# SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
**(AUTONOMOUS)**
**DEPARTMENT OF CIVIL ENGINEERING**
**M.Tech (Structural Engineering)**
**COURSE STRUCTURE**

**I Year – I Semester**

| S.No. | Course code | Subject | L | T | P | CP |
|---|---|---|---|---|---|---|
| 1. | 16CE2001 | Advanced Concrete Technology | 4 | 0 | - | 4 |
| 2. | 16CE2002 | Theory of Elasticity | 4 | 0 | - | 4 |
| 3. | 16CE2003 | Advanced Structural Analysis | 4 | 0 | - | 4 |
| 4. | 16CE2004 | Structural dynamics (SD) | 4 | 0 | - | 4 |
| 5. | 16CE2005 | Advanced Prestressed Concrete | 4 | 0 | - | 4 |
| **ELECTIVE-I** | | | | | | |
| 6 | 16CE2006 | Low Cost Housing Techniques | 4 | 0 | - | 4 |
| | 16CE2007 | Bridge Engineering | | | | |
| | 16CE2008 | Pre-fabricated Concrete Structures | | | | |
| **LABORATORY** | | | | | | |
| 7. | 16CE2009 | Structural Engineering Lab | - | - | 4 | 2 |
| Contact periods / week | | | 24 | 0 | 4 | 26 |
| | | | Total/Week 28 | | | |

**I Year – II Semester**

| S.No. | Course code | Subject | L | T | P | CP |
|---|---|---|---|---|---|---|
| 1. | 16CE2010 | Advanced Reinforced Concrete Design | 4 | 0 | - | 4 |
| 2. | 16CE2011 | Advanced Structural Steel Design | 4 | 0 | - | 4 |
| 3. | 16CE2012 | Finite Element Methods | 4 | 0 | - | 4 |
| 4. | 16CE2013 | Theory And Design of Plates and Shells | 4 | 0 | - | 4 |
| 5. | 16CE2014 | Stability of Structures (SS) | 4 | 0 | - | 4 |
| **ELECTIVE- II** | | | | | | |
| 6. | 16CE2015 | Experimental Stress Analysis (ESA) | 4 | 0 | - | 4 |
| | 16CE2016 | Construction Project Management (CPM) | | | | |
| | 16CE2017 | Earthquake Resistant Structures(ERS) | | | | |
| **LABORATORY 1** | | | | | | |
| 7. | 16CE2018 | Computing Techniques Lab | - | - | 4 | 2 |
| Contact Periods / Week | | | 24 | 0 | 4 | 26 |
| | | | Total/Week 28 | | | |

**II YEAR (III & IV Semesters)**

| S. No | Subject Code | Subject | Credits |
|---|---|---|---|
| 1 | 16CE2019 | Seminar | 2 |
| 2 | 16CE2020 | Project work | 16 |

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2001) ADVANCED CONCRETE TECHNOLOGY**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
|---|---|---|---|
| | **4** | **-** | **4** |

**Course Educational Objectives:**

- Lot of advances is taking place in the concrete technology as par with development taking place in the engineering.
- The present day industry needs the knowledge of concrete technology thoroughly.
- The subject is designed to give the basic knowledge as well as latest developments in concrete technology.

**Course Outcomes:**

Students undergoing this course are able to

- Know the various materials in concrete and admixtures
- Do the Mix design by different methods
- Get a thorough knowledge of various types of cement, aggregates and properties of special concrete
- Know the different procedures for testing concrete

**UNIT-I**

**MATERIALS:** Concrete materials - Reinforcements and admixtures.

**UNIT-II**

**MIX DESIGN:** Specifications - Design of concrete mixes by IS code method – ACI method - Road Note No: 4 methods – High strength concrete.

**UNIT-III**

**BEHAVIOUR OF CONCRETE:** Modern trends in concrete manufacture and placement techniques - Theological behaviour of fresh concrete and hardened concrete – Resistance to static and dynamic loads.

**UNIT-IV**

**TESTING OF CONCRETE:** Non-destructive testing and quality control – Durability – Corrosion protection and fire resistant.

**UNIT-V**

**SPECIAL CONCRETE:** Pre-cast concrete - Light weight concrete - Under water concrete – Pump concrete - Polymer concrete - Composites and fibre reinforced concrete.

**TEXT BOOKS:**

1. *Properties of concrete*, A.M. Neville, 5th edition, Pearson India Education Services Pvt. Ltd.
2. *Concrete Technology (Theory and Practice)*, M.S.Shetty, 7th edition, S.Chand Publishers.

**REFERENCES:**

1. *Lea's Chemistry of cement and concrete,* edited by Peter C. Hewlett, 4th edition, Elsevier publications.
2. *Text book of concrete Technology,* P.D. Kulkarni, R.K. Ghosh, Y.R. Phull, 2nd edition, New age international.
3. *Concrete Technology,* by ML Gambhir 3rd edition, Tata McGraw Hill Publishing Company.
4. *Concrete (Microstructure, Properties and Minerals),* 4th edition,P. Kumar Mehta, Paulo J. M. Monteiro, Tata McGraw Hill publications.
5. *Design of Concrete Mixes,*by N. Krishna Raju, 4th edition, CBS publications.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2002) THEORY OF ELASTICITY**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

- Student shall learn about plane stress and plane strain analysis
- Analysis of Stress and strain in three dimensions and torsion of Prismatic bars

**Course Outcomes:**

After completion of this course, the student shall understand

- Two dimensional analysis of stress and strain
- Three dimensional analysis of stress and strain

**UNIT-I**

**INTRODUCTION:** Elasticity, Notation for forces and stresses, Components of stress, Components of strain, Hooke's law.

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

**UNIT-II**

**TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES:** Solution by polynomials, Saint Venant's principle, Determination of displacements, Bending of simple beams, Application of Fourier series for two dimensional problems, Gravity loading.

