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I & II YEAR M. TECH COURSE STRUCTURE (R19): STRUCTURAL ENGINEERING

I Year – I Semester

Subject Code	Category	Course Title	Int. marks	Ext. marks	L	T	P	C
19D1CS1101	PC-1	Theory of Elasticity	30	70	4	0	0	4
19D1CS1102	PC-2	Structural Dynamics	30	70	4	0	0	4
19D1CS1103	PC-3	Advanced Structural Analysis	30	70	4	0	0	4
19D1E11101 19D1E11102 19D1E11103	PE-1	1. Advanced Concrete Technology 2. Tall Buildings 3. Advanced Foundation Engineering	30	70	3	0	0	3
19D1E21101 19D1E21102 19D1E21103	PE-2	1. Advanced R.C. Design 2. Soil Dynamic & Foundation Engineering 3. Plastic Analysis & Design	30	70	3	0	0	3
19D1OE1101	OE-1	***Open Elective –I** Cost management of Engineering projects	30	70	3	0	0	3
19D1LB1101	Laboratory I	Advanced Concrete Lab	30	70	0	0	3	2
19D1SM1101	Seminar I	Seminar-I	100	0	0	0	3	2
	Total Credits		**310**	**490**	**21**	**0**	**6**	**25**

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I Year – II Semester

	Category	Course Title	Int. marks	Ext. marks	L	T	P	C
19D1CS1204	PC-4	Advanced Steel Design	30	70	4	0	0	4
19D1CS1205	PC-5	Theory of Plates	30	70	4	0	0	4
19D1CS1206	PC-6	Pre-stressed Concrete	30	70	4	0	0	4
19D1E31201 19D1E31202 19D1E31203 19D1E31203E3	PE-3	1. Finite Element Method 2. Bridge Engineering 3. Design of Sub Structures	30	70	3	0	0	3
19D1E41201 19D1E41202 19D1E41203	PE4	1. Earthquake Resistant Design of Buildings 2. Repair & Rehabilitation of Buildings 3. Stability of Structures	30	70	3	0	0	3
19D1OE1201	OE-2	*Open Elective – II Sustainable Building Technology	30	70	3	0	0	3
19D1LB1201	Laboratory II	Computer aided structural design Lab	30	70	0	0	3	2
19D1SM1201	Seminar II	Seminar-II	100	0	0	0	3	2
	Total Credits		**310**	**490**	**21**	**0**	**6**	**25**

II Year – I Semester

Subject Code	Course Title	L	T	P	C
19D5CS2107	Technical Paper Writing	0	3	0	2
19D5CV2101	Comprehensive Viva-Voce	0	0	0	4
19D5PW2101	Project work Review I	0	0	22	8
	Total Credits	**0**	**3**	**22**	**14**

II Year – II Semester

Subject Code	Course Title	L	T	P	C
19D5PW2202	Project work Review II	0	0	24	8
19D5PE2201	Project Evaluation (Viva-Voce)	0	0	0	16
	Total Credits	**0**	**0**	**24**	**24**

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THEORY OF ELASTICITY (PC – 1)

Course Objectives

To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

Course Outcomes

The learner will be able to solve problems of elasticity and be able to apply numerical methods to solve continuum problems.

UNIT – I

Introduction**:** Elasticity – notation for forces and stress – components of stresses – components of strain – Hooks law. Plane stress and plane strain analysis – differential equations of equilibrium – boundary conditions – Strain Displacement Relations – compatibility equations – stress function.

UNIT – II

Two dimensional problems in rectangular coordinates – solution by polynomials – Saint – Venants principle – determination of displacements – bending of simple beams – Simple Supported and Cantilever Beam.

UNIT – III

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 Edge Dislocation – general solution of two – dimensional problem in polar coordinates – application to Plates with Circular Holes – Rotating Disk. Bending of Prismatic Bars**:** Stress function – bending of cantilever – circular cross section – elliptical cross section – rectangular cross section.

UNIT – IV

Analysis of stress and strain in three dimensions – principal stress – stress ellipsoid – director surface – determination of principal stresses Stress Invariants – max shear stresses Stress Tensor – Strain Tensor – 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 Strain Energy.

UNIT – V

Torsion of Circular Shafts – Torsion of Straight Prismatic Bars – Saint Venant's Method – torsion of prismatic bars – bars with elliptical cross sections – membrane analogy – torsion of a bar of narrow rectangular bars – solution of torsional problems by energy method – torsion of shafts, tubes, bars etc. – Torsion of Rolled Profile Sections.

Text books

1. Theory of Elasticity by Timoshenko, Mc-Graw hill Publications
2. Advanced Mechanics of Materials by Arthur P. Boresi, John Willey publishers

References

1. Theory of Elasticity by Y.C. Fung, Dover publications, New york
2. Theory of Elasticity by Sadhu singh, Khanna Publishers
3. Advanced Mechanics of solids by L.S.Srinath, Tata Mc-Graw Hill
4. Continuum Mechanics by P.N. ChandraMouli, Yes Dee Publishe

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STRUCTURAL DYNAMICS (PC-2)

Course Objectives

To impart knowledge on the fundamental of structural dynamics and their applications.

Course Outcomes

The learner will be able to understand the equation of motion, dynamics response of single, and multi degree of freedom systems.

UNIT – I

Theory of vibrations: Introduction – Elements of vibratory system – Degrees of 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 – Band width

UNIT – II

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.

UNIT – III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom – Evaluation of structural property matrices – Formulation of the MDOF equations of motion – Undamped 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.

UNIT – IV

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.

UNIT – V

Deterministic Earthquake Response of Systems – Rigid Foundation, Types of Earthquake Excitation – Response to Rigid – Soil Excitation, Lumped SDOF elastic systems – Lumped SDOF elastic system – Distributed Parameter Elastic Systems – SRSS, CQC combination of modal responses.

Text books

1. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi
2. Dynamics of Structures by Clough & Penzien, McGraw Hill, New York

References

1. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
2. Vibrations, Dynamics and Structural systems by Madhujit Mukhopadhyay, CRC pres

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ADVANCED STRUCTURAL ANALYSIS (PC-3)

Course Objectives

To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

Course Outcomes

The learner will be able to analyse different indeterminate structures using Matrix methods.

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 – band 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.

Text books

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.
2. Advanced Structural Analysis by Ashok. K. Jain, Nem Chand Brothers.

