RCC flexural & shear members using Limit state method.
CO3	Design	Design and detailing of various RCC structural elements as per Indian code guidelines.
CO4	Design	Design of RCC compression member and footing of structures using limit state method.
CO5	Design	Apply the principles, procedures and current Indian code requirements to design structural elements.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	1	-	-	1	1	1	1	2	2	2
CO2	3	2	3	1	3	1	1	2	2	3	2	3	3	3
CO3	2	2	2	1	2	1	-	2	2	1	1	2	3	2
CO4	2	2	3	1	2	1	2	1	2	1	1	2	3	3
CO5	3	3	3	1	3	1	1	3	2	2	1	3	3	3
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)

SUBJECT: THEORY OF THIN PLATES AND SHELLS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	1	0	4	4	60	40	25	0	125

A. COURSE OVERVIEW

Objective of the course:

- To study the behaviour of the plates and shells with different geometry under various types of loads.

- Classical approaches will be used to provide the student with a firm grasp of the fundamentals necessary to perform critical interpretations, required when computer-based solutions are implemented in practice.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Thin plate: small deflection theory, plate equation. Applications of Navier's solution, Levy's solution, tables & charts for solution of rectangular and circular plates, use for rectangular water tanks with different boundary conditions.	**16**	CO1, CO2
[2]	Shell behaviour, shell surfaces and characteristics, classification of shells equilibrium equations in curvilinear co-ordinates. Stress-strain & force displacement relations. Membrane analysis of shells of revolution and cylindrical shells under different loads.	**16**	CO3
[3]	Applications of membrane solution of elliptic paraboloids and hyperboloids. Solution of some typical problems.	**4**	CO4

C. TEXT BOOKS

1. S. Timoshenko, S. Woinowsky-Krieger; *Theory of Plates and Shells*; McGraw-Hill

D. REFERENCE BOOKS

1. W. T. Marshall*; The Design of Cylindrical Shell Roofs*; Princeton
2. G. S. Ramaswamy; *Design and Construction of Concrete Shell Roofs*; R.E. Krieger
3. N. K. Bairagi; *A Text Book of Plate Analysis*; Khanna Publishers
4. N. K. Bairagi; *Shell Analysis*; Khanna Publishers
5. R. Szilard; *Theory and Analysis of Plates: Classical, Numerical and Engineering Methods;* John Wiley & Sons

E. COURSE OUTCOMES

On the successful completion of this course students will be able to
CO1: Students will demonstrate key factual knowledge of the underlying assumptions in the theory of plates and shells.
CO2: Students shall understand the rudimentary principles involved in the analysis and design of plates and shells.
CO3: The solutions will be developed by the students towards understanding of structural behaviour using applications of plates & shells.
CO4: Students will be able to relate the academic material of the theory of plates and shells to real-life problems.

F. COURSE MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	3	1	2	1	2	2	1	3	1
CO2	1	3	1	3	1	3	3	1	3	2	2	3	1	3
CO3	2	2	1	2	3	2	3	2	1	1	1	2	3	1
CO4	2	2	3	3	2	1	1	3	2	3	3	1	2	3

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)

SUBJECT: THEORY OF STRUCTURAL STABILITY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	1	0	4	4	60	40	25	0	65

A. COURSE OVERVIEW

To make students familiar with the concepts of structural stability.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.	5	CO1
[2]	Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of frame members.	8	CO2
[3]	Stability of Beams: Lateral torsional buckling. Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling. Stability of Plates: Axial flexural buckling, shear flexural buckling, buckling under combined loads.	8	CO3 CO4
[4]	Introduction to Inelastic Buckling and Dynamic Stability	3	CO5