**UNIT-III**

**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 problems.

**UNIT-IV**

**ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS:** Introduction, Principal stresses, Stress ellipsoid and stress-director surface, Determination of the principal stresses, Determination of the maximum shearing stress, Homogeneous deformation, Principal axes of strain, Rotation, Differential equations of equilibrium, Conditions of compatibility, Determination of displacements, Equations of equilibrium in terms of displacements.

**UNIT-V**

**TORSION OF PRISMATIC BARS:**

Torsion of prismatic bars – Elliptical cross section – Other elementary solutions – Membrane analogy – Torsion of rectangular bars.

**TEXT BOOKS:**

1. *Theory of Elasticity*, S.P. Timoshenko, G.N. Goodier, Tata McGraw-Hill Education Private Limited, New Delhi.
2. *Theory of Elasticity and Plasticity*, Dr. Sadhu Singh, 4th edition, Khanna Publications.

**REFERENCES:**

1. *Mechanics of materials*, 2nd edition, E. P. Popov, Prentice Hall publications.
2. *Elasticity Theory, Applications and Numerics*, 3rd edition, Martin H. Sadd, Elsevier publications, Academic Press, India.
3. *Introduction to Theory of Elasticity*, R.J. Atkin, N. Fox, Reprint of the Longman Group Ltd., London, 1980 edition.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2003) ADVANCED STRUCTURAL ANALYSIS**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

- Student shall learn analysis of continuous beam, portal frames, pin jointed structures by Flexibility and Stiffness matrix methods.
- Formation of global Stiffness matrix from local Stiffness matrix and equation solving Techniques.

**Course Outcomes:**

- After completion of this course, the student shall understand
- Analysis of continuous beam by stiffness & flexibility matrix methods
- Analysis of Rigid Jointed frames by Stiffness & flexibility matrix methods
- Analysis of Pin Jointed Structures by Stiffness & Flexibility matrix methods
- Formation global & element stiffness matrix, direct stiffness method
- Equation solution Techniques

**UNIT-I**

**INDETERMINACY:** Determination of static and kinematic indeterminacies of two, dimensional and three dimensional portal frames, Pin-jointed trusses and hybrid frames, Coordinate systems, Structural idealization.

**UNIT-II**

**INTRODUCTION TO MATRIX METHODS OF ANALYSIS:**Flexibility and stiffness matrices, Force displacement relationships for axial force, couple, torsional moments, Stiffness method of analysis and flexibility method of analysis.

**UNIT-III**

**ANALYSIS OF CONTINUOUS BEAMS:**Stiffness method and flexibility method of analysis, Continuous beams of two and three spans with different end conditions.

**ANALYSIS OF TWO-DIMENSIONAL PIN JOINTED TRUSSES:** Stiffness and flexibility methods, Computation of joint displacement and member forces.

**UNIT-IV**

**ANALYSIS OF TWO - DIMENSIONAL PORTAL FRAMES:**Stiffness and flexibility method of analysis of 2-D portal frames with different end conditions - Plotting of bending moment diagrams.

**UNIT-V**

**TRANSFORMATION OF CO-ORDINATES:**Local and Global co-ordinate systems, Transformation of matrices from local to global coordinates of element stiffness matrix, direct stiffness method of analysis, Assembly of global stiffness matrix from element stiffness matrices, Static condensation, Sub-structuring**.**

**EQUATION SOLUTION TECHNIQUES:** Solution of system of linear algebraic equations, direct inversion method, Gauss elimination method, Cholesky method, Banded equation solvers, Frontal solution technique.

**TEXT BOOKS:**

1. *Basic Structural Analysis,* C. S. Reddy, 3rd edition, Tata McGraw-Hill Education Private Limited, New Delhi.
2. *Structural Analysis (A Matrix Approach),* 2nd edition, G.S. Pandit, S.P. Gupta, Tata McGraw-Hill Education Private Limited, New Delhi.

**REFERENCES:**

1. *Structural Analysis,* 3rd edition, R.C. Coates, M.G. Coutie, F.K. Kong, Van Nostrand Reinhold publishers.
2. *Matrix Structural Analysis*, 2nd edition, William McGuire, Richard H. Gallagher, Ronald D. Ziemian, Create Space Independent Publishing Platform.
3. *Theory of Matrix Structural Analysis,* J. S. Prezemieniecki, Dover Publications.
4. *Structural Analysis*, 8th edition, R.C. Hibbeler, Pearson Prentice Hall.
5. *Matrix Structural Analysis,* John L Meek, Tata McGraw-Hill Education Private Limited, New Delhi.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2004) STRUCTURAL DYNAMICS**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

- Student shall learn about introduction to structural dynamics-single and multi-degree of freedom systems
- To understand Free and Forced vibrations, Practical vibration analysis

**Course Outcomes:**

After completion of this course, the student shall understand

- Structural dynamics-single and multi-degree of freedom systems
- Free and Forced vibrations
- Practical Vibration analysis

**UNIT-I**

**INTRODUCTION TO STRUCTURAL DYNAMICS:** Introduction - Elements of a vibratory system, Degrees of freedom, Continuous systems, lumped mass idealization, Oscillatory motion, Simple harmonic motion, Fundamental objective of dynamic analysis, Types of prescribed loading, Methods of discretization, Formulation of the equations of motion for single degree of freedom (SDOF) systems,

**UNIT-II**

**SINGLE DEGREE OF FREEDOM SYSTEM:** Solutions of the equation of motion, Free vibration response, Undamped and damped, Critical damping, Logarithmic decrement, Forced vibrations of SDOF systems, Harmonic excitation, Dynamic magnification factor, Bandwidth. Response to harmonic, periodic, impulsive and general dynamic loading, Duhamel integral.

**UNIT-III**

**MULTI DEGREE OF FREEDOM SYSTEM:** Selection of the degree of freedom, Evaluation of structural property matrices, Formulation of 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**

**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.

**UNIT-V**

**PRACTICAL VIBRATION ANALYSIS:** Stodola method, Fundamental mode analysis, Analysis of second and higher modes, Holzer method - Basic procedure, Transfer matrix procedure.

