**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**(Established by Govt. of A.P., ACT No.30 of 2008)**
**ANANTHAPURAMU – 515 002 (A.P) INDIA**

**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

## SEMESTER – I

| S. No. | Course codes | Course Name | Category | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **1.** | 21D35101 | Theory of Elasticity | PC | 3 | 0 | 0 | 3 |
| **2.** | 21D20101 | Advanced Structural Analysis | PC | 3 | 0 | 0 | 3 |
| **3.** | 21D35203b<br>21D21103a<br>21DBS105 | **Program Elective - I**<br>Theory and Analysis of Plates and Shells<br>Advanced Concrete Technology<br>Advanced Mathematical Methods | PE | 3 | 0 | 0 | 3 |
| **4.** | 21D35104b<br>21D20103a<br>21D20103b | **Program Elective – II**<br>Design of Prestressed Concrete<br>Maintenance and Rehabilitation of Structures<br>Design of Bridges | PE | 3 | 0 | 0 | 3 |
| **5.** | 21D35206 | Advanced Concrete Laboratory | PC | 0 | 0 | 4 | 2 |
| **6.** | 21D35106 | Advanced Structural Engineering Laboratory | PC | 0 | 0 | 4 | 2 |
| **7.** | 21DRM101 | Research Methodology and IPR | MC | 2 | 0 | 0 | 2 |
| **8.** | 21DAC101a<br>21DAC101b<br>21DAC101c | **Audit Course – I**<br>English for Research paper writing<br>Disaster Management<br>Sanskrit for Technical Knowledge | AC | 2 | 0 | 0 | 0 |
| **Total** | | | | | | | **18** |

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## SEMESTER – II

| S.No. | Course codes | Course Name | Category | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **1.** | 21D35201 | Structural Dynamics | PC | 3 | 0 | 0 | 3 |
| **2.** | 21D20201 | Finite Element Methods for Structural Engineering | PC | 3 | 0 | 0 | 3 |
| **3.** | 21D20202a<br>21D20202b<br>21D20202c | **Program Elective – III**<br>Design of Reinforced Concrete Foundations<br>Experimental Stress Analysis<br>Stability of Structures | PE | 3 | 0 | 0 | 3 |
| **4.** | 21D20203a<br>21D20203b<br>21D20203c | **Program Elective – IV**<br>Advanced Steel Design<br>Fracture Mechanics<br>Advanced Reinforced Concrete Design | PE | 3 | 0 | 0 | 3 |
| **5.** | 21D20204 | Computer Aided Design Laboratory | PC | 0 | 0 | 4 | 2 |
| **6.** | 21D20205 | Advanced Structural Design Laboratory | PC | 0 | 0 | 4 | 2 |
| **7.** | 21D20206 | Technical seminar | PR | 0 | 0 | 4 | 2 |
| **8.** | 21DAC201a<br>21DAC201b<br>21DAC201c | **Audit Course – II**<br>Pedagogy Studies<br>Stress Management for Yoga<br>Personality Development through Life Enlightenment Skills | AC | 2 | 0 | 0 | 0 |
| **Total** | | | | | | | **18** |

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## SEMSTER - III

| S.No. | Course codes | Course Name | Category | Hours per | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **1.** | 21D35301a<br>21D20301a<br>21D20301b | **Program Elective – V**<br>Earthquake Resistant Design of Buildings<br>Low-Cost Housing Techniques<br>Building Construction Management | PE | 3 | 0 | 0 | 3 |
| **2.** | 21DOE301a<br>21DOE301b<br>21DOE301c | **Open Elective**<br>Cost Management of Engineering Project<br>Industrial Safety<br>Business Analytics | OE | 3 | 0 | 0 | 3 |
| **3.** | 21D20302 | Dissertation Phase – I | PR | 0 | 0 | 20 | 10 |
| **4.** | 21D203013 | Co-curricular Activities | | | | | 2 |
| **Total** | | | | | | | **18** |

## SEMESTER - IV

| S.No. | Course codes | Course Name | Category | Hours per | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **1.** | 21D20401 | Dissertation Phase – II | PR | 0 | 0 | 32 | 16 |
| **Total** | | | | | | | **16** |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | THEORY of ELASTICITY | L | T | P | C |
|---|---|---|---|---|---|
| 21D35101 | | 3 | 0 | 0 | 3 |
| | Semester | I | | | |

**Course Objectives:** This Course Will Enable Students:

- To make students understand the principles of elasticity.
- To familiarize students with basic equations of elasticity.
- To expose students to two dimensional problems in Cartesian and polar coordinates.
- 4. To make students understand the principle of torsion of prismatic bars.

**Course Outcomes (CO):** Student will be able to

- To apply elastic analysis to study the fracture mechanics.
- To apply linear elasticity in the design and analysis of structures such as beams, plates, shells and sandwich composites.
- To apply hyper elasticity to determine the response of elastomer-based objects.
- To analyze the structural sections subjected to torsion.

**UNIT - I** Lecture Hrs:10

**INTRODUCTION TO PLANE STRESS and PLANE STRAIN ANALYSIS:**
Elasticity –Notation for Forces and Stresses-Components of Stresses –Components of Strain – Hooke's Law. Plane Stress-Plane Strain-Differential Equations of Equilibrium- Boundary Conditions- Compatibility Equations-Stress Function-Boundary Conditions.

**UNIT - II** Lecture Hrs:10

**TWO DIMENSIONAL PROBLEMS in RECTANGULAR COORDINATES:**
Solution by Polynomials-Saint Venant's Principle-Determination of Displacements-Bending of Simple Beams-Application of Fourier Series for Two Dimensional Problems - Gravity Loading.

**UNIT - III** Lecture Hrs:10

**TWO DIMENSIONAL PROBLEMS in POLAR COORDINATES :**
General Equation in Polar Co-Ordinates - Stress Distribution Symmetrical About An Axis –Pure Bending of Curved Bars- Strain Components in Polar Coordinates-Displacements for Symmetrical Stress Distributions-Simple Symmetric and Asymmetric Problems-General Solution of Two Dimensional Problem in Polar Coordinates-Application of The General Solution of Two Dimensional Problem in Polar Coordinates-Application of The General Solution in Polar Coordinates.

**UNIT - IV** Lecture Hrs:9

**ANALYSIS of STRESS and STRAIN in THREE DIMENSIONS:** Principle Stress - Ellipsoid and Stress-Director Surface-Determination of Principle Stresses- Maximum Shear Stresses-Homogeneous Deformation-Principle Axis of Strain Rotation.
**General Theorems:** Balance Laws - Differential Equations of Equilibrium- Conditions of Compatibility - Determination of Displacement-Equations of Equilibrium in Terms of Displacements-Principle of Superposition-Uniqueness of Solution –The Reciprocal Theorem.

**UNIT - V** Lecture Hrs:9

**TORSION of PRISMATIC BARS:**
**T**orsion of Prismatic Bars- Elliptical Cross Section-Other Elementary Solutions-Membrane Analogy-Torsion of Rectangular Bars-Solution of Torsional Problems by Energy Method-Use of Soap Films in Solving Torsional Problems-Hydra Dynamical Analogies-Torsion of Shafts, Tubes and Bars.

**Textbooks:**

1. Theory of Elasticity and Plasticity by Timoshenko, S., MC Graw Hill Book company.
2. Advanced Strength of materials by Papoov, MC Graw Hill Book company.
3. Theory of Elasticity and Plasticity by Sadhu Singh. Khanna Publishers.

**Reference Books:**

1. Plasticity for structural Engineers- Chen, W.F. and Han, D.J., Springer – Verlag, New York.
2. Plasticity theory, Lubliner, J., Mac Millan Publishing Co., New York.
3. Foundations of Solid Mechanics by Y.C.Fung, PHI Publications.
4. Advanced Mechanics of Solids by L.S. Srinath, Tata MC Graw Hill Book company.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED STRUCTURAL ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| 21D20101 | | 3 | 0 | 0 | 3 |
| | **Semester** | **I** | | | |

**Course Objectives:** This Course Will Enable Students:

- To understand the static and kinematic indeterminacy of the structures
- To understand the concepts of matrix methods of analysis of structures
- To understand the analysis of continuous beams.
- To understand the analysis of rigid and pin jointed frames

**Course Outcomes (CO):** Student will be able to

- Distinguish determinate and indeterminate structures.
- Identify the method of analysis for indeterminate structures.
- Apply matrix methods of analysis for continuous beams.
- Apply matrix methods of analysis for rigid and pin jointed frames.

**UNIT - I** Lecture Hrs:

Introduction to matrix methods of analysis - statical indeterminacy and kinematical 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 torsional element.
Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

**UNIT - II** Lecture Hrs:

Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method.

**UNIT - III** Lecture Hrs:

Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using system approach.

**UNIT - IV** Lecture Hrs:

Analysis of plane truss - continuous beams with and without settlement - plane frame including sides sway, grids and gable frames by stiffness methods, single bay – two storey, two bay single – storey.

**UNIT - V** Lecture Hrs:

Special analysis procedures - static condensation and sub structuring - initial and thermal stresses.

**Textbooks:**

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. Matrix method of S.A by Pandit & Gupta

**Reference Books:**

1. Matrix Structural Analysis by Madhu B. Kanchi.
2. Matrix Methods of Structural Analysis by J.Meek.
3. Structural Analysis by Ghali and Neyveli.
4. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt Ltd.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | THEORY and ANALYSIS of PLATES and SHELLS (PE-I) | L | T | P | C |
|---|---|---|---|---|---|
| 21D35203b | | 3 | 0 | 0 | 3 |
| | **Semester** | **I** | | | |

**Course Objectives:** This Course Will Enable Students:

- Introduce with concept of plate theory,the behaviour and analysis
- Knowledge about classification of shell surfaces
- To analyse the plate with different boundary conditions
- To understand the classical theory oh shells based on the kirchoff-love assumptions.

