



# SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

[www.sathyabama.ac.in](http://www.sathyabama.ac.in)

## School of Building and Environment Department of Civil Engineering

### 1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

#### Programme: B.E. Civil Engineering

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Employability

Entrepreneurship

Skill Development

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## School of Building and Environment

### Department of Civil Engineering

#### 1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

##### Programme: M.E. Structural Engineering

| S. No.                   | Course Code | Course Name                                  | Page No. |
|--------------------------|-------------|----------------------------------------------|----------|
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Employability



Entrepreneurship



Skill Development

| SCIA1102 | CONSTRUCTION MATERIALS | L | T | P | Credits | Total Marks |
|----------|------------------------|---|---|---|---------|-------------|
|          |                        | 3 | 0 | 0 | 3       | 100         |

## COURSE OBJECTIVE

- To introduce the basic materials used in civil engineering construction field.

### UNIT 1 BUILDING MATERIALS

9 Hrs.

Soil - classification of soil - Stone - Tests on stones - Deterioration and Preservation of stone work - Bricks - Classification - Manufacturing of clay bricks - Tests on bricks - Compressive Strength - Water Absorption - Efflorescence - Bricks for special use - Refractory bricks - Fly Ash Bricks and Concrete blocks - Light weight blocks and panels.

### UNIT 2 LIME CEMENT AGGREGATES MORTAR STEEL

9 Hrs.

Lime - Preparation of lime mortar - Cement - Ingredients - Manufacturing process - Types and Grades - Properties of cement and Cement mortar - Hydration - Compressive strength - Tensile strength - Fineness - Soundness and consistency - Setting time - Aggregates - Natural stone aggregates - Crushing strength - Impact strength - Flakiness Index - Elongation Index - Abrasion Resistance - Mortar - classifications - properties of good mortar - uses of mortar - Manufacture of steel - properties and uses of different types of steel - mechanical and heat treatment of steel - Anticorrosive measures for steel.

### UNIT 3 CONCRETE

9 Hrs.

Constituents of concrete (Cement and aggregate): Proportioning of concrete, water-cement ratio, Fresh concrete, Batching, Mixing, Transportation and placing, Compaction, Curing and finishes - Admixtures (Chemical, mineral) - RMC specifications.

### UNIT 4 TIMBER AND MODERN MATERIALS

9 Hrs.

Timber - Market forms - Industrial timber - Doors and Windows - specification - Plywood - Veneer - False ceiling materials - Panels of laminates - Steel - Aluminum and Other Metallic Materials - Composition - Aluminium composite panel - Uses - Market forms - Mechanical treatment. Glass - Ceramics - Sealants for joints - Fibre glass reinforced plastic.

### UNIT 5 MODERN MATERIALS, PLASTERING - PAINT - VARNISHING - DPC

9 Hrs.

Clay products - Refractory's - Composite materials - Types - Applications of laminar composites Fibre textiles - Geo-membranes and Geo-textiles for earth reinforcement - Internal and external plastering materials - white and colour washing - painting, varnishing and distempering - Dampness and fire proofing - anti termite measures.

Max. 45 Hrs.

## COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Assess the characteristics of soil, stone, brick and concrete blocks in construction
- CO2 - Assess the various physical and mechanical properties of cement, aggregate and steel in construction
- CO3 - Elaborate the properties and quality control measures of concrete
- CO4 - Identify the suitability of timber and modern materials in construction
- CO5 - Adopt the appropriate method of building finishes.
- CO6 - Rectify the defects due to dampness, fire and termites

## TEXT / REFERENCE BOOKS

- Duggal S.K., "Building Materials", 4<sup>th</sup> Edition, New Age International, 2008.
- Gambhir M.L., "Concrete Technology", 3<sup>rd</sup> Edition, Tata McGraw Hill Education, 2004.
- Gambhir M.L. & Neha Jamwal, "Building Materials, products, properties and systems", Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2012.
- IS456 - 2000: Indian Standard specification for plain and reinforced Concrete, 2011.
- IS4926 - 2003: Indian Standard specification for ready-mixed concrete, 2012.
- Jagadish K.S., "Alternative Building Materials Technology", New Age International, 2007.
- Rangwala S.C., "Engineering Materials," Charotar Publishing House, Anand, 1993.
- Varghese P.C., "Building Materials", PHI Learning Pvt. Ltd., New Delhi, 2015.

## END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Employability

Entrepreneurship

Skill Development

| SCIA1201 | CONCRETE AND CONSTRUCTION TECHNOLOGY | L | T | P | Credits | Total Marks |
|----------|--------------------------------------|---|---|---|---------|-------------|
|          |                                      | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To study details regarding properties and testing of building materials.
- To study details regarding the construction of building components.
- To study properties of concrete and concrete mix design.
- To impart the basic concepts in different types of concrete.

### UNIT 1 INTRODUCTION

11 Hrs.

Mortar - Types - Sand - properties - uses Timber products: properties and uses of plywood, fibre board, particle board. Iron and Steel -Reinforcing steel - types - specifications. Structural steel - specifications miscellaneous materials (only properties, classifications and their use in construction industry): Glass, Plastics, A.C. Sheets, Bitumen, Adhesives, Aluminium. Cement - Different types - Chemical composition and Properties - Hydration of cement - Tests on cement - IS Specifications - Aggregates - Classification - Mechanical properties and tests as per BIS - Grading requirements - Water - Quality of water for use in concrete.

### UNIT 2 CONCRETE AND ADMIXTURES

9 Hrs.

Concrete - Aggregates - Mechanical & Physical properties and tests - Grading requirements -Water quality for concrete - Admixtures - types and uses - plasticizers - accelerators - retarders-water reducing agents Making of concrete - batching - mixing - types of mixers -transportation - placing - compacting - curing. Properties of concrete - fresh concrete - workability - segregation and bleeding - factors affecting workability & strength - tests on workability - tests for strength of concrete in compression, tension& flexure Concrete quality control - statistical analysis of results - standard deviation - acceptance criteria - mix proportioning (B.I.S method) - nominal mixes.

### UNIT 3 PROPORTIONING OF CONCRETE MIX

8 Hrs.

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - **Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples**

### UNIT 4 FRESH AND HARDENED PROPERTIES OF CONCRETE

9 Hrs.

**Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete** - Compressive strength - split tensile strength - Flexural strength - Stress-strain curve for concrete - Modulus of elasticity - durability of concrete - water absorption - permeability - corrosion test - acid resistance- destructive and non destructive test.

### UNIT 5 SPECIAL CONCRETES

8 Hrs.

Light weight concretes - foam concrete- self compacting concrete - vacuum concrete - High strength concrete - Fibre reinforced concrete - Ferrocement - Ready mix concrete - SIFCON - Shotcrete - Polymer concrete - High performance concrete - Geopolymer Concrete- Bio Concrete.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the properties of plywood, steel, glass and cement as building materials
- CO2 - Determine the properties of concrete admixtures.
- CO3 - Discuss the mix design of concrete.
- CO4 - Discuss the properties of fresh and hardened concrete.
- CO5 - Determine the uses of special concrete
- CO6 - Recommend the suitable concrete may used in construction

### TEXT / REFERENCE BOOKS

1. Arora and Bindra, Building construction, Dhanpath Rai and Sons.
2. Punmia B.C., Building construction. Laxmi Publications.
3. Rangwala S.C., Engineering Materials, Charotar Publishers.
4. Shetty M.S., Concrete Technology, S. Chand & Company.
5. Gambhir M.L., Concrete Technology, Tata McGraw Hill.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Employability

Entrepreneurship

Skill Development

| SCIA1202 | FUNCTIONAL DESIGN OF BUILDINGS | L | T | P | Credits | Total Marks |
|----------|--------------------------------|---|---|---|---------|-------------|
|          |                                | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To study about the climate and orientation and understand the Design of building suitable to the Tropical climate with Green Building Concepts.

#### UNIT 1 INTRODUCTION TO CLIMATE AND ORIENTATION

9 Hrs.

Factors that determine Climate - Components of climate - Site Climate - Characteristics of different climates, Climatic zones of India. Orientation - Sun path diagram, Meaning, factors affecting orientation, orientation criteria for tropical climate.

#### UNIT 2 THERMAL SENSATION AND TRANSFER OF HEAT IN BUILDINGS

9 Hrs.

Body heat balance - Introduction to effective temperature and comfort zone. Transfer of heat definitions Periodic heat flow in building elements - introduction to time - lag and decrement factor - Thermal comfort factors.

#### UNIT 3 BUILDING ENVELOPE

9 Hrs.

General, Mandatory requirements - Fenestration - Opaque construction - building envelope sealing, Prescriptive requirements - Roofs - cool roofs - opaque walls - vertical fenestration - skylights.