References

1. Basic Structural Analysis by C.S. Reddy, Tata Mc-Graw hill
2. Matrix Structural Analysis by Madhu B. Kanchi, John Willey publishers
3. Indeterminate Structural Analysis by K.U. Muthu*et al*., I.K. International Publishing House Pvt.Ltd.
4. Matrix Methods of Structural Analysis by J.L. Meek, Mc-Graw hill

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ADVANCED CONCRETE TECHNOLOGY (PE-1)

Course Objectives

To impart knowledge on ingredients of concrete, concrete mix design for proportioning and their testing.

Course Outcomes

The learner will be able to design concrete mixes of different grades and also use the special concretes.

UNIT – I

Ingredients of concrete**:** Cement-Bogue's compounds – Hydration Process – Types of cement – Setting times of cement – Aggregates – Shapes Testes on 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 Behaviour – Creep and Shrinkage – Durability tests on concrete – Non destructive testing of concrete.

UNIT – III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design of 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**:** Micro Structure, Properties and Materials by P.K. Mehta, Tata Mc-Graw Hill Publishing House Pvt. Ltd

References

1. Concrete Technology by M.S. Shetty, S. Chand & Co.
2. Concrete Technology by A. K. Santhakumar, Oxford University Press
3. Special Structural concretes by Rafat Siddique, Galgotia Publications.
4. IS**:** 10262**:** 2009 Code of practice for design of Concrete mix

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TALL BUILDINGS (PE-1)

Course Objective

To impart knowledge on analysis of tall buildings.

Course Outcomes

The learner will be able to analyse and chose a appropriate systems for tall buildings.

Unit – I

Introduction: Evolution of tall buildings – Classification of Buildings – Low-rise, medium – rise , high- rise — Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements – Strength, Stiffness & Stability.

Unit – II

Lateral load resisting elements: Frames, Shear walls & Tubes – Shear, Bending & combined modes of deformation – Structural behavior of Rigid frames – Simplified methods of analysis – Substitute frame method, Portal method, Cantilever method, Equivalent frame method –Structural behaviour of Shear walls – Approaches of analysis – Elastic continuum approach & Discrete approach – Structural behavior of Tubes – Actions.

Unit – III

Choice of System for a Building: Frame building, Shear wall building, Shear walls acting with frames, Single framed tubes – Other structural forms – Staggered Wall-beam system, Tube-in-tube system, Base isolation technique for earthquake resistance. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffness method.

Unit – IV

Methods of Analysis: Shear walls without Openings – Estimation of Stiffness by simple Cantilever theory & Deep beam theory – Shear walls with Openings – Equivalent frame for large openings – Muto's method for small openings – Elastic Continuum approach – Coull & Chowdhry's method – Design Charts – Limitations of Continuum approach. Shear wall- Frame Interaction**:** Sharing of loads between wall & frame – Different methods – comparison – Khan & Sbrounis' method – Design charts – Mac Leod's method – Advantages & limitations – Cooperation of Floor slabs – Equivalent width.

Unit – V

Modern Methods: Analysis of Tall buildings by Stiffness method – Available Softwares for analysis of tall buildings.

Text books

1. Design of Tall Buildings by Taranath B., McGraw Hill.

References

1. Reinforced Concrete Design of Tall Buildings by Bungales. Taranath, CRC Press.
2. Analysis of Shear Walled Buildings by S. M. A. Kazimi& R. Chandra, Tor-steel Research Foundation, Calcutta, India.
3. Analysis of Framed Structures by Gere & Weaver
4. Design of Building Structures by Wolfgang Schuller, Prentice Hall

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ADVANCED FOUNDATION ENGINEERING (PE-1)

Course Objective

To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

Course Outcome

Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

Unit – I

Soil Exploration: Exploration Methods, Planning the Exploration Program, Boring and Sampling, In Situ Tests – Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter, Rock Sampling, Core Recovery, RQD, Geophysical Exploration, Preparation of Soil Report, Case Studies.

Unit – II

Shallow Foundations: Bearing Capacity:- Shear Failure, Effect of Water Table, Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

Unit – III

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils, Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter, Settlement of foundations on Sands-Schmertmann and Burland & Burbridge methods, Structure Tolerance to Settlement and Differential Settlements, Rotation, Codal Provisions.

Unit – IV

Deep Foundations: Single Pile: Vertically loaded piles, Static capacity – α, β and λ Methods, Dynamic formulae, Wave Equation Analyses, Point Bearing Resistance with SPT and CPT Results, Bearing Resistance of Piles on Rock, Settlement, Pile Load Test, Uplift Resistance, Laterally Loaded Piles – Ultimate Lateral Resistance, Negative Skin Friction, Batter Piles, Under Reamed Piles, Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load, Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions.

Unit – V

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

Introduction to Reliability Based Design: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

Text books

1. Das, B. M – Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008)

References

1. Bowles, J.E. Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Poulos, H.G & Davis, E.H. Pile Foundation Analysis Design Wiley & sons inc(1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering, Wiley Publications (2003)

ADVANCED REINFORCED CONCRETE DESIGN (PE-2)

Course Objectives

To impart knowledge on the behavior and design on various reinforced concrete structural elements.

Course Outcomes

The learner will be able to design the reinforced concrete elements like beams, slabs and compression members.

UNIT – I

Basic Design Concepts: Behaviour 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, estimate on 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, and 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 Elevated intz type of Water Tank **Design of Combined Footings**- Distribution of soil Pressure – Geometry of Two Column Combined Footing – Design Considerations in Combined Footing for Two – Columns.

Text books

1. Reinforced concrete design by S.UnnikrishnaPillai & Menon, Tata Mc. Graw Hill, 2nd Edition,2004
2. Advanced Reinforced Concrete Design – P.C. Varghese, Prentice Hall of India, 2008

References

1. Reinforced concrete design by Kennath Leet, Tata Mc.Graw-Hill International, editions, 2ndedition,1991.
2. Design of Reinforced concrete structures by N.Subramanian, Oxford University Press
3. Reinforced Concrete Structures by Park and Paulay, John Willey Publishers.
4. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
5. Limit state theory and design of reinforced concrete by Dr. S.R. Karve and Dr. V.L. Shah, Standard Publishers, Pune, 3rd Edition, 1994.
6. IS **:** 456 **:** 2000, Code of Practice for Plane and Reinforced Cement Concrete,
7. SP 16, SP 34.
8. IS 3370 Part I to Part IV.

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SOIL DYNAMICS AND FOUNDATIONS ENGINEERING (PE-2)

Course Objective

To understand the wave propagation in soils, determine dynamic properties of soil for analysing and designing foundations subjected to vibratory loading.

Course Outcome

Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines.

Unit – I

Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

Unit – II

Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits, Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties, Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.