**Course Outcomes (CO):** Student will be able to

- Assess the strength of plate panels under point,linearly varying and uniformly distributed loads
- Analyze plates under different boundary conditions by various classical methods and approximated methods
- Familiar with classification of shells and classical shell theories and apply them in engineering design
- Exposed to single curved shells, doubly curves shells and cylindrical shells

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

**Introduction:** Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

| **UNIT - II** | Lecture Hrs:10 |
|---|---|

**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 solution – Application to different cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

| **UNIT - III** | Lecture Hrs:10 |
|---|---|

**Circular Plates:** Differential Equation for symmetrical bending of Laterally loaded circular Plates – Uniformly loaded circular plates –circular plate concentrically loaded – circular plate loaded at center

| **UNIT - IV** | Lecture Hrs:9 |
|---|---|

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 - V** | Lecture Hrs:9 |
|---|---|

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.
Axi- Symmetrical shells: General equation - Analysis and axi-symmetrical by membrane theory. Application to spherical shell and hyperboloid of revolution cooling towers.

**Textbooks:**

1. Theory of Plates & Shells –Stephen, P.Timoshenko, S.Woinowsky-Krieger – Tata MC Graw Hill Edition
2. Analysis and design of concrete shell roofs by G.S.Ramaswami. CBS publications.
3. Design of concrete shell roofs by Billington – Tata MC Graw Hill, New York

**Reference Books:**

1. Shell Analysis by N.K.Bairagi. Khanna Publishers, New Delhi.
2. Design of Shells and Folded Plates by P.C. Varghese, PHI Learning Pvt. Ltd
3. Design of concrete shell roofs by Chaterjee. Oxford and IBH.**,**

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED CONCRETE TECHNOLOGY (PE-I) | L | T | P | C |
|---|---|---|---|---|---|
| 21D21103a | | 3 | 0 | 0 | 3 |
| | Semester | I | | | |

**Course Objectives:** This Course Will Enable Students:

- To study the properties of concrete making materials
- To do mix design
- Famiiar with the methods of concrete
- Knowledge about advance tests on concrete

**Course Outcomes (CO):** Student will be able to

- To be familiar with the properties of concrete making materials
- Identify the influence and compatibility of chemcial,mineral admixtures in concrete
- Update the knowledge on recent advances in special concretes.
- Know about various methods of concrete
- Analyse the performance of concrete structure through microstructure analysis

**UNIT - I** Lecture Hrs:10

**Cements and Admixtures**: Portland Cement – Chemical Composition - Hydration, Setting and Finenesses of Cement – Structures of Hydrated Cement – Mechanical Strength of Cement Gel - Water Held in Hydrate Cement Paste – Heat of Hydration of Cement – Influence of Compound Composition on Properties of Cement – Tests on Physical Properties of Cement – I.S. Specifications – Different Types of Cements – Admixtures.

**UNIT - II** Lecture Hrs:10

**Aggregates**: Classification of Aggregate – Particle Shape and Texture – Bond Strength and Other Mechanical Properties of Aggregate Specific Gravity, Bulk Density, Porosity, Absorption and Moisture in Aggregate – Soundness of Aggregate – Alkali – Aggregate Reaction, Thermal Properties – Sieve Analysis – Fineness Modulus – Grading Curves – Grading Requirements – Practical Grading – Road Note No.4 Grading of Fine and Coarse Aggregates Gap Graded Aggregate – Maximum Aggregate Size.

**UNIT - III** Lecture Hrs:10

**Fresh Concrete**: Workability – Factors Affecting Workability – Measurement of Workability by Different Tests – Effect of Time and Temperature on Workability – Segregation and Bleeding – Mixing and Vibration of Concrete – Quality of Mixing Water.
**Hardened Concrete**: Water/Cement Ratio-Abram's Law – Gel Space Ratio – Effective Water in Mix – Nature of Strength of Concrete – Strength in Tension and Compression- Griffith's Hypothesis – Factors Affecting Strength – Autogeneous Healing –Relation Between Compression and Tensile Strength – Curing and Maturity of Concrete Influence of Temperature on Strength – Steam Curing – Testing of Hardened Concrete – Compression Tests – Tension Tests – Factors Affecting Strength – Flexure Tests – Splitting Tests – Non Destructive Testing Methods.

**UNIT - IV** Lecture Hrs:9

**Elasticity, Shrinkage and Creep**: Modulus of Elasticity – Dynamic Modulus of Elasticity – Poisson's Ratio – Early Volume Changes – Swelling – Draying Shrinkage - Mechanism of Shrinkage – Factors Affecting Shrinkage – Differential Shrinkage – Moisture Movement Carbonation Shrinkage-Creep of Concrete – Factors Influencing Creep – Relation Between Creep and Time – Nature of Creep – Effect of Creep.

**UNIT - V** Lecture Hrs:9

**Mix Design**: Proportioning of Concrete Mixes by Various Methods – Fineness Modulus, Trial and Error, Mix Density, Road Note. No. 4, ACI and ISI Code Methods – Factors in The Choice of Mix Proportions – Durability of Concrete – Quality Control of Concrete – Statistical Methods – High Strength Concrete Mix Design.
**Special Concretes**: Light Weight Concretes –Light Weight Aggregate Concrete- Cellular Concrete - No Fines Concrete – High Density Concrete – Fiber Reinforced Concrete – Different Types of Fibers - Factories Affecting Properties of FRC – Applications Polymer Concrete – Types of Polymer

| Concrete Properties of Polymer Concrete and Applications |
|---|
| **Textbooks:** |
| 1. Properties of Concrete by A.M.Neville – Pearson Publication – 4th Edition<br>2. Concrete Technology by M.S.Shetty. – S.Chand & Co. ; 2004<br>3. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi |
| **Reference Books:** |
| 1. Concrete: Micro Structure, Properties and Materials – P.K.Mehta and J.M.Monteiro, Mc-Graw Hill Publishers<br>2. Design of Concrete Mix by Krishna Raju, CBS Pubilishers.<br>3. Concrete Technology by A.M.Neville – Pearson Publication<br>4. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi<br>5. Non-Destructive Test and Evaluation of Materials by J.Prasad & C.G.K. Nair , Tata Mcgraw Hill Publishers, New Delhi |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED MATHEMATICAL METHODS | L | T | P | C |
|---|---|---|---|---|---|
| 21DBS105 | Common to (SE and CM and SE (PEC-I)) | 3 | 0 | 0 | 3 |
| | Semester | I | | | |

**Course Objectives:** This Course Will Enable Students:

- With calculus of variation, numerical methods of solving ordinary and partial differential equations.
- To impart knowledge in basic concepts of finite element methods and applications.

**Course Outcomes (CO):** Student will be able to

- Solve functionals using Hamilton's principle .
- Numerically solve ordinary and partial differential equations that are initial value or boundary value problems.
- Apply the concepts of finite element method for 1-D and 2-D problems.

| UNIT - I | Calculus of Variation | Lecture Hrs: 8 |
|---|---|---|

**Calculus of Variation** – Functionals – Euler's Equation - Solution of Euler's Equation – Isoperimetric problems – several dependent variables – Functionals involving higher Order derivatives – Hamilton's principle – Lagrange's Equations.

| UNIT - II | Numerical Solution of ordinary Differential Equations & Eigen values and Eigen vectors | Lecture Hrs: 8 |
|---|---|---|

**Numerical Methods**: Eigen values and Eigen vectors – general method – power Method, spectral method.
**Numerical Solution of ordinary Differential Equations** - Taylor Series Method, Picard's method, Euler's method modified Euler's method & R.K. Method.

| UNIT - III | Numerical solution of partial differential equations | Lecture Hrs: 10 |
|---|---|---|

**Numerical solution of partial differential equations** –elliptical equations standard five Points formula, Diagonal five point formula –Solution of Laplace equation by Leibmann's iteration method, Poisson's equation and its applications.

| UNIT - IV | Numerical Solution of Partial Differential Equations | Lecture Hrs: 8 |
|---|---|---|

**Numerical Solution of Partial Differential Equations** – Parabolic Equations Bender –Schmidt Method-Bender - Schmidt Recurrence Equation, Crank-Nicholson Difference Method.

| UNIT - V | Finite Element Method | Lecture Hrs: 8 |
|---|---|---|

**Finite Element Method** – Weighted residual methods, least square method, Gelarkin's method – Finite Elements – Interpolating over the whole Domain – one dimensional case, two dimensional case – Application to Boundary value Problems.

**Textbooks:**

1. Higher Engineering Mathematics By B.S. Grewal Khanna Publishers.
2. Numerical Methods For Engineers By Steven C.Chapra And Raymond P.Canale – Mc Graw Hill Book Company.

**Reference Books:**

1. Applied Numerical Analysis By Curtis. F.Gerald- Addeson Wesely Publishing Company.
2. C-Language And Numerical Methods By C-Xavier. New Age International Publishers.

| |
|---|
| 3. Computational Methods For Partial Differential Equations By M.K.Jain, SKR Lyengar, R.K.Jain. |
| **Online Learning Resources:** |
| After completion of this course the student should be able to :<br>• Understand the concept and steps of calculus of variation.<br>• Solve ordinary and partial differential equations numerically.<br>• Solve the initial and boundary value problems numerically.<br>• Solve the 1-D and 2-D problems using finite element method.<br>• Identify, formulate and solve structural engineering problems. |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | DESIGN of PRESTRESSED CONCRETE (PE-II) | L | T | P | C |
|---|---|---|---|---|---|
| 21D35104b | | 3 | 0 | 0 | 3 |
| | **Semester** | **I** | | | |

**Course Objectives:** This Course Will Enable Students:

- Familiarize students with concrept of prestressing and analysis of prestress
- Design and analysis of pretension and post tensioned concrete memebers
- Determination of deflections of prestressed members
- To calculate the losses of prestress,creep and shrinkage.

**Course Outcomes (CO):** Student will be able to

- To understand the basic concepts about prestressed concrete and analysis of prestress
- Estimate the effective losses in prestress
- Analyse the effect of prestressing force in the beahviour of beams in flexure
- To design shear, torsion and transmission length in prestressed concrete members
- Design of compression and tension members as per codes of practice

**UNIT - I** — Lecture Hrs:10

**INTRODUCTION:** Development of Prestressed Concrete –Advantages and Disadvantages of PSC Over RCC –General Principles of Pre-Stressing-Pre Tensioning and Post Tensioning –Materials Used in PSC-High Strength Concrete –High Tension Steel-Different Types /Methods/Systems of Prestressing.

**UNIT - II** — Lecture Hrs:10

**Losses of Prestress**: Estimation of The Loss of Prestress Due To Various Causes Like Elastic Shortening of Concrete ,Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Slip in Anchorage and Friction.