C. TEXT BOOKS

1. Stephen P. Timoshenko, James M Gere, *Theory of Elastic Stability*; 2nd ed; Dover Publications, Inc.

D. REFERENCE BOOKS

1. Alexander Chajes. *Principles of Strctural Stability Theory:* Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
2. N. G. R. Iyenger. *Structural Stability of Columns and Plates*; Ellis Horwood Publisher, Ltd.
3. Bleich F. Buckling, *Buckling Strength of Metal Structures*; 1st ed; McGraw-Hill.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Students will be able to understand basic concepts of stability of structures, concept of stability of discrete and continuous systems, linear and nonlinear behaviour.
CO2	Evaluate	Students will be able understand the concept of stability and evaluate the stability of frames

CO3	Analysis	Students will be able to understand the concept of stability for member and evaluate the stability of member such as beam and column
CO4	Analysis	Students will be able to evaluate the stability of plates element
CO5	Comprehension	Students will be able to understand the concepts of inelastic buckling and dynamic stability

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	1	1	2	2	2	2	1	1	1	2
CO2	3	2	2	3	2	2	3	3	1	3	2	2	2	2
CO3	2	3	1	2	3	2	1	2	1	2	3	2	1	1
CO4	1	2	2	1	1	1	2	2	2	1	1	1	2	3
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: NUMERICAL METHODS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	1	0	4	4	60	40	25	0	125

A. COURSE OVERVIEW

To familiarize the students in the field of differential equations to solve Initial -Boundary value problems associated with engineering applications. To obtain solutions for functional optimization related problems using MATLAB software. Student developed MATLAB code of numerical methods to structural engineering problem. Students developed in depth knowledge of various structural engineering software.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Advanced MATLAB Applications for Solution of non – linear algebraic equations, numerical solutions of ordinary differential equations and partial differential equations, its applications to structural engineering problems. Solution of Eigen value problems, iterative methods & transformation methods. Use of software for transformation methods. Computer oriented algorithms	18	CO1 CO2, CO3
[2]	Correlation and regression, Principles of least squares, Euler's equation -Functional dependent on first and higher order derivatives	8	CO4
[3]	• Laplace transform methods, Laplace equation -Properties of harmonic functions -Fourier transform methods for Laplace equation. • Application to Structural Engineering: Software Usage: Modeling, analysis and design using professional software like STAAD, STRAP, STRUDS, RISA 3D as Group exercise	10	CO5

C. TEXT BOOKS

1. Chapra S C and Canale R P, *Numerical Methods for engineering*, Mcgraw-Hilllnc, 7th Edition, 2016.

D. REFERENCE BOOKS

1. Rajasekaran. S, *Numerical Methods in Science and Engineering A Practical Approach*, S.Chand & Co., New Delhi, 1st edition, 1999 (Reprint 2012).
2. Scheid F, *Theory and problems of Numerical analysis*, New York. McGraw Hill Book Co. (Shaum Series), 1988.
3. Sastry S S, *Introductory Methods of Numerical Analysis*, Prentice-Hall of India, 1998
4. S.C. Chhapra, *Applied Numerical Methods with MATLAB for Engineers and Scientists*, McGraw Hill Education.
5. J.H. Mathews and K.D. Fink, *Numerical Methods using MATLAB*, Pearson Publishing.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Understand the basics of MATLAB programming
CO2	Application	Develop the computer programs in MATLAB for numerical methods
CO3	Application	Apply MATLAB for solving structural engineering problems
CO4	Application	Applying Laplace equation and Laplace transformation to engineering problem and Euler's equation
CO5	Analysing	Develop mathematically model and analyse physical system

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	2	2	1	1	2	1	1	1	2	1
CO2	2	2	1	3	2	1	2	3	1	2	2	1	2	1
CO3	3	2	1	2	3	1	2	2	2	1	1	1	1	2
CO4	1	1	2	1	1	3	3	1	3	2	1	2	2	1
CO5	1	1	1	2	2	2	1	2	2	1	1	1	1	1
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: DYNAMICS AND EARTHQUAKE ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