Unit – III

Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.

Unit – IV

Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

Unit – V

Machine Foundations on Piles: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

Text books

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd. (2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)

References

1. Prakash, S. and Puri, V. K – Foundation for Machines**:** Analysis and Design, John Wiley & Sons, 1998.
2. Kameswara Rao, N. S. V. – Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
3. Das, B. M. & Ramana, G.V. – Principles of Soil Dynamics, 2nd Edition, CL Engineering Publishers, 2010.

PLASTIC ANALYSIS AND DESIGN (PE-2)

Course Objectives

To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

Course Outcomes

The learner will be able to design continuous beams and steel frames

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.

UNIT – II

Design of Continuous Beams**:** Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

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.

UNIT – IV

Design of Connections**:** Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT – V

Design of Steel Frames**:** Introduction – Single bay, single storey frames – simplified procedures for Single span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections**:** Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Single span frames.

References

1. Plastic Design of Steel Frames, L.S. Beedle. John Willey & Sons.
2. Plastic Analysis, B.G.Neal. SponPres
3. Design of Steel Structures by N. Subramanian, Oxford University Press

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ADVANCED CONCRETE LABORATORY

Course Objectives

To impart knowledge on the test on cement and aggregates.

Course Outcome

The learner will be able to understand the properties of the materials and the behavior of the concrete.

EXPERIMENTS

1. Tests on cement – Consistency, Setting time, Soundness, Compressive Strength.
2. Gradation Charts of Aggregates.
3. Bulking of fine Aggregate.
4. Aggregate Crushing and Impact value
5. Workability Tests on 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.

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ADVANCED STEEL DESIGN (PC - IV)

Course Objectives

To impart knowledge on behavior and design of various connections, industrial and steel girders.

Course Outcomes

The learner will be able to design different steel structures

UNIT – I

Simple connections – Bolted, Pinned and Welded 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.

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.

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.

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.

UNIT – V

Design of Steel Bunkers and Silos: Introduction, Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom – Design of Bins.

Text books

1. Limit State Design of Steel Structures S. K. Duggal, McGraw Hill Education Private Ltd. New Delhi.
2. Design of Steel Structures, K. S. Sairam, Pearson Education.

References

1. Design of Steel Structures, N. Subramanian, Oxford University Press.
2. Design Steel Structures Volume – II, Dr. Ramachandra & Vivendra Gehlot, Scientific Publishers Journals Department.
3. Design of Steel Structures Gaylord & Gaylord, Publisher; Tata McGraw Hill, Education Edition 2012.
4. Indian Standard Code – IS – 800-2007 General Construction in Steel- Code of Practice,
5. Steel Tables.

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THEORY OF PLATES (PC - V)

Course Objectives

To impart knowledge on the behavior of plates and to analyse the problems pertaining to beams on elastic foundation.

Course Outcomes

The learner will be able to understand the behavior of plates for loadings and boundary conditions.

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.

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 uniformlydistributed.

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 byconcentrated 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.

Text book

1. Theory of Plates and Shells by Timoshenko, McGraw Hill Book Co., New York.

References

1. Theory and Analysis of Plates by P. Szilard, Prentice Hall.
2. Theory of Plates by K. Chandrasekhara, University Press.
3. Plate Analysis by N. K. Bairagi, Khanna Publishers. New Delhi.
4. Numerical Methods for Engineering Problems, N. Krishna Raju & K. U Muthu, Mac-Millan publishers

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PRE-STRESSED CONCRETE (PC - VI)

Course Objectives

To impart knowledge on basics of prestressing and designing of different structural elements using Prestressing techniques.

Course Outcomes

The learner will be able to understand the prestressing techniques, design the various structural elements using Prestressing techniques.

UNIT – I

General Principles of Prestressed Concrete: Pre–tensioning and post-tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, 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.

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 – IS**:** 1343**:** 2012 provisions.

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.

UNIT – IV

Transfer of Prestress in Pretensioned Members: Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS**:**1343-2012 provisions – Anchorage zone stresses in post tensioned members – stress distribution in End block – Analysis by approximate, Guyon and Magnel methods – Anchorage zone reinforcement.

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)

Text books

1. Prestressed concrete by Krishna Raju, Tata McGraw Hill Book – Co., New Delhi.
2. Prestressed Concrete by K.U. Muthu, et.al, PHI Learning Pvt. Ltd.

References

1. Design of Prestressed Concrete Structures by T.Y. Lin and Burn, John Wiley, New York.
2. Prestressed Concrete by N. Rajagopalan, Alpha Science International.
3. IS 1343 -2012 Prestressed Concrete – Code of Practice, Bureau of Indian Standards.

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FINITE ELEMENT METHOD (PE – III)

Course Objectives

To impart knowledge about various finite element techniques and development of finite element code.

Course Outcome

The learner will be able to solve continuum problems using finite element analysis.

UNIT – I

Introduction**:** Concepts of FEM – steps involved – merits and demerits – energy principles – Discretization – 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 axi-symmetric loading.

UNIT – II

One dimensional FEM**:** Stiffness matrix for beam and bar elements – shape functions for 1-D 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

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.

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.

UNIT – V

Introduction to non – linear finite analysis – basic methods – application to Special structures.

Text books

1. A First Course in a Finite Element by Daryl L .Logan, CL Engineers.
2. Concepts and Applications of Finite Element Analysis by Robert D. Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons.

References

1. Introduction to Finite element Method by Tirupathi Chandra Patla and Belugunudu
2. Finite element Methods by OC Zienkiewicz
3. Finite element analysis, theory and programming by GS Krishna Murthy.
4. Introduction to Finite element Method by JN Reddy

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BRIDGE ENGINEERING (PE - III)

Course Objectives

To impart knowledge on the behavior and design aspects of various types of bridges.

Course Outcomes

The learner will be able to analyze and design of different types of bridges

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 – Frictioal resistance of expansion bearings – Secondary Stresses – Temperature Effect – Erection Forces and effects – Width of raodway 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 prestessed concrete member – Concrete cover and spacing of pre-stressing steel - Slender beams – Composite Section – Propped – Design of Propped Composite Section – Unproped 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.

Text books

1. Essentials of Bridge Engineering by Johnson Victor, Oxford & IBH
2. Design of Bridges by N. Krishna Raju, Oxford & IBH

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. Design of Bridges by V. V. Sastry, Dhanpat Rai & Co
4. Concrete Bridge Design and Practice by V. K. Raina.
5. Design of Bridge Structures by Jagadeesh & Jayaram, PHI learning Pvt. ltd.
6. IRC**:** 112, 2011, Code of Practice for Concrete Road Bridges.
7. IRC**:** 6 and 21 2000,Code of Practice for Concrete Road Bridge

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DESIGN OF SUBSTRUCTURES (PE - III)

Course Objectives

To impart knowledge on geotechnical and structural design of different types of foundation appropriate to the type of soil for different structures.

