Department of Civil Engineering

STUDY & EVALUATION SCHEME											
M.TECH 1st YEAR 1st SEMESTER (STRUCTURAL ENGINEERING)											
Theory Subjects			EVALUATION SCHEME								
S.No.	Subject Code	Name of the Subject	Periods			Sessional Assessment			SEE	Subject Total	Credits
			L	T	P	MST	TA	Total			
1	MTST-101	Advanced structural analysis	3	-	-	15	15	30	70	100	3
2	MTST-102	Structural Dynamics	3	-	-	15	15	30	70	100	3
3	MTST-01*	Departmental Elective-I	3	-	-	15	15	30	70	100	3
4	MTST-02*	Departmental Elective-II	3	-	-	15	15	30	70	100	3
5	MTST-103	Research Process& Methodology	3	-	-	15	15	30	70	100	3
		Total	**15**	**-**	**-**	**75**	**75**	**150**	**350**	**500**	**15**
Laboratory Courses											
6	MTST-151	Advanced concrete design Lab	-	-	3	-	20	20	30	50	2
7	MTST-152	CAD Lab (Practice on analysis and design software)	-	-	2	-	20	20	30	50	1
		Total	**-**	**-**	**5**	**-**	**40**	**40**	**60**	**100**	**3**
		GRAND TOTAL	**15**	**-**	**5**	**75**	**115**	**190**	**410**	**600**	**18**

Elective I (MTST-01*)
MTST-011 Computer oriented numerical methods
MTST-012 pre-stressed concrete
MTST-013 Experimental stress analysis
MTST-014 Structural health monitoring
MTST-015 Design of Industrial structures.

Elective II (MTST-02*)
MTST-021 Theory of Elasticity and Plasticity
MTST-022 Advanced Steel Design
MTST-023 Stability of Structures
MTST-024 Soil structure interaction
MTST-025 Business Analytical

****Audit Course**
(Student have to pass the paper in First Semester)
MTST-A01 Research Process and methodology

STUDY & EVALUATION SCHEME											
M.TECH 1st YEAR 2nd SEMESTER (STRUCTURAL ENGINEERING)											
Theory Subjects			EVALUATION SCHEME								
S.No.	Subject Code	Name of the Subject	Periods			Sessional Assessment			SEE	Subject Total	Credits
			L	T	P	MST	TA	Total			
1	MTST-201	Advanced concrete design	3	-	-	15	15	30	70	100	3
2	MTST-202	Finite element methods	3	-	-	15	15	30	70	100	3
3	MTST-03*	Departmental Elective-III	3	-	-	15	15	30	70	100	3
4	MTST-04*	Departmental Elective-IV	3	-	-	15	15	30	70	100	3
5	MTST-05*	Departmental Elective-V	3	-	-	15	15	30	70	100	3
		Total	**15**	**-**	**-**	**75**	**75**	**150**	**350**	**500**	**15**
Laboratory Courses											
8	MTST-251	Finite element analysis Lab	-	-	3	-	20	20	30	50	2
9	MTST-252	Seminar-I	-	-	2	-	20	20	30	50	1
		Total	**-**	**-**	**5**	**-**	**40**	**40**	**60**	**100**	**3**
		GRAND TOTAL	**15**	**-**	**5**	**75**	**115**	**190**	**410**	**600**	**18**

Elective III (MTST-03*)

MTST-031	Theory and analysis of plates
MTST-032	Earthquake resistant design of structures
MTST-033	Concrete technology
MTST-034	Industrial Safety

Elective IV(MTST-04*)

MTST-041	Optimization techniques in structural engineering
MTST-042	Plastic analysis and design
MTST-043	Analysis and Design of Shell sand folded plates
MTST-044	Fracture Mechanics of Concrete Structures

Elective – V (MTST-05*)

MTST-051	Composite materials
MTST-052	Computer aided design in structural engineering
MTST-053	Bridge Engineering
MTST-054	Design of Prestressed Concrete Structures

STUDY & EVALUATION SCHEME

M.TECH 2nd YEAR 3rd SEMESTER (STRUCTURAL ENGINEERING)

S.No.	Subject Code	Name of the Subject	Periods			Sessional Assessment			SEE	Subject Total	Credits
			L	T	P	MST	TA	Total			
1	MTST-351	Seminar II	-	-	6	-	100	100	-	100	3
2	MTST-352	Dissertation	-	-	30	-	200	200	300	500	15
		Total	**-**	**-**	**36**	**-**	**300**	**300**	**300**	**600**	**18**

STUDY & EVALUATION SCHEME

M.TECH 2nd YEAR 4th SEMESTER (STRUCTURAL ENGINEERING)

S.No.	Subject Code	Name of the Subject	Periods			Sessional Assessment			SEE	Subject Total	Credits
			L	T	P	MST	TA	Total			
1	MTST-451	Dissertation (Final)	-	-	36	-	200	200	400	600	18
		Total	**-**	**-**	**36**	**-**	**200**	**200**	**400**	**600**	**18**

SYLLABUS

L	T	P	
3	0	0	**Credit- 3**

MTCE-101 ADVANCED STRUCTURAL ANALYSIS
(SEM-I)

COURSE OUTCOME

1. Apply energy principles for the analysis of determinate/indeterminate structures.
2. Analyze structures comprising axial elements, Beams, Grids, Plane and space frames using matrix methods.
3. Analyze continuous beams and grids by flexibility and stiffness matrix methods.
4. Apply matrix methods for elastic instability and second order effects including plane frames and space frames
5. Analyze static condensation and thermal stress applied over structures.

UNIT-I:

Introduction to matrix methods of analysis - static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates

UNIT II

Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - bank matrix - semi bandwidth - computer algorithm for assembly by direct stiffness matrix method.

UNIT III

Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods.

UNIT IV

Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT V.

Special analysis procedures - static condensation and sub structuring - initial and thermal stresses. Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls. (8L)

REFERENCES 1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Geve, CBS publications.

2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.