#### UNIT 4 ENERGY CONSERVATION IN BUILDINGS THROUGH VENTILATION AND LIGHTING

9 Hrs.

Introduction to ventilation - Fresh air - Stack effect - Air movement through buildings - Air movement around buildings - layout planning for air movement - Traditional methods for aiding ventilation. Lighting - different types of lighting - study of interiors in lighting - their effects. Mandatory requirements - lighting control - exit signs - exterior building grounds lighting - Introduction to Energy conservation in buildings.

#### UNIT 5 ENERGY EFFICIENT BUILDINGS AND TECHNOLOGIES

9 Hrs.

Introduction and need for energy efficiency in existing buildings. Renewable energy systems - solar passive cooling and heating of buildings, solar active thermal and photovoltaic systems, building management system Introduction to Green Buildings Concepts and green buildings ratings for certification, Case studies.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Plan the orientation of the building based on various climatic conditions
- CO2 - Apply thermal comfort concepts in designing the buildings
- CO3 - Identify the planning requirements for building envelope
- CO4 - Incorporate design aspects of energy conservation through ventilation and lighting system in buildings
- CO5 - Propose the energy efficient technologies in existing buildings.
- CO6 - Investigate the green building concepts through case studies.

### TEXT / REFERENCE BOOKS

- Otto Koenigsberger, Ingersoll and Szokalay, "Manual of Tropical Housing and Building Part 1 - Climate Design". Longmans London, 2013.
- Arvind Krishnan, Nick baker and Simos Yannas, "Climate Response Architecture", Tata McGraw Hill Publication, 2010.
- Martin Events, "Housing, Climate and Comfort", Architectural Press, London, 2008.
- Francis D.K.Ching, "Interior Design Illustrated", VNR Publications.
- USAID India - User Guide on "Energy Conservation Building Code", Bureau of Energy Efficiency, 2011.
- Baird, George, "Energy performance of Buildings" C R C Publisher, 2011.
- Desai, Ashok K., "Non - Conventional energy", Wiley Eastern Publisher, 2012.
- IGBC, ECBC 2017 Latest version for Reference.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA1301 | MECHANICS OF SOLIDS - I | L | T | P | Credits | Total Marks |
|----------|-------------------------|---|---|---|---------|-------------|
|          |                         | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To study and understand the behavior of deformable structural elements, beams and trusses in civil engineering.

### UNIT 1 STRESS AND STRAIN

9 Hrs.

**Stress & strain** - Hooke's law, Application to Prismatic and non prismatic sections, Composite sections. Elastic constants - Poisson's ratio, Young's Modulus, Rigidity Modulus, Bulk Modulus Problems in relation between Elastic constants. Thermal stresses - elongation of a bar due to temperature.

### UNIT 2 PRINCIPAL STRESSES AND STRAIN

9 Hrs.

Principal Planes and Principal stresses - Two dimensional stress systems - Mohr's Circle construction for principal stresses. Analysis of Strain - Direct strain on a oblique plane due to direct pull - Direct strain on a oblique plane due to shear stress - strain on inclined section due to two perpendicular normal strains - Mohr's circle of strains.

### UNIT 3 BENDING MOMENTS AND SHEAR FORCE

9 Hrs.

**Types of Beams, supports and loads** - Concept and Significance of Shear force and Bending moment - **Shear force and Bending moment diagram for cantilever, simply supported and overhanging beams.**

### UNIT 4 BENDING & SHEAR STRESS DISTRIBUTION, TORSION

9 Hrs.

Stresses in Beams - Simple bending theory - Shear stress distribution for Rectangular and I section - Simple Torsion theory - Stresses and deformations in Solid and Hollow circular shafts.

### UNIT 5 ANALYSIS OF TRUSSES

9 Hrs.

Frames - Assumptions - Reactions and supports - Various types of trusses - **Analysis of simple trusses** Method of joints, sections and tension co-efficients.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the stress-strain and axial deformation of prismatic and composite bars.
- CO2 - Construct the mohr's circle to find the principal stresses for two-dimensional system
- CO3 - Evaluate the shear force and bending moment of various beams with different load conditions.
- CO4 - Examine the behavior of beams under bending and shear stresses..
- CO5 - Assess the stresses and deformations of solid shafts and hollow shafts.
- CO6 - Analyse the forces in trusses using various methods..

### TEXT / REFERENCE BOOKS

1. Bansal R.K., "Strength of Materials", 5<sup>th</sup> Edition, Laxmi Publications, 2013.
2. Ramamrutham R., "Strength of Materials", 14<sup>th</sup> Edition, Dhanpat Rai Publications, 2011.
3. Punmia B.C., "Strength of Materials", Laxmi Publications, 2011.
4. Subramanian R., "Strength of Materials - Theory and Problems", Oxford University Press, 2010.
5. Rajput R.K., "Strength of Materials", S.Chand and Company Ltd., New Delhi, 2007.
6. Timoshenko S.P. and Gere J.M., "Mechanics of Materials", 6<sup>th</sup> Edition, Tata McGraw Hill, 2007.
7. Egor.P. Popov, "Introduction of Mechanics of Solids", 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2007.
8. Kazimi, "Solid Mechanics", 1<sup>st</sup> Edition, Tata McGraw Hill Book Co Ltd., 2003.
9. Vazirani V.N. and Ratwani N.M., "Strength of Materials" Vol.I, Khanna Publishers, 1996.
10. Senthil.S., "Strength of Materials", 14<sup>th</sup> Edition, Laxmi Publications, 2013.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1302 | MECHANICS OF FLUIDS | L | T | P | Credits | Total Marks |
|----------|---------------------|---|---|---|---------|-------------|
|          |                     | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics
- To analyse and appreciate the complexities involved in solving the fluid flow problems.
- To develop an understanding of fluid flow patterns and learns to use boundary layer theory and drag.

### UNIT 1 FLUID PROPERTIES AND FLUID STATICS

9 Hrs.

Fluid - Definition, - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, Types of fluids - Compressibility - Vapour pressure, Capillarity and Surface tension. Fluid statics: Concept of fluid static pressure (Pascal's law and Hydrostatic law), absolute and gauge pressures - Pressure measurements by manometers and pressure gauges - forces on planes (vertical, horizontal and inclined) - Total pressure - centre of pressure - buoyancy - Meta centre.

### UNIT 2 FLUID KINEMATICS AND DYNAMICS

9 Hrs.

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms) - Equation of streamline - stream function - velocity potential function - circulation - flow net.

Fluid dynamics - equations of motion - Euler's equation along streamline - Bernoulli's equation - applications Venturi meter, Orifice meter and Pitot tube. Momentum equation and its application.

### UNIT 3 FLOW THROUGH PIPES

9 Hrs.

Viscous flow - Laminar flow through circular tubes (Hagen poiseuille's) - friction factor - pipe roughness - Major and minor losses of flow in pipes - Darcy - Weisbach's equation - Hydraulic and energy gradient - Pipes in series and in parallel - Moody's diagram

### UNIT 4 BOUNDARY LAYER

9 Hrs.

Boundary layer - definition - boundary layer on a flat plate - thickness and classification - displacement, energy and momentum thickness - Boundary layer separation and control - drag in flat plate - drag and lift coefficients.

### UNIT 5 DIMENSIONAL ANALYSIS AND MODEL STUDIES

9 Hrs.

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem Dimensionless parameters - Similitude and model studies - Distorted Models.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyse the properties and statics of fluid
- CO2 - Analyze the equation of motion of fluids relevant to flow measurement devices.
- CO3 - Determine the major and minor losses in pipe flow
- CO4 - Solve the boundary layer problems in pipes and arbitrary bodies and examines the lift and drag.
- CO5 - Apply the principles of dimensional analysis in fluid mechanics.
- CO6 - Interpret the prototype and model for fluid flow condition

### TEXT / REFERENCE BOOKS

1. Modi P.N. and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi. 2002.
2. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 2014, 9<sup>th</sup> Edition.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5<sup>th</sup> edition, Laxmi Publications Pvt. Ltd, New Delhi, 2018, 10<sup>th</sup> Edition.
4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 9<sup>th</sup> Edition, 2017.
5. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John Wiley and Sons, Singapore, 9<sup>th</sup> Edition, 2005.
6. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2014.
7. Roberson J.A, and Crowe C.T., "Engineering Fluid Mechanics", Jaico Books Mumbai, 12<sup>th</sup> Edition.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA1303 | SURVEYING - I | L | T | P | Credits | Total Marks |
|----------|---------------|---|---|---|---------|-------------|
|          |               | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To study the basic principles of surveying and calculate the area by considering various aspects with optimization technique used in plane surveying and geodetic surveying.

