Course Structure for M.Tech (Structural Engineering) Regular Programme

Applicable for students admitted from 2017-18 Academic Year

M.Tech 1st Semester – Structural Engineering

S.No	Code	Course	L	P	C
1	16ST1101	Higher Engineering Mathematics	3	0	3
2	16ST1102	Advanced Structural Analysis	3	0	3
3	16ST1103	Theory of Elasticity and Plasticity	3	0	3
4	16ST1104	Theory and Analysis of Plates	3	0	3
5	16ST1105	Low cost Housing Techniques	3	0	3
6	**ELECTIVE-I**				
	16ST1106	Prestressed concrete	3	0	3
	16ST1107	Maintenance and Rehabilitation of Structures			
	16ST1108	Advanced Foundation Engineering			
7	16ST2109	Concrete Laboratory - I	0	3	2
8	16ST2110	Advanced Staad.Pro Lab	0	3	2
9	16ST2111	Technical Seminar	2	0	2
		TOTAL	**20**	**6**	**24**

M.Tech 2nd Semester – Structural Engineering

S.No	Code	Course	L	P	C
1	16ST1201	Structural Dynamics	3	0	3
2	16ST1202	Finite Element Method	3	0	3
3	16ST1203	Stability of Structures	3	0	3
4	16ST1204	Analysis of shells and folded plates	3	0	3
5	16ST1205	Design of Bridges	3	0	3
6	**ELECTIVE-II**				
	16ST1206	Concrete Technology	3	0	3
	16ST1207	Earthquake Resistant Structures			
	16ST1208	Building Construction Management			
7	16ST2209	Concrete Laboratory - II	0	3	2
8	16ST2210	Structural Engineering Lab	0	3	2
9	16ST2211	Term Paper	2	0	2
10	16ST2212	Comprehensive Viva-Voce	0	0	2
		TOTAL	**20**	**6**	**26**

M.Tech 3rd Semester – Structural Engineering

S.No	Code	Course	L	P	C
1	16ST2301	Internship + Project Work	0	0	4
		TOTAL	**0**	**0**	**4**

M.Tech 4th Semester – Structural Engineering

S.No	Code	Course	L	P	C
1	16ST2401	Project Work	0	0	20
		TOTAL	**0**	**0**	**20**

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1101 **Higher Engineering Mathematics**

UNIT-I

CALCULUS OF VARIATION – Concepts of maxima and minima of functions – constraints and Lagranges multipliers – Extreme value of functional – Euler‟s equations – Solutions of Euler‟s equation.

HAMILTON PRINCIPLE – Lagranges equations generalized dynamic exitations-constraints in dynamical systems.

UNIT-II

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS series method, Picard‟s method, Euler‟s method modified Euler‟s method & R.K. method.

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS – Elliptical equations standard five point formula, diagonal five point formula – solution of Laplace equation by Leibmann‟s iteration method, Poisson‟s equation

UNIT-III

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS – parabolic equations Bender – Schmidt method – Bender – Schmidt recurrence equation, Crank – Nicholson difference method.

EIGEN VALUES AND EIGEN VECTORS – general method – Power method, spectral method.

UNIT-IV

INTRODUCTION TO FINITE ELEMENT METHOD – weighted Residual methods, least square method, Galerkin‟s method – Finite elements – Inter polating over the whole domain – one dimensional case, two dimensional case – application to boundary value problems.

TEXT BOOKS:

1 Numerical methods for Engineers by Steven C.Chapra and Raymond P.Canale – McGraw Hill Book company
2 Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
3

REFERENCE BOOKS:

1 Computational methods for partial differential equations by M.K. Jain, SKR Lyengar, R.K.Jain
2 Applied Numerical Analysis by Curtis.F.Gerald – Addeson Wesley Publishing company

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L	T	P	C
3	0	0	3

16ST1102 ADVANCED STRUCTURAL ANALYSIS

UNIT-I

INDETERMINACY-Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses.

INTRODUCTION TO MATRIX METHODS OF ANALYSIS-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, stiffness method of analysis and flexibility method of analysis.

UNIT-II

ANALYSIS OF CONTINUOUS BEAMS- (stiffness method)–continuous beams of two and three spans with different end conditions-internal hinges.

ANALYSIS OF CONTINUOUS BEAMS-(flexibility method)-continuous beams of two and three spans with different end conditions-internal hinges.

UNIT-III

ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES (stiffness method) Analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams.

ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES (flexibility method) Analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams

UNIT-IV

ANALYSIS OF TWO-DIMENSIONAL PINJOINTED TRUSSES -(stiffness method) computation of joint displacement and member forces.

ANALYSIS OF TWO-DIMENSIONAL PINJOINTED TRUSSES -(flexibility method) computation of joint displacement and member forces.

TEXT BOOKS:

1 Structural Analysis by Pundit & Gupta
2 Structural Analysis by C.S.Reddy.
3 Structural Analysis by S.Ramamrutham

REFERENCE BOOKS:

1 Structural Analysis – R.C.Hibbeler
2 Intermediate Structural Analysis – C.K.Wang

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1103 Theory of Elasticity and Plasticity

UNIT-I

INTRODUCTION:
Elasticity –Notation for forces and stresses-Components of stresses –components of strain – Hooke's law.

PLANE STRESS AND PLANE STRAIN ANALYSIS:
Plane stress-plane strain-Differential equations of equilibrium- Boundary conditions-Compatibility equations-stress function-Boundary conditions.

UNIT-II

TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES: Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES :
General Equation in polar co-ordinates - 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.

UNIT-III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS: Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.

GENERAL THEOREMS:
Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

UNIT-IV

TORSION OF PRISMATICAL BARS:
Torsion of prismatic bars- Elliptical cross section-other elementary solutions-membrane anology-Torsion of rectangular bars-solution of torsional problems by energy method

THEORY OF PLASTICITY:
Introduction- concepts and assumptions -yield criterions.

TEXT BOOKS:

1 Timoshenko, S., Theory of Elasticity and Plasticity, McGraw Hill Book company.

2 Adavnced Strength of materials by Papoov, McGraw Hill Book company.
3 Theory of Elasticity and Plasticity by Sadhu Singh. Khanna Publishers.

REFERENCE BOOKS:

1 Advanced Mechanics of Solids by L.S. Srinath
2 Foundations of Solid Mechanics by Y.C.Fung

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1104 THEORY AND ANALYSIS OF PLATES

UNIT-I

DERIVATION OF PLATE EQUATIONS –In plane bending and transverse bending effects.

RECTANGULAR PLATES: Plates under various loading conditions like concentrated, U.D.L and hydrostatic pressure- Navier and Levy"s type of solutions for various boundary conditions.

UNIT-II

CIRCULAR PLATES: Symmetrically loaded, circular plates under various loading conditions, annular plates

UNIT-III

PLATES UNDER SIMULTANEOUS BENDING AND STRECTHING: Derivation of the governing equation and application to simple cases.

ORTHOTROPIC PLATES: Derivation of the governing equation, applications to grillage problems as equivalent orthotropic plates.

UNIT-IV

NUMERICAL AND APPROXIMATE METHODS: Energy solutions by variational methods, finite difference and finite element methods of analysis for plate problems.

LARGE DEFLECTION THEORY OF PLATES: Study of few simple cases.

TEXT BOOKS:

1 Timoshenko, S., and Krieger, S.W., Theory of plates and shells, McGraw Hill Book company.
2 Szilard, R., Theory and Analysis of Plates, Prentice Hall Inc

REFERENCE BOOKS:

1 N.K.Bairagi, Plate analysis, Khanna Publishers, Delhi

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1105 **Low cost Housing Techniques**

UNIT-I

HOUSING SCENARIO
Introduction - Status of urban housing - Status of Rural Housing

HOUSING FINANCE:
Introduction to - Existing finance system in India - Government role as facilitator
- Status of Rural Housing Finance - Impediments in housing finance and related issues

LAND USE AND PHYSICAL PLANNING FOR HOUSING Introduction - Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye laws - Residential Densities

HOUSING THE URBAN POOR
Introduction - Living conditions in slums - Approaches and strategies for housing urban poor

UNIT-II

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY
Introduction - Adoption of innovative cost-effective construction techniques - Adoption of precast elements in partial prefatroices - Adopting of total prefactcation of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick load bearing wall - 19cm thick load bearing masonery walls - Half brick thick load bearing wall - Flyash gypsym brick for masonary - Stone Block masonery - Adoption of precast R.C. plank and join system for roof/floor in the building

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Alternative building maintenance

UNIT-III

LOW COST INFRASTRUCTURE SERVICES:
Introduction to - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

RURAL HOUSING:
Introduction to traditional practice of rural housing-continuous Mud Housing technology
Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

UNIT-IV

HOUSING IN DISASTER PRONE ARESAS Introduction – Earthquake - Damage to houses - Disaster prone areas - Type of Damages and Repairs of non-engineered buildings - Repair and restoration of earthquake Damaged non-engineered buildings recommendations for future constructions Requirement‟s of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

TEXT BOOKS:

1 Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai.