**TEXT BOOKS:**

1. *Dynamics of Structures*, 2nd edition, Clough and Penzium, Tata McGraw-Hill Education Private Limited, New Delhi.
2. *Structural Dynamics (Theory and Computation),* 3nd edition, Mario Paz, Springer publications.

**REFERENCES:**

1. *Dynamics of structures (Theory and Applications to Earthquake Engineering),* Anil K Chopra, 4th edition,Pearson Education, New Delhi.
2. *Elements of Mechanical Vibrations,* R.N. Iyengar, I.K. International Publishing House.
3. *Dynamics of Structures,* 3rd edition, Jagmohan L. Humar, CRC Press (Taylor and French Group).
4. *Engineering Vibrations,* 2nd edition, William J. Bottega, CRC Press (Taylor and French Group).

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2005) ADVANCED PRESTRESSED CONCRETE**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Objectives:**

- Student shall learn about Losses of prestress, Analysis and design of sections for flexure and shear, Bond and anchorage.
- To understand deflections of prestressed concrete beams, Circular prestressing and analysis and design of statically indeterminate structures.

**Course Outcomes:**

After completion of this course, the student shall understand

- Concept of pre-stressed concrete
- Losses of Prestress
- Deflections of prestressed concrete elements
- Circular prestressing, Analysis and design of statically indeterminate beams.

**UNIT I**

**INTRODUCTION:**Historic development – General principles of prestressing pretensioning and post tensioning –Advantages and limitations of prestressed concrete – Materials – High strength concrete and hightensile steel their characteristics.

**METHODS OF PRESTRESSING:** Methods and Systems of Prestressing; Pre-tensioning and post tensioning methods – Analysis of post tensioning - Different systems of prestressing like Hoyer System, Magnel System Freyssinet system and Gifford – Udall System

**UNIT-II**

**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 stress in steel, Slip in anchorage, friction etc.

**UNIT-III**

**FLEXURE:** Elastic analysis of concrete beams prestressed with straight, eccentric, bent and parabolic tendons, Kern lines, Cable profile, Design criteria as per I.S. code of practice, Elastic design of Beams (rectangular, I, and T-sections) for flexure, Introduction to partial prestressing.

**UNIT-IV**

**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**

**DEFLECTIONS:** Introduction, Factors influencing deflections, Short term and long term/ time deflections of un-cracked and cracked members.

**CIRCULAR PRESTRESSING:** Introduction, Circumferential prestressing, Design of prestressed concrete tanks, Dome prestressing.

**TEXT BOOKS:**

1. *Prestressed Concrete,* 4th edition, N Krishna Raju, Tata Mc Graw-Hill Education Private Limited, New Delhi.
2. *Design of Reinforced Concrete Structures,* S. Ramamrutham, Dhanpat Rai Publishing Company.
3. *Prestressed Concrete (Problems and Solutions),* N. Krishna Raju, CBS Publishers.
4. *Prestressed Concrete,* 2nd edition, N. Rajagopalan, Narosa Book Distributors.

**REFERENCES:**

1. *Design of Prestressed Concrete Structures*, 3rd edition, T.Y. Lin, Ned H. Burns, John Willey and Sons.
2. *Design of Prestressed Concrete,* 2nd edition, Arthur H. Nilson, Wiley Publications.
3. *Prestressed Concrete,* K.U. Muthu, Azmi Ibrahim, Maganti Janardhana, M. Vijayanand, PHI Learning Publications.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-I)**
**(16CE2006) LOW COST HOUSING TECHNIQUES**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

- Student shall learn about Housing Scenario, Housing Finance, Land Use and Planning for Housing, Housing the Urban poor, Development and Adoption of Low Cost Housing Technology
- Alternative building materials for Low Cost Housing, Low cost Infrastructure services, Rural Housing &Housing in Disaster Prone Areas

**Course Outcomes:**

After completion of this course, the student shall understand

- Housing Scenario and Housing Finance
- Use of Land and Planning for Housing
- Housing the Urban poor
- Development and Adoption of Low Cost Housing Technology
- Alternative building materials for Low Cost Housing

**UNIT-I**

**HOUSING SCENARIO:** Introduction, Status of urban housing, Status of rural housing.

**HOUSING FINANCE:** Introduction, Existing finance system in India, Government role as facilitator, Status at rural housing finance, Impediments in housing finance and related issues.

**UNIT-II**

**LAND USE AND PHYSICAL PLANNING FOR HOUSING:** Introduction, Planning of urban land, Urban land ceiling and regulation act, Effectiveness of building bye laws, Residential densities.

**HOUSING THE URBAN POOR:** Introduction – Living condition in slums – Approaches and strategies for housing urban poor.

**UNIT-III**

**DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY:** Introduction, Adoption of innovative cost effective construction techniques, Adoption of precast elements in partial prefabrication, Adoption of total prefabrication of mass housing in India, General remarks on pre cast roofing/ flooring systems, Economical wall system, Single brick thick load bearing wall, 19 cm thick load bearing masonry walls, Half brick thick load bearing wall, Fly ash, gypsum brick for masonry, Stone block masonry, Adoption of precast R.C. plank and join system for roof/floor in the building.

**UNIT-IV**

**ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING:** Introduction, Substitute for scarce materials, Ferro cement, Gypsum boards, Timber substitutions, Industrial wastes, Agricultural wastes.

**UNIT-V**

**LOW COST INFRASTRUCTURE SERVICES:**Introducing, Present status, Technological options, Low cost sanitations, Domestic wall, Water supply, energy.

**RURAL HOUSING:**Introduction, Traditional practice of rural housing, Mud housing technology, Mud roofs, Characteristics of mud, Fire resistant treatment for thatched roof, Soil stabilization, rural housing programmers.