The course is designed for impart the knowledge of causes and effects of earthquakes on structures in structural engineering. This course provides the concepts of theories of vibration of SDOF and MDOF systems also gives the background of seismic analysis of RCC structures using IS Code provisions. This course helpful to understand design methodology as per IS codes provisions that improved later load resistance of the structures.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	SDOF Systems: Equation of motion, free vibration, harmonic load, evaluation of damping, periodic load, general load (time-domain, frequency domain) response spectrum load.	8	CO1, CO2
[2]	MDOF systems: Structural matrices, undamped free vibrations; generation of damping matrix; mode superposition analysis; practical considerations.	10	CO1, C03
[3]	Characterization of ground motion; earthquake intensity and magnitude; recording instruments and baseline correction; predominant period and amplification through soil; Earthquake spectra for elastic and in-elastic systems, idealization of structural systems for low, medium and high-rise building;	10	CO4
[4]	Effect of foundation/soil on earthquake response; Codal provisions.	8	CO5

C. TEXT BOOKS

1. A.K.Chopra; *Dynamics of structures*, Pearson, New Delhi
2. Manish Shrikhande & Pankaj Agrawal; *Earthquake resistant design of structures*, PHI Publication, New Delhi.

D. REFERENCE BOOKS

1. Mario Paz, *Structural Dynamics: Theory and Computation*, 2nd Edition, CBS Publisher.
2. R,W.clough and J.Penzien, *Dynamics of Structures*, 2nd revised Edition, McGraw – Hill Education,
3. S.K.Duggal, *Earthquake resistance design of structures*, Oxford University Press, New Delhi.
4. Park & Pauly; *Behaviour of RC structure*
5. Criteria for earthquake resistant design General provision & Building - IS: 1893 (Part I)-2016
6. Code of Practice for Ductile Detailing of RC Structures - IS: 13920 (2016).

7. IITK-bmtpc, Earthquake Tips "Learning Earthquake Design and Construction" by C.V.R.Murthy, Building Material and Technology Promotion Council

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Analysis	Determine the response of single and multi-degree freedom systems.
CO2	Application	Demonstrate the knowledge and understanding of principles of dynamics under varying loading conditions.
CO3	Application	Apply appropriate techniques to analyze and interpret data for solving problems related to single and multi-degree freedom systems.
CO4	Understanding	Understand earthquake ground motion characteristics and earthquake spectra
CO5	Analysis	Determine response of foundation/soil under dynamic loading and IS codal provision

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	2	1	1	3	2	1	2	1	3	1	2
CO2	2	1	2	1	2	2	2	2	2	2	2	2	2	1
CO3	3	3	2	1	3	1	3	3	2	3	1	3	2	2
CO4	2	1	1	2	1	2	3	2	1	1	2	1	1	2
CO5	1	3	1	1	2	1	1	2	3	2	2	3	2	1
Avg														

M. TECH. SEMESTER – II (CIVIL-STRUCTURAL ENGINEERING)

SUBJECT: STRUCTURE DEISGN PRACTICE-II

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	3	6	4.5	60	40	25	25	150

A. COURSE OVERVIEW

To make students familiar with the design of Steel structures.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Introduction to various design methods i.e., Working Stress Method, Ultimate Load Method and Limit State Method - Brief History and Comparison.	1	CO1
[2]	Connections (riveted, bolted & welded) for Unstiffened, Moment and Shear resisting Structural Connections, Design and detailing of connection between Roof Truss to Column, Column to Beam, Beam to Beam and Truss to Bed Block.	9	CO1 CO2
[3]	• Design of Tension and Compression members made up of single and built-up sections, Choice of sections • Lacing and battering column. • Design of Slab base subjected to axial load, uniaxial bending.	8	CO1 CO3
[4]	• Design of members subjected to combined actions, bending with compression/tension. • Design of laterally restrained and unrestrained beams including deflection check.	6	CO1 CO4
[5]	Complete design and structural detailing of Industrial buildings, Gantry Girder, Godowns, cantilever sheds, platform roofs etc.	12	CO1 CO5

C. TEXT BOOKS

1. Subramanian. N, *Design of steel structures*; Oxford Publication Press.
2. Duggal, S.K, *Limti State Design of Steel Strctures*; McGraw Hill Education (P) Ltd, New Delhi.