2 Low cost Housing – G.C. Mathur

REFERENCE BOOKS:

1 Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1106 **PRESTRESSED CONCRETE**

UNIT-I

INTRODUCTION: Development of prestressed concrete –Advantages and Disadvantages of PSC over RCC –General principles of pre-stressing-pre tensioning and post tensioning – Materials used in PSC-high strength concrete –High tension steel-Different types /methods/systems of prestressing.

LOSSES OF PRESTRESS: Estimation of the loss of prestress due to various causes like elastic shortening of concrete ,creep of concrete, shrinkage of concrete, relaxation of steel, slip in anchorage, friction etc.

UNIT-II

SHEAR AND BOND: shear in PSC beams – Principal stresses –Conventional elastic design for shear-transfer of prestress in pretensioned members-transmission length –Bond stresses

BEARING AND ANCHORAGE: bearing at anchorage – Anchorage zone stresses in post-tensioned members-Analysis and design of end blocks by Guyon, Magnel and approximate methods –Anchorage zone reinforcements.

UNIT-III

FLEXURE: Analysis of sections for flexure in accordance with elastic theory-Allowable stresses-Design criteria as per I.S code of practice –Elastic design of Beams (rectangular, I and T sections) for Flexure –Introduction to partial prestressing.

DEFLECTIONS: Introduction-Factors influencing deflections-short term and long term deflections of uncracked and cracked members.

UNIT-IV

STATISTICALLY INDETERMINATE STRUCTURES: Introduction –advantages and disadvantages of continuity –Layouts for continuous beams-primary and secondary moments – Elastic analysis of continuous beams-Linear transformation-Concordant cable profile-Design of continuous beams.

CIRCULAR PRESTRESSING: Introduction –Circumferential prestressing Design of Prestressed concrete tanks –vertical prestressing in tanks-Dome prestressing.

TEXT BOOKS:

1 Prestressed Concrete by S. Krishnam raju
2 Prestressed Concrete by S. Ramamrutham

REFERENCE BOOKS:

1 Prestressed Concrete – by Raj Gopalan
2 Edward P.Nawy, Prentise Hall – Prestressed Concrete

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M.Tech 1st Semester –ST

L	T	P	C
3	0	0	3

16ST1107 **MAINTENANCE AND REHABILITATION OF STRUCTURES**

UNIT-I

GENERAL: Quality assurance for concrete construction, As built concrete properties, strength, permeability, volume changes, thermal properties, cracking.
INFLUENCE ON SERVICEABILITY AND DURABILITY:- Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, inhibitors, resistant steels, coatings cathodic protection.

UNIT-II

MATERIALS FOR REPAIR :- Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

UNIT-III

TECHNIQUES FOR REPAIR & RETROFIT: - Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning, Fibre reinforced polymer

UNIT-IV

MAINTENANCE AND REPAIR STRATEGIES :- Inspection, Structural Appraisal, Economic appraisal, components of quality assurance, conceptual bases for quality assurance schemes.
CASE STUDIES :- Repairs to overcome low member strength, Deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure

TEXT BOOKS:

1 MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi.

2 Santhakumar, A.R.Training Course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras.

REFERENCE BOOKS:

1 A.R. Santhakumar, Concrete chemicals – Theory and applications, Indian society for construction Engineering and Technology, Madras.
2 N.Palaniappan, Estate Management, Anna Institute of Management, Madras.

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L	T	P	C
3	0	0	3

16ST1108 **ADVANCED FOUNDATION ENGINEERING**

UNIT-I

SHALLOW FOUNDATIONS-I: General requirements of foundations. types of shallow foundations and the factors governing the selection of type of shallow foundation. Bearing capacity of shallow foundations by Terzaghi‟s theory and Meyerhof‟s theory (derivation of expressions and solution to problems based on these theories). Local shear and general shear failure and their identification

UNIT-II

SHALLOW FOUNDATIONS-II: Bearing capacity of isolated footing subjected to eccentric and inclined loads. bearing capacity of isolated footing resting on stratified soils-Button‟s theory and Siva reddy analysis. Analysis and structural design of R.C.C isolated, combined and strap footings

DEEP FOUNDATIONS-I: Pile foundations-types of pile foundations. estimation of bearing capacity of pile foundation by dynamic and static formulae. Bearing capacity and settlement analysis of pile groups. Negative skin Friction, Pile load tests.