3. Structural Analysis by C.S.Reddy.

4. Matrix Structural Analysis by Kanchi.

5. Matrix Methods of Structural Analysis by J.Meek. 6. Structural Analysis by Ghali and Neyveli.

L	T	P	
3	0	0	**Credit- 3**

MTST-102 STRUCTURAL DYNAMICS
(SEM-I)

COURSE OUTCOME

1. classify the principles of structural dynamics
2. summarize the solution technique for dynamics of MDOF systems.
3. design and develop analytical skills to calculate natural frequencies and mode shape
4. Solve Engineering Problems Using Iterative Method

UNIT I:

Theory of vibrations: Introduction -Elements of vibratory system-Degreesof Freedom - Continuous System - Lumped mass idealization - Oscillatory motion – Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth (8L)

UNITII

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis - Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

Single Degree of Freedom Systems : Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral. (10L)

UNITIII

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion – Un damped free vibrations -Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure. (8L)

UNITIV

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

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams. (8L)

UNITV

Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation- Lumped mass approach -SDOF and MDOF systems - I.S. Code methods of analysis for obtaining response of multi storeyed buildings. (6L)

REFERENCES:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New york
2. Structural Dynamics by Mario Paz,C.B.SPublishers, NewDelhi.
3. Dynamics of Structures by AnilK. Chopra, Pearson Education(Singapore),Delhi.
4. I.S:1893-1984,"CodeofpracticeforEarthquakeresistantdesignofStructures" and latest I.S: 1893 - 2002 (version) Part-1

L	T	P	Paper Code- MTST-201
3	0	0	Credit- 3

MTST-201 ADVANCED CONCRETE DESIGN
(SEM-II)

COURSE OUTCOME

1. Design reinforced concrete beams for flexure, shear, torsion and evaluate serviceability requirements such as deflection and crack width as per IS 456
2. Apply limit analysis and yield line theory to determine collapse loads and moment redistribution in RC beams and slabs.
3. Analyze and design ribbed slabs and flat slabs using Direct Design Method, including checks for shear and reinforcement detailing.
4. Design reinforced concrete deep beams and corbels by evaluating force transfer mechanisms and applying codal provisions.
5. Design short and slender reinforced concrete columns under axial load and bending, and proportion combined footings based on soil pressure distribution

UNIT I

Basic Design Concepts: Behavior in flexure, Design of singly reinforced rectangular sections, Design of doubly reinforced rectangular sections, Design of flanged beams, Design of shear, Design for Torsion, Limit state of Serviceability: Deflections of Reinforced concrete beams and slabs, short term deflection and long term deflection, estimation of crack width in RCC members, calculation of crack widths.

UNIT II

Limit Analysis of R.C.Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis for square and circular slabs with simple and continuous end conditions.

UNIT III

Design of Ribbed slabs, Flat slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears - Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels, Design of Nibs.

UNIT V

Design of Compression members: Estimation of effective length of a column-Code requirements on Slenderness Limits, Design of Short Columns under Axial Compression, Design of Short Columns with Uniaxial Bending, Design of Short Columns under Biaxial Bending, Design of Slender Columns.

Design of Combined Footings- Distribution of soil Pressure – Geometry of Two Column

TEXT BOOKS:

1. Reinforced concrete design by S. Unnikrishna Pillai & Menon, Tata Mc. Graw Hill, 2nd Edition, 2004
2. Advanced Reinforced Concrete Design – P.C. Varghese, Practice Hall, 2008
3. Limit state theory and design of reinforced concrete by Dr. S.R. Karve and Dr. V.L. Shah, Standard
publishers, Pune, 3rd Edition, 1994

REFERENCE BOOKS:

1. Reinforced concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
2. Reinforced concrete structural elements – behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced concrete structures, Vol.1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.
5. Reinforced concrete structures – I.C. Syal & A.K. Goel, S. Chand, 2004.

ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)
U.P. STATE GOVERNMENT UNIVERSITY,
(Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE)

L-3, T-0, P-0

MTST-202 FINITE ELEMENT METHODS

(SEM-II)

COURSE OUTCOME

1. Explain the fundamental concepts of the Finite Element Method, energy principles, and matrix elasticity formulations for plane stress, plane strain, and axisymmetric problems.
2. Develop stiffness matrices and shape functions for 1D and 2D finite elements.
3. Formulate iso parametric, axi-symmetric, and 3D finite elements using appropriate shape functions.
4. Apply FEM to analyze plate and shell elements using thin plate and Mindlin theories.
5. Understand and apply basic nonlinear analysis methods to special structural systems.

UNIT I

Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination - Raleigh - Ritz method of functional approximation. Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axisymmetric loading. (8L)

UNIT II

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices (10L)

UNIT III

Isoparametric formulation: Concept - different isoparametric elements for 2D analysis - formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements. Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements. Three dimensional FEM: Different 3-D elements-strain-displacement relationship– formulation of hexahedral and isoparametric solid element. (10L)

UNIT IV

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element. (6L)

UNIT V

Introduction to non – linear analysis – basic methods – application to Special structures. (6L)

REFERENCES:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook,

David S. Malkus and Michael E. Plesha, John Wiley & Sons.

2. Finite element Methods by OC Zienkiewicz

3. Finite element analysis, theory and progarmming by GS Krishna Murthy.

DEPARTMENTAL ELECTIVE - I

L	T	P	Paper Code- MTST-011
3	0	0	Credit- 3

COMPUTER ORIENTED NUMERICAL METHODS

COURSE OUTCOME

1. Solve linear equations and find eigenvalues using numerical methods.
2. Apply interpolation methods to estimate function values.
3. Use finite difference techniques for numerical differentiation and differential equations
4. Perform numerical differentiation and integration using interpolation-based formulas.
5. Solve ordinary differential equations and boundary value problems numerically.

Unit I:

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss – Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over – relaxation method.

Eigen values and eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

(8L)

UNIT II:

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation. (6L)

Unit III

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas

– Backward and forward and central differences- Derivation of Differentiation formulae using Taylor series- Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal pointsIntegration formulae by interpolating parabolas-Numerical solution to spatial differential equations. (10L)

UNIT IV.

Numerical Differentiation: Difference methods based on undetermined coefficientsoptimum choice of step length– Partial differentiation.

Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration methodcomposite integration method – Double integration using Trapezoidal and Simpson's method. (10L)

UNIT V

Ordinary Differential Equation: Euler's method – Backward Euler method – Mid point method – single step method, Taylor's series method- Boundary value problems.

REFERENCES:

1. Numerical methods for scientific and engineering computations. M.K.JainS.R.K.Iyengar – R.K.Jain Willey Eastern Limited.
2. Numerical methods by S.S.Shastry.
3. Applied numerical analysis by – Curtis I.Gerala- Addission Wasley – published campus.
4. Numerical methods for Engineers Stevan C.Chopra, Raymond P.Canal Mc. Graw Hill book company.
5. C Language and Numerical methods by C.Xavier – New age international publisher.
6. Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers, New Delhi

L	T	P	Paper Code- MTST-012
3	0	0	Credit- 3

PRE-STRESSED CONCRETE

COURSE OUTCOME

1. Understand prestressing systems, methods, and compute losses of prestress in pre-tensioned and post-tensioned members.
2. Design prestressed concrete sections for flexure and shear, including cable profiles and code-based shear reinforcement.
3. Estimate short-term and long-term deflections of prestressed concrete beams and check compliance with IS code limits.
4. Analyze transfer of prestress, transmission length, anchorage zone stresses, and design anchorage zone reinforcement.
5. Analyze statically indeterminate prestressed structures using concordant and non-concordant cable profiles.

UNIT I

General Principles of Prestressed Concrete : Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic prestressing like Hoyer system, Freyssinet system, tendons – Different methods and systems of Magnel Blaton system – Lee-Mc call system. Losses of Prestress : Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure. (10L)

UNIT II.

Design of Section for Flexure : Allowable stresses – Elastic design of simple beams having rectangular and I-section for flexure – kern lines – cable profile and cable layout. Design of Sections for Shear : Shear and Principal stresses – Improving shear resistance by different prestressing techniques – horizontal, sloping and vertical prestressing – Analysis of rectangular and I– beam – Design of shear reinforcement – Indian code provisions. (8L)

UNIT III.

Deflections of Prestressed Concrete Beams : Short term deflections of uncracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. deflections. (6L)

UNIT IV

Transfer of Prestress in Pretensioned Members : Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS code provisions – Anchorag e zone stresses in post tensioned members – stress distribution in End Guyon and Magnel methods – Anchorage zone bloc k – Analysis by approximate, reinforcement. (8L)

UNIT V.

Statically Indeterminate Structures : Advantages & disadvantages of continuous PSC beams – Primary and secondary moments – P and C lines – Linear transformation concordant and non-concordant cable profiles – Analysis of continuous beams and simple portal frames (single bay and single story) (8L)

REFERENCES :
1. Prestressed concrete by Krishna Raju, Tata Mc Graw Hill Book – Co ., New Delhi.
2. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, NewYork. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi

L	T	P	Paper Code- MTST-013
3	0	0	Credit- 3

EXPERIMENTAL STRESS ANALYSIS

COURSE OUTCOME

1. Understand plane elasticity theory, Airy's stress function, and basic experimental stress analysis methods.
2. Measure strains using different types of strain gauges and analyze strain rosette data for stress evaluation.
3. Apply the brittle coating method to identify stress patterns, perform testing procedures, and interpret crack data
4. Explain the principles of photoelasticity, stress–optic laws, and behavior of stressed models under polarized light.
5. Analyze two-dimensional photo elastic fringe patterns, apply compensation/calibration techniques, and use photo elastic materials effectively.

UNIT I

Basic equations and Plane Elasticity Theory: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two-dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.
Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis, Different methods, Simplification of problems. (10L)

UNIT II

Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and Optical strain gauges. Electrical Strain Gauges - Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc. Strain Rosettes: Introduction, The three-element rectangular Rosette - The delta rosette - Corrections for Transverse strain effects. (10L)

UNIT III

Brittle Coating Method: Introduction, Coating stresses - Failure theories - Brittle coating Crack pattern - Crack detection - Types of Brittle coating - Test procedures for brittle coating analysis - Calibration procedures - Analysis of brittle coating data. (6L)

UNIT IV

Theory of Photo Elasticity: Introduction, Temporary double refraction - The stress optic law - Effects of stressed model in a Polaris cope for various arrangements - Fringe sharpening, Brewster stress optic law. (6L)

UNIT V

Two-Dimensional Photo Elasticity: Introduction, Isochromatic Fringe patterns - Isoclinic fringe patterns, passage of light through plane Polaris cope and circular Polaris cope, Isoclinic fringe pattern - Compensation techniques - calibration methods, separation methods, scaling Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic materials. (8L)

REFERENCES :

1. Experimental Stress Analysis by J.W.Dally and W.F.Riley
2. Experimental Stress Analysis by Dr. Sadhu Singh
3. Experimental Stress Analysis by Dove and Adams

L	T	P	Paper Code- MTST-014
3	0	0	Credit- 3

Structural Health monitoring

COURSE OUTCOME

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

UNIT-I

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

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

UNIT-II

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

UNIT-III

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

.

UNIT-IV

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

UNIT-V

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

Reference Books:

- Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
- Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
- Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
- Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)
U.P. STATE GOVERNMENT UNIVERSITY,
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L	T	P	Paper Code- MTST-015
3	0	0	Credit- 3

Design of Industrial structures

COURSE OUTCOME

1. Design Steel Gantry Girders.
2. Design Steel Portal, Gable Frames.
3. Design Steel Bunkers and Silos.
4. Design Chimneys and Water Tanks.

UNIT-I

• Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

UNIT-II

• Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

UNIT-III

• Steel Bunkers and Silos – Design of square bunker – Jansen's and Airy's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners. Model Curriculum of Engineering & Technology PG Courses [Volume -II] [26]

UNIT-IV

• Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

UNIT-V

• Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts – • Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation.