**UNIT - III** — Lecture Hrs:10

**Flexure & Deflections:** Analysis of Sections for Flexure in Accordance With Elastic Theory-Allowable Stresses-Design Criteria As Per I.S Code of Practice –Elastic Design of Beams (Rectangular, I and T Sections) for Flexure –Introduction To Partial Prestressing. Introduction-Factors Influencing Deflections-Short Term and Long Term Deflections of Un-cracked and Cracked Members.

**UNIT - IV** — Lecture Hrs:10

**Shear, Bond, Bearing and Anchorage:** Shear in PSC Beams –Principal Stresses –Conventional Elastic Design for Shear-Transfer of Prestress in Pre-tensioned Members-Transmission Length –Bond Stresses-Bearing At Anchorage –Anchorage Zone Stresses in Post-Tensioned Members-Analysis and Design of End Blocks by Guyon, Magnel and Approximate Methods –Anchorage Zone Reinforcements.

**UNIT - V** — Lecture Hrs:10

**Statistically Indeterminate Structures**: Introduction –Advantages and Disadvantages of Continuity –Layouts for Continuous Beams-Primary and Secondary Moments –Elastic Analysis of Continuous Beams-Linear Transformation-Concordant Cable Profile-Design of Continuous Beams.

**Textbooks:**

1. Prestressed Concrete by N. Krishna Raju, TMH Pubilishers.
2. Prestressed Concrete by K.U.Muthu, I.K. International Publishing House.
3. Prestressed Concrete Design by Praveen Nagarajan, Pearson Pubilications.

**Reference Books:**

1. Design of Prestressed Concrete Structures, T.Y.Lin, Asian Publishing House, Bombay, 1953.
2. Prestressed Concrete, Vol.I&II, Y.Guyon, Wiley and Sons, 1960.
3. Prestressed Concrete Design and Construction, F.Leohhardt, Wilhelm Ernst and Shon, Berlin, 1964.
4. Reinforced concrete designers hand bood, A view point publication, C.E.Reynolds and J.C. Steedman, 1989.



5. Prestressed Concrete, Edward P.Nawy, Prentice Hall –.
6. Prestressed Concrete – by Raj Gopal, Narsoa Pubilications.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | MAINTENANCE and REHABILITATION of STRUCTURES (PE – II) | L | T | P | C |
|---|---|---|---|---|---|
| 21D20103a | | 3 | 0 | 0 | 3 |
| Semester | | I | | | |

**Course Objectives:** This Course Will Enable Students:

- To judge the rateof corrosion in various exposure conditions
- To conduct non destructive testing of structural elements
- To selecta sutiable bonding technique
- To judge the effect of fire and earthquake loads on discontinuites

**Course Outcomes (CO):** Student will be able to

- Estimate the causes for distress and deterioration of structures
- Apply the NDT for condition assessment of structures,identify damages in RC structures
- Select repair material and retrofitting strategy suitable for distress
- Formulate guidelines for repair management of deteriorated structures
- Strengthening of earthquake and fire damaged elements using various techniques.

| UNIT - I | Lecture Hrs:10 |
|---|---|

**Influence on Serviceability and Durability**:- General : Quality Assurance for Concrete Construction, As Built Concrete Properties, Strength, Permeability, Volume Changes, Thermal Properties, Cracking. Effects Due To Climate, Temperature, Chemicals, Wear and Erosion, Design and Construction Errors, Corrosion Mechanism, Effects of Cover Thickness and Cracking Methods of Corrosion Protection, Inhibitors, Resistant Steels, Coatings Cathodic Protection.

| UNIT - II | Lecture Hrs:10 |
|---|---|

**Maintenance and Repair Strategies** :- Inspection, Structural Appraisal, Economic Appraisal, Components of Equality Assurance, Conceptual Bases for Quality Assurance Schemes.

| UNIT - III | Lecture Hrs:10 |
|---|---|

**Materials for Repair :-** Special Concretes and Mortar, Concrete Chemicals, Special Elements for Accelerated Strength Gain, Expansive Cement, Polymer Concrete, Sulphur Infiltrated Concrete, Ferro Cement, Fibre Reinforced Concrete.

| UNIT - IV | Lecture Hrs:9 |
|---|---|

**Techniques for Repair :-** Rust Eliminators and Polymers Coating for Rebars During Repair, Foamed Concrete, Mortar and Dry Pack, Vacuum Concrete, Gunite and Shotcrete Epoxy Injection, Mortar Repair for Cracks, Shoring and Underpinning.

| UNIT - V | Lecture Hrs:9 |
|---|---|

**Case Studies :-** Repairs To Overcome Low Member Strength, Deflection, Cracking, Chemical Disruption, Weathering, Wear, Fire, Leakage, Marine Exposure.

**Textbooks:**

1. Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K. 1991.
2. RT.Allen and S.C. Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1987.
3. MS. Shetty, Concrete Technology – Theory and Practice, S.Chand and Company, New Delhi, 1992.

**Reference Books:**

1. Santhakumar, A.R.Training Course Notes on Damage Assessment and Repair in Low Cost Housing RHDC-NBO Anna University, Madras, July, 1992.
2. Raikar, R.N.Learning From Failures – Deficiencies in Design, Construction and Service – R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
3. N.Palaniappan, Estate Management, Anna Institute of Management, Madras Sep. 1992.
4. F.K.Garas, J.L.Clarke, GST Armer, Structural Assessment, Butterworths, UK Aporil 1987.

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**ANANTHAPURAMU – 515 002 (A.P) INDIA**
**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | DESIGN of BRIDGES | L | T | P | C |
|---|---|---|---|---|---|
| 21D20103b | (PE-II) | 3 | 0 | 0 | 3 |
| | **Semester** | **I** | | | |

**Course Objectives:** This Course Will Enable Students:

- To understand the various types of bridges
- To understand the codal provisions for loading and design standards of bridges
- To design the superstructure of bridge using different methods and loading conditions
- To understand the design of bearings

**Course Outcomes (CO):** Student will be able to

- Finalize with the usage of codal provisions in the design of bridges
- Analyze and design substructure elements of bridges
- Analyze and design various types of bridges like t-beam bridge,slab bridge ,box culvert.
- To analyze and design of T beam bridge

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

**Introduction** – Classification, Investigations and Planning, Choice of Type – Economic Span Length – IRC Specifications for Road Bridges, Standard Live Loads, Other Forces Acting on Bridges, General Design Considerations.

| **UNIT - II** | Lecture Hrs:10 |
|---|---|

**Design of Box Culverts** – General Aspects – Design Loads – Design Moments, Shears and Thrusts – Design of Critical Section.
**Design of Slab Bridges** – Effective Width of Analysis – Workings Stress Design and Detailing of Slab Bridges for IRC Loading.

| **UNIT - III** | Lecture Hrs:10 |
|---|---|

**T-Beam Bridges** – Introduction – Wheel Load Analysis – B.M. in Slab – Pigaud's Theory – Analysis of Longitudinal Girders by Courbon's Theory Working Stress Design and Detailing of Reinforced Concrete T-Beam Bridges for IRC Loading.

| **UNIT - IV** | Lecture Hrs:9 |
|---|---|

**Prestressed Concrete Bridges** – General Features – Advantages of Prestressed Concrete Bridges – Pre-tensioned Prestressed Concrete Bridges – Post Tensioned Prestressed Concrete Bridge Decks. Design of Post Tensioned Prestressed Concrete Slab Bridge Deck. Bridge Bearings – General Features – Types of Bearings – Forces on Bearings Basis for Selection of Bearings – Design Principles of Steel Rocker and Roller Bearings and Its Design – Design of Elastometric Pad Bearing Detailing of Elastomeric Pot Bearings.

| **UNIT - V** | Lecture Hrs:9 |
|---|---|

**Piers and Abutments** – General Features – Bed Block – Materials for Piers and Abutments – Types of Piers – Forces Acting on Piers – Design of Pier – Stability Analysis of Piers – General Features of Abutments – Forces Acting on Abutments – Stability Analysis of Abutments.

**Textbooks:**

1. Essentials of Bridges Engineering – D.Hohnson Victor Oxford & IBH Publishers Co-Private Ltd.
2. Design of Concrete Bridges MC Aswanin VN Vazrani, MM Ratwani, Khanna Publishers.
3. Bridge Engineering – S.Ponnuswamy.

**Reference Books:**

1. Concrete Bridge Design, Browe, R.E., C.R.Books Ltd., London, 1962.
2. Reinforced Concrete Bridges, Taylor F.W., Thomson, S.E., and Smulski E., John Wiley and Sons, New York, 1955.
3. An Introduction To Structural Design of Concrete Bridges, Derrick Beckett, Surrey University; Press, Henlely – Thomes, Oxford Shire, 1973
4. Bridge Analysis Simplified, Bakht.B.And Jaegar, L.G. Mc Graw Hill, 1985.
5. Design of Bridges – N.Krishna Raju – Oxford & IBH
6. Design of Bridge Structures – FR Jagadeesh, M.A. Jaya Ram – Eastern Economy Edition.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED CONCRETE LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21D35206 | | 0 | 0 | 4 | 2 |
| | Semester | I | | | |

**Course Objectives:** The students will acquire knowledge about

- To learn the principles of workability in cement concrete.
- To learn the preliminary tests on aggregates like flakiness test, elongation test, specific gravity, bulk density fineness modulus.
- To know the compression test, Young's modulus test procedures
- To learn the mix design procedure

**Course Outcomes (CO):** At the end of the course, students will be able to:

- Assess the workability of cement concrete and its suitability, quality of concrete
- Assess the quality of fine and coarse aggregates after testing the aggregates according to IS specifications.
- Test the quality of cement concrete by conducting compressive strength on concrete cubes.
- Design different grades of mix design and also asses the fineness of cement, flash, silica

**List of Experiments**:

1. Mix Design of Concrete and Casting of Specimen
2. Mix Design of High Strength Concrete Including Casting and Testing of Specimens.
3. Fresh properties of self-compacting concrete
4. Permeability of Hardened concrete
5. Rapid chloride permeability of hardened concrete & Carbonations Studies.
6. Compressive strength split tensile strength & flexural strength of self compacting
7. concrete.
8. Young's Modulus of Concrete
9. Accelerated Curing Test on Concrete Cubes.
10. Non Destructive Tests on Concrete.
11. Mix Design of Concrete using Mineral Admixtures.
12. Bending Test on A RCC Beam Under:
    i. Single Point Load
    ii. Two Point Load

**References:**

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006.
3. Concrete Technology by A.R. Santha kumar, Oxford University Press.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED STRUCTURAL ENGINEERING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21D35106 | | 0 | 0 | 4 | 2 |
| | Semester | I | | | |

**Course Objectives:** The students will acquire knowledge about

- Ddesign of experiments,
- To investigate the performance of structural elements.
- To evaluate the different testing methods and equipments.