UNIT-III

DEEP FOUNDATIONS-II: Well foundations-Elements of well foundation. forces acting on a well foundation. Depth and bearing capacity of well foundation. Design of individual components of well foundation (only forces acting and principles of design). Problems associated with well sinking

SHEET PILE WALLS: Cantilever sheet piles and anchored bulkheads, Earth Pressure diagram,Determination of depth of embedment in sands and clays-Timbering of trenches-Earth Pressure diagrams-forces in struts.

UNIT-IV

FOUNDATIONS IN PROBLEMATIC SOILS: Foundations in black cotton soils-basic foundation problems associated with black cotton soils. Lime column techniques-principles and execution. Under reamed piles-principle of functioning of under reamed pile-Analysis and structural design of under reamed pile. Use of Cohesive Non Swelling (CNS) layer below shallow foundations

TEXT BOOKS:

1 Geotechnical Engg – C.Venkatramaiah
2 Foundation Design-Teng

REFERENCE BOOKS:

1 Foundation Design and Construction-Tomlinson
2 Analysis and Design of Foundations-J.E.Bowl

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M.Tech 1st Semester –ST

L	T	P	C
0	0	3	2

16ST2109 **CONCRETE LABORATORY - I**

LIST OF EXPERIMENTS

1 Workability
(a)Slump Test
(b)Compaction Factor Test
(c)Vee-Bee Test

2 Flakiness Test

3 Elongation Test

4 Specific Gravity of
(a) Cement
(b) Coarse Aggregate
(c) Fine Aggregate

5 Bulk density of
a) Fine Aggregate
b) Coarse Aggregate

6 Fineness Modulus of
a) Fine Aggregate
b) Coarse Aggregate

7 Compressive strength of Cement

8 Mix Design of Concrete and Casting of Specimen

9 Young‟s Modulus of Concrete

10 Fineness by Blain‟s apparatus for cement, fly ash, Silica

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M.Tech 1st Semester –ST

L	T	P	C
0	0	3	2

16ST2110 **ADVANCED STAAD.PRO LAB**

LIST OF EXPERIMENTS

1. Analysis and Design of Singly reinforced concrete beam
2. Analysis and Design of Doubly reinforced concrete beam
3. Analysis and Design of One way slab
4. Analysis and Design of Two way slab
5. Analysis and Design of Trusses
6. Analysis and Design of Isolated footing
7. Analysis and Design of Combined Footing
8. Analysis and Analysis of 3-D Frames

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M.Tech 1st Semester –ST

L	T	P	C
2	0	0	2

16ST2111 **TECHNICAL SEMINAR**

A Technical Seminar shall have two components, one chosen by the student from the course work as an extension and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a rSTroduction of the concSTt in any standard research paper or an extension of concSTt from earlier course work. A hard copy of the information on seminar topic in the form of a rSTort is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before a committee consisting of Head of the dSTartment, seminar supervisor and a senior faculty member. Each Technical Seminar shall be evaluated for 100 marks. Technical Seminar component-I for 50 marks and component-II for 50 marks making total 100 marks. (**Distribution of marks for 50:** 10 marks for rSTort, 10 marks for subject content, 20 marks for presentation and 10 marks for queries).

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M.Tech 2nd Semester –ST

L	T	P	C
3	0	0	3

16ST1201 **STRUCTURAL DYNAMICS**

UNIT-I

THEORY OF VIBRATIONS: Introduction –Elements of a vibratory system – degrees of freedom-continuous systems –lumped mass idealization –Oscillatory motion –Simple harmonic motion –pictorial representation of S.H.M - free vibrations of single degree of Freedom (SDOF) systems –undamped and Damped –Critical damping –Logarithmic decrement –Forced vibrations of SDOF systems-Harmonic excitation –Dynamic magnification factor- Bandwidth

INTRODUCTION TO STRUCTURAL DYNAMICS: Fundamental objective of dynamic analysis-types of prescribed loading- Methods of discretization- Formulation of the equations of motion.

UNIT-II

SINGLE DEGREE OF FREEDOM SYSTEM: Formulation and solutions of the equation of motion - free Vibration response –response to harmonic, periodic, Impulsive and general Dynamic loading –Duhamel integral.