Reference Books:

• Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers, 1998.
• Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers, 2009.
• Design of Steel Structures, Subramaniyam

DEPARTMENTAL ELECTIVE-II

L	T	P	Paper Code- MTST-021
3	0	0	Credit- 3

THEORY OF ELASTICITY AND PLASTICITY

COURSE OUTCOME

1. Understand stress–strain components, Hooke's law, and apply plane stress/plane strain formulations with equilibrium and compatibility conditions.
2. Solve two-dimensional elasticity problems in rectangular and polar coordinates, including displacement and bending analysis of beams and curved bars.
3. Analyze three-dimensional stress and strain states, determine principal stresses/strains, and apply general theorems of elasticity for displacement and equilibrium.
4. Apply torsion and bending theories to prismatic bars of various sections using analytical, energy, and analogy methods
5. Understand basic concepts of plasticity and apply yield criteria for material behavior beyond elasticity.

UNIT-I Introduction: Elasticity - notation for forces and stresses - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - plane stress - plane strain - differential equations of equilibrium - boundary conditions - compatibility equations - stress function - boundary condition. (6L)

UNIT II. Two dimensional problems in rectangular coordinates - solution by polynomials - SaintVenant's principle - determination of displacements - bending of simple beams - application of corier series for two dimensional problems - gravity loading. Two dimensional problems in polar coordinates - stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distributions - simple symmetric and asymmetric problems - general solution of two- dimensional problem in polar coordinates - application of general solution in polar coordinates. (10L)

UNIT III. Analysis of stress and strain in three dimensions - principal stresses - stress ellipsoid - director surface - determination of principal stresses - max shear stresses – homogeneous deformation - principal axes of strain rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem. (10L)

UNIT IV. Torsion of Prismatic Bars - torsion of prismatic bars - bars with elliptical cross sections - other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy method - use of soap films in solving torsion problems - hydro dynamical analogies - torsion of shafts, tubes, bars etc. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section - bending problems by soap film method - displacements. (10L)

UNIT V. Theory of Plasticity: Introduction - concepts and assumptions - yield criterions. (4L)

REFERENCES

1. Theory of Elasticity by Timeshanko, McGrawhill Publications.
2. Theory of Plasticity by J.Chakarbarthy, McGrawhill Publications.
3. Theory of Elasticity by Y.C.Fung.
4. Theory of Elasticity by Gurucharan Singh

L	T	P	Paper Code- MTST-022
3	0	0	Credit- 3

ADVANCED STEEL DESIGN

COURSE OUTCOME

1. Design riveted, bolted, and welded connections considering load transfer, failure modes, and codal requirements.
2. Analyse and design eccentric and moment-resistant connections for beam–column and bracket systems.
3. Analyse loads on industrial buildings and design roof trusses, purlins, bracings, and related steel components.
4. Design steel truss girder bridges, including compression/tension members and wind bracing systems
5. Analyse and design steel bunkers and bins using Janssen's and Airy's theories and hopper bottom principles.

UNIT-I

SIMPLE CONNECTIONS –RIVETED, BOLTED PINNED AND WELDED CONNECTIONS:

Riveted connections-Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying Action – Combined Shear and Tension for Slip Critical Connections. Design of Groove welds- Design of Fillet Welds- Design of Intermittent fillet welds- Failure of Welds. (8L)

UNIT –II

ECCENTRIC AND MOMENT CONNECTIONS:

Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections – Welded Bracket Connections - Moment Resistant Connections. (8L)

UNIT III

ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS:

Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins, design of knee braced trusses and stanchions. Design of bracings. (10L)

UNIT IV:

DESIGN OF STEEL TRUSS GIRDER BRIDGES:

Types of truss bridges, component parts of a truss bridge, economic proportions of trusses, self-weight of truss girders, design of bridge compression members, tension members; wind load on truss girder bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing. (8L)

UNIT V:
DESIGN OF STEEL BUNKERS AND SOILS
Introduction – Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins. (6L)

References:

1. Design of Steel Structures. P. Dayaratnam, Publisher : S. Chand, Edition 2011 – 12.
2. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot Scientitic Publishes Journals Department.
3. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
4. Design of Steel Structures Galyord & Gaylord, Publisher ; Tata Mc Graw Hill, Education. Edition 2012.
5. Indian Standard Code – IS – 800-2007.

L	T	P	Paper Code-MTST-023
3	0	0	Credit- 3

STABILITY OF STRUCTURES

COURSE OUTCOME

1. Analyse beam-columns under various loadings, evaluate deflections with initial curvature, and determine allowable stresses.
2. Evaluate the elastic buckling behavior of columns and frames considering shear, eccentric loading, variable cross-section, and elastic foundations.
3. Explain inelastic buckling theories and use experimental/empirical design approaches for columns with different end conditions.
4. Explain inelastic buckling theories and use experimental/empirical design approaches for columns with different end conditions.
5. Determine lateral buckling of beams and derive buckling behavior of simply supported rectangular plates under uniaxial and biaxial compression.

UNIT I:

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads – continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load – application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowable stresses.

UNIT II:

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built up columns.

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UNIT III:

In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various end conditions.

UNIT IV:

Torsion Buckling: Pure torsion of thin-walled bars of open cross section – non-uniform torsion of thin-walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

UNIT V:

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions

REFERENCES AND TEXT BOOKS:

1. Theory of elastic Stability by Timshenko & Gere-Mc Graw Hill
2. Stability of metallic structures by Blunch- Mc Graw Hill
3. Theory of Beam- Columns Vol I by Chem. & Atste Mc. Graw Hill

L	P	Paper Code- MTST-024
3	0	Credit- 3

Soil structure interaction

COURSE OUTCOME

1. Understand soil structure interaction concept and complexities involved.
2. Evaluate soil structure interaction for different types of structure under various conditions of
3. Loading and subsoil characteristics.
4. Prepare comprehensive design-oriented computer programs for interaction problems based on
5. Theory of sub grade reaction such as beams, footings, rafts etc.

UNIT-I

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

UNIT-II

Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.

Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

UNIT-III

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.

UNIT-IV

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

UNIT-V

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

Reference Books:

- Analytical and Computer Methods in Foundation, Bowels J.E.,McGraw Hill Book Co., New York, 1974.
- Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
- Soil Structure Interaction - The real behavior of structures, Institution of Structural Engineers.
- Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.