### UNIT 1 FUNDAMENTAL KNOWLEDGE OF CONVENTIONAL SURVEYING

7 Hrs.

Unit Conversion - Basic principles of surveying - Conventional Signs - Scales - Accessories used for ranging - **Ranging** - classification of surveying.

### UNIT 2 APPLICATION OF VARIOUS INSTRUMENTS IN PLANE SURVEYING

12 Hrs.

Measurements of distance, angles and direction by different types of instrument (Chain, Compass and Plane table surveying), used in the plane surveying. Method of leveling - curvature and refraction correction - contouring - computation of volumes - **measurement of cross section** - practical problems. Sources of errors in measurements.

### UNIT 3 APPLICATION OF THEODOLITE

10 Hrs.

Basic principles of theodolite - fundamentals of theodolite - Heights and distances - Omitted measurements - Types of Curves - **Setting out simple Curves, compound curves and transition curves.**

### UNIT 4 DISTANCE AND ELEVATION BY TACHEOMETRY

9 Hrs.

**Tacheometry** - Stadia tacheometry - Tangential tacheometry - **Triangulation** - Classification of triangulation - Signals - Station - types of station - Baseline - Method of Baseline - Adjustments.

### UNIT 5 CONTROL SURVEYING AND ITS ADJUSTMENT

7 Hrs.

Basic of Geodetic surveying with horizontal and Vertical control - classification of errors - true and most probable values - principles of least square - normal equation - method of correlates.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Compute the area of land based on linear measurements using chain instrument.

CO2 - Estimate the area of land based on angular measurements using prismatic compass and plane table instruments.

CO3 - Estimate both area and volume for cutting and filling of earthwork using dumpy level instrument.

CO4 - Compute angular measurements, distance and elevation difference between two station points using theodolite instrument in the field.

CO5 - Conduct various types of engineering survey for engineering projects.

CO6 - Set out horizontal and vertical curves for roadways and railways.

### TEXT / REFERENCE BOOKS

1. Punmia B.C., "Surveying and Levelling", Vol. I & II, Laxmi Publications, 2016.
2. Arora K.R. "Surveying Vol. I, II & III", Standard Book House, New Delhi.
3. Roy S.K. "Fundamentals of Surveying", Prentice Hall of India, 2009.
4. Ramamrutham.S, Dhanpat Rai, "Plane and Geodetic Surveying", Publishing Company, New Delhi, 2<sup>nd</sup> Edition, 2016.
5. Basak.N.N., "Surveying and leveling", Tata Mc Graw Hill Publishing Company Limited.
6. Subramanian R., "Surveying and Leveling", Oxford University Press, 2014.
7. Punmia B.C., Ashok K. Jain and Arunn K. Jain, "Surveying Vol. I and Vol. II".
8. Kanetkar T.P. and S.V Kulkarni, "Surveying and Levelling, Parts 1 and parts 2", Pune Vidyarthi Griha Prakashan, Pune, 2008.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1304 | HIGHWAY ENGINEERING | L | T | P | Credits | Total Marks |
|----------|---------------------|---|---|---|---------|-------------|
|          |                     | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVE

- To understand the concept of planning, design, construction and maintenance of highways as per Indian Road Congress standards, specifications and methods in Highway Engineering.

#### UNIT 1 HIGHWAY DEVELOPMENT, PLANNING AND ALIGNMENT

9 Hrs.

Introduction to Transportation systems - Highway development in India - Classification of Roads - Planning of roads - Significance of Highway planning - Highway alignment - factors influencing highway alignment - Planning or Engineering surveys for alignment: objectives, conventional and modern methods - Sustainability and its importance in Highway Engineering

#### UNIT 2 GEOMETRIC DESIGN ELEMENTS

9 Hrs.

Cross section of Urban and Rural Roads - Cross sectional elements - Sight distance - Horizontal Curves, Super elevation, Transition Curves, Widening of pavement on curves - Vertical Curves, Gradient (problems included) - Considerations on Hill Roads, Hairpin Bends - Lateral and Vertical Clearance of Underpasses

#### UNIT 3 HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE

9 Hrs.

Highway construction materials and its properties - CBR test on Sub grade soil - Tests on Aggregates - Tests on Bitumen and Bituminous Mix Design - Construction procedure of Bituminous Roads and Cement Concrete Roads - Recycled materials - Quality Control Measures - Construction Machineries

#### UNIT 4 PAVEMENT DESIGN

9 Hrs.

Pavement Components and their role - Types of Pavements: Flexible and Rigid - Design of Flexible and Rigid Pavements (IRC Methods only) - Joints in Rigid Pavements

#### UNIT 5 PAVEMENT EVALUATION AND MANAGEMENT

9 Hrs.

Types of Pavement failures - Pavement Maintenance - Pavement evaluation: Surface and Structural - Pavement Management System - Strengthening of pavements - Highway drainage - Formulation of Highway Project report

Max. 45 Hrs.

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply knowledge on engineering survey for highway planning and its alignment
- CO2 - Evaluate the geometric design elements of roadways
- CO3 - Assess the properties of materials for the construction of various roads
- CO4 - Design the flexible and rigid pavements based on codal provisions
- CO5 - Adopt pavement management system for repairing and strengthening of pavements
- CO6 - Plan roads on water logged areas and desert sand with suitable drainage system

#### TEXT / REFERENCE BOOKS

1. Khanna S.K., Justo C.E.G. and Veeraragavan A., "Highway Engineering", NemChand Publishers, 2014.
2. Kadiyali L.R., "Principles and Practices of Highway Engineering", 8<sup>th</sup> Edition, Khanna Technical Publication, New Delhi, 2013.
3. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", SciTech Publications India, Chennai, 2010.
4. Indian Road Congress (IRC), "Guidelines and Special Publications of Planning and Design".
5. IRC - 37 "Guidelines for Design of flexible Pavements", IRC, New Delhi, 2001.
6. IRC: 58, 2002: "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways", IRC, N. Delhi, 2002.
7. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth Impression, South Asia, 2012.
8. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA1305 | ENGINEERING GEOLOGY | L | T | P | Credits | Total Marks |
|----------|---------------------|---|---|---|---------|-------------|
|          |                     | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To introduce the basic concepts of geology and engineering geology.
- To introduce the main tools and methods of Engineering Geology and the problems (directly and indirectly) that can create the geological conditions in the construction of civil works.

### UNIT 1 GENERAL GEOLOGY

9 Hrs.

Geology in Civil Engineering - Branches of geology - Earth structure and composition - Continental drift, Weathering - types and products - Geological work of Rivers, Wind and Sea - Geophysical Methods - Seismic and Electrical Methods for Subsurface Investigation.

### UNIT 2 MINEROLOGY

9 Hrs.

Physical properties of Minerals - Study of following rock forming minerals - Quartz, Felspar, Piroxene, Amphibole, Mica, Calcite, Gypsum and Clay minerals, Fundamentals of the process of formation of ore minerals coal and petroleum - their origin and occurrence in India.

### UNIT 3 PETROLOGY

9 Hrs.

Classification of Rocks - Igneous, Sedimentary and Metamorphic Rocks - Origin, Structure and Classification Metamorphism - Engineering Properties - Distribution of Dolerite, Syenite, Basalt, Sandstone, Limestone, Conglomerate, Quartzite, Marble, and Schist - Rock mechanics - Introduction - Laboratory test - Uniaxial compressive strength, tensile, shear strength, modulus of elasticity, triaxial test - Field test - jack test, shear test, seismic test.

### UNIT 4 STRUCTURAL GEOLOGY

9 Hrs.

Civil Engineering Importance of Folds, Faults, Unconformity and Joints relevance to civil engineering, prospecting of ground water.

### UNIT 5 ENGINEERING APPLICATIONS IN GEOLOGY

9 Hrs.

Geological consideration in construction of Dam, Tunnel and important international and Indian examples of failures of dams, tunnels and their causes, factors affecting the seepage and leakage of the reservoirs and the remedial measures, silting of reservoirs. Earthquake, causes and Distribution in India - Remote Sensing for Civil Engineering Applications.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Elaborate the various geological process and geophysical investigation.
- CO2 - Inspect the properties of minerals, and formation of petroleum and coal..
- CO3 - Distinguish formation, structure, texture of rocks and their engineering properties..
- CO4 - Identify the various important geological structures.
- CO5 - Apply geological principles in site selection for dams and tunnels.
- CO6 - Appraise the causes of earthquakes activities and remotesensing application

### TEXT / REFERENCE BOOKS

1. Parbin Singh, "Engineering and General Geology", Katson Publication House, 2009.
2. Chenna Kesavulu N., "Text book of Engineering Geology", Macmillan India Ltd, 2003.
3. Mukherjee P.K., "Engineering Geology", World Press, 2006.
4. Billings M.P., "Structural Geology": Prentice Hall, 2006.
5. Legget., "Geology and Engineering", 2<sup>nd</sup> Edition, McGraw Hill Book Company, 2006.
6. Varghese P.C., "Engineering Geology for Civil Engineering", Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2012.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

|          |                          |   |   |   |         |             |
|----------|--------------------------|---|---|---|---------|-------------|
| SCIA1401 | MECHANICS OF SOLIDS - II | L | T | P | Credits | Total Marks |
|          |                          | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To learn the computation of deflection of beams, columns, thin and thick cylindrical shell and also various theories of failure.