**Course Outcomes (CO):** At the end of the course, students will be able to:

- Achieve Knowledge of design and development of experimenting skills.
- Understand the principles of design of experiments
- Design and develop analytical skills.
- Summerize the testing methods and equipments.

**List of Experiments**:

1. Load deflection characteristics of under reinforced concrete beam.
2. Load Deflection characteristics of over reinforced concrete beam.
3. Comparison of reinforced concrete beam with and without shear reinforcement.
4. Detection of reinforcement in structural members using profometer.
5. Temperature effects on compressive strength of concrete.
6. Impact strength of concrete beam.
7. Testing of Brick masonry wall.
8. Load deflection characteristics of reinforced concrete beam under cyclic loading using 500kN actuator.
9. Load deflection characteristics of reinforced concrete column under cyclic loading using 1000kN actuator.
10. Load deflection characteristics of reinforced concrete beam under torsion.
11. Ambient Vibration Testing.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | RESEARCH METHODOLOGY AND IPR | L | T | P | C |
|---|---|---|---|---|---|
| 21DRM101 | | 2 | 0 | 0 | 2 |
| | Semester | I | | | |

**Course Objectives:**

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Understand the Adequate knowledge on IPR

**Course Outcomes (CO):** Student will be able to

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

**UNIT - I** Lecture Hrs:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT - II** Lecture Hrs:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

**UNIT - III** Lecture Hrs:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**UNIT - IV** Lecture Hrs:

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

**UNIT - V**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Textbooks:**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

**Reference Books:**

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | STRUCTURAL DYNAMICS | L | T | P | C |
|---|---|---|---|---|---|
| 21D35201 | | 3 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:** This Course Will Enable Students:

- Determine vibration characteristics of structures like frequency,amplitude,impedence and time period
- Differentiate the response of single and multi degree of freedom systems
- Determine the response of structures for pulse excitation like blast load
- Differentiate the response of Multi Degree of Freedom systems

**Course Outcomes (CO):** Student will be able to

- Write equation of motion for single and multi degree of freedom systems
- Understand the impact of damping on charecterstics of vibrating system
- Gain Knowledge about arbitary and pulse excitation
- Understand applications of Numerical methods in dynamics
- Analyse in various theories of failure and plasticity

**UNIT - I** — Lecture Hrs:10

**Theory of Vibrations:** Introduction –Elements of A Vibratory System – Degrees of Freedom-Continuous Systems –Lumped Mass Idealization –Oscillatory Motion –Simple Harmonic Motion – Pictorial Representation of S.H.M - Free Vibrations of Single Degree of Freedom (SDOF) Systems – Undamped and Damped –Critical Damping –Logarithmic Decrement –Forced Vibrations of SDOF Systems-Harmonic Excitation –Dynamic Magnification Factor- Bandwidth.Fundamental Objective of Dynamic Analysis-Types of Prescribed Loading- Methods of Discretization- Formulation of The Equations of Motion.

**UNIT - II** — Lecture Hrs:10

**Single Degree of Freedom System**: Formulation and Solutions of The Equation of Motion - Free Vibration Response –Response To Harmonic, Periodic, Impulsive and General Dynamic Loading – Duhamel Integral

**UNIT - III** — Lecture Hrs:10

**Multi Degree of Freedom System:** Selection of The Degree of Freedom –Evaluation of Structural Property Matrices-Formulation of The MDOF Equations of Motion –Undamped Free Vibrations-Solution of Eigen Value Problem for Natural Frequencies and Mode Shapes- Analysis of Dynamic Response –Normal Coordinates –Uncoupled Equations of Motion –Orthogonal Properties of Normal Modes-Mode Superposition Procedure

**UNIT - IV** — Lecture Hrs:9

**Practical Vibration Analysis:** Stodola Method- Fundamental Mode Analysis –Analysis of Second and Higher Modes –Holzer's Method –Basic Procedure –Transfer Matrix Procedure

**UNIT - V** — Lecture Hrs:9

**Introduction To Earthquake Analysis:** Introduction –Excitation by Rigid Base Translation – Lumped Mass Approach -SDOF and MDOF System- I.S Code Methods of Analysis.
**Continuous System:** Introduction –Flexural Vibrations of Beams- Elementary Case-Equation of Motion –Analysis of Undamped Free Shapes of Simple Beams With Different End Conditions-Principles of Application To Continuous Beams.

**Textbooks:**

1. Structural Dynamics for Earthquake Engineering,A.K.Chopra,Pearson Pubilications
2. Dynamics of Structures by Clough & Penziem
3. Structural Dynamics by Roy. R. Craig John willy & fours.

**Reference Books:**

1. Structural Dynamics by Mario Paz
2. I.S:1893(Latest)" Code of Practice for Earthquakes Resistant Design of Stuctures"
3. Fundamentals of Vibration, Anderson R.A, Amerind Pulblishing Co.,1972.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | FINITE ELEMENT METHODS for STRUCTURAL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| 21D20201 | | 3 | 0 | 0 | 3 |
| | **Semester** | **II** | | | |

**Course Objectives:** This Course Will Enable Students:

- To provide an overview and basic fundamentals of Finite Element Analysis.
- To introduce basic aspects of finite element theory, including domain discretization, interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
- To explain the underlying concepts behind variational methods and weighted residual methods in FEM.
- Formulate simple structural problems in to finite elements

**Course Outcomes (CO):** Student will be able to

- Analyse and build FEA models for various Engineering problems.
- Able to identify information requirements and sources for analysis , design and evaluation
- Use professional-level finite element software to solve engineering problems.
- Interpret results obtained from FEA software solutions, not only in terms of conclusions but also awareness of limitations.

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

**Introduction-**Concepts of FEM –Steps Involved –Merits &Demerits –Energy Principles – Discretization –Rayleigh –Ritz Method of Functional Approximation. **Elastic Formulations:** Stress Equations-Strain Displacement Relationships in Matrix Form-Plane Stress, Plane Strain and Axi-Symmetric Bodies of Revolution With Axi Symmetric Loading

| **UNIT - II** | Lecture Hrs:10 |
|---|---|

**One Dimensional FEM-**Stiffness Matrix for Beam and Bar Elements Shape Functions for ID Elements –Static Condensation of Global Stiffness Matrix-Solution –Initial Strain and Temperature Effects.

| **UNIT - III** | Lecture Hrs:10 |
|---|---|

**Two Dimensional FEM-**Different Types of Elements for Plane Stress and Plane Strain Analysis – Displacement Models –Generalized Coordinates-Shape Functions-Convergent and Compatibility Requirements –Geometric Invariance –Natural Coordinate System-Area and Volume Coordinates-Generation of Element Stiffness and Nodal Load Matrices –Static Condensation.

| **UNIT - IV** | Lecture Hrs:9 |
|---|---|

**Isoparametric Formulation-**Concept, Different Isoparametric Elements for 2D Analysis-Formulation of 4-Noded and 8-Noded Isoparametric Quadrilateral Elements –Lagrangian Elements-Serendipity Elements. **Axi Symmetric Analysis** –Bodies of Revolution-Axi Symmetric Modelling – Strain Displacement Relationship-Formulation of Axi Symmetric Elements.

| **UNIT - V** | Lecture Hrs:9 |
|---|---|

**Three Dimensional FEM-**Different 3-D Elements, 3D Strain –Displacement Relationship-Formulation of Hexahedral and Isoparametric Solid Element.

**Textbooks:**

1. Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications.
2. Finite Element Analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers
3. Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla, Universities Press India Ltd. Hyderabad.

**Reference Books:**

1. Finite Element Method and Its Application by Desai ,2012, Pearson Pubilications.
2. finite Element Methods by Darrel W.Pepper, Vikas Pubilishers

3. Finite Element Analysis and Procedures in Engineering by H.V.Lakshminaryana, 3rd Edition, Universities Press, Hyderabad.
4. Finite Element Analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
5. Finite Element Analysis by S.S. Bhavakatti-New Age International Publishers
6. Finite Element Analysis by P Seshu-PHI Learning Publications.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | DESIGN of REINFORCED CONCRETE FOUNDATIONS (PE-III) | L | T | P | C |
|---|---|---|---|---|---|
| 21D20202a | | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To explore and examine a site
- Analyse lateral soil pressures acting on to a wall
- Determine bearing capacity of a soil using different theories at different conditions
- Analyse various dynamic forces
- Design a special foundation for vibrating machinery

**Course Outcomes (CO):** Student will be able to

- Determine the earthpressures on foundations and retaining structures
- Analyses shallow and deep foundations
- Calculate the bearing capacity of soils and foundation settlements
- Design foundations for different machines
- Assess the influence of vibrations

**UNIT - I** — Lecture Hrs:10

**SHALLOW FOUNDATIONS-I:** General Requirements of Foundations. Types of Shallow Foundations and The Factors Governing The Selection of Type of Shallow Foundation. Bearing Capacity of Shallow Foundations by Terzaghi's Theory and Meyerhof's Theory (Derivation of Expressions and Solution To Problems Based on These Theories). Local Shear and General Shear Failure and Their Identification

**UNIT - II** — Lecture Hrs:10

**SHALLOW FOUNDATIONS-II:** Bearing Capacity of Isolated Footing Subjected To Eccentric and Inclined Loads. Bearing Capacity of Isolated Footing Resting on Stratified Soils- Button's Theory and Siva Reddy Analysis. Analysis and Structural Design of R.C.C Isolated, Combined and Strap Footings.

**UNIT - III** — Lecture Hrs:10

**DEEP FOUNDATIONS-I:** Pile Foundations-Types of Pile Foundations. Estimation of Bearing Capacity of Pile Foundation by Dynamic and Static Formulae. Bearing Capacity and Settlement Analysis of Pile Groups. Negative Skin Friction, Pile Load Tests.Sheet Pile Walls.Cantilever Sheet Piles and Anchored Bulkheads, Earth Pressure Diagram,Determination of Depth of Embedment in Sands and Clays-Timbering of Trenches-Earth Pressure Diagrams-Forces in Struts.