L	P	Paper Code- MTST-025
3	0	Credit- 3

Business Analytical

COURSE OUTCOME

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights

Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology. 8

Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization. 9

Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

Reference:

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

L	T	P	Paper Code- MTST-031
3	0	0	Credit- 3

Departmental Elective-III

THEORY AND ANALYSIS OF PLATES

COURSE OUTCOME

1. Understand and analyze bending behavior of plates using classical and energy methods
2. Apply small-deflection theory and solve plate problems using Navier and Levy solutions.
3. Analyze circular and orthotropic plates under different loading conditions.
4. Evaluate plate behavior on elastic foundations using analytical solutions.
5. Determine buckling of plates and use finite difference methods for plate analysis.

UNIT I:

Cylindrical Bending: Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load

Pure Bending of Plates: Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending –Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNIT II:

Small Deflection Theory of Thin Rectangular Plates: Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – simply supported plate under sinusoidal load – Navier's solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure. (6L)

UNIT III:

Circular Plates: Symmetrical loading – Relations between slope, deflection, moments and curvature – Governing differential equation – Uniformly loaded plates with clamped and simply supported edges – Central hole – bending by moments and shearing forces uniformly distributed. Orthotropic Plates: Introduction – Bending of anisotropic plates - Derivation of governing differential equation – Determination of Rigidities in various cases like R.C. slabs, corrugated sheet – Application to the theory of grid works

UNIT IV:

Plates on Elastic Foundations: Governing differential equation – deflection of uniformly loaded simply supported rectangular plate – Navier and Levy type solutions - large plate loaded at equidistant points by concentrated forces P.

UNIT V:

Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads – Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate.

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simple loading

REFERENCES:

1. Theory of Plates and Shells by Timoshenko, McGraw Hill Book Co., New York.
2. Theory and Analysis of Plates by P. Szilard, Prentice Hall.
3. Theory of Plates by Chandrasekhar, University Press.
4. Plate Analysis by N. K. Bairagi, Khanna Publishers. New Delhi.

L	T	P	Paper Code- MTST-032
3	0	0	Credit- 3

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

COURSE OUTCOME

1. Learn basics of earthquakes, seismic waves, measurement, and seismic zoning.
2. Understand conceptual seismic design and basic seismic analysis methods
3. Apply IS-code procedures to analyze and design RC and masonry buildings for earthquakes.
4. Understand behavior and design of structural walls and non-structural elements under earthquakes.
5. Apply ductile detailing and capacity design concepts for earthquake-resistant RC buildings.

UNIT - I

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate Tectonics-Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy Released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. (4L)

UNIT - II

Conceptual design: Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical Members-Twisting of buildings-Ductility-definition-ductility relationships flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel. Introduction to earthquake resistant design: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses seismic methods of analysis-factors in seismic analysis-equivalent lateral force method dynamic analysis-response spectrum method-Time history method. (10L)

UNIT - III

Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods- IS code-based methods for seismic design- Seismic evaluation and retrofitting Vertical irregularities- Plan configuration problems- Lateral load resisting systems Determination of design lateral forces-Equivalent lateral force procedure- Lateral distribution of base shear. Masonry Buildings: Introduction-Elastic properties of masonry assemblage- Categories of masonry buildings-Behavior of unreinforced and reinforced masonry walls- Behavior of walls- Box action and bands-Behavior of infill walls Improving seismic behavior of masonry buildings- Load combinations and permissible stresses-Seismic design requirements- Lateral load analysis of masonry buildings. (12L)

UNIT - IV

Structural Walls and Non-Structural Elements: Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements-Prevention of non-structural damage Isolation of non-structures. (6L)

UNIT - V Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground story and short columns during earthquakes. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

REFERENCE BOOKS: 1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press

2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

3. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons

4. Masory and Timber structures including earthquake Resistant Design –Anand S.Arya, Nem chand & Bros

5. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial college Press.

6. Earthquake Tips – Learning Earthquake Design and Construction C.V.R. Murty

REFERENCE CODES:

1. IS: 1893 (Part-1) -2002. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.

2. IS:4326-1993, “Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.

3. IS:13920-1993, “Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi

L	T	P	Paper Code- MTST-033
3	0	0	Credit- 3

CONCRETE TECHNOLOGY

COURSE OUTCOME

1. Understand properties of concrete materials and role of admixtures.
2. Evaluate fresh and hardened concrete behavior using tests and durability assessment.
3. Explain production, properties, and mix design of High Strength and High Performance Concrete.
4. Understand special concretes and apply standard mix design methods.
5. Understand formwork materials, design principles, and safe construction practices.

UNIT-I

Concrete Making Materials: Cement- Bogues compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined Aggregate-Alkali Silica Reaction - Admixtures – Chemical and Mineral admixtures.

UNIT – II

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding.
Hardened Concrete: Abram's law- Gel space ratios, Maturity Concept – Stress Behavior – Creep and Shrinkage – Durability tests on concrete - Nondestructive testing of concrete.

UNIT - III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design 0s HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete.
High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

UNIT –IV

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete –Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete.
Concrete mix design: Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method.

UNIT –V

Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal for forms – reshoring – failure of form work.

TEXT BOOKS:

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete Technology by A.K. Santhakumar, Oxford Press.
3. Concrete Technology by M.S.Shetty, S.Chand & Co.

REFERENCES:

1. Special Structural concretes by Rajat Siddique, Galgotia Publications.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.

L	T	P	Paper Code- MTST-034
3	0	0	Credit- 3

INDUSTRIAL SAFETY

COURSE OUTCOME

1. Understand industrial accidents, safety laws, hazard control, and fire prevention practices.
2. Explain maintenance functions, types, tools, and cost–replacement principles
3. Identify causes of wear and corrosion and apply suitable lubrication and prevention methods.
4. Apply fault-finding techniques using decision trees for mechanical, thermal, pneumatic, and electrical systems.
5. Perform periodic and preventive maintenance procedures and prepare maintenance schedules.

Unit-I: 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.

Unit-II: 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.

Unit-III: 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.

Unit-IV: 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.

Unit-V: 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.

Reference:

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.