D. REFERENCE BOOKS

1. S.S Bhavikati. *Design of Steel Strcutures: By Limit State Method as per IS 800-2007;* I. K. International Pvt. Ltd.
2. Ramamrutham. S. *Design of steel structures*; Dhanpat Rai Publishing Company.
3. Dr. Ramchandra, & Virendra Gehlot, Design of Steel Structures; Vol-1 & Vol-2; Scientific Publishers Journals Dept.
4. Dayaratnam. P, *Design of steel structures*; S.Chand Publisher, 2007.

E. IS SPECIFICATION

1. IS: 800:2007, Indian Standard General Construction in Steel-Code of Practice.

2. IS: 875 (Part 1 to 5), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
3. IS: 6533 (Part-1 & 2), Design and Construction of steel Chimney- Code of Practice.
4. SP 6(1):1964, Handbook for Structural Engineers

F. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Students will be able to understand the fundamental concept of manufacture of steel, methods of design, connection, tension member, compression member, built-up sections, slab base, flexure member, member subjected to combine effects, plate girder, gantry girder and Industrial buildings.
CO2	Application	Students will be able to understand fundamental concepts of Connection analysis and their design & detailing
CO3	Decision Making	Students will be able to design and detail Tension member, Compression member, and slab base.
CO4	Decision Making	Students will be able to design and detail of flexure members and member subjected to combined actions.
CO5	Decision Making	Students will be able to design and detail the Industrial structure, gantry girder, Gowdowns, platform roofs etc.

G. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	.
CO1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CO5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
..		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Avg																	

M. TECH. SEMESTER – II (CIVIL-STRUCTURAL ENGINEERING)

SUBJECT: DESIGN OF SPECIAL STRUCTURES

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	-	125

A. COURSE OVERVIEW

To make students understand design practices for Reinforced Concrete and Steel structures and solve design problems. To provide a coherent development to the students for the courses in sector of Reinforced Concrete Designing and Steel Structure. To present the foundations of many engineering concepts related designing of structures. To involve the application of scientific and technological principles of design of buildings according to limit state method of design.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
(a)	**DESIGN OF REINFORCED CONCRETE STRUCTURES**		
[1]	**DESIGN OF FOUNDATION** Design of different types of combined footing on boundary of plot, strip footing, strap footing, raft foundation with IS provision.	**06**	CO2, CO1
[2]	**DESIGN OF RCC FLAT SLAB** Advantages and Disadvantages of flat slab, Drop and capital in flat slab. Direct design method and equivalent frame method. IS provision related to flat slab.	**06**	CO2, CO1
[3]	**DESIGN OF SHEAR-WELL** Classification of shear walls, loads in shear wall, design of rectangular and flanges shear walls, coupled shear wall	**06**	CO3, CO1
(b)	**DESIGN OF STEEL STRUCTURES**		
[1]	**DESIGN FOR TORSION** Torsion loading in practice, behaviour of member to torsion, approximate design procedure for torsion, torsional stiffening, torsional buckling, torsional deformation.	**07**	CO3, CO1
[2]	**DESIGN OF STEEL STRUCTURES** Design & Detailing of Steel structures such as Plate Girders, Chimney, Towers, foot overbridge etc.	**07**	CO4, CO1
[3]	**FIRE RESISTANCE DESIGN OF STEEL STRUCTURES** Fire engineering design of steel structures, calculation approaches, design curves and fire models	**04**	CO5

C. TEXTBOOKS

1. Shah. H.J.; *Design of R.C.C. Structures*, 12th ed.; Vol-II; Charotar Publication, 2021.
2. Unnikrishna. S. P., Devdas. M.; *Reinforced Concrete Design*, 4th ed.; McGraw Hill Publication, 2021.
3. Subramanian. N.; *Design of Steel Structures*; Oxford University Press, 2008.
4. Duggal. S.K, *Limit State Design of Steel Structures*, 3rd ed.; McGraw Hill Publication, 2017.
5. Ram Chandran.; *Limit State Design of Steel;* Structure Standard Publication, 2008.