### UNIT 1 SLOPE AND DEFLECTION OF BEAMS

9 Hrs.

Double integration method - Macaulay's method - Moment area method - Conjugate beam method for simply supported and cantilever beams - **problems in finding slope & deflection of beams.**

### UNIT 2 STRAIN ENERGY

9 Hrs.

Strain energy - Strain energy due to axial forces, Strain energy due to bending, Strain energy in pure shearing, Strain energy in torsion. Castiglino's first theorem - Betti's theorem - **Maxwell's law of Reciprocal deflection** - problems in calculating the Strain Energy.

### UNIT 3 THEORY OF COLUMNS

9 Hrs.

**Axial load combined bending and axial load** - Euler's formula for long struts - Limitations of Euler's formula Long columns under eccentric loading - Secant, Perry's & IS code formula. Rankine, Gordon's formula - problems in finding the safe load on the column.

### UNIT 4 THIN CYLINDERS AND SPHERES, THICK CYLINDERS

9 Hrs.

Stresses in Thin cylindrical shell due to internal pressure - Deformation in Thin cylinders - Spherical shells subjected to internal pressure - Deformation in Thin spherical shells. Thick cylinders - Lamé's equation - Shrink fit Compound cylinders.

### UNIT 5 THEORIES OF FAILURE

9 Hrs.

Theories of Failure - Maximum Principal Stress theory - Maximum Principal strain theory - Maximum shear stress theory - Strain energy theory - shear strain energy theory - problems in finding factor of safety - Graphical representation of theories for two dimensional stress system.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the slope and deflection with various load conditions in cantilever and simply supported beams
- CO2 - Apply Castiglino's first theorem, Betti's theorem and strain energy concepts..
- CO3 - Illustrate the behavior of columns with different end conditions.
- CO4 - Examine the behavior of columns with eccentric Loading
- CO5 - Estimate the stresses produced for thin and thick cylinder
- CO6 - Analyze the failure of material using various theories.

### TEXT / REFERENCE BOOKS

1. Bansal R.K., "Strength of Materials", 5<sup>th</sup> Edition, Laxmi Publications, 2013.
2. Ramamrutham R., "Strength of Materials", 14<sup>th</sup> Edition, Dhanpat Rai Publications, 2011.
3. Punmia B.C., "Strength of Materials", Laxmi Publications, 2011.
4. Subramanian R., "Strength of Materials - Theory and Problems", Oxford University Press, 2010.
5. Rajput R.K., "Strength of Materials", S.Chand and Company Ltd., New Delhi, 2007.
6. Timoshenko S.P. and Gere J.M., "Mechanics of Materials", 6<sup>th</sup> Edition, Tata McGraw Hill, 2007.
7. Egor.P. Popov, "Introduction of Mechanics of Solids", 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2007.
8. Kazimi, "Solid Mechanics", 1<sup>st</sup> Edition, Tata McGraw - Hill Book co Ltd., 2003.
9. Vazirani V.N. and Ratwani N.M., "Strength of Materials" Vol.I, Khanna Publishers, 1996.
10. Senthil S., "Strength of Materials", 14<sup>th</sup> Edition, Laxmi Publications, 2013.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1402 | APPLIED HYDRAULIC ENGINEERING | L | T | P | Credits | Total Marks |
|----------|-------------------------------|---|---|---|---------|-------------|
|          |                               | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

### UNIT 1 UNIFORM FLOW

9 Hrs.

Free surface flows - comparison with pipe flow, Classification of flow in open channels. Uniform flow Equations for uniform flow - Chezy's and Manning's equations, Most efficient channel sections of different geometry, Velocity distribution in open channels- Determination of normal depth and velocity, Specific energy and Specific force diagrams, Critical flow in rectangular channel.

### UNIT 2 GRADUALLY VARIED FLOW

9 Hrs.

Dynamic Equation for gradually varied flow - in wide rectangular channels - different forms of the dynamic equation, channel bottom slopes - Study of surface profiles and its Characteristics in prismatic channels, backwater computation Direct step method and Standard step method, Graphical method - Applications.

### UNIT 3 RAPIDLY VARIED FLOW

9 Hrs.

Rapidly varied flow, hydraulic jump - initial and sequent depths, non-dimensional equation, Practical application of hydraulic jump, Types of jump in horizontal floor, Basic characteristics of the jump, Energy loss, efficiency, height of jump. Energy dissipation - Surges and surge through channel transitions.

### UNIT 4 TURBINES

9 Hrs.

Impact of Jet on vanes - Turbines - classification - impulse turbines - Pelton wheel -Reaction turbines - Francis and Kaplan Turbines - draft tubes - Governing of a Francis turbine - Performance of turbines - specific speed and their significance.

### UNIT 5 PUMPS

9 Hrs.

Centrifugal pump: description and working - Head, discharge and efficiency - pressure rise - minimum starting speed - cavitation - priming - multistage pumps -characteristic curves. Reciprocating pump: Description and working types - discharge and slip - power required to drive the pump-Indicator diagram - Airvessel - work done against friction with and without airvessels.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Analyze the flow in open channels for the most economical sections.

CO2 - Evaluate the Gradually varied flow profiles for prismatic channel.

CO3 - Analyze the rapid flow profile and its hydraulic transients.

CO4 - Identify the components, working principles and function of various turbines CO5

- Identify the components, working principles and function of various pumps CO6 -

Determine the power required for driving the pumps and turbines

### TEXT / REFERENCE BOOKS

1. Jain. A.K., "Fluid Mechanics", Khanna Publishers, Delhi, 2014.
2. Modi P.N.and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2002.
3. Subramanya K., "Flow in open channels", Tata McGraw Hill, New Delhi, 2009, 3<sup>rd</sup> Edition.
4. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
5. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
6. Bansal R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2018.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Employability

Entrepreneurship

Skill Development

| SCIA1403 | ENVIRONMENTAL ENGINEERING - I | L | T | P | Credits | Total Marks |
|----------|-------------------------------|---|---|---|---------|-------------|
|          |                               | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To create the awareness and importance of the water among the students for public usage with following the standards.
- To equip the students with the principles and design of water treatment units and distribution system.

### UNIT 1 WATER AND ENVIRONMENT

9 Hrs.

Objectives of public water supply - Requirements of water supply - Need of protected water supply - Planning factors for public water supply - Types of demand - Rate of consumption - Factors affecting the rate of consumption population Forecasting Methods and its applications - Variation in demand pattern - Sources of water - Types Quantitative and qualitative studies.

### UNIT 2 CONVEYANCE OF WATER

10 Hrs.

Intake and intake works - Channels and pipes for conveying water - Hydraulic design of pressure pipe Materials for pipes - Selection, specification and applications - CI, GI, Steel, RCC, AC and plastic - Laying of pipes Jointing and testing of pipes - Appurtenances of pipes - Corrosion of pipes and prevention. Pumps and pumping stations - Suitable location for pumping station - Selection of pumps.