**UNIT - IV** — Lecture Hrs:9

**DEEP FOUNDATIONS-II:** Well Foundations-Elements of Well Foundation. Forces Acting on A Well Foundation. Depth and Bearing Capacity of Well Foundation. Design of Individual Components of Well Foundation (Only Forces Acting and Principles of Design). Problems Associated With Well Sinking.

**UNIT - V** — Lecture Hrs:9

**FOUNDATIONS in PROBLEMATIC SOILS:** Foundations in Black Cotton Soils-Basic Foundation Problems Associated With Black Cotton Soils. Lime Column Techniques-Principles and Execution. Under Reamed Piles-Principle of Functioning of Under Reamed Pile-Analysis and Structural Design of Under Reamed Pile. Use of Cohesive Non Swelling (CNS) Layer Below Shallow Foundations.

**Textbooks:**

1. Analysis and Design of Foundations and Retaining Structures-Shamsher Prakash,Gopal Ranjan and Swami Saran.

**Reference Books:**

1. Analysis and Design of Foundations-J.E.Bowles
2. Foundation Design and Construction-Tomlinson
3. Foundation Design-Teng.
4. Geotechnical Engg – C.Venkatramaiah

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | EXPERIMENTAL STRESS ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| 21D20202b | (PE-III) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To perform NDT test and interpret the results
- To understand the science behind working of strain gauge
- Understand the practical applicationsof strain gauge
- To determine the stress distribution in anacrylic block using the concept of photoelasticity

**Course Outcomes (CO):** Student will be able to

1. To understand the mechanical properties of strain gaugees andapplications
2. To understand the design and performance of strain gauges
3. To understand the methodsof Non destructive testing
4. To understand the methods of photo elasticity and models

| UNIT - I | Lecture Hrs:10 |
|---|---|

**PRINCIPLES of EXPERIMENTAL APPROACH**
Merits of Experimental Analysis Introduction, Uses of Experimental Stress Analysis Advantages of Experimental Stress Analysis, Different Methods –Simplification of Problems.

| UNIT - II | Lecture Hrs:10 |
|---|---|

**STRAIN MEASUREMENT USING STRAIN GAUGES :-**
Definition of Strain and Its Relation of Experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction To Electrical Strain Gauges - Inductance Strain Gauges – LVDT – Resistance Strain Gauges – Various Types –Gauge Factor – Materials of Adhesion Base.

| UNIT - III | Lecture Hrs:10 |
|---|---|

**STRAIN ROSSETTES and NON – DESTRUCTIVE TESTING of CONCRETE:-**Introduction – The Three Elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity Method –Application To Concrete. Hammer Test – Application To Concrete.

| UNIT - IV | Lecture Hrs:9 |
|---|---|

**THEORY of PHOTOELASTICITY** :-
Introduction –Temporary Double Refraction – The Stress Optic Law –Effects of Stressed Model in A Polariscope for Various Arrangements – Fringe Sharpening. Brewster's Stress Optic Law.

| UNIT - V | Lecture Hrs:9 |
|---|---|

**TWO DIMENSIONAL PHOTOELASTICITY :-**
Introduction – Isochromatic Fringe Patterns- Isoclinic Fringe Patterns Passage of Light Through Plane Polariscope and Circular Polariscope Isoclinic Fringe Patterns – Compensation Techniques – Calibration Methods – Separation Methods – Scaling Model To Prototype Stresses – Materials for Photoelasticity- Properties of Photoelastic Materials.

**Textbooks:**

1.Experimental Stress Analysis by J.W.Dally and W.F.Riley, College House Enterprises
2. Experimental Stress Analysis by Dr.Sadhu Singh.Khanna Publishers
3. Abdul Mubeen, "Experimental Stress Analysis", DhanpatRai and Sons, 2001.

**Reference Books:**

1. Experimental Stress Analysis by U.C.Jindal, Pearson Pubilications.
2. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.
3. Moire Fringes in Strain Analysis, PS Theocaris, Pergammon Press, 2002.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | STABILITY of STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| 21D20202c | (PE-III) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- Determine stability of columns and frames
- Determine stability of beams and plates
- Use stability criteria and concepts for analyzing discrete and continuous systems,
- To form differential equations for plate buckling

**Course Outcomes (CO):** Student will be able to

- Apply the torisonal buckling and platesfor buckling concept
- Apply the inelastic behaviour of materials and analyse the inelastic charecter of column
- Analyse the frame structures
- Analyse the plate structures

| UNIT - I | Lecture Hrs:10 |
|---|---|

**Formulations Related To Beam Columns :** Concept of Stability, Differential Equation for Beam Columns –Beam Column With Concentrated Loads –Continuous Lateral Load –Couples -Beam Column With Built in Ends –Continuous Beams With Axial Load –Application of Trignometric Series –Determination of Allowable Stresses.

| UNIT - II | Lecture Hrs:10 |
|---|---|

**Elastic Buckling of Bars:** Elastic Buckling of Straight Columns –Effect of Shear Stress on Buckling-Eccentrically and Laterally Loaded Columns –Energy Methods –Buckling of A Bar on Elastic Foundation, Buckling of A Bar With Intermediate Compressive Forces and Distributed Axial Loads –Buckling of Bars With Change in Cross Section –Effect of Shear Force on Critical Load – Built Up Columns

| UNIT - III | Lecture Hrs:10 |
|---|---|

**Inelastic Buckling and Torsional Buckling :** Buckling of Straight Bars-Double Modulus Theory – Tangent Modulus Theory. Pure Torsion of Thin Walled Bar of Open Cross Section-Non –Uniform Torsion of Thin Walled Bars of Open Cross Section-Torsional Buckling –Buckling Under Torsion and Flexure.

| UNIT - IV | Lecture Hrs:9 |
|---|---|

**Mathematical Treatment of Stability Problems:** Buckling Problem Orthogonality Relation –Ritz Method-Timoshenko Method, Galerkin Method

| UNIT - V | Lecture Hrs:9 |
|---|---|

**Lateral Buckling of Simply Supported Beams and Rectangular Plates :** Beams of Rectangular Cross Section Subjected for Pure Bending. Derivation of Equation of Rectangular Plate Subjected To Constant Compression in Two Directions and One Direction.

**Textbooks:**


1. Stability of Metalic Structure by Bleich –Mc Graw Hill
2. Theory of Beam Columns Vol I by Chen & Atsuta Mc.Graw Hill
3. Timoshenko, S., and Gere., Theory of Elastic Stability, Mc Graw Hill Book Company, 1973.


**Reference Books:**


1. Elastic Stability of Structures, Smitses, Prentice Hall,1973.
2. Buckling of Bars Plates and Shells, Brush and Almorth., Mc Graw Hill Book Company ,1975.
3. Principles of Structural Stability Theory, Chajes, A., Prentice Hall,1974
4. Stability Theory of Structures, Ashwini Kumar, TATA Mc Graw Hill Publishing Company Ltd, New Delhi,1985.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED STEEL DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| 21D20203a | (PE-IV) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To understand the relation between structural analysis and design provisions
- Design and analysis of girders under maximum load effects
- Design and analysis of cold formed steels under stiffened and un stiffened conditions
- Design and analysis of industry buildings

**Course Outcomes (CO):** Student will be able to

- Gain knowledge about plastic analysis of steel structures
- Analyze and design of girders
- Analyze and design of steel tanks and stacks
- Analyze and design of industrial buildings
- Analyze and design of light gauge steel structures

**UNIT - I** — Lecture Hrs:10

Design of Self Supporting Steel Stacks/Chimneys – Considerations for Preliminary Design (Industrial Requirements – Thermal Requirement – Mechanical Force Requirement – Wind Load and Dead Load Estimation) – Detailed Estimation of Wind; Dead-And Other Accidental – Loads; Analysis; Detailed Design Including Provision of Stakes /Spoilers – Design of Super Structure Only.

**UNIT - II** — Lecture Hrs:10

Analysis of Multi-Storey Frames Using Approximate Methods and Substitute Frame Method:
Cantilever Method &
Portal Method

**UNIT - III** — Lecture Hrs:10

Design of Gantry Girder – Introduction – Loads Acting on The Gantry Girder – Permissible Stresses - Types of Gantry Girders and Crane Sails – Crane Data – Maximum Moments and Shears – Design Procedure (Restricted To Electrically Operated Cranes)

**UNIT - IV** — Lecture Hrs:9

Theorems of Plastic Analysis, Applications To The Cases of Rectangular Portal Frames. Principles of Optimization in Structural Design – Application To Simple – Rectangular Portal Frame – Minimum Weight Design.

**UNIT - V** — Lecture Hrs:9

General Methods of Plastic Design: Combining Mechanics Methods, Plastic Moment Redistribution Method; Application To Few Cases of Simple Two Storied Rectangular Portal Frames Including Estimation of Deflection.