**TEXT BOOKS:**

1. *Hand Book of Low Cost Housing*, A.K. Lal, Newage International publishers.
2. *Low Cost Housing in Developing Countries*, G.C. Mathur, South Asia Books Private Limited.

**REFERENCES:**

1. *Properties of Concrete*, Adam M. Neville, 5th edition, Prentice Hall, Pearson publications.
*2. Light Weight Concrete (Academic)*, Kiado, Rudhai. G, Publishing home of Hungarian Academy of Sciences, 1963.
3. *Modern Trends in Housing in Developing Countries*, edited by A.G.Madhava Rao, D.S.Ramachandra Murthy and G.Annamalai, and published in London ; New York : E. & F.N. Spon, 1984.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-I)**
**(16CE2007) BRIDGE ENGINEERING**

**M.Tech I Year -I Sem. (Struc. Engg.)**

| L | T | C |
|---|---|---|
| 4 | - | 4 |

**Course Educational Objectives:**

Student shall learn about fundamentals of bridge design, Design of Box Culvers, Design of Deck Slab Bridges, T-Beam Bridges, Prestressed Concrete bridges, Bridge Bearings, Types of Piers and Abutments for bridges.

**Course Outcomes:**

After completion of this course, the student shall be able to

- Design Box Culverts, Deck Slab Bridges,
- Design T-Beam Bridges,
- Design post tensioned Prestressed Concrete slab bridge decks and Bridge Bearings.

**UNIT-I**

**INTRODUCTION:** Classification, Investigations and planning, choice of type, Economic span length - Classification of IRC loadings - IRC specifications for road bridges - Standard live loads - forces acting on bridges - General design considerations.

**UNIT-II**

**DESIGN OF BOX CULVERTS:** General aspects, Design loads - Design moments, shears and thrusts - Design of critical section.

**UNIT-III**

**DESIGN OF DECK SLAB BRIDGES:** Effective width analysis, working stress design and detailing of deck slab bridges for IRC loading.

**UNIT-IV**

**DESIGN OF T-BEAM BRIDGES:** Introduction - Wheel load analysis – Bending moments in slab - Pigaurd's theory – Analysis of longitudinal girders by Courbon's theory - Working stress design and detailing of reinforced concrete T-beam bridges for IRC loading.

**DESIGN OF COMPOSITE BRIDGES:** Introduction - Advantages - Design of composite bridges consisting of RCC slabs over Steel Girders including shear connectors

**UNIT-V**

**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 and detailing of elastomeric pad bearing.

**TEXT BOOKS:**

1. *Essentials of Bridge Engineering*, D. Johnson Victor, 6th edition, Oxford & IBH Publishers Co. Pvt. Ltd.
2. *Design of Bridges*, 4th edition, N. Krishna Raju, Oxford & IBH & IBH Publishers Co. Pvt. Ltd.
3. *Bridge Engineering*, 2nd edition, S. Ponnuswamy, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.

**REFERENCES:**

1. *Design of Concrete Bridges*,Mc Aswanin, 2nd edition, VN Vazarani and MM Ratwani, Khanna Publishers, 1981.
2. *Concrete Bridge Design (Supplement)*, R.E. Rowe, C.R. Books Ltd. London.
3. *Reinforced Concrete Bridges*, Taylor F.W., Thomson S.E., and Smulski E, John Wiley and Sons New York, London.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-I)**
**(16CE2008) PRE-FABRICATED CONCRETE STRUCTURES**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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| | **4** | **-** | **4** |

**Course Educational Objectives:**

Student shall learn about introduction to prefabricated structures, Functional Design Principles, design of Floors, Stairs, Roofs and Walls, Industrial buildings.

**Course Outcomes:**

After completion of this course, the student shall understand

- Functional Design Principles of Pre-Fabricated Structures
- Design of Floors, Stairs, Roofs and Walls
- Design of Industrial buildings

**UNIT-I**

**TYPES OF RC PREFABRICATED STRUCTURES:** Long wall and cross wall large panel buildings- One way and two way prefabricated slabs - Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells - Crane – Gantry systems.

**UNIT-II**

**FUNCTIONAL DESIGN PRINCIPLES:** Modular coordination – Standardization - Disuniting, Diversity of prefabricates – Production – Transportation – Erection - Stages of loading and codal provisions - Safety factors - Material properties - Deflection control - Lateral load resistance - Location and types of shear walls.

**UNIT-III**

**FLOORS, STAIRS AND ROOFS:** Types of floor slabs - Analysis and design example of cored and panel types and two-way systems - Staircase slab design - Types of roof slabs and insulation requirements - Description of joints, their behavior and requirements - Deflection control for short term and long term loads - Ultimate strength calculations in shear and flexure.

**UNIT-IV**

**WALLS:** Types of wall panels - Blocks of large panels – Curtain partition and load bearing walls -Load transfer from floor to wall panels - Vertical loads - Eccentricity and stability of wall panels - Design curves - Types of wall joints, their behavior and design - Leak prevention, Joint sealants, sandwich wall panels.

**UNIT-V**

**INDUSTRIAL BUILDINGS:**Components of single storey industrial sheds with crane gantry systems - Design of R.C. Roof Trusses - Roof panels - Design of R.C. Crane - Gantry Girders - Corbels and columns -Wind bracing design.

**TEXT BOOKS:**

1. *Practical Design of Reinforced Concrete Structures*, Ghosh, Karunamoy, Prentice Hall India Learning Private Limited.

**REFERENCES:**

1. *Building with Large Prefabrication*, B. Leweicki, Elsevier Publishing Company.
2. S.S.Bhavikatti, "*Advanced R.C.C.Design (R.C.C.,Vol. II)"*, New Age International Publishers Pvt.Ltd., New Delhi.
2. *SERC,Design& Construction of Prefabricated Residential & Industrial Buildings*, Organized by SERC, Chennai.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2009) STRUCTURAL ENGINEERING LABORATORY**

| **M.Tech I Year -I Sem. (Struc. Engg.)** | **L** | **P** | **C** |
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**Course Educational Objectives:**

The objective of concrete laboratory is to determine the strength characteristics of reinforced cement concrete and conducting NDT.