Course Outcome

The learner will be able to design shallow and deep foundations from both geotechnical and structural considerations.

UNIT – I

Shallow Foundations: Basic requirements of foundation – Types and selection of foundations. Bearing capacity of foundations, structural design of isolated, combined, eccentric, strip, and strap footings, Detailing of reinforcement.

UNIT – II

Raft Foundations: Types of rafts, SBC of raft foundation and structural design of different raft foundations, Detailing of reinforcement.

UNIT – III

Pile Foundations: Types of piles, Load carrying capacity of single and pile groups, structural design of piles, pile caps and pile-raft foundation, Detailing of reinforcement.

UNIT – IV

Design of Retaining walls: Stability Checks and structural design of gravity, Cantilever retaining walls, Detailing of reinforcement.

UNIT – V

Machine Foundations: Vibration analysis of machine foundation – Design of foundation for Reciprocating machines and Impact machines – as per IS Codes, Detailing of reinforcement.

Text books

1. Varghese P.C. Design of RC foundations, PHI Learning Pvt. Ltd.
2. Unnikrishnana Pillai & Devadas Menon, Reinforces Concrete Design, McGraw Hill Publishing Pvt. Ltd.

References

1. Bowles .J.E., "Foundation Analysis and Design", McGraw Hill Publishing co., New York, 1986
2. Tomlinson. M.J, "Foundation Design and Construction", Longman, Sixth Edition, New Delhi,1995.
3. Das,B.M Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Narayan V. Nayak, Foundation design manual, Dhanpat Rai & Sons, 2006.
5. Prakash Shamsher and Puri Vijay K, Foundations for Machines, Analysis and Design" John Wiley and Sons, USA, 1988.
6. IS 2911**:** Part 1**:** Sec 1**:** 1979 Code of practice for design and construction of pile foundations**:** Part 1 Concrete piles, Section 1 Driven cast in-situ concrete piles.

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EARTHQUAKE RESISTANT DESIGN OF BUILDINGS (PE - IV)

Course Objectives

To impart knowledge on the seismology and behavior of buildings during earthquakes.

Course Outcomes

The learner will be able to analyse and design buildings to resist seismic forces

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.

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.

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 – Behaviour of unreinforced and reinforced masonry walls – Behaviour of walls – Box action and bands – Behaviour of infill walls – Improving seismic behaviour of masonry buildings – Load combinations and permissible stresses – Seismic design requirements – Lateral load analysis of masonry buildings.

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.

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. Behaviour of beams, columns and joints in RC buildings during earthquakes –

Vulnerability of open ground storey and short columns during earthquakes. Capacity Based Design**:** Introduction to Capacity Design, Capacity Design for Beams and Columns – Case studies.

Text 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.

References

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Masory and Timber structures including earthquake Resistant Design – Anand S.Arya, Nemchand & Bros
3. Earthquake – Resistant Design of Masonry Building – Miha Tomazevic, Imperial College Press.
4. Earthquake Tips – Learning Earthquake Design and Construction C. V. R. Murty

Reference codes

1. IS**:** 1893 (Part-1) -2016. "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- 2016, "Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

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REPAIR & REHABILITATION OF BUILDINGS (PE - IV)

Course Objectives

To impart knowledge on the distress in structures.

Course Outcomes

The learner will be able to understand the reasons for distress in structures and will be able to suggest suitable solutions

UNIT – I

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage.

UNIT – II

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation.

UNIT – III

Inspection and Testing – Symptoms and Diagnosis of Distress - Damage assessment – NDT.

UNIT – IV

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shotcreting – Underpinning -Strengtheningof Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V

Health Monitoring of Structures – Use of Sensors – Building Instrumentation

References

1. Concrete Technology by A. R. Santhakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
4. Maintenance, Repair & Rehabilitation and Minor Works of Buildings by P. C. Varghese, PHI.
5. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
6. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
7. Building Failures**:** Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991**).**

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STABILITY OF STRUCTURES (PE - IV)

Course Objectives

To impart knowledge on the elastic, inelastic buckling and torsional buckling of structures.

Course Outcomes

The learner will be able to understand buckling of bars and frames.

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.

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.

Text books

1. Theory of elastic Stability by Timshenko & Gere -McGraw Hill

References

1. Stability of metallic structures by Blunch- McGraw Hill
2. Theory of Beam- Columns Vol. I by Chem. & Atste McGraw Hill
3. Stability Theory of Structures by Ashwini Kumar, Allied Publishers.

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COMPUTER AIDED STRUCTURAL DESIGN LAB

Course Objectives

To impart knowledge ability to analysis and design different structural components using software tools.

Course Outcome

Students will be able to analysis and design of structural elements using computer aided tool and also able to understand the concept using software packages.

EXPERIMENTS

1. Program for design of slabs Using Excel.
2. Program for design of beams Using Excel.
3. Program for design of column using excel.
4. Program for design of footing using excel.
5. Program for design of staircase using excel.
6. Program for design of cantilever Retaining wall using excel.
7. Analysis of 2D building frame using STAAD Pro.
8. Analysis of truss using STAAD Pro.
9. Analysis of R.C.C. T -beams using STAAD Pro.
10. Analysis of multistoreyed space frame using STAAD Pro.
11. Analysis of circular water tank using STAAD Pro.
12. Analysis of bridge deck slab using STAAD Pro.

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Open Elective - I

COST MANAGEMENT OF ENGINEERING PROJECTS

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

References

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

Open Elective - II

SUSTAINABLE BUILDING TECHNOLOGY

UNIT – I

Introduction**:** The shifting landscape of Green buildings, The driving forces for sustainable construction, Ethics and sustainability, Basic Concepts and Vocabulary, Major Environmental and resource concerns. International Building Assessment systems.

UNIT – II

The green building assessment system**:** Structure of the LEED suite of Building rating systems, LEED Credentials, LEED Building Design and construction Rating system, Green Globes Building Rating Tools, Structure of Green Globes for New Construction, Green Globes Assessment and Certification Process, Green Globes Professional Credentials.

UNIT – III

Green building design**:** Conventional versus Green Building Systems, Executing the Green Building Project, Integrated Design Process, Role of the charrette in the design process, Green Building Documentation Requirements.