D. REFERENCE BOOKS

1. Varghese. C.P.; *Design of R.C.C. Structures*, 2nd ed.; PHI Publication., 2008.
2. Sinha. N. S.; *Reinforced Concrete Design*, 3rd ed.; McGraw Hill Education., 2017.
3. Pillai and Devadas Menon, *Reinforced Concrete Design*, 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., 2003.
4. S. Ramamrutham, *Design of Reinforced concrete Structures*, 2nd Edition, Dhanpat Rai Publishing Co Pvt Ltd, , 2015.
5. *Design of Steel Strcutures: By Limit State Method as per IS 800-2007;* I. K. International Pvt. Ltd.
6. Ramamrutham. S.; *Design of Steel Structures*, 3rd ed.; Dhanpatrai Publication Company., 2018.
7. Arya. A. S, & Ajmani. L.J.; *Design of steel Structures*,; NemChand & Sons Publication, 2011.
8. Dayaratnam. P, *Design of steel structures*; S.Chand Publisher, 2007.
9. IS 456, *Plain and Reinforced Concrete - Code of Practice*, Bureau of Indian Standards, 2000. (Reaffirmed 2005), (Fourth Revision).
10. IS 800, *General Construction in Steel – Code of Practice*, Bureau of Indian Standards, 2007. (Third Revision).
11. IS 875 (Part 1), *Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Dead Loads)*, Bureau of Indian Standards, 1987.
12. IS 875 (Part 2), *Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Imposed Loads)*, Bureau of Indian Standards, 1987.
13. IS 875 (Part 3), *Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Wind Loads)*, Bureau of Indian Standards, 2015.
14. SP24, *Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete Structures*, Bureau of Indian Standards,1983.
15. SP16, *Design Aids for Reinforced Concrete Structures*, Bureau of Indian Standards,1980.
16. SP34, *Handbook on Concrete Reinforcement and Detailing*, Bureau of Indian Standards,1987.
17. SP6(1), *Handbook for Structural Engineers (Structural Steel Section)*, Bureau of Indian Standards,1964, (Reaffirmed 2003).

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Applying	Applying diverse knowledge of design practices to real life problems
CO2	Design	Design concepts of foundations and flat slabs
CO3	Design	Design of shear wall, design of steel element subjected to torsion
CO4	Design	Design & Detailing of plate girder, chimney, foot overbrige & towers
CO5	Design	Design of steel structure subjected to fire.

G. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	.	.
CO1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1		
CO2	1	2	3	1	2	2	2	3	2	2	1	3	3	2	2		
CO3	1	3	3	2	3	1	2	3	2	2	2	3	3	2	2		
CO4	1	3	2	1	3	1	2	3	2	2	1	3	3	2	2		

CO5	1	3	3	2	3	1	2	3	2	2	2	3	3	2	2		
Avg																	

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: SOIL STRUCTURE INTERACTION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

The objective of this course is to make student understand about the importance of Soil Structure Interaction in design of structures. Application of Soil Structure Interaction to various structural elements will be shown.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Critical study of conventional methods of foundation design; Nature of complexities of soil structure interaction; Application of advanced techniques of analysis such as the finite element method, finite differences, relaxation and interaction for the evaluation of soil-structure interaction for different types of structures under various conditions of loading and subsoil characteristics;	12	CO1
[2]	Preparation of comprehensive design-oriented computer programs for specific problems.	04	CO2
[3]	Interaction problems based on the theory of sub-grade reaction such as beams, footings, rafts bulkheads etc, Analysis of different types of framed structures founded on stratified natural deposits with linear and non-linear stress-strain characteristics.	10	CO4
[4]	Determination of axial and lateral pile capacities; group action of piles considering stress-strain characteristics of real soils.	10	CO3