**Course Outcomes:**

Students undergoing this course are able to,

- Determine the water/cement ratio on workability and strength of concrete.
- Determine the mechanical properties of hardened concrete.
- Determine the proportion of the mix design for different grades of concrete
- Perform non-destructive failure analysis for hardened concrete.

**LIST OF EXPERIMENTS:**

1. Study of effect of water/cement ratio on workability and strength of concrete.
2. Study of effect of aggregate/cement ratio on strength of concrete.
3. Study of effect of fine aggregate/coarse aggregate ratio on strength and permeability of concrete.
4. Mix Design methods: (a) I.S. Code method (b) ACI Code method.
5. Study of stress-strain curve of concrete for different mixes and different rates of loadings.
6. Study of Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
7. Study of stress-strain curve for high tensile steel.
8. Study of behavior of under reinforced and over-reinforced beam in flexure.
9. Study of behavior of steel beam under flexure.
10. Demonstration experiments on non-destructive testing of concrete.

*__Minimum of Eight experiments__ must be performed in lab session.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2010) ADVANCED REINFORCED CONCRETE DESIGN**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
|---|---|---|---|
| | **4** | **-** | **4** |

**Course Educational Objectives:**

Student shall learn about the estimation of crack width, Redistribution of moments in Reinforced concrete beams, design of deep beams, ribbed (voided) slabs, grid floors, flat slabs, plain concrete wall and shear wall using IS 456-2000.

**Course Outcomes:**

After completion of this course, the student shall able to (as per 13456 2000),

- Estimation of crack width and Redistribution of moments in Reinforced concrete beam.
- Design of deep beams, ribbed (voided) slabs.
- Design of Grid floors, flat slabs.
- Design of plain concrete walls.
- Design of shear walls.

**UNIT-I**

**ESTIMATION OF CRACK WIDTH AND REDISTRIBUTION OF MOMENTS IN REINFORCED CONCRETE BEAMS:** Limit State of cracking, Cracking in R.C. members, Causes, mechanism and effects of cracking, Classification and effect of cracks, Factors affecting crack width in beams, Calculation of crack width, Empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking, Redistribution of moments in a fixed beam and a two-span continuous beam, Advantages and disadvantages of moment redistribution, Moment-Curvature relation of reinforced concrete sections.

**UNIT-II**

**DESIGN OF DEEP BEAMS AND CORBELS:** Steps of designing deep beams by IS 456, Detailing of deep beams, Design of corbels.

**UNIT-III**

**DESIGN OF RIBBED (VOIDED) SLABS:**Analysis of the ribbed slabs for moment and shears, Design for shear, Deflections, Arrangement of reinforcements.

**UNIT-IV**

**DESIGN OF GRID FLOORS:**Introduction, Design of grid floors by IS Code method.

**DESIGN OF FLAT SLABS:**Introduction, Advantages and disadvantages of flat slabs, Design of flat slabs using direct design method and equivalent frame method, Design for interior panel.

**UNIT-V**

**DESIGN OF PLAIN CONCRETE WALLS:** Braced and unbraced walls, Eccentricities of vertical loads, Empirical design method (walls carrying axial load), Design of wall for In-plane horizontal forces.

**DESIGN OF SHEAR WALLS:** Classification of shear walls, Loads in shear walls, Design of rectangular and flanged shear walls, Moment of resistance of rectangular shear walls.

**TEXT BOOKS:**

1. *Advanced Reinforced Concrete Design*, 2nd edition, P.C. Varghese, Prentice-Hall of India, Private Ltd., New Delhi.
2. *Advanced Reinforced Concrete Design-SI Units*, N. Krishna Raju, 3rd edition, CBS Publications, New Delhi.
3. A*dvanced R.C.C. Design (R.C.C., Vol. II),* S.S. Bhavikatti, 3rd edition New Age International Publishers Pvt. Ltd., New Delhi.

**REFERENCES:**

1. *Illustrated Design of Reinforced Concrete Buildings,* 4th edition, Dr. V.L. Shah and Dr. S.R. Kharve, Structures Publications, Pune.
2. *Reinforced Concrete Design*, S. Unnikrishn Pillai and Devdas Menon, 3nd edition, Tata McGraw-Hill Education Private Limited, New Delhi.
3. *Reinforced Concrete. Vol.II, (Advanced Reinforced Concrete),* 7th edition, H.J. Shah, Charotar Publishing House Pvt. Ltd., Anand.

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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2011) ADVANCED STRUCTURAL STEEL DESIGN**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

Student shall learn about design of Light Gauge compression members and beams, Analysis and design of Transmission Towers, Plastic analysis and design of continuous beams, Portal frames, Limit State Design of steel Tension members and laterally restrained beams.

**Course Outcomes:**

After completion of this course, the student shall be able to,

- Design light Gauge steel compression and Flexural members
- Analyze and design Transmission towers
- Analyze and design continuous beams and portal frames using plastic theory
- Design steel Tension members and laterally restrained beams using limit state method

**UNIT-I**

**LIGHT GAUGE STEEL STRUCTURES:** Light gauge steel, Types of sections, Specifications, Permissible stresses.

**COMPRESSION MEMBERS:** Local buckling of elements, Stiffened compression elements, Computation of permissible stresses, Design of columns.

**FLEXURAL MEMBERS**: Bending Deflection, Local buckling of compression elements, laterally supported and unsupported beams, Computation of permissible stresses, Design of beams, Connections, Various methods, Welding.

**UNIT-II**

**TRANSMISSION LINE TOWERS:** Introduction, Types of towers, Tower configuration, Loads, Analysis and design of self-supporting simple towers.