**Textbooks:**

1. Plastic Analysis of Structures by B.G.Neal
2. Steel Skeleton V.I and II by Baker
3. Design of Steel Structures by Vazarani and Ratwani

**Reference Books:**

1. Strength of Materials (Vol-II)) by Timoshenko.
2. Analysis of Steel Structure by Manohar.
3. Analysis of Steel Structure by Pinfold
4. Analysis of Steel Structure by Arya & Azmani
5. Analysis of Steel Structure by Relevant IS Codes.
6. Analysis of Steel Structure by Punmia, B.C.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | FRACTURE MECHANICS | L | T | P | C |
|---|---|---|---|---|---|
| 21D20203b | (PE-IV) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To design based on linear elastic fracture mechanics
- To find out the variation of plastic zone over thickness of various elements
- To know about the plane strain and plane stress in slip planes
- To understand the fracture process of concrete and different materials

**Course Outcomes (CO):** Student will be able to

- Acquire basic skills in fracture mechanism of brittle materials
- Apply fracture mechanics theory to calculate stress areas
- Calculate the "energy release rate" around crack tips
- Examine crack growth due to fatigue

**UNIT - I** — Lecture Hrs:10

**Summary of Basic Problems and Concepts:**
Introduction - A Crack in A Structure - The Stress At A Crack Tip - The Griffith Criterion The Crack Opening Displacement Criterion - Crack Propagation - Closure

**UNIT - II** — Lecture Hrs:10

**The Elastic Crack – Tip Stress Field :**
The Airy Stress Function - Complex Stress Functions - Solution To Crack Problems - The Effect of Finite Size - Special Cases - Elliptical Cracks - Some Useful Expressions

**UNIT - III** — Lecture Hrs:10

**The Crack Tip Plastic Zone:**
The Irwin Plastic Zone Correction - The Dugdale Approach - The Shape of The Plastic Zone - Plane Stress Versus Plane Strain - Plastic Constraint Factor - The Thickness Effect

**UNIT - IV** — Lecture Hrs:9

**The Energy Principle:**
The Energy Release Rate - The Criterion for Crack Growth - The Crack Resistance (R Curve) - Compliance , The J Integral (Definitions Only)
**Plane Strain Fracture Toughness:**
The Standard Test - Size Requirements - Non-Linearity – Applicability
**Plane Stress and Transitional Behaviour:**
Introduction - An Engineering Concept of Plane Stress - The R Curve Concept

**UNIT - V** — Lecture Hrs:9

**The Crack Opening Displacement Criterion:**
Fracture Beyond General Yield - The Crack Tip Opening Displacement - The Possible Use of The CTOD Criterion
**Determination of Stress Intensity Factors:**
Introduction - Analytical and Numerical Methods - Finite Element Methods, Experimental Methods (An Ariel Views Only)

**Textbooks:**

1. Elementary Engineering Fracture Mechanics - David Broek, Battelle, Columbus Laboratories, Columbus, Ohieo, USA
2. Fracture and Fatigue Control in Structures - John M.Barsom, Stanley T.Rolfe, Ross H.Forney
3. Rock and other Quasi-brittle materials - Surender P Shah , Stuart E Swartz,Wiley 1995.

**Reference Books:**

1. Analysis of Concrete Structures by fracture mechanics, Elfgren L, Routledge,1990
2. Fracture Mechanics- Applications to concrete, Victor C.Li and Z P Bazant , ACI SP118
3. Fracture Mechanics , CT Suri and Zh jin , Elsevier Academic Press,2012

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED REINFORCED CONCRETE DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| 21D20203c | (PE-IV) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To design of reinforced concrete beam
- To design of reinforced concrete slab
- To analyze and design of multi storey building and Industrial Building
- To design special structures such as Deep beams,Corbels and Grid Floors

**Course Outcomes (CO):** Student will be able to

- Design the strength and serviceability of reinforced concrete elements
- Design special reinforced concrete elements
- Analyse and design of slabs and grid floor
- Design the inelastic behaviour of concrete beams

**UNIT - I** — Lecture Hrs:10

**Deflection of Reinforced Concrete Beams and Slabs**:
Introduction -Short-Term Deflection of Beams and Slabs -Deflection Due To -Imposed Loads - Short- Term Deflection of Beams Due To Applied Loads- Calculation of Deflection by IS 456 - Calculation of Deflection by BS 8110 - Deflection Calculation by Eurocode – ACI Simplified Method - Deflection of Continuous Beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs

**UNIT - II** — Lecture Hrs:10

**Estimation of Crack Width in Reinforced Concrete Members and Design of Deep Beams:**
Introduction - Factors Affecting Crack width in Beams - Mechanism of Flexural Cracking Calculation of Crack Widths - Simple Empirical Method - Estimation of Crack width in -Beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking.

**Deep Beams:**
Introduction - Minimum Thickness - Steps of Designing Deep Beams - Design by IS 456 - Design According To British Practice - ACI Procedure for Design of Deep Beams - Checking for Local Failures - Detailing of Deep Beams.

**UNIT - III** — Lecture Hrs:10

**Shear in Flat Slabs and Flat Plates:**
Introduction - Checking for One-Way (Wide Beam) Shear - Two-Way (Punching) Shear Permissible Punching Shear - Shear Due To Unbalanced Moment (Torsional Moments) Calculation of J Values - Strengthening of Column Areas for Moment Transfer by Torsion Which Produces Shear - Shear Reinforcement Design - Effect of Openings in Flat Slabs - Recent Revisions in ACI 318 - Shear in Two – Way Slabs With Beams.

**UNIT - IV** — Lecture Hrs:9

**Design of Plain Concrete Walls and Shear Walls:**
Introduction - Braced and Unbraced Walls - Slenderness of Walls- Eccentricities of Vertical Loads At Right Angles To Wall - Empirical Design Method for Plane Concrete Walls Carrying Axial Load - Design of Walls for In-Plane Horizontal Forces - Rules for Detailing of Steel in Concrete Walls

**Design of Shear Walls:**
Introduction - Classification of Shear Walls - Classification According To Behavior - Loads in Shear Walls - Design of Rectangular and Flanged Shear Walls - Derivation of Formula for Moment of Resistance of Rectangular Shear Walls

**UNIT - V** — Lecture Hrs:9

**Design of Reinforced Concrete Members for Fire Resistance :** Introduction - ISO 834 Standard Heating Conditions- Grading Or Classification - Effect of High Temperature on Steel and Concrete - Effect of High Temperatures on Different Types of Structural Members - Fire Resistance by Structural Detailing From Tabulated Data - Analystical Determination of The Ultimate Bending Moment Capacity of Reinforced Concrete Beams Under Fire - Other Considerations

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| **Textbooks:** |
|---|
| 1. Reinforced Concrete Structural Elements: Behaviour, Analysis and Design, P.Purushothaman, Tata Mcgraw Hill.<br>2. Reinforced Concrete Desigers Hand Bood, C.E. Reynolds and J.C. Steedman, A View Point Publication.<br>3. Advanced Reinforced Concrete Design , Varghese PC, Prentice Hall of India,2008 |
| **Reference Books:** |
| 1. Limit State Design of Reinforced Concrete Structures by P.Dayaratnam, Oxford & Ibh Publishers.<br>2. Advanced RCC by N.Krishna Raju, Cbs Publishers & Distributors.<br>3. Reinforced Cement Concrete Structures – Devdas Menon & Unnikrishna Pillai, Tata Mcgraw Hill |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | COMPUTER AIDED DESIGN LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| 21D20204 | | 0 | 0 | 4 | 2 |
| | Semester | II | | | |

**Course Objectives:** The students will acquire knowledge about

- To learn the software applications in structural engineering.
- To learn the analysis of plane, space truss and frames subjected to different types of loadings.
- To draw the detailing of RCC members and to learn the estimations.
- To study the design concepts of steel members like truss, beams and columns.

**Course Outcomes (CO):** At the end of the course, students will be able to:

- Understand the software usages for structural members.
- Able to analyse plane, space frames and dynamic response and natural frequency for beams and frames.
- Able to design, detailing and estimations of RC members.
- Able to design the steel members like truss, beams and columns.

**List of Experiments**:

1. Analysis of Cantilever, Simply Supported Beam, Fixed Beams, Continuous Beams for Different Loading Conditions.
2. Design of R.C.C. Beams, Slabs, Foundations.
3. Design of Steel Tension Members
4. Reinforcement Detailing in Beam Using Graphics.
5. Reinforcement Detailing in Slabs Using Graphics.
6. Reinforcement Detailing in Foundation Using Graphics.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | ADVANCED STRUCTURAL DESIGN LAB | L | T | P | C |
|---|---|---|---|---|---|
| 21D20205 | | 0 | 0 | 4 | 2 |
| | Semester | II | | | |

**Course Objectives:** The students will acquire knowledge about

- To develop MATLAB codes for solution of simultaneous linear equations.
- To construct codes for 1D Finite Element problems.
- To identify methods to code for numerical integration techniques & statistical methods.
- To model finite difference methods.

**Course Outcomes (CO):** At the end of the course, students will be able to:

- Design and Detail all the Structural Components of Frame Buildings.
- Design and Detail complete Multi-Storey Frame Buildings
- design the frames using Excel sheets
- Design the Shells and folded plates using ETABS

**List of Experiments**:

1. Static and Dynamic analysis of Building structure using software (ETABS / STAADPRO)
2. Design of RCC and Steel structure using software (ETABS / STAADPRO)
3. Analysis of folded plates and shells using software.
4. Preparation of EXCEL sheets for structural design.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | EARTHQUAKE RESISTANT DESIGN of BUILDINGS | L | T | P | C |
|---|---|---|---|---|---|
| 21D35301a | (PE-V) | 3 | 0 | 0 | 3 |
| | Semester | III | | | |

**Course Objectives:** This Course Will Enable Students:

- To understant effects of earthquakes on engineering structures and its measurement
- To apply dynamics loadson various structures
- To design buildings for earthquake loads as per IS Codes
- To understand and implement the concept of ductility in Earthquake Resistant Design

**Course Outcomes (CO):** Student will be able to

- Illustrate the measurement of earthquakes and their effect on engineering structures
- Analyse the free and forced vibration response of single degree and multi degree of freedom and continuous systems
- Apply the basic principles of conceptual design of Earthquake Resistant buildings
- Learn the various seismic control methods

**UNIT - I** — Lecture Hrs:10

**Engineering Seismology :**
Earthquake – Causes of Earthquake – Earthquakes and Seismic Waves – Scale and Intensity of Earthquakes – Seismic Activity – Measurements of Earth Quakes – Seismometer- Strong Motion Accelerograph / Field Observation of Ground Motion – Analysis of Earthquakes Waves – Earth Quake Motion – Amplification of Characteristics of Surface Layers – Earthquake Motion on The Ground Surface

**UNIT - II** — Lecture Hrs:10

**Vibration of Structures Under Ground Motion:**
Elastic Vibration of Simple Structures – Modelling of Structures and Equations of Motion – Free vibrations of Simple Structures – Steady State Forced Vibrations – Non Steady State Forced Vibrations – Response Spectrum Representations; Relation Between The Nature of The Ground Motion and Structural Damage.

**UNIT - III** — Lecture Hrs:10

Lateral Force Procedure Seismic Base Shear – Seismic Design Co-Efficient - Vertical Distribution of Seismic Forces and Horizontal Shear – Twisting Moment - Over Turning Moment – Vertical Seismic Load and Orthogonal Effects Lateral Deflection – P- Δ Characteristics Effect – Soil Structure Interaction. Seismic – Graphs Study, Earthquake Records for Design – Factors Affecting Accelerogram Characteristics - Artificial Accelerogram – Zoning Map. Dynamic – Analysis Procedure: Model Analysis – Inelastic – Time History Analysis Evaluation of the Results.