### UNIT 3 QUALITY OF WATER

8 Hrs.

Analysis of water - physical, chemical & bacteriological characteristics - Coliform test, Algae toxins and Algae index - Most Probable Number - Sampling - Drinking water standards - Water borne diseases

### UNIT 4 TREATMENT OF WATER

9 Hrs.

Objectives - Layout of treatment plants - Theory, principles, types and design of Sedimentation, coagulation, flocculation and filtration - Disinfection - Iron and Manganese Removal - De-fluoridation - **Water softening Desalination Membrane filtration**

### UNIT 5 DISTRIBUTION SYSTEM

9 Hrs.

General requirements, Classification - Methods of supply - Storage and distribution reservoirs - Function, classification, Balancing or equalizing tank - Capacity - Layout of distribution system - Analysis of distribution networks Equivalent pipes and Hardy cross method - Operation and maintenance - Leak detection - Appurtenances - Water supply to buildings.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Estimate the water demand based on growing population
- CO2 - Design the hydraulic pressure pipes for conveyance of water
- CO3 - Analyze the physio-chemical and biological characteristics of drinking water as per quality standards
- CO4 - Design the various units of water treatment plant
- CO5 - Layout the suitable water distribution systems
- CO6 - Analyze the various water supply distribution networks

### TEXT / REFERENCE BOOKS

1. Garg S.K., "Water Supply Engineering", Khanna Publishers, 2010.
2. Birdie G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2014.
3. Duggal K.N., "Elements of Environmental Engineering", S.Chand & Co Ltd., 2008.
4. "Manual on Operation and Maintenance of Water Supply Systems", CPHEEO, 2003.
5. Peavy H.S, Rowe D.R. and George Tchobanoglous, "Environmental Engineering", McGraw Hill Book Company, New Delhi, 2010.
6. Environmental Engineering Hand Book.
7. Ruth F. Weiner and Robin Matthews, "Environmental Engineering", Elsevier Science.
8. 200 Wheeler Road, Burlington, MA 01803, 4<sup>th</sup> Edition.
9. Modi, P.N., "Water Supply Engineering", Vol.I, Standard Book House, New Delhi, 2010.
10. Punmia B.C., Ashok Jain and Arun Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2014.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA1404 | SURVEYING - II | L | T | P | Credits | Total Marks |
|----------|----------------|---|---|---|---------|-------------|
|          |                | 3 | * | 0 | 3       | 100         |

## COURSE OBJECTIVE

- To determine the area and volume with different plane are calculated with current method, considering with filed observation.

### UNIT 1 HYDROGRAPHIC SURVEY

7 Hrs.

Tides - Prediction of tides - Tide gauges - Sounding - Method of Locating soundings - Three point problems - Reduction of sounding and Plotting of sounding - stream measurements.

### UNIT 2 AERIAL PHOTOGRAPHY

7 Hrs.

Aerial Survey - Terrestrial stereo photography - Aerial photography - Scale of vertical photography - Scale of vertical Tilted photograph - Photo interpretation - Parallax.

### UNIT 3 REMOTE SENSING AND GIS

9 Hrs.

Remote sensing - basic procedure of setting out remote sensing - electromagnetic spectrum - energy interaction with earth surface - remote sensing in India - Global Information system - Hardware of GIS - Software of GIS - vector and raster data - Application of GIS - Remote sensing and GIS

### UNIT 4 ASTRONOMICAL SURVEYING

12 Hrs.

Astronomical terms and definition - Celestial sphere - Motion of sun and stars - Physical characteristics of the sun, the moon, the planets and satellites - Field observation - spherical trigonometry - Napier's rule of circular parts - determination of hour angle, azimuth, Latitude and longitude of a place and time.

### UNIT 5 TOTAL STATION AND ITS APPLICATION

10 Hrs.

Total Station - advantages of total station - principles of total station - application of total station - basic elements of total station - parts and accessories - errors - problems.

Max. 45 Hrs.

## COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine elevation and depression of a station point using tacheometric surveying.
- CO2 - Determine distance and relative position of points in the field using triangulation method..
- CO3 - Rectify the errors found in angular measurements in the field using different methods.
- CO4 - Locate the positions of water bodies and astronomical co-ordinates..
- CO5 - Locate the position of ground points using aerial Camera.
- CO6 - Operate modern surveying equipments like total station, electronic distance measuring instruments.

## TEXT / REFERENCE BOOKS

1. Kanetkar T.P., "Surveying and Levelling" Vol. I and Vol. II, Pune Vidyarthi Griha Prakashan, 2013.
2. Punmia B.C., "Surveying", Vol. I and Vol. II, Lakshmi Publications(P) Ltd., New Delhi, 2014.
3. Clark D., "Plane and Geodetic surveying", Vol. I and Vol. II, CBS Publishers, New Delhi, 2009.
4. Duggal S.K., "Surveying", Vol. I and Vol. II, Tata McGraw Hill publisher, 2011.
5. Basak N.N., "Surveying and Levelling", Tata McGraw Hill Publisher, 2008.
6. Subramanian R., "Surveying and Levelling", Oxford University Press, 2010.
7. Bhavikatti S.S., "Surveying Theory and Practice", I.K. International Publishing House Pvt. Ltd, New Delhi, 2010.

## END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1501 | STRUCTURAL ANALYSIS - I | L | T | P | Credits | Total Marks |
|----------|-------------------------|---|---|---|---------|-------------|
|          |                         | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To learn the modern method of analysis of beams, frames, Arches, Suspension and Bridges.

#### UNIT 1 FIXED AND CONTINUOUS BEAMS

9 Hrs.

Introduction - statically indeterminate beams and frames. Fixed beam - Bending moment and Shear force diagram-Slope and Deflection - point load and UDL - Continuous beams - Theorem of three moments - Bending moment and shear force diagram.

#### UNIT 2 SLOPE DEFLECTION METHOD

9 Hrs.

Analysis of continuous beams with and without settlement - Rigid plane frames with and without sway.

#### UNIT 3 MOMENT DISTRIBUTION METHOD

9 Hrs.

Stiffness and carry over factors - Distribution and carryover of moments - Analysis of continuous Beams with and without settlement - Plane rigid frames with and without sway.

#### UNIT 4 ARCHES

9 Hrs.

Theoretical Arch - Eddy's theorem analysis of two and three hinged arches for parabolic and circular, Settlement and Temperature effect.

#### UNIT 5 CABLES AND SUSPENSION BRIDGES

9 Hrs.

General Cable theorem - Analysis of cables under Concentrated and Uniformly Distributed Loads-Shape and Stresses due to self weight - Anchor Cables - Temperature effect - Suspension bridges with three hinged and two hinged stiffening girders.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the Bending moment, Shear force and Deflection of Fixed beams with various loading cases CO2 - Discuss the theorem of three moments and its application in Continuous beams with various conditions CO3 - Analyse the continuous beams, and Frames with various conditions by using Slope deflection method.  
CO4 - Analyze beams and frames by moment distribution method  
CO5 - Analyse the types of Arches by using various Theorems and methods.  
CO6 - Analyze the cables and suspension bridges

### TEXT / REFERENCE BOOKS

1. Reddy C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Co., 2011.
2. Punmia BC, "Strength of Materials", Laxmi Publications, New Delhi, 2017.
3. Rajasekharan & Sankarasubramanian.G., "Computational Structural Mechanics", Prentice Hall of India, 2001.
4. Sadhu Singh, "Strength of Materials", Khanna Publishers, 1988.
5. Vaidyanathan R., "Structural Analysis", Vol.I and II, Laxmi Publications, 2017.
6. Bhavikatti.S.S. "Structural Analysis" Vol.I & II, Vikas Publishing House Pvt. Ltd., 2013.
7. Devadas Menon, "Structural analysis", Narosa Publishing House Pvt. Ltd., 2017.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Employability

Entrepreneurship

Skill Development

| SCIA1502 | REINFORCED CONCRETE STRUCTURES - I | L | T | P | Credits | Total Marks |
|----------|------------------------------------|---|---|---|---------|-------------|
|          |                                    | 3 | * | 0 | 3       | 100         |

**COURSE OBJECTIVE**

- To introduce the various philosophies of R.C. design and to study in detail the limit state design of structural elements such as beams, columns and footings.

**UNIT 1 BASIC CONCEPTS****9 Hrs.**

Properties of Reinforced concrete materials, Stress - Strain diagrams of concrete and steel, Design philosophies (Principles of Elastic method, ultimate load and limit state method) Design code and specification. Behaviour of RC beams in bond development length and Anchorage, Loading standard as per IS 875. Behavior of RC structural systems under gravity and lateral load.

**UNIT 2 BEAMS****9 Hrs.**

Flexure of RCC beams of rectangular section - Balanced, Under Reinforced and Over Reinforced Sections. Analysis and Design of Singly and Doubly Reinforced beams - Design of flanged Sections (T and L beams) and Continuous Beams - Analysis and design with and without shear reinforcement as per IS: 456.

**UNIT 3 SLABS****9 Hrs.**

Analysis and Design of one way and two way slab for uniformly distributed load, various Boundary conditions and corner effects. Design of continuous slabs - Using code Coefficient.

**UNIT 4 COLUMNS****9 Hrs.**

Behaviour of Columns, Types of columns, Design of Axially loaded and Eccentrically loaded columns - Using IS: 456 & SP -16.

**UNIT 5 FOOTINGS****9 Hrs.**

Types of footing, SBC of soil - Design loads - Design of axially and eccentric loaded rectangular footing Combined rectangular footing.

**Max. 45 Hrs.****COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply design philosophies as per codal provisions in reinforced concrete structures.
- CO2 - Design the beams to resist bending, shear and torsion based on limit state method.
- CO3 - Design the slabs for various boundary conditions and corner effects.
- CO4 - Design suitable columns under different loading conditions
- CO5 - Design appropriate footings to axial and eccentric loading.
- CO6 - Analyse the given reinforced concrete element.