UNIT – IV

Low – energy building strategies**:** Building Energy Issues, High – Performance Building Energy Design Strategy, Passive Design Strategy, Building Envelope, Internal Load Reduction, Smart Buildings and Energy Management Systems.

UNIT –V

Green building economics and sustainable construction**:** General approach, The Business Case for High – Performance Green Buildings, Economics of Green Building, Quantifying Green Building Benefits, Articulating Performance Goals for Future Green Buildings

Text books

1. Sustainable Construction by CHARLES J. KIBERT published by John Wiley& sons,2016
2. Sustainable Construction**:** Green Building Design and Delivery- 9 Nov 2007 by Charles J. Kibert

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M.Tech R15 Regulations

M. TECH (STRUCTURAL ENGINEERING)
COURSE STRUCTURE AND SYLLABUS

I Year – I Semester

Subject Code	Category	Course Title	Int. marks	Ext. marks	L	P	C
15D1CS1101	Core Course I	Theory of Elasticity and plasticity	40	60	4	--	4
15D1CS1102	Core Course II	Theory of Plates	40	60	4	--	4
15D1CS1103	Core Course III	Advanced Structural Analysis	40	60	4	--	4
15D1E11101	Core Elective I	Advanced Concrete Technology	40	60	4	--	4
15D1E11102		Tall Buildings					
15D1E11103		Advanced Foundation Engineering					
15D1E21101	Core Elective II	Advanced R.C. Design	40	60	4	--	4
15D1E21102		Bridge Engineering					
15D1E21103		Plastic Analysis & Design					
15D1OE1101	Open Elective I	Computer Oriented Numerical Methods	40	60	4	--	4
15D1OE1102		Reliability Engineering					
15D1OE1103		Experimental Stress Analysis					
15D1LB1101	Laboratory I	Advanced Concrete Lab	40	60	--	4	2
15D1SM1101	Seminar I	Seminar	50	--	--	4	2
	Total Credits				**24**	**8**	**28**

I Year – II Semester

Subject Code	Category	Course Title	Int. marks	Ext. marks	L	P	C
15D1CS1204	Core Course IV	Finite Element Method	40	60	4	--	4
15D1CS1205	Core Course V	Structural Dynamics	40	60	4	--	4
15D1CS1206	Core Course VI	Pre-stressed Concrete	40	60	4	--	4
15D1E31201	Core Elective III	Advanced Steel Design	40	60	4	--	4
15D1E31202		Soil Dynamic & Foundation Engineering					
15D1E31203		Stability of Structures					
15D1E41201	Core Elective IV	Design of shells & folded plates	40	60	4	--	4
15D1E41202		Earthquake Resistant Design of Buildings					
15D1E41203		Fracture Mechanics					
15D1OE1201	Open Elective II	Repair & Rehabilitation of Buildings	40	60	4	--	4
15D1OE1202		Composite Materials					
15D1OE1203		Optimisation Techniques					
15D1LB1201	Laboratory II	CAD Lab	40	60	--	4	2
15D1SM1201	Seminar II	Seminar	50	--	--	4	2
	Total Credits				**24**	**8**	**28**

II Year - I Semester

Subject Code	Course Title	Int. marks	Ext. marks	L	P	C
15D1CV2101	Comprehensive Viva-Voce	--	100	--	--	4
15D1PW2101	Project work Review I	50	--	--	24	12
	Total Credits			--	24	**16**

II Year - II Semester

Subject Code	Course Title	Int. marks	Ext. marks	L	P	C
15D1PW2202	Project work Review II	50	--	--	8	4
15D1PE2201	Project Evaluation (Viva-Voce)	--	150	--	16	12
	Total Credits			--	**24**	**16**

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY OF ELASTICITY AND PLASTICITY

Objectives : To impart knowledge on the basic concepts of theory of elasticity, and solve the Structural Engineering problems.

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.

UNIT II.

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint- Venant'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.

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.

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.

UNIT V.

Theory of Plasticity: Introduction - concepts and assumptions - yield criterions.

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.

Course outcomes: The learner will be able to solve problems of elasticity and plasticity and be able to apply numerical methods to solve continuum problems.

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY OF PLATES

Objectives : To impart knowledge on the behavior of plates and to analyse the problems pertaining to beams on elastic foundation.

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.

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.

Outcomes : The learner will be able to understand the behavior of plates for loadings and boundary conditions.

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED STRUCTURAL ANALYSIS

Objectives : To impart knowledge on the analysis of indeterminate structures like continuous beams, trusses and portal frames.

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 - band 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.

REFERENCES

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Gere, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Basic Structural Analysis by C.S.Reddy.
4. Matrix Structural Analysis by Madhu B. Kanchi.
5. Indeterminate Structural Analysis by K.U.Muthu *et al*.,I.K.International Publishng House Pvt. Ltd.
6. Matrix Methods of Structural Analysis by J.Meek.
7. Structural Analysis by Ghali and Neyveli.

Outcomes: The learner will be able to analyse different indeterminate structures using Matrix methods.

Vidya Jyothi Institute of Technology (Autonomous)

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

M.Tech R15 Regulations

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE TECHNOLOGY
(Core Elective – I)

Objectives : To impart knowledge on concrete making materials, concrete mix design for proportioning and their testing.

UNIT – I

Concrete Making Materials: Cement- Bogue's 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 Behaviour – Creep and Shrinkage – Durability tests on concrete - Non destructive 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: Micro Structure, Properties and Materials by P.K.Mehta, Tata Mc Graw Hill Publishing House Pvt. Ltd
3. Concrete Technology by A.K. Santhakumar, Oxford Press.
4. 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.

Outcomes : The learner will be able to design concrete mixes of different grades and also use the special concretes.

M. Tech – I Year – I Sem. (Structural Engg.)

TALL BUILDINGS
(Core Elective – I)

Objective : To impart knowledge on analysis of tall buildings.

Unit-I

Introduction : Classification of Buildings – Low-rise, medium-rise, high-rise – Evolution of tall buildings – Ordinary framed buildings & Shear-wall buildings –Behaviour of buildings under lateral loads like Wind loads, Earthquake loads & Blast loads – Basic structural & functional design requirements –Strength, Stiffness & Stability.

Unit-II

Lateral load resisting elements : Frames, Shear walls & Tubes – Shear, Bending & combined modes of deformation – Structural behavior of Rigid frames – Simplified methods of analysis – Substitute frame method, Portal method, Cantilever method, Equivalent frame method –Structural behaviour of Shear walls – Approaches of analysis – Elastic continuum approach & Discrete approach -- Structural behavior of Tubes –Actions.