**UNIT - IV** — Lecture Hrs:9

**Earthquake – Resistant Design of Structural Components and Systems:**
Introduction – Monolithic Reinforced – Concrete Structures – Precast Concrete Structures – Prestressed Concrete Structures – Steel Structures – Composite – Structures, Masonry Structures – Timber Structures.

**UNIT - V** — Lecture Hrs:9

Fundamentals of Seismic Planning: Selection of Materials and Types of Construction Form of Superstructure – Framing Systems and Seismic Units – Devices for Reducing. Earthquake Loads,

**Textbooks:**

1. Design of Earthquake Resistant Structures by Minoru Wakabayashi.
2. Strucutural Dynamics for Earthquake Engineering", A.K.Chopra,Pearson Pubilications.
3. Dynamics of Structures. R.W.Clough, Mc Graw – Hill, 2nd Edition,

**Reference Books:**

1. Fundamentals of Earthquake Engineering,N.M Newmark and E.Rosenblueth, Prentice Hall,1971.
2. Earthquake Design Practice for Buildings. David Key," Thomas Telford,London,1988

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3. Earthquake Engg; R.L. Wegel, Prentice Hall 12nd Edition 1989.
4. Design of Multi –Storied Buildings for Earthquake Ground Motions J.A. Blume, N.M. Newmark, L.H. Corning.,', Portland Cement Association, Chicago,1961
5. I.S.Codes No. 1893,4326,13920.
6. Earthquake Resistant Design by Pankaj Agarwal.

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**COURSE STRUCTURE & SYLLABI**

| Course Code | LOW COST HOUSING TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| 21D25301a | (PE- V) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This course will enable students:

- To possess comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects.
- To focuses on cost effective construction materials and methods.
- To understand on the principles of sustainable housing policies and programmes.
- to adopt the suitable techniques in rural and disaster prone areas by using locally available materials.

**Course Outcomes (CO):** Student will be able to

- Development of construction technology and innovative techniques as tools to address demand mass construction
- Knowledge of eco friendly material with their application
- Learn the use of locally available material according to their availability and maintenance

**UNIT - I** Lecture Hrs:10

**Housing Scenario**
Introduction - Status of Urban Housing - Status of Rural Housing
**Housing Finance:**
Introducing - Existing Finance System in India - Government Role As Facilitator - Status At Rural Housing Finance - Impedimently in Housing Finance and Related Issues
**Land Use and Physical Planning for Housing**
Introduction - Planning of Urban Land - Urban Land Ceiling and Regulation Act - Efficiency of Building Bye Lass - Residential Densities
**Housing The Urban Poor**
Introduction - Living Conditions in Slums - Approaches and Strategies for Housing Urban Poor

**UNIT - II** Lecture Hrs:10

**Development and Adoption of Low Cost Housing Technology**
Introduction - Adoption of Innovative Cost Effective Construction Techniques - Adoption of Precast Elements in Partial Prefatroices - Adopting of Total Prefactcation of Mass Housing in India- General Remarks on Pre Cast Rooting/Flooring Systems -Economical Wall System - Single Brick Thick Loading Bearing Wall - 19cm Thick Load Bearing Masonery Walls - Half Brick Thick Load Bearing Wall - Flyash Grypsym Thick for Masonry - Stone Block Masonery - Adoption of Precast R.C. Plank and Join System for Roof/Floor in The Building

**UNIT - III** Lecture Hrs:10

**Alternative Building Materials for Low Cost Housing**
Introduction - Substitute for Scarce Materials – Ferrocement - Gypsum Boards - Timber Substitutions - Industrial Wastes - Agricultural Wastes - Fitire Starateru; for ,P,Topm of Alternative Building Maintenance
**Low Cost Infrastructure Services:**
Introduce - Present Status - Technological Options - Low Cost Sanitation - Domestic Wall - Water Supply, Energy

**UNIT - IV** Lecture Hrs:9

**Rural Housing:**
Introduction Traditional Practice of Rural Housing Continuous - Mud Housing Technology
Mud Roofs - Characteristics of Mud - Fire Treatment for Thatch Roof - Soil Stabilization - Rural Housing Programs

**UNIT - V** Lecture Hrs:9

**Housing in Disaster Prone Areas:**
Introduction – Earthquake - Damages To Houses - Traditional Prone Areas - Type of Damages and

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**COURSE STRUCTURE & SYLLABI**

| |
|---|
| Railways of Non-Engineered Buildings - Repair and Restore Action of Earthquake Damaged Non-Engineered Buildings Recommendations for Future Constructions. Requirement's of Structural Safety of Thin Precast Roofing Units Against Earthquake Forces, Status of R&D in Earthquake Strengthening Measures - Floods, Cyclone, Future Safety |
| **Textbooks:** |
| 1. Building Materials for Low –Income Houses – International Council for Building Research Studies and Documentation.<br>2. Hand Book of Low Cost Housing by A.K.Lal – Newage International Publishers.<br>3. Modern Trends in Housing in Developing Countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G.Annamalai. |
| **Reference Books:** |
| 1. Properties of Concrete – Neville A.M. Pitman Publishing Limited, London.<br>2. Light Weight Concrete, Academic Kiado, Rudhai.G – Publishing Home of Hungarian Academy of Sciences 1963.<br>3. Low Cost Housing – G.C. Mathur. |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | BUILDING CONSTRUCTION MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| 21D25301b | (PE- V) | 3 | 0 | 0 | 3 |
| | Semester | II | | | |

**Course Objectives:** This Course Will Enable Students:

- To create construction project cost estimates.
- Analyze construction documents for planning and management of construction processes.
- Understand the legal implications of contract, common, and regulatory law to manage a construction project.
- Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.

**Course Outcomes (CO):** Student will be able to

- Plan, coordinate and control of a project from beginning to completion.
- Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.
- Implement different methods of project delivery
- Follow the legal provisions implied

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

Introduction – Types Constructions Public and Private Contract Management – Scrutinizing Tenders and Acceptance of Tenders, Contracted, Changes and Terminating of Contract – Subcontracts Construction Organizations – Organizational Chart-Decentralization Payrolls and Records – Organization Chart of A Construction Company.

| **UNIT - II** | Lecture Hrs:10 |
|---|---|

Construction Practices – Times Management – Bar Chart, CPM, PERT – Progress Report

| **UNIT - III** | Lecture Hrs: |
|---|---|

Resources Management and Inventor- Basic Concepts Equipment Management, Material Management Inventory Control.

| **UNIT - IV** | Lecture Hrs:9 |
|---|---|

Accounts Management – Basic Concepts, Accounting System and Book Keeping, Depreciation, Balance Sheet, Profit and Loss Account, Internal Auditing. Quality Control by Statistical Methods, Sampling Plan and Control Charts, Safety Requirements.

| **UNIT - V** | Lecture Hrs:9 |
|---|---|

Cost and Financial Management – Cost Volume Relationship, Cost Control System, Budget Concept of Valuation, Cost of Equity Capital Management Cash. Labor and Industrial; Laws – Payment of Wages Act. Contract Labor, Workmen's Compensation, Insurance, Industrial Disputes Act.

**Textbooks:**

1. Construction Project Management by Jha ,Pearson Pubilications,New Delhi.
2. Construction Technology by Subir K.Sarkar and Subhajit Saraswati – Oxford Higher Education- Univ.Press, Delhi.

**Reference Books:**

1. Project Planning and Control With PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi.
2. Optimal Design of Water Distribution Networks P.R.Bhave, Narosa Publishing House 2003.
3. Total Project Management, The Indian Context- by : P.K.JOY- Mac Millan Publishers India Limited.

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# AUDIT COURSE-I

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**COURSE STRUCTURE & SYLLABI**

| Course Code | ENGLISH FOR RESEARCH PAPER WRITING | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC101a | | 2 | 0 | 0 | 0 |
| | **Semester** | I | | | |

**Course Objectives:** This course will enable students:

- Understand the essentials of writing skills and their level of readability
- Learn about what to write in each section
- Ensure qualitative presentation with linguistic accuracy

**Course Outcomes (CO):** Student will be able to

- Understand the significance of writing skills and the level of readability
- Analyze and write title, abstract, different sections in research paper
- Develop the skills needed while writing a research paper

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

**1**Overview of a Research Paper- Planning and Preparation- Word Order- Useful Phrases - Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy -Avoiding Ambiguity

| **UNIT - II** | Lecture Hrs:10 |
|---|---|

Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization

| **UNIT - III** | Lecture Hrs:10 |
|---|---|

Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion-Conclusions-Recommendations.

| **UNIT - I**V | Lecture Hrs:9 |
|---|---|

Key skills needed for writing a Title, Abstract, and Introduction

| **UNIT - V** | Lecture Hrs:9 |
|---|---|

Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions

**Suggested Reading**


1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | DISASTER MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC101b | | 2 | 0 | 0 | 0 |
| | Semester | I | | | |

**Course Objectives:** This course will enable students:

- Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from Multiple perspectives.
- Developanunderstandingofstandardsofhumanitarianresponseandpracticalrelevanceinspecific types of disasters and conflict situations
- Criticallyunderstandthestrengthsandweaknessesofdisastermanagementapproaches,planningand programming in different countries, particularly their home country or the countries they work in

**UNIT - I**

**Introduction:**
Disaster:Definition,FactorsandSignificance;DifferenceBetweenHazardandDisaster;Naturaland Manmade Disasters: Difference, Nature, Types and Magnitude.

**Disaster Prone Areas in India:**
Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post- Disaster Diseases and Epidemics

**UNIT - II**

**Repercussions of Disasters and Hazards**:
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes,Volcanisms,Cyclones,Tsunamis,Floods,DroughtsandFamines,Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**UNIT - III**

**Disaster Preparedness and Management:**
Preparedness: Monitoring of Phenomena Triggering ADisasteror Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

**UNIT - IV**

**Risk Assessment Disaster Risk:**
Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. TechniquesofRiskAssessment,GlobalCo-OperationinRiskAssessmentand Warning, People's Participation in Risk Assessment. Strategies for Survival.

**UNIT - V**

**Disaster Mitigation:**
Meaning,ConceptandStrategiesofDisasterMitigation,EmergingTrendsInMitigation.Structural Mitigationand Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**Suggested Reading**

1. R.Nishith,SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies
2. "'New Royal book Company..Sahni,PardeepEt.Al.(Eds.),"DisasterMitigationExperiencesAndReflections",PrenticeHall OfIndia, New Delhi.