**TEXT / REFERENCE BOOKS**

1. Varghese P.C., "Advanced Reinforced Concrete Design", Prentice Hall India, 2010.
2. Sinha N.C. and Roy S.K., "Fundamentals of Reinforced Concrete", S.Chand Company, 2007.
3. Ashok. K. Jain, "Reinforced Concrete Design", Nem Chand and Bros, 2012.
4. Krishnaraju N., "Design of Reinforced Concrete Structures", CBS, 2009.
5. Unnikrishnan Pillai S. & Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill, 2007.
6. Robert Park and Thomas Paulay, "Reinforced concrete Structure", Wiley India Pvt. Limited, 2009.
7. Ramamrutham S., "Design of reinforced concrete structures", Dhanpat Rai Publishing Company, 2016.

**CODE BOOK**

1. IS 456 -2000 - Code of practice for plain and reinforced concrete.
2. SP 16 (1980) - Design Aids for Reinforced concrete.
3. SP 34(1987) - Hand book on Concrete reinforcement and Detailing.

**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**
 Employability

 Entrepreneurship

 Skill Development

| SCIA1503 | DESIGN OF STEEL STRUCTURES - I | L | T | P | Credits | Total Marks |
|----------|--------------------------------|---|---|---|---------|-------------|
|          |                                | 3 | * | 0 | 3       | 100         |

**COURSE OBJECTIVE**

- To learn the design of steel Components and structures using Limit State Design method subjected to external loading.

**UNIT 1 INTRODUCTION****9 Hrs.**

Material properties of steel - Structural steel sections and their properties - General design requirements Limit state design concepts - Loads on structures - Classification of sections.

**UNIT 2 CONNECTIONS****9 Hrs.**

Types of connections - Riveted, Bolted and Welded connections - Failure modes of bolts - Design of ordinary and high strength friction grip bolts - Types of welded connections and failure modes - Design of welded connections - Eccentric connections - Efficiency of joints.

**UNIT 3 DESIGN OF TENSION MEMBERS****9 Hrs.**

Types of Tension members - Net area - Net effective sections - concept of shear lag - Design strength of simple and compound members - Use of lug angles - Design of tension splices.

**UNIT 4 DESIGN OF COMPRESSION MEMBERS****9 Hrs.**

Types of compression members - Theory of columns - column curves - Effective length of compression members - Slenderness ratio - Design of simple and compound section compression members - Design of lacing and battened types of columns - Design of column bases and column splicing.

**UNIT 5 DESIGN OF MEMBERS SUBJECTED TO BENDING****9 Hrs.**

Effective span of beams - Design strength in bending - Laterally supported beams - Laterally unsupported beams - Effective length for lateral torsional buckling - Design for shear - Web crippling and web buckling - Members subjected to combined forces - Biaxial bending - Purlins and Girts.

**Max. 45 Hrs.****COURSE OUTCOMES**

On completion of the course, student will be able to

CO1 - Apply the codal provisions of Limit State method as per IS 800: 2007 in steel structure

CO2 - Design the different types bolted and Welded connections in steel structures

CO3 - Design the simple and compound tension members

CO4 - Design the simple and compound compression members along with base plates..

CO5 - Design the different types of beams subjected to various modes of local buckling.

CO6 - Design the purlins and girts subjected to biaxial bending.

**TEXT / REFERENCE BOOKS**

1. Subramanian N., "Design of Steel Structures", Oxford University Press, 2008.
2. Dayaratnam P., "Design of Steel Structures", A.H. Wheeler & Co. Ltd., Allahabad, 1976.
3. Duggal.S.K., "Limit State design of steel structures", Tata Mc Graw Hill Publishing Company, New Delhi, 2010.
4. Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain, "Design of Steel Structures", Vol. I and II, Arihant Publications, Mumbai, 1998.
5. Dowling P.J., Knowles P.R., Owens G.W., "Structural Steel Design", The Steel Construction Institute, Butterworths, London, 1988.
6. "Teaching Resources for structural Steel Design", Vol. 1 & 2, INGDA, Calcutta.

**CODE BOOK**

1. IS: 800-2007, "Indian Standard for General Construction in Steel - Code of Practice" (Third Revision).
2. SP 6(1) - 1964 Hand book for Structures Engineers

**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

| SCIA1504 | SOIL MECHANICS | L | T | P | Credits | Total Marks |
|----------|----------------|---|---|---|---------|-------------|
|          |                | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To develop an understanding of the relationships between physical characteristics and mechanical properties of soils.
- To understand and experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice.
- To understand and be able to apply the modeling and analysis techniques used in soil mechanics: (a) Darcy's Law and flow-nets for seepage (b) consolidation models for load-time deformation responses of soils (c) Mohr's - Coulomb models for shear strength behavior of soils.

### UNIT 1 SOIL PROPERTIES

9 Hrs.

Objectives and Values of Geotechnical Engineering - Nature of soil, Formation of soil and functional relationships - **types of soil and the soil properties** - Phase relations - Index properties - Specific gravity using pycnometer and specific gravity bottle - Grain size analysis - sieve analysis and hydrometer analysis - **Consistency of soils - Atterberg's limit** - soil classification for Engineering purposes - Classification of coarse grained and fine grained soil as per BIS - Soil deposits in India.

### UNIT 2 SOIL WATER AND WATER FLOW

7 Hrs.

Effective and Neutral stress - capillary stress - **Permeability measurement in the laboratory** and field pumping in and pumping out tests - **Factors influencing permeability of soils** - Seepage - Introduction to Flow net - Simple problems.

### UNIT 3 COMPRESSIBILITY AND CONSOLIDATION

9 Hrs.

Compaction - Proctor test and Modified proctor test - Concept of OMC and maximum dry density - Zero air voids line - **Factors influencing compaction** - Effect of compaction in soil properties - Difference between consolidation and compaction - Definition - Concepts of coefficient of compressibility - Components of settlement Immediate and consolidation settlement - **Terzaghi's one dimensional consolidation theory** - Governing differential equation - Laboratory consolidation test - Field consolidation curve- Introduction to sand drain, radial drainage and vacuum consolidation - Problems on final and time rate settlement.

### UNIT 4 STRESS DISTRIBUTION AND SHEAR STRENGTH

11 Hrs.

Stress distribution in soil media - **Boussinesque's and Westergaard's equations for vertical pressure due to point loads and uniformly distributed loads** - assumptions and limitations - pressure bulb - Newmark's influence chart - principle, construction and use - line loads and strip loads - **Shear strength of cohesive and cohesionless soils Mohr's Coulomb failure theory** - Saturated soil - Strength parameters - Measurement of shear strength, Direct shear, Triaxial compression, UCC and Vane shear tests - **Types of shear tests based on drainage and their applicability Drained and undrained behaviour of clay and sand** - Stress path for conventional triaxial test.

### UNIT 5 SLOPE STABILITY

9 Hrs.

Slope failure mechanisms - Modes - Infinite slopes - Finite slopes - **Total and effective stress analysis** - Stability analysis for purely cohesive and Cohesion less soils - Method of slices - Modified Bishop's method - Friction circle method - Stability number - problems - Slope protection measures.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Assess the index properties of given soil for its classification
- CO2 - Analyze the total and effective pressure components based on permeability characteristics
- CO3 - Evaluate compressibility and consolidation behavior of soil.
- CO4 - Predict different components of soil settlement and rate of settlement
- CO5 - Evaluate the theory of stress distribution and shear strength parameters for different field conditions
- CO6 - Analyze stability of slopes for cohesive and cohesionless soil

### TEXT / REFERENCE BOOKS

1. Punmia B.C, "Soil mechanics and Foundations", Laxmi Publications, 1998.
2. Terzaghi K Pech. R.B "Soil mechanics in Engineering Practice", John Wiley Ltd., 2012.
3. Lambe T.W & Whitman, "Soil mechanics", John Wiley Ltd., 1976.
4. Alam Singh, "Soil Engineering", Asia Publications, 2006.
5. Murthy V.N.S, "A text book of Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors Pvt. Ltd., 2011.
6. Sourabh Kumar Soni, "Geo Technical Engineering", S.K.Kataria & Sons, New Delhi, Edition, 2013.
7. Cheng Liu & Jack Evett, "Soil Properties: Testing, Measurement and Evaluation", Pearson; 4<sup>th</sup> Edition, 1999.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1505 | ENVIRONMENTAL ENGINEERING - II | L | T | P | Credits | Total Marks |
|----------|--------------------------------|---|---|---|---------|-------------|
|          |                                | 3 | 0 | 0 | 3       | 100         |

**COURSE OBJECTIVE**

- To implicate the importance of sewerage system and treatment of wastewater.
- To help students develop the ability to apply basic understanding of physical, chemical and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

**UNIT 1 SEWERAGE SYSTEM****9 Hrs.**

Sewage, Sewerage - Classification - Quantity of sanitary sewage - Estimation of sanitary sewage and storm runoff - Fluctuations - Hydraulics of sewer - Shapes and materials of sewer - Design criteria for sewer system - Ventilation - Recent Methods on Cleaning of Sewers.