C. TEXT BOOKS

1. Analysis and design of foundation - J. Bowles
2. Numerical Methods in Geotechnical Engg. - Desai & Christian

D. REFERENCE BOOKS

1. Elastic Analysis of Soil Foundation Interaction - A P S Selvadurai
2. Advanced Geotechnical Engineering - C S Desai, M. Zaman

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Students will have basic understanding of Soil Structure Interaction.
CO2	Analysis	Students will solve beams on elastic foundation problem and its application.
CO3	Understanding	Students will be able to understand effect of Soil structure interaction to deep foundation.
CO4	Analysis	Students will be able to analyse raft foundation resting on soil using soil springs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	3	3	1	2	1	2	2	1	3	1	
CO2	1	3	1	3	1	3	3	1	3	2	2	3	1	3	
CO3	3	2	1	2	1	2	3	2	1	1	1	2	3	1	
CO4	2	2	3	3	2	1	1	3	2	3	3	1	2	3	
Avg															

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: ADVANCED CONCRETE TECHNOLOGY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

Concrete is the integral part of the structures so it is important to know the rudiments as well as the advancements in the field of concrete technology. This subject would deal with the important advanced learning topics on cement chemistry, microstructure properties of concrete, mix proportioning, Non-destructive testing and special concretes.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Cement: Hydration, chemistry and microstructure of cement paste, special cement	4	CO1
[2]	Microstructures of concrete: Interfacial transition zone, Structure-property relationships.	4	CO1
[3]	Chemical and mineral admixtures in concrete: Types, Mechanism, Application.	4	CO2
[4]	Properties of hardened concrete: Strength, stress-strain behavior, Dimensional stability, Fracture mechanics and concrete failure mechanism.	4	CO4
[5]	Mix Design: Concrete mix design (IS, ACI, BS)	6	CO3
[6]	Concrete Durability: Physical deterioration (abrasion, erosion, cracking) Chemical attack (sulphates/seawater/acid), Corrosion, Durability improvement measures.	4	CO1
[7]	Testing and quality assurance of concrete: Testing of fresh concrete, Destructive and non-destructive evaluation of hardened concrete, statistical quality control.	6	CO4
[8]	Special concrete: Cement and polymer concrete compositions, Self-compacting concrete, Ready mixed concrete, High performance concrete.	4	CO5

C. TEXT BOOKS

1. Neville, A.M. *Properties of Concrete*; 5th ed.; Pearson education publication: 2012.

D. REFERENCE BOOKS

1. Mehta, P. K.; Monterio, P. J. M. *Concrete -Microstructure, Properties and Materials*; 4th ed.;, McGraw Hill Publishers: New Delhi,2017

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand chemistry of cement, microstructure of concrete and durability related aspects of cement concrete.
CO2	Application	Learn various types of chemical and mineral admixtures and apply this knowledge in using these admixtures in cement concrete
CO3	Design	Design the concrete mixes using various mix proportioning techniques
CO4	Evaluation	Evaluate the hardened properties of concrete using various destructive and non-destructive techniques
CO5	Decision Making	Decide the correct type of special concrete for the specific engineering construction by applying the knowledge on special concretes.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	1	1	2	1	-	1	2	-	-
CO2	1	1	2	2	-	2	3	2	1	1	2	2	1	-
CO3	1	1	2	2	1	2	2	2	2	2	2	2	1	-
CO4	1	1	2	2	1	2	1	2	2	2	2	2	1	-
CO5	1	1	1	2	-	2	2	2	2	2	3	2	1	-
Avg														

M. TECH. SEMESTER – II (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: RESEARCH METHODOLOGY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	0	3	3	40	0	0	0	40