**PLASTIC DESIGN:** Analysis and design of continuous beams, Portal frames (up to two bay two storey) and single span gable frames.

**UNIT-III**

**LIMIT STATE DESIGN:** Introduction, Characteristic strength, Characteristic load, Partial safety factor, Limit state of collapse in flexure and shear, Limit state of serviceability.

**UNIT-IV**

**DESIGN OF TENSION MEMBERS:** Introduction, Types of tension members, Types of sections, Slenderness ratio, Net area of cross section, Design of tension members, Lug angles.

**UNIT-V**

**DESIGN OF BEAMS:** Introduction, Effective length of compression flange, Design of laterally restrained beams and unrestrained beams.

**DESIGN OF COMPRESSION MEMBERS:** Design of Plain and built up compression members.

**TEXT BOOKS:**

1. *Design of Steel Structures*, 3rd edition, S.K. Duggal, Tata McGraw-Hill Education Private Limited, New Delhi.
2. *Design of Steel Structures*, 2nd edition, N Subramanian, Oxford Higher Education, New Delhi.
3. *Comprehensive Design of Steel Structures*, 2nd edition, B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications Private Limited, New Delhi.

**REFERENCES:**

1. *Design of Steel Structures*, K.S. Sai Ram, Dorling Kindersley(India), Pvt. Ltd, Pearson Education in South Asia.
2. *Design of Steel Structures*, L.S. Negi, 2nd edition, Tata McGraw-Hill Education Private Limited, New Delhi.
3. (ISI)-No.6, *Structural Engineers Handbook*, Bureau of Indian Standard.
4. *Design of Steel Structures*, 6th edition, Arya and Ajmani, New Chand Publishers.

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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2012) FINITE ELEMENT METHODS**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

The Student shall learn the concepts of FEM, Discretization, and Rayleigh Ritz method of functional approximation. Principles of Elasticity, 1-D, 2-D, 3-D FEM, isoperimetric formulation and finite element analysis of plates.

**Course Outcomes:**

The student shall be able to know

- The history of FEM, methods of functional approximation
- Principles of Elasticity, isoperimetric formulation
- Finite element analysis of plates

**UNIT-I**

**INTRODUCTION:** Concepts of FEM, Steps involved Merits and demerits, Energy principles, Discretization, Rayleigh Ritz method of functional approximation.

**PRINCIPLES OF ELASTICITY:** Stress equations, Strain displacement relationships in matrix form, Plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

**UNIT-II**

**ONE DIMENSIONAL FEM:** Stiffness matrix for beam and bar Elements-Shape functions for 1-D elements, Static condensation of global stiffness matrix, Solution, Initial strain and temperature effects.

**UNIT-III**

**TWO DIMENSIONAL FEM:**Different types of elements for plane stress and plane strain analysis, Displacement models, Generalized coordinates, Shape functions, Convergent and compatibility requirements, Geometric invariance, Natural coordinate system, Area and volume coordinates, Generation of element stiffness and nodal load matrices, Static condensation.

**UNIT-IV**

**ISOPARAMETRIC FORMULATION:**Concept, Different isoperimetric elements for 2-D analysis, Formulation of 4-noded and 8-noded isoperimetric quadrilateral elements, Lagrangian elements - Serendipity elements.

**AXI-SYMMETRIC ANALYSIS:** Bodies of revolution, Axi-symmetric modeling, Strain displacement relationship, Formulation of axi-symmetric elements.

**UNIT-V**

**THREE DIMENSIONAL FEM:** Different 3-D elements, 3-D strain, displacement relationship, Formation of hexahedral and isoperimetric solid element.

**FINITE ELEMENT ANALYSIS OF PLATES:** Basic theory of plate bending, thin plate theory, Stress resultants, Mindlin's approximations, Formulation of 4-noded isoperimetric quadrilateral plate element.

**TEXT BOOKS:**

1. *Finite Element Analysis –Theory & Programming*, 2nd edition, C.S. Krishna Murthy, Tata Mc Graw-Hill Education Private Limited, New Delhi.
2. *Introduction to Finite Element Method*, 4th edition, Tirupathi Chandrupatla, Ashok D. Belegundu, Prentice Hall Publications.

**REFERENCES:**

1. *Concepts and Applications of Finite Element Analysis*, 4th edition, Robert D. Cook, John Wiley and sons Inc., New York.
2. *An Introduction to Finite Element Method*, 3rd edition, J.N. Reddy, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
3. *Finite Element Procedures*, 2nd edition, Klaus-Jurgen Bathe, Prentice Hall.
4. *Finite Element Analysis (Theory and Programming)*, 2nd edition, C.S. Krishnamoorthy, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2013) THEORY AND DESIGN OF PLATES AND SHELLS**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

This subject is taught to impart knowledge about the behaviour of plates and shells.

**Course Outcomes:**

After completion of this course, the student shall be able to

- Analyze the plates using Navier's and Levy's method
- Analyze the circular, rectangular and square plates by finite difference method
- Design the curved shells and roofs
- Design the various folded plate structures

**UNIT-I**

Laterally loaded thin plates – Differential equation – Boundary conditions. Bending of plates – Simply supported rectangular plates – Navier's solution and Levy's method – Rectangular plates with various edge conditions.

**UNIT-II**

Symmetrical bending of circular plates – Finite difference method for analysis of square and rectangular plates.

**UNIT-III**

Types of shells – Structural action – Membrane theory – Limitations – Beam method of analysis.

**UNIT-IV**

Analysis and design of doubly curved shells – Elliptic paraboloid - Conoid and hyperbolic paraboloid roofs - Spherical Shells.

**UNIT-V**

Folded plate structures – Structural behaviour – Various types – Design of folded plates - Reinforced detailing.

**TEXT BOOKS:**

1. *Design and construction of concrete shell roofs*, 1st edition, G.S. Ramaswamy, CBS Publishers and distributors.
2. *Design of Reinforced Concrete Shells and Folded Plates,* P.C. Varghese, Eastern Economy Edition, PHI Learning Pvt. Ltd., New Delhi.