**UNIT 2 LAYOUT OF SEWERAGE SYSTEM****9 Hrs.**

Laying, jointing and testing of sewers - Sewer appurtenances, Principles governing the design for drainage in buildings - Plumbing systems for drainage - Layout of house Drainage - Pumps - Selection of pumps and pipe drainage.

**UNIT 3 CHARACTERISTICS OF SEWAGE****8 Hrs.**

Characteristics and composition of sewage - Method of sampling - Analysis of Sewage - Physical, Chemical (DO, COD and BOD and their significance) and Microbiological characteristics - Population equivalent, Relative stability - Decomposition of sewage - Nitrogen, Sulphur and Carbon cycles

**UNIT 4 TREATMENT OF SEWAGE****10 Hrs.**

Objectives - Layout of treatment plants - Screening, grit chambers, skimming tanks, grease traps Sedimentation tank - Trickling filter Activated Sludge Process - UASB - Oxidation pond - Septic tank.

**UNIT 5 DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT****9 Hrs.**

Objectives, Methods, dilution and irrigation - Disposal standards for dilution and irrigation of sewage effluent self purification of streams-oxygen sagcurve -Land disposal-Sewage farming-Soil dispersion system-Sludge Characterization - Sludge Digestion - Sludge conditioning and dewatering - Sludge disposal

**Max. 45 Hrs.****COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Discuss the types of sewerage systems and quantity estimation of sewage and storm runoff.
- CO2 - Design of sewer pipes and various plumbing systems for drainage.
- CO3 - Analyze the characteristics of sewage.
- CO4 - Design the wastewater treatments units in a cost effective and sustainable way.
- CO5 - Develop the layout of wastewater treatment plants..
- CO6 - Discuss the methods of sewage disposal and sludge management.

**TEXT / REFERENCE BOOKS**

- Garg. S.K, "Environmental Engineering", Vol. I and II, Khanna Publishers, 2010.
- Punmia B.C., Jain, A.K. and Jain A., Environmental Engineering, Vol.II., Lakshmi Publications, News Letter, 2005.
- Birdie. G.S., and Birdie J.S., "Water supply and sanitary Engineering", Dhanpat Rai and Sons, New Delhi, 2013.
- CPHEEO, "Manual on sewerage & Sewerage Treatment", Ministry of Urban Development, Govt. of India, 2010.
- Metcalf & Eddy, "Waste Water Engineering, Collection, Treatment & Disposal", Tata McGraw Hill Inc., New York, 2013.
- Shah. C.S., "Water Supply and Sanitation", Galgotia Publishing Company, New Delhi, 1998.
- Eddy Metcalf, "Waste Water Engineering, Treatment and Reuse", McGraw Hill Education; 5<sup>th</sup> Edition, 2013.
- Syed R. Qasim, "Wastewater Treatment Plants", CRC Press, Washington D.C., 2010.

**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

Employability



Entrepreneurship



Skill Development

| SCIA1506 | WATER RESOURCES ENGINEERING | L | T | P | Credits | Total Marks |
|----------|-----------------------------|---|---|---|---------|-------------|
|          |                             | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To introduce the theoretical concepts in hydrological components and understanding of water resources systems and to develop the skills in modeling of flood flows and flood routing.
- To develop skills in the ground water flow, type of aquifer and yield from the well.
- To provide the knowledge of design of reservoir, operation and sedimentation.
- To study the effect, causes and remedial measures of watershed management

### UNIT 1 INTRODUCTION

8 Hrs.

Water resources projects - Introduction - Water resources of India - Range of water resources projects General planning philosophy - Water allocation priorities - Irrigation - Flood control - Hydropower. Data requirement and data collection for different projects - Water availability studies. Environmental checklist for Water Resources projects. - **Intergrated Water Resources Management - Key issues in water management - Concepts and principles of Water Management - Benefits of IWRM to various sectors - Environment, Agriculture, Water supply and sanitation**

### UNIT 2 BASIC CONCEPTS OF HYDROLOGY

10 Hrs.

Hydrologic cycle - rainfall and its measurement - computation of mean rainfall over a catchment area using arithmetic mean, Thiessen polygon and Isohyetal methods - Abstraction from rainfall - evaporation, factors affecting evaporation, measurement of evaporation - evapotranspiration - Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices. Runoff - components of runoff, factors affecting runoff, stream gauging, effective rainfall, separation of base flow.

### UNIT 3 GROUND WATER HYDROLOGY

10 Hrs.

Soil water zones, Soil moisture relations Specific retention, Specific yield. Occurrence of ground water - Types of aquifers - unconfined aquifer, confined aquifer, aquitard - Storage coefficients - coefficient of permeability and transmissibility, Steady radial flow into a well under confined and unconfined condition, pumping and recuperation tests, Tube wells and Open wells - yield from an open well.

### UNIT 4 RESERVOIR PLANNING

8 Hrs.

Reservoir planning: Investigation - selection of site - storage zones in a reservoir - mass inflow curve - demand curve - calculation of reservoir capacity and safe yield from mass inflow curve - reservoir sedimentation reservoir sediment control. Single and multipurpose reservoirs.

### UNIT 5 WATERSHED MANAGEMENT

9 Hrs.

Flood and Drought: Design flood - assessment and mitigation measures - causes - methods of flood control, flood forecasting - Drought assessment and mitigation measures. Levees and flood walls, Channel improvement. Delineation of basin boundary - **watershed management. Remote sensing application to water resource engineering** - case study. **Max. 45 Hrs.**

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the information required for water resource planning
- CO2 - Analyze the factors affecting hydrology
- CO3 - Develop skills in the concepts of groundwater flow and the types of aquifers
- CO4 - Plan the location and storage capacity of reservoir
- CO5 - Access the causes of flood and drought and its mitigation measures
- CO6 - Acquire the knowledge in watershed management and applications of water resource engineering

### TEXT / REFERENCE BOOKS

1. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw Hill Inc, 2009.
2. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23<sup>rd</sup> Revised Edition, New Delhi, 2009.
3. Punmia B.C. et al., Irrigation and water power Engineering, Laxmi Publications, 16<sup>th</sup> Edition, New Delhi, 2009
4. Ven Te Chow, "Applied Hydrology", McGraw Hill Inc., 1990.
5. Subramanya, K., Engineering Hydrology, Tata McGraw Hill Publishers, 2008.
6. Todd D.K., "Groundwater Hydrology", John Wiley & Sons, Inc., New York.
7. Sharma R.K. and T.K. Sharma, "Hydrology and Water Resources Engineering", Dhanpat Rai Publications, New Delhi.
8. Rushton K.R., "Groundwater hydrology conceptual and computational models", Wiley Publisher.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1601 | STRUCTURAL ANALYSIS - II | L | T | P | Credits | Total Marks |
|----------|--------------------------|---|---|---|---------|-------------|
|          |                          | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To learn the influence lines and its uses in various applications like bridge arches. Also to learn advanced methods like matrix methods of structural analysis of structures, plastic theory.

### UNIT 1 ROLLING LOADS

9 Hrs.

**Rolling loads** - Single Concentrated load - Uniformly distributed load - Two Concentrated loads - System of moving loads - Curves of maximum B.M.D. and S.F.D. - Equivalent UDL.

### UNIT 2 INFLUENCE LINE FOR STATICALLY DETERMINATE AND IN DETERMINATE STRUCTURES

9 Hrs.

**Influence line for Statically Determinate Beams for Bending moment and Shear force** - Muller Breslau's Principles and its application to determine the influence lines of reactions. S. F and B. M at a section of continuous beams - propped cantilevers - Qualitative influence lines for Horizontal thrust, reactions and moments for portal frames.

### UNIT 3 FLEXIBILITY MATRIX METHOD

9 Hrs.

Definition and determination of Static and Kinematic Indeterminacy - Concepts co-ordinates - element transformation approach - **Applications to analysis of continuous beams and rigid jointed plane frames.**

### UNIT 4 MATRIX STIFFNESS METHOD

9 Hrs.

**Element and global stiffness matrices** - Co-ordinate transformations - Rotation matrix - transformations of stiffness matrices - Analysis of Continuous Beams - and rigid jointed plane frames - Introduction to FEM.