DEPARTMENTAL ELECTIVE-IV

L	T	P	Paper Code- MTST-041
3	0	0	Credit- 3

OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

COURSE OUTCOME

1. Understand and apply basic optimization concepts and calculus-based methods.
2. Solve linear and non-linear optimization problems using simplex and search methods.
3. Apply dynamic programming to multistage decision problems.
4. Solve routing and flow problems using network analysis.
5. Use optimization techniques for truss, beam, and frame design

UNIT I:
Introduction to Optimization: Introduction - Historical developments - Engineering applications of Optimization - Statement of an Optimization problem - Classification of Optimization problems - Optimization Techniques. Optimization by calculus: Introduction - Unconstrained functions of a single variable - Problems involving simple constraints - Unconstrained functions of several variables - treatment of equality constraints - Extension to multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method.

UNIT II:
Linear Programming: Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - Pivotal reduction of a general system of equations - Motivation of the Simplex Method - Simplex Algorithm - Two phases of the simplex method. non-Linear Programming: Introduction - Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method - Fibonacci method - Golden section method - Comparison of elimination methods - Unconstrained optimization techniques - Direct search methods - Random search methos - grid search method - Univariate method - Powell's method - Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method

UNIT III:
Dynamic Programming: Introduction - Multistage decision processes - concept of suboptimization and the principle of optimality - computational procedure in dynamic programming - example illustrating the Calculus method of solution - example illustrating the Tabular of solution - conversion of a final value problem into an initial value problem - continuous dynamic programming - Additional applications

UNIT IV:

Network Analysis: Introduction - Elementary graph theory - Network variables and problem types - Minimum-cost route - Network capacity problems - Modification of the directional sense of the network.

UNIT V:

Application of Optimization techniques to trusses, Beams and Frames.

REFERENCES:

1. Optimization: Theory and Applications by S.S.Rao.
2. Numerical Optimization Techniques for Engineering Design with applications by G.N.Vanderplaats.
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal.
4. Optimum Structural Design by U.Kirsch.
5. Optimum Design of Structures by K.I.Majid.
6. Introduction to Optimum Design by J.S.Arora

L	T	P	Paper Code- MTST-042
3	0	0	Credit- 3

PLASTIC ANALYSIS AND DESIGN

COURSE OUTCOME

1. Analyze structures using ultimate load theories and plastic analysis methods
2. Design continuous beams with uniform and varying cross-sections under ultimate loads.
3. Evaluate secondary effects such as axial force, shear, and buckling on plastic design
4. Design safe and efficient steel beam-column and corner connections.
5. Design steel frames and calculate ultimate and service load deflections.

UNIT-I

Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method. (8L)

UNIT - II Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections. (8L)

UNIT - III Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability. (8L)

UNIT - IV Design of Connections: Introduction – requirement for connections – straight corner connections – Hunched connection – Interior Beam-Column connections. (8L)

UNIT - V Design of Steel Frames: Introduction – Single span frames – simplified procedures for Single span frames – Design of Gable frames with Hunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Single span frames. (8L)

REFERENCES:

1. Plastic Design of Steel Frames, L.S.Beedle.
2. Plastic Analysis, B.G.Neal .
3. Plastic Analysis, Horve

L	T	P	Paper Code- MTST-043
0	0	0	Credit- 0

ANALYSIS AND DESIGN OF SHELLS AND FOLDED PLATES

COURSE OUTCOME

1. Classify the shells and know the shell action.
2. Understand the bending theory of cylindrical shells.
3. Design and detail cylindrical shells.
4. Analyze and detail folded plates.
5. Analyze and design doubly curved shells

UNIT I:
SHELL CLASSIFICATION AND SHELL ACTION:
Singly curved and doubly curved shells – shells of translation and rotation – ruled surfaces – synclastic and anti-clastic shells – stress- resultants in a plate element and a plate-shell element – equilibrium equations for membrane stress- resultants – application to a simply supported cylindrical shell – limitations of the membrane theory.

UNIT II:
BENDING THEORY OF CYLINDRICAL SHELLS:
Theory of circular cylindrical shells with combined action of membrane and bending stress-resultants – derivation of D-K-J equation – use of ASCE Manual No. 31 method for analysis and design of long shells and short shells without edge beams.

Unit III:
SIMPLIFIED DESIGN AND DETAILING OF CYLINDRICAL SHELLS:
Simplified beam theory of simply supported long cylindrical shells with and without edge beams – design of end diaphragms – detailing of reinforcement in shells, edge beams and end diaphragms

Unit IV:
FOLDED PLATES:
Structural behavior of trough types folded plate roofs–slab-beam analysis of folded plates – correction analysis for edge shears – stress distribution – correction analysis for deflection and rotation – reinforcement in folded plates.

Unit V:
DOUBLY CURVED SHELLS:
Membrane theory for doubly curved shells of revolution – stress- resultants in a spherical dome – membrane theory of doubly curved shells other than shells of revolution – approximation for shallow shells – stress-resultants in an umbrella type HP shell roof – example of design of a HP shell roof.

Text Books:

1.G.S. Rama Swamy, Design and Construction of Concrete Shell Roofs, CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.

2. ASCE Manual of Engineering practice No.31, Design of cylindrical concrete shell roofs ASC, NewYork.

3.P.C. Varghese, Design of Reinforced Concrete Shells and Folded plates, PHI Learning Private Limited, New Delhi (2010).

References 1. B.K. Chatterjee, Theory and Design of Concrete Shells, Chapmann and Hall, New York, 3rdEdition.
2. K. Chandrasekhara, Analysis of Thin Concrete Shells, Oxford and IBH, Kolkata,1971.
3. BandopadhyayJ.N., Thin Shell Structures, New Age International Publishers, New Delhi,1986.

L	T	P	Paper Code- MTST-044
3	0	0	Credit- 3

FRACTURE MECHANICS OF CONCRETE STRUCTURE

COURSE OUTCOME

1. Identify and classify cracking of concrete structures based on fracture mechanics
2. Implement stress intensity factor for notched members
3. apply fracture mechanics models to high strength concrete and FRC structures.
4. Compute J-integral for various sections understanding the concepts of LEFM

UNIT-I

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

UNIT-II

Stress at Crack Tip: Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

UNIT-III

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete, Fiber Reinforced Concrete, Crack Concepts and Numerical Modeling.