A. COURSE OVERVIEW

The objective of this course is to understand the basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters, prepare a research proposal and research documentation.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Meaning of research, Types of research, Steps involved in research process, Criteria of good research, Research methods vs methodology, Problems encountered by researchers. 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. Need for research design, Types of research design.	7	CO1
[2]	Approaches of investigation of solutions for research problem, Sampling design and Sampling Fundamentals, Measurement and Scaling Techniques, Data Collection Methods, Processing and Analysis of Data, Interpretation.	10	CO2
[3]	Effective literature studies approaches, Sources of Literature, Plagiarism, Citation, Ethics in research, importance of ethics, research misconducts, codes and policies for research ethics.	6	CO3
[4]	Effective technical writing, how to write report, Significance of report writing; Types of reports; Different steps in report writing; Structure of the research report; Precautions for writing research reports; Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee, Oral presentation	6	CO4
[5]	Nature of Intellectual Property - Patents, Designs, Trademark, Copyright, and Geographical Indications. 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. Licensing and transfer of technology. Patent information and databases. Administration of Patent System.	7	CO5

C. TEXT BOOKS

1. Ranjit Kumar, “Research Methodology: A Step-by-Step Guide for beginners”
2. C. R. Kothari and G. Garg. Research Methodology: Methods and Techniques, 4th Edition, New Age International, 2019.

D. REFERENCE BOOKS

1. R. Pannerselvam. Research Methodology, 2nd Edition, PHI Learning, 2014.
2. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
3. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Create	To understand the concept of research and its methodologies and formulate research problem and research design.
CO2	Analysis	To acquire scientific data, analyze and forecast need or/and solution.
CO3	Understand	To understand importance of research ethics and review existing literature
CO4	Application	To document research findings effectively.
CO5	Understand	To explore on various IPR components and process of filing.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	2	2	1	2	3	3	1	3	1	-
CO2	3	3	3	2	2	3	2	2	2	3	2	3	-	-
CO3	2	3	2	1	2	1	1	3	3	3	-	3	-	-
CO4	1	1	-	1	2	1	-	2	3	3	-	3	-	-
CO5	1	1	-	-	1	1	-	1	2	2	1	3	-	-
Avg.														

M. TECH. SEMESTER – II (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: PRESTRESSED CONCRETE

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

Understand the basics of prestressed concrete and analysis of beams. And Students able understand the concept of Design, deflection, losses as per the relevant design code

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Prestressing concepts, materials, systems of prestressing and losses	8	CO1
[2]	Introduction to working stress method, limit state analysis and design of members for bending. Shear torsion and forces.	14	CO2 CO4
[3]	End block design. Deflections, use of relevant codes of practice.	14	CO3 CO5

C. TEXT BOOKS

1. N. Krishna Raju. Prestressed Concrete.; Tata McGraw-Hill Publishing Co. 2006.

D. REFERENCE BOOKS

1. Mallick S.K. and Gupta A.P, “Prestressed Concrete”, Oxford & IBH. 2009
2. Lin T.Y. and Ned.H.Burns, “Design of prestressed Concrete Structures”, Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
3. Pandit.G.S. and Gupta.S.P., “Prestressed Concrete”, CBS Publishers and Distributers Pvt. Ltd, 2012
4. Rajagopalan.N, “Prestressed Concrete”, Narosa Publishing House, 2002.
5. D Nawy E.G, “Prestressed Concrete: A fundamental approach”, Prentice Hall, 2013

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the principles & necessity of prestressed concrete structures
CO2	Evaluate	Able to Analyse the flexural, shear and torsion behaviour of Prestressed beams
CO3	Analysis	learn to handle element design the of pre-stress concrete structure
CO4	Evaluate	Design the prestressed concrete members for flexure and shear as per the relevant design code
CO5	Application	Design of end block as per the relevant design code