MULTI DEGREE OF FREEDOM SYSTEM: selection of the degree of freedom – Evaluation of structural property matrices-Formulation of the MDOF equations of motion –Undamped free vibrations-Solution of Eigen value problem for natural frequencies and mode shapes- Analysis of dynamic response –Normal coordinates –Uncoupled equations of motion – Orthogonal properties of normal modes-mode superposition procedure

UNIT-III

PRACTICAL VIBRATION ANALYSIS: Stodola method- Fundamental mode analysis – analysis of second and higher modes –Holzer‟s method –basic procedure – transfer matrix procedure

UNIT-IV

INTRODUCTION TO EARTHQUAKE ANALYSIS: Introduction Response spectrum – Excitation by rigid base translation –Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.

CONTINUOUS SYSTEM: Introduction –Flexural vibrations of beams- Elementary case-Equation of motion –Analysis of undamped free shapes of simple beams with different end conditions-principles of application to continuous beams.

TEXT BOOKS:

1 Dynamics of structures by Clough & Penziem
2 A.K.Chopra, "Structural Dynamics for Earthquake Engineering",Prentice Hall

REFERENCE BOOKS:

1 I.S:1893(latest)" code of practice for earthquakes resistant design of stuctures
2 Anderson R.A fundamentals of vibration, Amerind Pulblishing Co

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L	T	P	C
3	0	0	3

16ST1202 **FINITE ELEMENT METHODS**

UNIT-I

INTRODUCTION-Concepts of FEM –steps involved –merits &demerits –energy principles – Discretization –Rayleigh –Ritz method of functional approximation.
ELASTIC FORMULATIONS: Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading.

UNIT-II

ONE DIMENSIONAL FEM-Stiffness Matrix for Beam and Bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects.
ISOPARAMETRIC FORMULATION-Concept, Different isoparametric elements for 2d analysis-Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

UNIT-III

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 –static condensation.

UNIT-IV

AXI SYMMETRIC ANALYSIS –bodies of revolution-axi symmetric modelling – strain displacement relationship-formulation of axi symmetric element.
THREE DIMENSIONAL FEM-Different 3-D elements, 3D strain –displacement relationship- formulation of hexahedral and isoparametric solid element.

TEXT BOOKS:

1 Finite element analysis -Theory & programming by G.S.Krishna murthy
2 Finite element methods by P.Seshu.
3 Introduction to finite element method –J.N.Reddy

REFERENCE BOOKS:

1 Hinton and Owen, Finite Element Programming, Academic Press, London
2 Gallagher R.H., & Wilson Finite Element Analysis Fundamentals, Prentice Hall Inc.,
3 Bathe K.J.., finite Element Procedures in Engineering Analysis, Prentice Hall.

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M.Tech 2nd Semester –ST

L	T	P	C
3	0	0	3

16ST1203 **STABILITY OF STRUCTURES**

UNIT-I

ELASTIC BUCKLING OF BARS: Buckling of a bar with intermediate compressive forces and distributed axial loads –Buckling of bars with change in cross section –Effect of shear force on critical load –Built up columns-Elastic buckling of straight columns –Effect of shear stress on buckling-Eccentrically and laterally loaded columns –energy methods –Buckling of a bar on elastic foundation

UNIT-II

FORMULATIONS RELATED TO BEAM COLUMNS : Concept of Stability, Differential equation for beam columns –Beam column with concentrated loads – continuous lateral load – couples -beam column with built in ends –continuous beams with axial load –application of Trignometric series –Determination of allowable stresses.
INELASTIC BUCKLING: Buckling of straight bars-Double modulus theory – Tangent modulus theory.

UNIT-III

MATHEMATICAL TREATMENT OF STABILITY PROBLEMS: Buckling problem orthogonality realation –Ritz method-Timoshenko method, Galerkin method.
TORSIONAL BUCKLING : Pure torsion of thin walled bar of open cross section-Non – Uniform torsion of thin walled bars of open cross section-Torsional buckling –Buckling under Torsion and Flexure.

UNIT-IV

LATERAL BUCKLING OF SIMPLY SUPPORTED BEAMS: Beams of rectangular cross section subjected for pure bending.
BUCKLING OF SIMPLY SUPPORTED RECTANGULAR PLATES: Derivation of equation of plate subjected to constant compression in two directions and one direction.