Unit-III

Choice of System for a Building : Frame building, Shear wall building, Shear walls acting with frames, Single framed tubes – Other structural forms – Staggered Wall-beam system, Tube-in-tube system, Base isolation technique for earthquake resistance. Load distribution in a tall building – Load resisted by different shear walls & frames – Determinate & Indeterminate problems – Equivalent Stiffness method.

Unit-IV

Methods of Analysis : Shear walls without Openings – Estimation of Stiffness by simple Cantilever theory & Deep beam theory – Shear walls with Openings – Equivalent frame for large openings –
Muto's method for small openings –Elastic Continuum approach – Coull & Chowdhry's method –

Design Charts – Limitations of Continuum approach. Shear wall- Frame Interaction : Sharing of loads between wall & frame - Different methods – comparison -- Khan & Sbrounis' method – Design charts - - Mac Leod's method - Advantages & limitations -- Cooperation of Floor slabs – Equivalent width.

Unit-V

Modern Methods : Analysis of Tall buildings by Stiffness method – Available Softwares for analysis of tall buildings.

REFERENCES

1. Concrete & Composite Design of Tall Buildings by Taranath B., Mc Graw Hill.
2. Reinforced Concrete Design of Tall Buildings by Bungales. Taranath, CRC Press.
3. Analysis of Shear Walled Buildings by S. M. A. Kazimi & R. Chandra, Tor-steel Research Foundation, Calcutta, India.
4. Analysis of Framed Structures by Gere & Weaver
5. Design of Building Structures by Wolfgang Schuller, Prentice Hall

Outcomes : The learner will be able to analyse and chose a appropriate systems for tall buildings.

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED FOUNDATION ENGINEERING
(Core Elective – I)

Objective: To determine the bearing capacity of shallow and deep foundations and to estimate settlements of structures subjected to external loads, leading to design of foundations resting on soils.

Unit-I

Soil Exploration: Exploration Methods; Planning the Exploration Program; Boring and Sampling; In Situ Tests: Standard & Cone Penetration Tests, Field Vane, Dilatometer, Pressure meter; Rock Sampling, Core Recovery, RQD; Geophysical Exploration; Preparation of Soil Report, Case Studies.

Unit-II

Shallow Foundations: **Bearing Capacity:**- Shear Failure; Effect of Water Table; Footings with Eccentric or Inclined Loads, Footings on Layered Soils, Slopes on finite layer with a Rigid Base at Shallow Depth, effect of compressibility of soil, on soils with strength increasing with depth, Plate Load tests, Presumptive bearing capacity.

Unit-III

Settlement: Components – Immediate, Primary and Secondary Settlements, Consolidation, Stresses and Displacements in Homogeneous, Layered and Anisotropic Soils; Bearing Pressure using SPT, CPT, Dilatometer and Pressure meter; Settlement of foundations on Sands-Schmertmann and Burland & Burbridge methods; Structure Tolerance to Settlement and Differential Settlements, Rotation, Codal Provisions.

Unit-IV

Deep Foundations: **Single Pile:** Vertically loaded piles, Static capacity- α, β and λ Methods, Dynamic formulae; Wave Equation Analyses; Point Bearing Resistance with SPT and CPT Results; Bearing Resistance of Piles on Rock; Settlement; Pile Load Test; Uplift Resistance; Laterally Loaded Piles -Ultimate Lateral Resistance; Negative Skin Friction; Batter Piles; Under Reamed Piles; Ultimate Capacity of Pile Groups in Compression, Pullout & Lateral Load; Efficiency; Settlements of Pile Groups; Interaction of Axially & Laterally Loaded Pile Groups, Codal Provisions.

Unit-V

Special Topics of Foundation Engineering

Foundations on Collapsible Soils: Origin and occurrence, Identification, Sampling and Testing, Preventive and Remedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence, Identifying, testing and evaluating expansive soils, typical structural distress patterns and Preventive design & construction measures.

***Introduction to Reliability-Based Design**: Brief introduction of probability and statistics, LRFD for structural strength requirements, LRFD for geotechnical strength requirements, Serviceability requirements

TEXT BOOKS

1. Das, B. M. - Principles of Foundation Engineering 5th Edition Nelson Engineering (2004)
2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012. Phi Learning (2008)

REFERENCE BOOKS

1. Bowles, J. E. - Foundation Analysis & Design 5th Edition McGraw-Hill Companies, Inc. (1996)
2. Poulos, H. G. & Davis, E. H. - Pile Foundation Analysis and Design john wiley & sons inc (1980-08)
3. Tomlinson, M. J. - Foundation Design and Construction - Prentice Hall (2003).
4. Baecher, G.B. & Christian, J.T. – Reliability and Statistics in Geotechnical Engineering, Wiley Publications (2003)

Outcome: Students should be in a position to design foundations for varieties of structures resting on soil deposits, and appreciate the importance of reliability based design in geotechnical engineering.

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED REINFORCED CONCRETE DESIGN
(Core Elective – II)

Objectives : To impart knowledge on the behavior and design on various reinforced concrete structural elements.

UNIT I

Basic Design Concepts: Behaviour 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 Combined Footing – Design Considerations in Combined Footing for Two – Columns.

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, Prentice Hall of India, 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.
4. Principles of Reinforced Concrete Design by Mete A. Sozen, Toshikatsu Ichinose, Santiago Pujol July 14, 2014 CRC Press

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.

Outcomes : The learner will be able to design the reinforced concrete elements like beams, slabs and compression members.

M. Tech – I Year – I Sem. (Structural Engg.)

BRIDGE ENGINEERING
(Core Elective – II)

Objectives : To impart knowledge on the behavior and design aspects of various types of bridges.

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-Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway 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 prestessed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped 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-srtucture 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. Essentials of Bridge Engineering by Johnson Victor, Oxford & IBH.
3. Bridge Deck Behaviour by E.C.Hambly.
4. Design of Bridges by N.Krishna Raju, Oxford & IBH.
5. Design of Bridges by V.V.Sastry, Dhanpat Rai & Co
6. Concrete Bridge Design and Practice by V.K.Raina.

Outcomes: The learner will be able to analyze and design of different types of bridges.

M. Tech – I Year – I Sem. (Structural Engg.)

PLASTIC ANALYSIS AND DESIGN
(Core Elective – II)

Objectives : To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

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.

UNIT - II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

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.

UNIT - IV

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT - V

Design of Steel Frames: Introduction – Single bay, single storey frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections:

Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

REFERENCES:

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

Outcomes : The learner will be able to design continuous beams and steel frames.