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	1	1	2	3	2	2	2	3	2
CO2	2	3	2	2	2	1	1	2	3	1	2	1	2	3
CO3	3	2	3	3	3	1	1	1	3	1	3	2	2	3
CO4	2	2	3	2	1	1	1	2	3	2	2	2	3	2
CO5	3	3	2	2	2	1	1	2	3	1	2	1	3	2
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: BRIDGE ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

The objective of this course is to make students aware about the different types of bridges and to understand design philosophy. Also, to mould them to be ready to analyse and design bridges.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Loading Standards.	06	CO1
[2]	Design of Slab Girder and T- Girder bridge.	10	CO2
[3]	Design of prestressed concrete girder and box girder bridges considering only primary torsion. Design of end block.	12	CO3, CO4
[4]	Piers, Abutments, Wing walls factors effecting and stability. Well foundations. Design of well, Construction, open sinking of walls, Plugging, sand filling and casting of well cap.	8	CO5

C. TEXT BOOKS

1. M. G. Aswani, V. N. Vazirani, M. M. Ratwani, *Design of Concrete Bridges;* Khanna Publishers

D. REFERENCE BOOKS

1. Dr. V. K. Raina, *Concrete Bridge Practice Analysis*, *Design and Economics*; 3rd Edition Shroff Publishers and Distributors Pvt. Ltd.
2. N. Krishna Raju, *Design of Bridges;* Oxford & IBH Publishing Company Pvt. Ltd.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Students will have basic knowledge about loading standards for bridge design
CO2	Design	Design Slab Girder and T- Girder RCC Bridges
CO3	Design	To understand need of prestress concrete for bridge design.
CO4	Design	Design prestressed concrete bridges
CO5	Application	To understand foundation design for bridges.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	3	1	2	1	2	2	1	3	1
CO2	1	3	1	3	1	3	3	1	3	2	2	3	1	3
CO3	2	2	1	2	3	2	3	2	1	1	1	2	3	1
CO4	2	2	3	3	2	1	1	3	2	3	3	1	2	3
	2	3	2	1	2	1	3	3	2	3	1	1	2	2
Avg														

M. TECH. SEMESTER – I (CIVIL-STRUCTURAL ENGINEERING)
SUBJECT: STRUCTURAL OPTIMIZATION AND RELIABILITY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

Objective of this course to make students aware, about the different optimization techniques used for structural optimization.
To introduce structural optimization and reliability as tool for future research activity.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to optimization, optimization techniques for unconstrained and constrained optimization problems, Classical Optimization, Lagrange Multiplier technique and Kuhn – Tucker conditions, Solution of NLP by direct methods and by series of unconstrained optimization problems, formulation of different types of structural optimization problems.	14	CO1
[2]	Computation of derivatives of response quantities with respect to design variables. Minimum weight design of trusses, frame, etc.	08	CO2
[3]	Concept of Structural safety, design methods, basic statistics, probability Theory, statistics for concrete and steel properties, probabilistic analysis of loads	08	CO3
[4]	Basic structural reliability Monte Carlo method, level 2 reliability, reliability-based design and reliability of simple structural systems	06	CO3

C. TEXT BOOKS

1. Singiresu S. Rao; *Optimization: Theory and Applications*; Halsted Press

D. REFERENCE BOOKS

1. Erwin Kreyszig; *Advanced Engineering Mathematics;* Wiley
2. A. J. Morris; *Foundations of Structural Optimization: A Unified Approach;* John Wiley & Sons Limited, Chichester.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Applying	To apply different optimization techniques in structural engineering.
CO2	Applying	To apply different structural reliability methods.

CO3	Understanding	Can develop research proposals on optimization and reliability in design practice.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	3	3	1	2	1	2	2	1	3	1
CO2	1	3	1	3	1	3	3	1	3	2	2	3	1	3
CO3	2	2	3	3	2	1	1	3	2	3	3	1	2	3
Avg														