TEXT BOOKS:

1 Stability of metalic structure by Bleich –Mc Graw hill
2 Theory of Beam columns Vol I by chen & Atsuta Mc.Graw Hill
3 Timoshenko, S., and Gere., theory of Elastic stability, Mc Graw Hill Book company

REFERENCE BOOKS:

1 Z.P. Bazant- Stability structures, CRC-Press
2 Elastic stability by Bleaigh

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M.Tech 2nd Semester –ST

L	T	P	C
3	0	0	3

16ST1204 **ANALYSIS OF SHELLS AND FOLDED PLATES**

UNIT-I

EQUATIONS OF EQUILIBRIUM : Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.
CYLINDRICAL SHELLS: Derivation of governing DKJ equation for bending theory, details of Schorer‟s theory, Applications to the analysis and design of short shells and long shells.

UNIT-II
INTRODUCTION TO SHELLS OF DOUBLE CURVATURE: (other than shells of revolution:) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-III

SHELLS OF DOUBLE CURVATURE-Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

UNIT-IV

FOLDED PLATES: Folded plate theory, plate and slab action, Whitney‟s theory, Simpson‟s theory for the analysis of different types of folded plates (Design is not included)

TEXT BOOKS:

1 Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2 N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi.

REFERENCE BOOKS:

1 Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New york, St. Louis, Sand Francisco, Toronto, London.

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M.Tech 2nd Semester –ST

L	T	P	C
3	0	0	3

16ST1205 **DESIGN OF BRIDGES**

UNIT-I

INTRODUCTION – Classification, investigations and planning, choice of type – economic span length – IRC specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.
DESIGN OF BOX CULVERTS – General aspects – Design loads – Design moments, shears and thrusts – Design of critical section.

UNIT-II

DESIGN OF SLAB BRIDGES – Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading.
T-BEAM BRIDGES – Introduction – wheel load analysis – B.M. in slab – Pigaud‟s theory – analysis of longitudinal girders by Courbon‟s theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading

UNIT-III

PRESTRESSED CONCRETE BRIDGES – General features – Advantages of Prestressed concrete bridges – pretensioned Prestressed concrete bridges – post tensioned Prestressed concrete Bridge decks. Design of post tensioned Prestressed concrete slab bridge deck.
BRIDGE BEARINGS – General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastometric pad bearing detailing of elastometric pot bearings.

UNIT-IV

PIERS AND ABUTMENTS – General features – Bed block – Materials for piers and abutments – typies of piers – forces acting on piers – Design of pier – stability analysis of piers – general features of abutments – forces acting on abutments – stability analysis of abutments.
BRIDGE FOUNDATIONS – General Aspects – Types of foundations – Pile foundations – well foundations – caisson foundations.

TEXT BOOKS:

1 Design of concrete bridges MC aswanin VN Vazrani, MM Ratwani, Khanna publishers
2 Design of Bridges – N.Krishna Raju – Oxford & IBH

REFERENCE BOOKS:

1 BRowe, R.E., Concrete Bridge Design, C.R.Books Ltd., London
2 Essentials of bridges engineering – D.Hohnson Victor oxford & IBH publishers co-Private Ltd.

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M.Tech 2nd Semester –ST

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16ST1206 **CONCRETE TECHNOLOGY**

UNIT-I

CEMENTS AND ADMIXTURES: Portland cement – Chemical composition - Hydration, setting and finenesses of cement – structures of hydrated cement – mechanical strength of cement gel - water held in hydrate cement paste – Heat of hydration of cement – Influence of compound composition on properties of cement
– tests on physical properties of cement – I.S. specifications – Different types of cements – Admixtures.
AGGREGATES: Classification of aggregate – particle shape and texture – Bond strength and other mechanical properties of aggregate specific gravity, Bulk density, porosity, absorption and moisture in aggregate – soundness of aggregate – Alkali – aggregate reaction, Thermal properties – sieve analysis – Fineness modulus – grading curves – grading requirements – practical grading – Road note No.4 grading of fine and coarse aggregates gap graded aggregate – maximum aggregate size

UNIT-II

FRESH CONCRETE: Workability – factors affecting workability – measurement of workability by different tests – Effect of time and temperature on workability – segregation and bleeding – mixing and vibration of concrete – quality of mixing water.
HARDENED CONCRETE: Water/cement ratio-Abram‟s law – Gel space ratio
– effective water in mix – Nature of strength of concrete – strength in tension and compression- Griffith‟s hypothesis – factors affecting strength – autogeneous healing – Relation between compression and tensile strength – curing and maturity of concrete Influence of temperature on strength – Steam curing – testing of Hardened concrete – compression tests – tension tests – factors affecting strength – flexure tests – splitting tests – Non destructive testing methods.