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Reference Books:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Elementary Engineering Fracture Mechanics, BroekDavid, 3rd Rev. Ed. Springer, 1982.
3. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEM Report, Chapman and Hall, 1989.
4. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989

DEPARTMENTAL ELECTIVE-V

L	T	P	Paper Code- MTST-051
3	0	0	Credit- 3

COMPOSITE MATERIALS

COURSE OUTCOME

1. Explain the basics, types, and roles of matrix and reinforcement in composites
2. Apply rule of mixtures to determine mechanical properties of composites.
3. Describe key manufacturing methods of MMCs, CMCs, and carbon–carbon composites.
4. Explain major processing techniques for polymer matrix composites.

UNIT-I

Introduction: Requirements of structural materials, influence of nature of materials in structural form, Nature of structural materials- Homogeneous materials, composite materials.

UNIT - II Macro mechanical Properties of composite Laminae: Introduction, Assumptions and Idealizations, Stress Strain relationships for composite Laminae- Isotropic, Orthotropic laminae, Strength Characteristics- Basic concepts, Strength hypothesis for isotropic and Orthotropic laminae. Macro mechanical composite Laminae: Introduction, and Limitations, Analysis of Assumptions characteristics of glass reinforced laminae Stiffness Stress- Strain relationships in continuous, discontinuous fiber laminae, Strength discontinuous characteristic cs of glass reinforced laminae Strengths in continuous, fiber laminae. (8L)

UNIT - III Behavior of Glass Fiber-Reinforced laminates: Introduction, Stiffness characteristics of Laminated composites-Behavior of Laminated beams and plates, Strength characteristics of Laminated composites- Strength analysis and failure criteria, Effect of inter laminar structures. Glass Reinforced Composites: Introduction, continuously reinforced laminates- uni-directionally and multi directionally continuously reinforced laminates, discontinuously reinforced laminates – Stiffness and Strength properties. (8L)

UNIT - IV GRP properties relevant to structural Design: Introduction, Short-term strength and stiffness- Tensile, Compressive, Flexural and Shearing. Long term strength and stiffness properties, Temperature effects, Effect of fire, Structural joints Adhesive, mechanical, Combinational, Transformed sections. (6L)

UNIT - V Design of GRP Box Beams: Introduction, loading, span and cross-sectional shape, Selection of material, Beam manufacture, Beam stresses, Experimental Behavior, Effect on Beam performance-Modulus of Elasticity, Compressive Strength, I value, prevention of compression buckling failure, Behavior under long term loading. Design of Stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis. (12L)

REFERENCE: 1. GRP in Structural Engineering M.Holmes and D.J.Just.
2. Mechanics of Composite materials and Structures by Manjunath Mukhopadhyay; Universities Press

L	T	P	Paper Code- MTST-052
3	0	0	Credit- 3

COMPUTER AIDED DESIGN IN STRUCTURAL ENGINEERING

RSE OUTCOME

1. Explain the fundamentals of C programming, including variables, operators, and basic input–output.
2. Apply control structures, arrays, pointers, and file operations to solve programming problems in C.
3. Describe basic computer graphics concepts and perform 2D geometric transformations and clipping.
4. Explain the architecture, components, and functioning of database management systems.
5. Understand expert systems, their components, and knowledge representation techniques

UNIT I

Introduction to computer aided design-An over view-computer as a design medium hardware components of a computer -programming languages. C - Programming language-Introduction-An over view of programming in C-variables and data types-Declaration of variables-Initialization of variables-operators-arithmetic operators- precedence and associability-Input and output-Character I/O-Formatted output. Print f ()-Formatted input scan f ()-Examples. (8L)

UNIT II

C Programming Language-Control structures-If statement-Switch statement-loops-nested loops-while and for ,Do-While-continue statement-Go to statement-Examples. C Programming Language-Arrays-One dimensional Arrays-Two Dimensional Arrays pointer operators-pointer arithmetic-pointers and arrays-Matrix manipulations using arrays and pointers-pointers to functions-data files-basic operations-reading and writing and file accessing files-examples. (10L)

UNIT III

Computer Graphics-introduction-applications graphic devices-display devices-output and input devices-two dimensional geometric transformations-homogeneous co-ordinates world co-ordinates-device co-ordinates-window to view port-transformations-clipping operations. (8L)

UNIT IV

Data base management system-introduction-data base systems-hardware-software users-operational data independence-architecture of data base system-distributed databases. (8L)

UNIT V

Knowledge based expert system-introduction-artificial intelligence-components of an expert system-stages in expert system development-knowledge representation inference mechanisms-applications. (6L)

REFERENCES

1. Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev.
2. Computational Structures by S.Rajasekharan.

L	T	P	Paper Code- MTCE-044
3	0	0	Credit-3

BRIDGE ENGINEERING

COURSE OUTCOME

1. Learn the basic types of concrete bridges and understand various loads and design requirements.
2. Understand how to analyze and design solid slab bridges.
3. Understand the analysis and design of girder bridges using simple methods like Courbon's theory and grillage analogy.
4. Learn the basic principles of prestressed concrete bridges and how to design their components.
5. Understand different methods for analyzing bridge decks and learn the basics of bridge substructure design.

UNIT-I

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

UNIT II.

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

UNIT III

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

UNIT IV.

Pre-Stressed Concrete Bridges: Basic Principles-General Design Requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of prestressing steel-slender beams-Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section-Two-stage Prestressing-Shrinking Stresses-General Design requirements for Road Bridges.

UNIT V.

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy Finite strip method and FEM. Sub-structure of bridges: Substructure- Beds block-piers Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments.

REFERENCES

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

L	T	P	Paper Code- MTCE-054
3	0	0	Credit-3

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

COURSE OUTCOME

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

UNIT-I

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.

UNIT-II

Transmission of prestress in pretensioned members; Anchorage zone stresses for posttensioned members.

UNIT-III

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordance.

UNIT-IV

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

Analysis and design of prestressed concrete pipes, columns with moments.