M. Tech – I Year – I Sem. (Structural Engg.)

COMPUTER ORIENTED NUMERICAL METHODS
(Open Elective – I)

Objectives : To impart knowledge about various methods of analysing linear equations and understand the different mathematical techniques.

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.

UNIT II:

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

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 points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

UNIT IV.

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

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

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.Jain-S.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.

Outcomes : The learner will be able to apply various mathematical techniques to Structural engineering problems.

M. Tech – I Year – I Sem. (Structural Engg.)

RELIABILITY ENGINEERING
(Open Elective – I)

Objectives : To impart knowledge on concepts of reliability, discrete distributions and hierarchical systems.

UNIT I

Basic Concepts of Reliability : Introduction, Reliability and Quality, Failures and Failure Modes, Cuses of Failures and Unreliability, Maintainability and Availability, History of Reliability, Reliability Literature.

UNIT II

Design for Reliability : Constraints and Considerations : Reliability Analysis, Mathematical Models and Numerical Evaluation, Designing for Higher Reliability, Redundancy Techniques, Equipment Hierarchy, Reliability and Cost.

UNIT –III

Discrete Distributions : Density and distributions, Continuous Distributions, Numerical Characteristics of Random Variables, Laplace Transform.

UNIT-IV

Maintainability and Availability Concepts : Introduction, Maintainability Function, Availability Function, Frequency of Failure, Two-unit parallel system with Repair, K-out-of M systems, Preventive Maintenance**.**

UNIT-V:

Hierarchical Systems : Introduction, Logic Diagram Approach, Conditional Probability Approach, System Cost, Illustrations and Discussions, Reliability Approximations.

TEXT BOOKS :

1. Reliability Engineering by E. Balagurusamy, McGraw Hill Education(India) Pvt. Ltd.
2. Reliability Evaluation of Engineering Systems by Roy Billinton & Ronald N. Allan, Springer.
3. Reliability of Structures, Second Edition by Andrzej S. Nowak, Kevin R. Collins December 20, 2012 by CRC Press

Outcomes : The learner will be able to design a reliable systems and develop and analyse reliability and cost models for hierarchical systems.

M. Tech – I Year – I Sem. (Structural Engg.)

EXPERIMENTAL STRESS ANALYSIS
(Open Elective – I)

Objectives : To impart knowledge on the strain measurement, brittle coating and photo elasticity.

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.

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.

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.

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.

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 - Computation techniques - calibration methods, separation methods, scaling Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic materials.

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

Outcomes : The learner will be able to understand the properties of strain-gauge systems and the computation techniques.

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE LABORATORY

Objectives : To impart knowledge on the test on cement and aggregates.

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.

Outcomes : The learner will be able to understand the properties of the materials and the behavior of the concrete.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH - STRUCTURAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

I Year I Semester

Code	Group	Subject	L	P	Credits
		Computer Oriented Numerical Methods	3	-	3
		Theory of Elasticity and Plasticity	3	-	3
		Theory and Analysis of Plates	3	-	3
		Advanced Reinforced Concrete Design	3	-	3
	Elective –I	Concrete Technology Experimental Stress Analysis Optimization Techniques in Structural Engineering	3	-	3
	Elective –II	Advanced Structural Analysis Soil Dynamics and foundation Engineering Composite Materials	3	-	3
	Lab	Advanced Concrete Laboratory	-	3	2
		Seminar	-	-	2
		Total Credits	18	3	22

I Year II Semester

Code	Group	Subject	L	P	Credits
		Finite Element Methods	3	-	3
		Structural Dynamics	3	-	3
		Analysis and Design of Shells and Folded Plates	3	-	3
		Advanced. Steel Design	3	-	3
	Elective –III	Pre stressed Concrete Advanced Foundation Engineering Computer Aided Design in Structural Engineering (CAD)	3	-	3
	Elective -IV	Principles of Bridge Engineering Earthquake Resistant Design of Buildings Plastic Analysis and Design. Stability of Structures	3	-	3
	Lab	CAD Laboratory	-	3	2
		Seminar	-	-	2
		Total Credits	18	3	22

II Year - I Semester

Code	Group	Subject	L	P	Credits
		Comprehensive Viva	-	-	2
		Project Seminar	-	3	2
		Project work	-	-	18
		Total Credits	-	3	22

II Year - II Semester

Code	Group	Subject	L	P	Credits
		Project work and Seminar	-	-	22
		Total Credits	-	-	22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

COMPUTER ORIENTED NUMERICAL METHODS

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.

UNIT II:

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

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 points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

UNIT IV.

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

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

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.Jain-S.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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY OF ELASTICITY AND PLASTICITY

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.

UNIT II.

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint- Venant'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.

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.

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.

UNIT V.

Theory of Plasticity: Introduction - concepts and assumptions - yield criterions.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

THEORY AND ANALYSIS OF PLATES

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.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED REINFORCED CONCRETE DESIGN

UNIT I

Basic Design Concepts: Behaviour 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 Combined Footing – Design Considerations in Combined Footing for Two – Columns.

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..

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

CONCRETE TECHNOLOGY

(ELECTIVE -I)

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 Behaviour – Creep and Shrinkage – Durability tests on concrete - Non destructive 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

EXPERIMENTAL STRESS ANALYSIS

(ELECTIVE -I)

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.

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.

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.

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.

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.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

(ELECTIVE -I)

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 sub-optimization 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED STRUCTURAL ANALYSIS

(ELECTIVE-II)

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.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

SOIL DYNAMICS AND FOUNDATION ENGINEERING

(ELECTIVE-II)

UNIT I

Types of machine foundations – general requirements design – criteria for machine foundations, permissible amplitudes and bearing pressure. Resonance and its effect – free and forced Vibrations with and without damping – constant force and rotating mass type excitation – magnification steady state vibrations – logarithmic decrement.

UNIT II

Natural frequency of foundation – soil system – Barkan's and I.S. methods of determining natural frequency.

UNIT III

Elastic properties of soil for dynamical purpose and their experimental determination – Elastic waves and their characteristics – Experimental determination of shear modulus from wave theory.

UNIT IV

Apparent soil mass – bulb of pressure concept – Pauw's analogy of foundation – soil systems (Concept only) - Theory of elastic half space – lamb and the dynamic Boussinesq's problem – Relsner's solution and its limitations – Quinlan and Sung's modifications – Hsiegh's equations for vertical vibration.