UNIT-III

ELASTICITY, SHRINKAGE AND CREEP: Modulus of elasticity – dynamic modulus of elasticity – poisson‟s ratio – Early volume changes – swelling – Draying shrinkage - Mechanism of shrinkage – factors affecting shrinkage – Differential shrinkage – moisture movement carbonation shrinkage-creep of concrete – factors influencing creep – relation between creep and time – Nature of creep – Effect of creep.
MIX DESIGN: Proportioning of concrete mixes by various methods – fineness modulus, trial and error, mix density, Road Note. No. 4, ACI and ISI code methods – factors in the choice of mix proportions – Durability of concrete – quality control of concrete – Statistical methods – High strength concrete mix design

UNIT-IV

SPECIAL CONCRETE'S: Light weight concretes –light weight aggregate concrete- Mix design – Cellular concrete - No fines concrete – High density concrete – Fiber reinforced concrete – Different types of fibers - factories affecting properties of FRC – Applications polymer concrete – types of polymer concrete properties of polymer concrete applications

TEXT BOOKS:

1 A. M. Neville, „Properties of concrete „„ Pitman Publishing Limited, London
2 Concrete Technology –M.S.Shetty.

REFERENCE BOOKS:

1 Concrete Technology by ML Gambhir 3rd edition, TATA Mc Graw Hill Publishing company
2 Concrete Technology: Krishna Raju

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16ST1207 **EARTHQUAKE RESISTANT STRUCTURES**

UNIT-I

ENGINEERING SEISMOLOGY :
Earthquake – causes of earthquake – earthquakes and seismic waves – scale and intensity of earthquakes – seismic activity – Measurements of earth quakes – seismometer- strong motion accelerograph / field observation of ground motion-Parameters – analysis of earthquakes waves – earth quake motion – amplification of characteristics of surface layers – earthquake motion on the ground surface.

VIBRATION OF STRUCTURES UNDER GROUND MOTION:
Elastic vibration of simple structures – modelling of structures and equations of motion – freevibrations of simple structures – steady state forced vibrations – Response spectrum representations; Relation between the nature of the ground motion and structural damage.

UNIT-II

DESIGN APPROACHES: Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δ characteristics effect – soil structure Interaction

Earthquake records for design – factors affecting Accelerogram characteristics - artificial Accelerogram – zoning map.

Dynamic analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the result

UNIT-III

EARTHQUAKE – RESISTANT DESIGN OF STRUCTURAL COMPONENTS AND SYSTEMS:
Introduction – monolithic reinforced – concrete structures – precast concrete structures – Prestressed concrete structures – steel structures – composite – structures, masonry structures – Timber structures.

UNIT-IV

FUNDAMENTALS OF SEISMIC PLANNING: Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads.

TEXT BOOKS:

1 Design of earthquake resistant structures by Minoru Wakabayashi
2 R.W.Clough and Penzium „Dynamics of structures‟. Mc Graw – Hill, 2nd edition
3 Earthquake Resistant Design by Pankaj Agarwal & Manish Shrikande, Printice Hall Publishers

REFERENCE BOOKS:

1 I.S.Codes No. 1893,4326,13920
2 N.M Newmark and E.Rosenblueth, Fundamentals of Earthquake Engineering‟ prentice hall.

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16ST1208 **BUILDING CONSTRUCTION MANAGEMENT**

UNIT-I

INTRODUCTION – Types constructions-public and private contract managements – scrutinizing tenders and acceptance of tenders, contracted, changes and terminating of contract – subcontracts construction organizations – organizational chart-Decentralization payrolls and records – organization chart of a construction company.

UNIT-II

CONSTRUCTION PRACTICES – Time Management – bar chart, CPM, PERT – Progress report.
RESOURCES MANAGEMENT AND INVENTOR- Basic concepts equipment management, material management inventory control.

UNIT-III

ACCOUNTS MANAGEMENT – Basic concepts, Accounting system and book keeping, depreciation, Balance sheet, profit and loss account, internal auditing. Quality control by statistical methods, sampling plan and control charts, safety requirements.

UNIT-IV

COST AND FINANCIAL MANAGEMENT – Cost volume relationship, cost control system, budget concept of valuation, cost of equity capital management cash. Labor and industrial; laws – payment of wages act. Contract labor, workmen‟s compensation, insurance, industrial disputes act.