3. GoelS.L.,DisasterAdministrationAndManagementTextAndCaseStudies",Deep&Deep Publication Pvt. Ltd., New Delhi

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**ANANTHAPURAMU – 515 002 (A.P) INDIA**

**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | SANSKRITFOR TECHNICAL KNOWLEDGE | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC101c | | 2 | 0 | 0 | 0 |
| | **Semester** | **I** | | | |

**Course Objectives:** This course will enable students:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- LearningofSanskrittodevelopthelogicinmathematics,science&othersubjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge
- Knowledge from ancientliterature

**Course Outcomes (CO):** Student will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science &technology can be understood
- Being a logical language will help to develop logic in students

**UNIT - I**

Alphabets in Sanskrit,

**UNIT - II**

Past/Present/Future Tense, Simple Sentences

**UNIT - III**

Order, Introduction of roots

**UNIT - IV**

Technical information about Sanskrit Literature

**UNIT - V**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

**Suggested Reading**

1.“Abhyaspustakam” –Dr.Vishwas, Sanskrit-Bharti Publication, New Delhi
2.“Teach Yourself Sanskrit” Prathama Deeksha- VempatiKutumbshastri, RashtriyaSanskrit Sansthanam, New Delhi Publication
3.“India’s Glorious ScientificTradition” Suresh Soni, Ocean books (P) Ltd.,New Delhi

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# AUDIT COURSE-II

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | PEDAGOGY STUDIES | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC201a | | 2 | 0 | 0 | 0 |
| | Semester | II | | | |

**Course Objectives:** This course will enable students:

- Reviewexistingevidenceonthereviewtopictoinformprogrammedesignandpolicy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

**Course Outcomes (CO):** Student will be able to

Students will be able to understand:

- Whatpedagogicalpracticesarebeingusedbyteachersinformalandinformalclassrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- Howcanteachereducation(curriculumandpracticum)andtheschoolcurriculumand guidance materials best support effective pedagogy?

**UNIT - I**

**Introduction and Methodology:** Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories oflearning,Curriculum,Teachereducation.Conceptualframework,Research questions**.** Overview of methodology and Searching.

**UNIT - II**

**Thematic overview:** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

**UNIT - III**

Evidence on theeffectivenessofpedagogicalpractices,Methodologyfortheindepthstage:quality assessmen t of included studies. How can teacher education (curriculumandpracticum) andthescho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of th body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

**UNIT - IV**

**Professional development:** alignment with classroom practices and follow-up support, Peer support, Support from the head teacherandthecommunity.Curriculumandassessment,Barrierstolearning:limitedresourcesand large class sizes

**UNIT - V**

**Researchgapsandfuturedirections:**Researchdesign**,**Contexts**,**Pedagogy**,**Teachereducation**,** Curriculum and assessment**,** Dissemination and research impact.

**Suggested Reading**


1. AckersJ,HardmanF(2001)ClassroominteractioninKenyanprimaryschools,Compare, 31 (2): 245-261.
2. AgrawalM(2004)Curricularreforminschools:Theimportanceofevaluation,Journalof
3. Curriculum Studies, 36 (3): 361-379.
4. AkyeampongK(2003) Teacher training in Ghana - does it count? Multi-site teachereducation research project (MUSTER) country report 1. London: DFID.

5. Akyeampong K, LussierK, PryorJ, Westbrook J (2013)Improving teaching and learning of basic maths and reading in Africa: Does teacherpreparation count?International Journal Educational Development, 33 (3): 272–282.
6. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
   Chavan M (2003)ReadIndia: A mass scale, rapid, 'learning to read'campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | STRESSMANAGEMENT BY YOGA | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC201b | | 2 | 0 | 0 | 0 |
| | **Semester** | II | | | |

**Course Objectives:** This course will enable students:

- To achieve overall health of body and mind
- To overcome stres

**Course Outcomes (CO):** Student will be able to

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

| | | |
|---|---|---|
| **UNIT - I** | | |
| Definitions of Eight parts of yog.(Ashtanga) | | |
| **UNIT - II** | | |
| Yam and Niyam. | | |
| **UNIT - III** | | |
| Do`sand Don't'sin life.<br>i) Ahinsa,satya,astheya,bramhacharyaand aparigrahaii)<br>Shaucha,santosh,tapa,swadhyay,ishwarpranidhan | | |
| **UNIT - IV** | | |
| Asan and Pranayam | | |
| **UNIT - V** | | |
| i)Variousyogposesand theirbenefitsformind &body<br>ii)Regularizationofbreathingtechniques and its effects-Types ofpranayam | | |

**Suggested Reading**

1.'Yogic Asanas forGroupTarining-Part-I": Janardan SwamiYogabhyasiMandal, Nagpur
2."Rajayogaor conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | PERSONALITY DEVELOPMENT THROUGHLIFE ENLIGHTENMENTSKILLS | L | T | P | C |
|---|---|---|---|---|---|
| 21DAC201c | | 2 | 0 | 0 | 0 |
| | **Semester** | **II** | | | |

**Course Objectives:** This course will enable students:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

**Course Outcomes (CO):** Student will be able to

- StudyofShrimad-Bhagwad-Geetawillhelpthestudentindevelopinghispersonalityand achieve the highest goal in life
- The person who has studied Geetawilllead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

**UNIT - I**

Neetisatakam- Holistic development of personality
Verses-19,20,21,22(wisdom)
Verses-29,31,32(pride &heroism)
Verses-26,28,63,65(virtue)

**UNIT - II**

Neetisatakam- Holistic development of personality
Verses-52,53,59(dont's)
Verses-71,73,75,78(do's)

**UNIT - III**

Approach to day to day work and duties.
ShrimadBhagwadGeeta:Chapter2-Verses41,47,48,
Chapter3-Verses13,21,27,35,Chapter6-Verses5,13,17,23,35,
Chapter18-Verses45,46,48.

**UNIT - IV**

Statements of basic knowledge.
ShrimadBhagwadGeeta:Chapter2-Verses 56,62,68
Chapter12 -Verses13,14,15,16,17,18
Personality of Rolemodel. Shrimad Bhagwad Geeta:

**UNIT - V**

Chapter2-Verses 17,Chapter3-Verses36,37,42,
Chapter4-Verses18,38,39
Chapter18– Verses37,38,63

**Suggested Reading**

1."SrimadBhagavadGita"bySwamiSwarupanandaAdvaitaAshram(PublicationDepartment), Kolkata
2.Bhartrihari'sThree Satakam (Niti-sringar-vairagya) by P.Gopinath, RashtriyaSanskrit Sansthanam, New Delhi.

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# OPEN ELECTIVE

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | COST MANAGEMENT OF ENGINEERING PROJECTS | L | T | P | C |
|---|---|---|---|---|---|
| 21DOE301a | | 3 | 0 | 0 | 3 |
| | Semester | I | | | |

**Course Objectives:**

- To explain cost concepts and objectives of costing system and cost management process
- To provide knowledge and explain Cost behaviour in relation to Volume and Profit and pricing decisions.
- To know the concepts of target costing, life cycle costing and activity based cost management in a project or business.
- To discuss on budget and budgetary control , type of budgets in a business to control costs
- To provide knowledge on project, types of projects, stages of project execution, types of project contracts and project cost control.

**Course Outcomes (CO):** Student will be able to

- Know the cost management process and types of costs
- Learn and apply different costing methods under different project contracts
- To understand relationship of Cost-Volume and Profit and pricing decisions.
- Prepare budgets and measurement of divisional performance.
- Acquires knowledge on various types of project contracts, stages to execute projects and controlling project cost..

| **UNIT - I** | Lecture Hrs:10 |
|---|---|

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** | Lecture Hrs:12 |
|---|---|

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; Pareto Analysis Just-in-time approach, Theory of constraints.; Divisional performance management: - Measurement of Divisional profitability - pricing decisions - transfer pricing.

| **UNIT - III** | Lecture Hrs:10 |
|---|---|

Target costing- Life Cycle Costing - Activity-Based Cost management:- Activity based costing- Value-Chain Analysis- Bench Marking; Balanced Score Card.

| **UNIT - IV** | Lecture Hrs:10 |
|---|---|

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

| **UNIT - V** | Lecture Hrs:12 |
|---|---|

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 non-technical 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.

**Textbooks:**

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

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|---|
| publisher |
| |
| **Reference Books:** |
| 1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi<br>2. Charles T. Horngren and George Foster, Advanced Management Accounting<br>3. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd |
| **Online Learning Resources:** |
| https://nptel.ac.in/courses/105/104/105104161/<br>https://nptel.ac.in/courses/112/102/112102106/ |

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| Course Code | INDUSTRIAL SAFETY | L | T | P | C |
|---|---|---|---|---|---|
| 21DOE301b | | 3 | 0 | 0 | 3 |
| | Semester | III | | | |

**Course Objectives:**

- To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment.

**Course Outcomes (CO):** Student will be able to

- To list out important legislations related to health, Safety and Environment.
- To list out requirements mentioned in factories act for the prevention of accidents.
- To understand the health and welfare provisions given in factories act.

**UNIT - I** — Lecture Hrs:

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**UNIT - II** — Lecture Hrs:

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**UNIT - III** — Lecture Hrs:

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working andapplications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**UNIT - IV** — Lecture Hrs:

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**UNIT - V** — Lecture Hrs:

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

**Textbooks:**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

**Reference Books:**

1.Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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**M.TECH. IN STRUCTURAL ENGINEERING**
**COURSE STRUCTURE & SYLLABI**

| **Course Code** | **BUSINESS ANALYTICS** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **21DOE301c** | | **3** | **0** | **0** | **3** |
| | **Semester** | **III** | | | |

**Course Objectives:**

- The main objective of this course is to give the student a comprehensive understanding of business analytics methods.

**Course Outcomes (CO):** Student will be able to

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

| **UNIT - I** | Lecture Hrs: |
|---|---|

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

| **UNIT - II** | Lecture Hrs: |
|---|---|

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

| **UNIT - III** | Lecture Hrs: |
|---|---|

Forming Requirements: Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents. Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

| **UNIT - IV** | Lecture Hrs: |
|---|---|

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

| **UNIT - V** | Lecture Hrs: |
|---|---|

Recent Trands in: Embedded and colleborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

**Textbooks:**

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

**Reference Books:**

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