References:

• Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955.
• Prestressed Concrete, Krishna raju N., Tata McGraw Hill, New Delhi, 1981.
• Limited State Design of Prestressed Concrete, Guyan Y., Applied Science Publishers, 1972.
• IS: 1343- Code of Practice for Prestressed Concrete • IRC: 112

LAB

L	T	P	Paper Code- MTST-151
0	0	2	Credit-2

ADVANCED CONCRETE DESIGN LAB

1. understand and determine the basic properties of cement such as consistency, setting time, soundness, and compressive strength.
2. Prepare and interpret gradation charts to classify aggregates.
3. Assess the strength and toughness of aggregates using crushing and impact value tests
4. Determine the air content in fresh concrete and understand the role of air entrainment.
5. Study how water–cement ratio and aggregate–cement ratio affect concrete workability and strength.

1. Tests on cement - Consistency, Setting times, Soundness, Compressive Strength.
2. Gradation Charts of Aggregates.
3. Bulking of fine Aggregate.
4. Aggregate Crushing and Impact value.
5. Workability Tests on Fresh self-compacting concrete
6. Air Entrainment Test on fresh concrete.
7. Marsh cone test.
8. Permeability of Concrete.
9. Non-Destructive Testing of Concrete.
10. Accelerated Curing of Concrete.
11. Influence of W/C ratio on strength and Aggregate / Cement ratio on workability and Strength
12. Influence of Different Chemical Admixtures on concrete.

L	T	P	Paper Code- MTST-152
0	0	2	Credit- 1

CAD LAB

COURSE OUTCOME

1. Analyze a bridge deck slab using suitable software tools.
2. Develop C programs to draw shear force and bending moment diagrams using graphics
3. Design reinforced concrete beams using Excel tools and formulas.
4. Analyze a bridge deck slab using suitable software tools
5. Analyze different types of trusses using STAAD Pro software

1. Program using arrays and functions for matrix manipulation.
2. Programs to draw bending moment and shear force diagrams. Using graphic in C.
3. Program for design of slabs. Using Excel.
4. Program for design of beams. Using Excel.
5. Program for design of column and footing using excel
6. Analysis of truss using STAAD Pro.
7. Analysis of multi storied space frame, using STAAD Pro.
8. Analysis of Bridge deck slab

L	T	P	Paper Code- MTST
0	0	3	Credit- 2

FINITE ELEMENT ANALYSIS LAB

COURSE OUTCOME

1. Perform stress analysis of an L-shaped bracket under applied loads.
2. Evaluate stresses in cantilever, simply supported, and fixed beams using FEM.
3. Perform conductive heat transfer analysis in 2D bodies.
4. Perform modal analysis of beams with different boundary conditions.
5. Conduct harmonic analysis to study frequency-dependent response of a 2D component.

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

Research Methodology and IPR

Teaching Scheme
Lectures: 1hrs/week

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- 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.
- 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.

Syllabus Contents:

Unit 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

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 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

Unit 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.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 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.

References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall , "Industrial Design", McGraw Hill, 1992.
- Niebel , "Product Design", McGraw Hill, 1974.
- Asimov , "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

SEMINAR-I

- **Topic Selection:** Identification and approval of a contemporary or emerging research-oriented topic in the field of Structural Engineering, such as advanced construction materials, seismic and wind-resistant design, computational and numerical methods, or sustainable and resilient structural systems.

- **Literature Review:** Systematic and critical review of relevant technical literature including peer-reviewed research journals, national and international codes and standards, reference books, conference proceedings, and authoritative technical reports pertaining to the selected topic.

- **Technical Report Preparation:** Compilation of a comprehensive seminar report adhering to prescribed academic formatting and citation standards, demonstrating analytical understanding and synthesis of the reviewed literature.

- **Oral Presentation:** Delivery of a structured technical presentation, typically of 15–30 minutes duration, before a panel of faculty members and peers, followed by an interactive question-and-answer session.

- **Evaluation Scheme:** Assessment based on the relevance and originality of the selected topic, depth of technical content, clarity and effectiveness of oral presentation, quality of written report, and the candidate's ability to respond to queries and participate in scholarly discussion.

Learning Outcomes

After completing Seminar, you should be able to:

- Identify and define a technical topic in structural engineering.
- Conduct an effective literature review.
- Explain complex engineering concepts clearly.
- Present and defend your work confidently.

SEMINAR-II

- **Research Problem Identification:**
Selection and formulation of a dissertation-relevant research problem in advanced Structural Engineering, aligned with current research trends, industry requirements, and societal needs.

- **Comprehensive Literature Review:**
In-depth and critical review of national and international research publications, design codes, standards, technical reports, and recent advancements relevant to the selected research problem.

- **Research Objectives and Scope Definition:**
Clearly defining research objectives, scope of work, assumptions, limitations, and expected outcomes of the proposed study.

- **Methodology Development:**
Formulation of an appropriate research methodology, including analytical, numerical, experimental, or computational approaches; identification of tools and software required for the study.

- **Preliminary Analysis / Conceptual Framework:**
Presentation of preliminary analytical results, conceptual models, case studies, or comparative assessments supporting the feasibility of the proposed research.

- **Technical Report Preparation:**
Preparation of a structured seminar report/proposal in standard academic format, including abstract, introduction, literature review, methodology, expected results, and references.

- **Oral Presentation and Defense:**
Delivery of a comprehensive technical presentation (20–30 minutes) before a departmental review committee, followed by critical discussion and incorporation of feedback.

Learning Outcomes

After completing Seminar, you should be able to:

- Formulate a dissertation-level research problem addressing advanced issues in Structural Engineering.
- Critically evaluate and synthesize advanced literature to justify the research scope and objectives.
- Develop and present an appropriate research methodology supported by preliminary analysis or conceptual modeling.
- Prepare a technically rigorous and well-structured seminar report in standard academic format.

Dissertation-I

Teaching Scheme Lectures: 3hrs/week

Mid Sem Evaluation weightage - 30%
End Sem Evaluation weightage - 70%

Course Outcomes:
At the end of the course, the student will be able to:
- Identify structural engineering problems reviewing available literature.
- Identify appropriate techniques to analyze complex structural systems.
- Apply engineering and management principles through efficient handling of project

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

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

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

Dissertation-II (Final)

Teaching Scheme
Contact Hours: 3hrs/week

Course Outcomes: At the end of the course, the student will be able to:
1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to the engineering community and society.
3. Demonstrate professional ethics and work culture.

Syllabus Contents:

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

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