TEXT BOOKS:

1 Construction Management and planning by B.Sengupata and H.Gula(Tata McGraw Hill)
2 Robert Schultheis, Mary Summer “management information systems-The Management View.”TATA Mc Graw Hill Edition, New Delhi.

REFERENCE BOOKS:

1 james C.Van Horne, Financial Management and Policy, Prentice Hall of India Pvt.Ltd., 4th Ed., NewDelhi

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M.Tech 2nd Semester –ST

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16ST2209 **CONCRETE LABORATORY-II**

LIST OF EXPERIMENTS

1 Accelerated curing test on Concrete cubes.
2 Non destructive test on concrete.
3 Study of effect of dosage of super plasticizer on Strength and workability of concrete.
4 Mix design of high strength concrete including casting and testing of specimens
5 Mix design of fly ash concrete including casting and testing of specimens.
6 Determination of coefficient of permeability of concrete.
7 Determination of drying shrinkage of concrete.
8 Bending test on a RCC beam under.
   a) single point load
   b) Three point load

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16ST2210 **Structural Engineering Lab**

LIST OF EXPERIMENTS

1. Program for Design of Slabs using Excel and analysis by STAAD Pro
2. Program for Design of Beams using Excel and analysis by STAAD Pro
3. Program for Design of Columns using Excel and analysis by STAAD Pro
4. Program for Design of Isolated Footings using Excel and analysis by STAAD Pro
5. Program for Design of Combined footings using Excel and analysis by STAAD Pro
6. Analysis of Multistoried space frame, using STAAD Pro

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16ST2211 **TERM PAPER**

The Term Paper is a precursor to the project work done in the 2nd year M.Tech Programme. The paper may be of 8-10 (A4 size) in length and follows the standard IEEE/Technical Journal Format.

The Term Paper helps to supplement the second year Project Work of the M.Tech students. It helps to identify their Research area/topic and complete the groundwork and preliminary research required for it comfortably. It trains the students to make use of Research Tools and Material available both in print and digital formats.

Based on the topic, a hypothesis is to be made by the student, under the supervision of the guide. The student is then required to collect literature and support information for his / her term paper from Standard Reference Books, Journals, and Magazines - both printed and online. Each student should refer to a minimum of 6 reference sources related to the topic. The student also presents his/her paper with the help of Power Point slides / OHP.

The Term Paper contains: The Aim and Objective of the study, The need for Rationale behind the study, Identify the work already done in the field, Hypothesis and Discussion, Conclusion Appendix with support data (Illustrations, Tables, Graphs, etc.).

Page Limit: minimum of eight pages.

Date of evaluation: During the Lab Internal Exam.

Method of Evaluation: Total 50 marks

1. Day to day work - 10 marks
2. Term Paper RSTort - 20 marks
3. Seminar - 20 marks

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M.Tech 2nd Semester –ST	**L**	**T**	**P**	**C**
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16ST2212 **COMPREHENSIVE VIVA-VOCE**

All the students shall face a Comprehensive viva-voce covering the total courses of first and second semesters. The comprehensive viva-voce will be conducted along with 2nd semester lab examination for 75 marks by a committee consisting of Head of the DSTartment, two senior faculty members nominated by the Head of the DSTartment

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M.Tech 3rd Semester –ST

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16ST2301 **INTERNSHIP + PROJECT WORK**

All the students shall undergo the summer internship during summer break after 2nd semester. The minimum internship period is eight weeks and the students have an option of choosing their own industry/area of interest, which may be related to their respective branch or any other service oriented task. A self study rSTort for the internship shall be submitted and evaluated during the 3rd semester and will be evaluated for a total of 75 marks consisting of 25 marks for internal assessment and 50 marks for semester end examination. Internal assessment shall be done by the internship supervisor. Semester end examination for 50 marks shall be conducted by two examiners, one of them being internship supervisor as internal examiner and an external examiner nominated by the Principal from the panel of experts recommended by HOD

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M.Tech 4th Semester –ST

L	T	P	C
0	0	0	20

16ST2401 **PROJECT WORK**

Students are required to take up a project work, in which the student can choose any specific problem of Industry or Industry based project work. Alternatively it can be secondary source based or Field based project work. Before the commencement of the project work each student is required to submit a synopsis indicating the objectives, Methodology, Framework for analysis, Action plan with milestones in order to have clarity for the subsequent work. The project should have an internal faculty as guide. The student can initiate the project work in the penultimate semester of the course.