UNIT V

Principles of design of foundations for reciprocating and impact type of machine – as per I.S. Codes. Vibration isolation – types and methods of isolation – isolating materials and their properties.

REFERENCES:

1. Hand Book of Machine Foundations by S. Srinivasulu and Vaidganathan.
2. Soil Mechanics & Foundation Engineering by B.C. Punmia.
3. Analysis and Design of Foundation and retaining structures-Sham Sher Prakets, Etal.
4. Vibration of Soils & Foundations – Richant Hall & Woods.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

COMPOSITE MATERIALS

(ELECTIVE-II)

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 Analysis of composite Laminae: Introduction, Assumptions and Limitations, Stiffness characteristics of glass reinforced laminae- Stress- Strain relationships in continuous, discontinuous fibre laminae, Strength characteristics of glass reinforced laminae- Strengths in continuous, discontinuous fibre aminae.

UNIT - III

Behaviour of Glass Fibre-Reinforced laminates: Introduction, Stiffness characteristics of Laminated composites-Behaviour 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.

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.

UNIT - V

Design of GRP Box Beams: Introduction, loading, span and cross-sectional shape, Selection of material, Beam manufacture, Beam stresses, Experimental Behaviour, Effect on Beam performance- Modulus of Elasticity, Compressive Strength, I value, prevention of compression buckling failure, Behaviour under long term loading.

Design of Stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis.

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Structural Engg.)

ADVANCED CONCRETE LABORATORY

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

FINITE ELEMENT METHODS

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 axi-symmetric loading.

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

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.

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.

UNIT V

Introduction to non – linear analysis – basic methods – application to Special structures.

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.
4. Introduction to Finite element Method by Tirupathi Chandra Patila and Belugunudu.
5. Introduction to Finite element Method by JN Reddy.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

STRUCTURAL DYNAMICS

UNIT I:

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of 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.

UNIT II

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.

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped 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.

UNIT IV

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.

UNIT V

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.

REFERENCES:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New york
2. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
4. I.S: 1893 - 1984, "Code of practice for Earthquake resistant design of Structures" and latest I.S: 1893 - 2002 (version) Part-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

ANALYSIS AND DESIGN OF SHELLS AND FOLDED PLATES

UNIT I

Shells – functional behaviour – examples – structural behaviour of shells classification of shells – Definitions – various methods of analysis of shells – merits and demerits of each method – 2D. Membrane equation.

Equations of equilibrium: Derivation of stress resultants – cylindrical shells – Flugges simulations equations.

UNIT II

Derivation of the governing DKJ equation for bending theory, - Schorer's theory - Application to the analysis and design of short and long shells.

Beam theory of cylindrical shells: Beam and arch action, Analysis using beam theory.

UNIT III

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.

UNIT IV

Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shells and hyperboloid of revolution cooling towers.

UNIT V

Folded plates – Introduction – Types of folded plates – structural behaviour of folded plates – advantages – Assumptions Whitney method of analysis – Edge shear equation - Analysis of folded plates of Whitney's method.

Simpsons method of Analysis of folded plates – moment and stress distribution – no rotation and rotation solutions – continuous folded plates – pre stressed continuous folded plates.

TEXT BOOKS:

1. Analysis and design of concrete shell roofs By G.S.Ramaswami.
2. Design of concrete shell roofs By Chaterjee.

REFERENCES:

1 Design of concrete shell roofs By Billington
2 Shell Analysis By N.K.Bairagi.
3 Advanced R.C Design By Dr.N.Krishna Raju.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

ADVANCED STEEL DESIGN

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.

UNIT –II

Eccentric and Moment Connections: Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Brackete Connections. Bolted Moment Connections – Welded Framed Connections – Welded Brackete Connections - Moment Resistant Connections.

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.

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.

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.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

PRE-STRESSED CONCRETE

(ELECTIVE -III)

UNIT I.

General Principles of Prestressed Concrete : Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, 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.

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.

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.

UNIT IV

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

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)

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, New York.
3. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

ADVANCED FOUNDATION ENGINEERING

(ELECTIVE -III)

UNIT – I

Bearing capacity of Footings subjected to Eccentric and Inclined Loading – Meyrhoff's and Hanse's theories – elastic settlement of Footings embedded in sands and clays of Infinite thickness – Footings on soils of Finite thickness-Schmertamaunn's method, Jaubu and Morgenstern method.

UNIT - II

Pile Foundations – settlement of Pile groups resting in sands and clays – Negative skin friction – in single piles and groups of piles – under – reamed piles – specifications – load – carrying capacity in sands and clays.

UNIT – III

Caissons and well foundations : Types of caissons – well foundation Different shapes of wells – Components of wells – functions and Design – Design Criteria – Sinking of wells – lateral stability by Terzaghi's analysis.

UNIT – IV

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 - V

Foundations in Expansive soils – Problems in Expansive soils – Mechanism of swelling – Swell Pressure and Swelling potential – Heave foundation practices – Sand cushion – CNS cushion – under –reamed pile Foundations – Granular pile – anchor technique, stabilization of expansive soils.

REFERENCES:

1. Analysis and Design of Substractenes – Swami Saran.
2. Basic and Applied Soil Mechanics – Gopal Ranjan and A.S.R.Rao.
3. Soil Mechanics & Foundation Engineering, Foundation Engineering – II V.N.S. Murthy.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

COMPUTER AIDED DESIGN IN STRUCTURAL ENGINEERING

(ELECTIVE -III)

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.

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.

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.

UNIT IV

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

UNIT V

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

REFERENCES

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Structural Engg.)

PRINCIPLES OF BRIDGE ENGINEERING

(ELECTIVE-IV)

UNIT I :

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- Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway 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 prestessed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped 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-srtucture 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.

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M. Tech – I Year – II Sem. (Structural Engg.)

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

(ELECTIVE -IV)

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.

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.

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- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings-Load combinations and permissible stresses- Seismic design requirements- Lateral load analysis of masonry buildings.

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.

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. Behaviour of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey 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.

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M. Tech – I Year – II Sem. (Structural Engg.)

PLASTIC ANALYSIS AND DESIGN

(ELECTIVE -IV)

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.

UNIT - II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

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.

UNIT - IV

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT - V

Design of Steel Frames: Introduction – Sinole span frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

REFERENCES:

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

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M. Tech – I Year – II Sem. (Structural Engg.)

STABILITY OF STRUCTURES

(ELECTIVE -IV)

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.

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

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.

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M. Tech – I Year – II Sem. (Structural Engg.)

CAD LAB

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 multistoreyed space frame, using STAAD Pro.
8. Analysis of Bridge deck slab.