**REFERENCES:**

1. *Theory of Plates and Shells*, 2nd edition, S. Timoshenko, S. Woinowsky-Krieger, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
2. *Theory and Design of Concrete Shells*,Chatterjee, Binoy Kumar, Oxford and IBH, New Delhi.
3. *Analysis of Thin concrete Shells*, K. Chandrasekhara, Oxford and IBH, Kolkata, 1971.
4. ASCE Manual of Engineering Practice No. 31, *Design of Cylindrical Concrete Shell Roofs*, ASC, New York.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2014) STABILITY OF STRUCTURES**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

Student shall learn about beam columns with different loads, elastic and inelastic buckling of bars, mathematical treatment of stability problems, torsional buckling of thin walled bars, lateral buckling of rectangular cross-sectional beams and buckling of rectangular plates.

**Course Outcomes:**

The student shall be able to,

- Analyze elastic and inelastic buckling of bars
- Understand the various numerical methods for treatment of stability problems and buckling of rectangular cross-sectional beams and plates

**UNIT-I**

**BEAM COLUMNS:** 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.

**UNIT-II**

**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 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**

**INELASTIC BUCKLING:** Buckling of straight bars, Double modulus theory and Tangent modulus theory.

**MATHEMATICAL TREATMENT OF STABILITY PROBLEMS:** Buckling problem, Orthogonality Relation-Ritz method, Timoshenko method and Galerkin's method.

**UNIT-IV**

**TORSIONAL BUCKLING:** Pure torsion of thin walled bar of open cross section, Non-uniform torsion of thin walled bars of open cross section, Torsional buckling, Buckling by Torsion and Flexure.

**UNIT-V**

**LATERAL BUCKLING OF SIMPLY SUPPORTED BEAMS:** Beams of rectangular cross section subjected to pure bending.

**BUCKLING OF SIMPLY SUPPORTED RECTANGULAR PLATES:** Derivation of equation of plate subjected to constant compression in two directions and one direction.

**TEXT BOOKS:**

1. *Theory of Elastic Stability*, 2nd edition, Stephen P. Timoshenko & James M. Gere, Dover Publications.
2. *Principles of Structural Stability Theory (Prentice-Hall Civil Engineering and Engineering Mechanic Series),* Alexander Chajes, Prentice Hall Publications, 1974.

**REFERENCES:**

1. *Structural Stability Theory and Implementation,* Reprint Edition of 1987, Wai-Fan Chen, E.M. Lui, PTI Prentice Hall Private Limited.
2. *Theory of Beam Columns, Vol I&II,* 2nd edition, Atsuta, Chen W.F., TataMcGraw-Hill Education Private Limited, New Delhi.
3. *Introduction to the Elastic Stability of Structures (Prentice-Hall Civil Engineering and Engineering Mechanic Series),* 1st edition, Smites, George, Prentice Hall Publishers.
4. *Guide to Stability Design Criteria for Metallic Structures,* 6th edition, Ronald D. Ziemian, Wiley Publications.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-II)**
**(16CE2015) EXPERIMENTAL STRESS ANALYSIS**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

Student shall learn about the Experimental approach, strain measurements by strain Gauges, Electrical Strain Gauges, Strain Rosettes and the basic concepts of one, two dimensional photo elasticity and brittle coating methods.

**Course Outcomes:**

Students will be able to know,

- Fundamental approach to experimental analysis
- Photo elasticity
- Principal stresses and shear stresses using strain rosettes, strain measurements through strain gauges and non-destructive techniques

**UNIT-I**

**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**

**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.

**UNIT-III**

**ELECTRICAL STRAIN GAUGES:** Inductance strain gauges, LVDT, Resistance strain gauges, Various types, Gauge factor, Material of adhesion base etc., Reduction of strain gauge data for computation of stresses.

**UNIT-IV**

**STRAIN ROSETTES:** Introduction, The three elemental rectangular Rosette, The delta Rosette, Corrections for transverse strain gauge.

**UNIT-V**

**NON DESTRUCTIVE TESTING:** Ultrasonic techniques for non-destructive testing, Rebound hammer test.

**BRITTLE COATING METHODS:** Introduction, Coating Stress, Failure theories, Brittle coating crack patterns, Crack Detection, Types of Brittle Coating, Test procedures for Brittle Coating Analysis, Calibration procedures, Analysis of Brittle coating data.

**TEXT BOOKS:**

1. *Experimental Stress Analysis,* 4th edition, J. W. Dally and W.F. Riley, Tata McGraw-Hill Publication Pvt. Ltd., New Delhi.
2. *Experimental Stress Analysis,* Revised edition December 2009, Dr. Sadhu Singh, Khanna Publications.
3. *Experimental Stress Analysis,* U.C. Jindal, 1st edition, Pearson Education, 2012.

**REFERENCES:**

1. *Experimental Stress Analysis,*Revised edition of 1984, L.S. Srinath, Tata McGraw-Hill Publishing Company Limited, New Delhi.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-II)**
**(16CE2016) CONSTRUCTION PROJECT MANAGEMENT**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

Student shall learn about concept of a project and Quality & Safety concern in construction. Apply various Networking & Optimization Techniques for planning a project. Prepares budget of a project and also prepares construction cost estimates.

**Course Outcomes:**

After completion of this course, the student shall understand

- The concept of a project along with Quality & Safety concerns in Construction
- Plan a project using various Networking Techniques and Optimization Techniques
- Prepare budget of a project and construction cost estimates

**UNIT-I**

**CONCEPT OF A PROJECT**: Characteristic features, Project life cycle, Phases, Project Management, Effects of project risks on organization, Organization of project participants, Traditional designer, Construction sequence, Professional construction management, Owner, builder Operation, Turnkey operation, Leadership and Motivation for the Project Team, Interpersonal behavior in project organizations, Perceptions of owners and contractors.

**UNIT-II**

**QUALITY AND SAFETY CONCERNS IN CONSTRUCTION**: Organizing for quality and safety, Work and material specifications, Total quality control, Quality control by statistical methods, Statistical quality control with sampling by attributes, Statistical quality control with sampling by variables, Safety.

**UNIT-III**

**NETWORK TECHNIQUES:** Bar charts, Critical path method, Programme evaluation and review technique, Time estimates, Uncertainties of time, Time computations, monitoring of projects, Updating, Crashing and time, Cost tradeoff.

**UNIT-IV**

**OPTIMIZATION TECHNIQUES**: Resource allocation, Heuristic approach, Linear programming, Graphical and simplex methods, Optimality analysis, Material transportation and Work assignment problems, Materials management, Planning and budgeting, Inventory control, Management of surplus materials, Equipment control, Process control, Work study, Crew size, Job layout, Process operation.

**UNIT-V**

**COST CONTROL PROBLEM:** Project budget, Forecasting for activity cost control, financial accounting systems and cost accounts, Control of project cash flows, Schedule control, Schedule and budget updates, Relating cost and schedule information.

**TEXT BOOKS:**

1. *Construction Management and Planning*, Senguptha. B andGuha. H, Tata McGraw-Hill Publishing Company, New Delhi.
2. *Construction Project Management: Planning, Scheduling and Control*, K.K. Chitkara, 3rd edition, Tata McGraw-Hill Publishing Company, New Delhi.
3. *Project Management*, 1st edition, S Choudhury, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. *Material Management (Procedures, Texts and Cases)*, 2nd edition, A.K. Datta, Prentice Hall of India, New Delhi.

**REFERENCES:**

1. *Project Planning Analysis, Selection, Implementation and Review*, 7th edition, Prasanna Chandra, Tata McGraw-Hill Publishing Company, New Delhi.
2. *Construction Scheduling with Primavera Project Planner*, Feigenbaum.L, Prentice Hall Inc.
3. *Project Management for Construction*, 2nd edition, Chris Hendrickson, Tung Au, Prentice Hall Publications.
4. *Financial Management and Accounting fundamentals for Construction*, 1st edition 2009, Daniel W. Halpin, Bolivar A. Senior, John Wiley and Sons, New Jersey, Canada.
5. *Total Project Management – The Indian Context*, P.K. Joy, Macmillan India Ltd., New Delhi.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(Elective-II)**
**(16CE2017) EARTHQUAKE RESISTANT STRUCTURES**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **T** | **C** |
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**Course Educational Objectives:**

Student shall learn about the fundamental concepts in the analysis of the structures subjected to seismic forces. Vibration of structures during earthquakes and fundamentals of Seismic Planning.

**Course Outcomes:**

Analyze the forces acting on structures due to earthquake,

- Computation of design moments and shears for framed structure as per is:1893 and its detailing
- Apply the concepts in the design of structures
- Implementing the selection process of materials and construction form of super structure

**UNIT-I**

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

**UNIT-II**

**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, Response spectrum representations; Relation between the nature of the ground motion and structural damage.

**UNIT-III**

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

**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**

**FUNDAMENTALS OF SEISMIC PLANNING:** Selection of materials and types of construction form of super structure, framing systems and seismic units, devices for reducing. Earthquake loads,

**TEXT BOOKS:**

1. *Dynamics of Structures,* 2nd edition, R.W. Clough and Penzium, Tata McGraw-Hill Publishing Company, New Delhi.
2. *Earthquake Resistant Design,* Eastern Economy Edition, Pankaj Agarwal& Manish Shrikande, Prentice Hall Publishers.
3. *Design of earthquake resistant structures,* revised edition of September 1985, Minoru, Wakabayashi, Tata McGraw-Hill Publishing Company, New Delhi.
4. *Structural Dynamics for Earthquake Engineering (Theory and Practice,* 1st edition (2009), S. Rajasekharan, CRC Press, Wood Head Publishing Limited.

**REFERENCES:**

1. *Dynamics of Structures (Theory and applications to Earthquake Engineering),* 3rd edition, Anil K. Chopra, Pearson Education.
2. *Earthquake design practice for buildings,* 2nd edition, Edmund Booth, David Key, Thomas Telford, London.
3. *Earthquake Engineering,* 12th edition, R.L. Wegel, Prentice Hall Publications.
4. I.S. Codes No. 1893-2002,4326-1993,13920-1993.
5. *Earthquake Resistant Design,* 3rd edition, Pankaj Agarwal& Manish Shrikande, Prentice Hall Publishers.

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY**
**(AUTONOMOUS)**
**(16CE2018) COMPUTING TECHNIQUES LABORATORY**

| **M.Tech I Year -II Sem. (Struc. Engg.)** | **L** | **P** | **C** |
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**Course Educational Objectives:**

Student shall learn about the software applications in structural engineering, analysis of plane, space truss and frames subjected to different types of loadings and the design concepts of steel members like truss, beams and columns.

**Course Outcomes**:

After completion of the course the student will be able to

- Understand the software usages for structural members
- Analyze plane, space frames and dynamic response and natural frequency for beams and frames
- Design, detailing and estimations of RC members
- Design the steel members like truss, beams and columns

**LIST OF EXPERIMENTS:**

1. Introduction to STAAD - Pro package.
2. Analysis and Design of R.C.C. Beams, Slabs and Columns subjected to axial forces Uni-axial bending and Bi-axial bending.
3. Analysis and Design of Steel Plane Truss subjected to gravity forces and joint forces.
4. Analysis and Design of Steel and Concrete space building frame subjected to gravity and wind forces.
5. Analysis and Design of Steel and Concrete building frame subjected to gravity forces and earthquake forces.
6. Analysis and Design of R.C.C. retaining Walls.
7. Analysis and Design of Industrial space truss for gravity and wind forces.
8. Analysis and Design of Gantry Girder for moving loads.