### UNIT 5 PLASTIC ANALYSIS OF STRUCTURES

9 Hrs.

Introduction - Ductility of steel - Beams in pure bending - Stages of bending in beams - **Plastic modulus Shape factor** - Load factor - Plastic hinge and mechanism - Upper and lower bound theorems - Static and Kinematic methods - Plastic analysis of indeterminate Beams and frames.

Max.45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Predict the position of rolling loads in beams..
- CO2 - Determine the shear force and bending moment for determinate and indeterminate structure
- CO3 - Analyse the beams and frame using flexibility matrix method.
- CO4 - Analyse the beams and frame using stiffness matrix method.
- CO5 - Elaborate the concepts of the plastic theory..
- CO6 - Determine collapse load for Indeterminate beams and frames.

### TEXT / REFERENCE BOOKS

1. Rajasekaran S., Sankara Subramanian, G., "Computational Structural Mechanics", Prentice Hall, New Delhi, 2001.
2. Bhavikatti, S.S., "Structural Analysis", Vol.1 & Vol.2, Vikas Publications, 2013.
3. Reddy CS, "Basic Structural Analysis", Tata McGraw Hill Publishing Co., 2011.
4. BhattP, "Problems in structural Analysis by Matrix Methods", Wheeler Publications, 1989.
5. Flemming, J.F., "Computer Analysis of Structural Systems", Tata McGraw Hill Publishing Company, 1989.
6. Devdass Menon, "Structural Analysis, Alpha Science" International Limited, 2008.
7. Pandit.G.S, Gupta.S.P, "Structural Analysis, A Matrix Approach", 2<sup>nd</sup> Edition, Tata McGraw Hill Education, 2010.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA1602 | REINFORCED CONCRETE STRUCTURES - II | L | T | P | Credits | Total Marks |
|----------|-------------------------------------|---|---|---|---------|-------------|
|          |                                     | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To learn design of R.C staircase, Circular, flat slabs, Retaining walls, Water tanks, and concept of yield line theory.

### UNIT 1 STAIRCASES

9 Hrs.

Stair case, Components of stair case, Types of stair case - Limit state design of dog legged and open newel staircase.

### UNIT 2 YIELD LINE THEORY

9 Hrs.

Concept of yield line theory - Determination of collapse load and design of rectangular, circular and triangular slabs (formulas only).

### UNIT 3 CIRCULAR SLABS AND FLAT SLABS

9 Hrs.

Limit state design of circular slabs - Simply Supported and fixed with UDL. Design of flat slabs by direct design method according to IS code.

### UNIT 4 RETAINING WALL

9 Hrs.

Limit state design of retaining walls, Design of Cantilever and Counter fort types

### UNIT 5 WATER TANKS

9 Hrs.

Types of water tanks - Design of water tanks using Elastic method - resting on ground - Underground rectangular - overhead circular and rectangular with staging.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design different types of staircases based on Limit State Design method
- CO2 - Apply the concept of yield line theory in the design of slabs
- CO3 - Design different cases of circular slab and flat slab.
- CO4- Design the different types of retaining wall
- CO5 - Estimate the various loads acting on the water tank
- CO6 - Design the different types of water tank based on working stress method

### TEXT / REFERENCE BOOKS

1. Varghese P.C., "Advanced Reinforced Concrete Design", Prentice Hall India, 2007.
2. Sinha N.C. and Roy S.K., "Fundamentals of Reinforced Concrete", S.Chand Company, 2013.
3. Ashok.K.Jain, "Reinforced Concrete Design", Nem Chand & Brothers -Roorkee, 2012.
4. Krishnaraju N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, 2016.
5. Unnikrishnan Pillai S. & Devdas Menon, "Reinforced Concrete Design", McGraw Hill Education, 2017.
6. Subramanian N., "Design of reinforced concrete structures", OUP India, 2014.
7. Jose Calavera "Manual for Detailing Reinforced Concrete Structures to EC2", CRC Press, 2009.

### CODE BOOK

1. Code of practice for Plain and Reinforced Concrete IS456-2000, BIS, New Delhi.
2. Design Aids for Reinforced Concrete to IS 456, Special Publication (SP16), BIS New Delhi, 1980.
3. "Code of practice for concrete Structures for the storage of liquids,"- IS3370- 1965, (Part 1 to 4) - BIS, New Delhi.
4. IS 456 - 2000 - Code of Practice for plain and reinforced concrete.
5. SP 16(1 980) - Design Aids for Reinforced Concrete.
6. SP 34 (1987) - Hand book on concrete reinforcement and detailing.
7. IS 3370 - 1965 Code of Practice for Concrete Structures for the storage of liquids.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1603 | DESIGN OF STEEL STRUCTURES - II | L | T | P | Credits | Total Marks |
|----------|---------------------------------|---|---|---|---------|-------------|
|          |                                 | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To learn the design of Plate girders, Industrial structures, water tanks, Bunkers, Silos and Light gauge sections.

#### UNIT 1 PLATE GIRDERS

9 Hrs.

Introduction - types of sections - elements of plate girder - general considerations - end panel design - tension field action - design of plate girders with solid webs - flange splices - connection of flanges to web - stiffener design various types of stiffeners.

#### UNIT 2 ROOF TRUSSES AND INDUSTRIAL STRUCTURES

9 Hrs.

Roof trusses - Roof and side coverings - Design loads, Design of purlin and elements of truss - end bearing Design of gantry girder.

#### UNIT 3 WATER TANKS

9 Hrs.

Introduction - permissible stresses - thickness specifications - elevated tanks - circular tanks - rectangular tanks - pressed steel tanks.

#### UNIT 4 BUNKERS AND SILOS

9 Hrs.

Introduction - Janssen's theory - Airy's theorem - Design parameters - Design criteria - analysis of bins Hopper bottom - design of bins.

#### UNIT 5 LIGHT GAUGE SECTIONS

9 Hrs.

Design of light gauge steel members - local and post buckling of thin elements - light gauge steel compression members - tension members - beams and connections.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Design the elements of plate girder as per the codal provision
- CO2 - Design the various members like roof truss, purlin and gantry girder of industrial structures..
- CO3 - Design the elevated water tanks of rectangular and circular shapes..
- CO4 - Design the Bunkers and Silos with current parameters
- CO5 - Analyze the different cold formed steel sections as per the codal provision
- CO6 -- Design the various structural members using light steel gauges.

### TEXT / REFERENCE BOOKS

- Subramanian N., "Design of Steel Structures", Oxford University Press, 2008.
- Ramchandra S., & Virendra Ghelot, "Design of Steel of Structures", Volume 1, Scientific Publishers, New Delhi, 2009.
- Duggal S.K., "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, New Delhi, 1<sup>st</sup> Edition, 2010.
- Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain, "Design of Steel Structures", Vol. I and II, Arihant Publications, Mumbai, 1998.
- Dowling P.J., Knowles P.R., Owens G.W., "Structural Steel Design", The Steel Construction Institute, Butterworth's, London, 1988.

### CODE BOOK

- IS: 800-2007, "Indian Standard for General Construction in Steel - Code of Practice" (Third Revision).
- IS: 801-1975, : Code of practice for use of cold - formed light gauge steel structural members in general building construction
- SP 6(1) - 1964 Hand book for Structures Engineers
- IS: 811 - 1987, "Specification for cold formed light gauge structural steel sections.
- IS: 804-1998 Code of practice for rectangular pressed steel tanks.
- IS: 805 - 1995 Code of practice for use of steel in gravity water tanks.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1604 | FOUNDATION ENGINEERING | L | T | P | Credits | Total Marks |
|----------|------------------------|---|---|---|---------|-------------|
|          |                        | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To learn about types and purposes of different foundation systems and structures.
- To provide students with exposure to the systematic methods for designing foundations.
- To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behavior.
- To build the necessary theoretical background for design and construction of foundation systems.

### UNIT 1 SOIL EXPLORATION AND SITE INVESTIGATION

9 Hrs.

Introduction - Planning and stages in sub-surface exploration - depth and spacing of exploration - **Methods of exploration** - Test pit - Trenches - Geophysical methods Seismic refraction and Electrical resistivity method - Boring Auger boring, Shell and Auger, Wash boring and Rotary drilling - Types of soil sample: disturbed and undisturbed soil samples - Features of sampler affecting soil disturbance - standard penetration test - static and dynamic cone penetration test - bore log report - selection of foundation and justification.

### UNIT 2 BEARING CAPACITY ON SETTLEMENT

9 Hrs.

Introduction - Bearing capacity - definition - types of shear failure - Bearing capacity of shallow foundation on homogeneous deposits - Methods: Terzaghi's, Skempton's and BIS methods- **Effect of water table on bearing capacity** - **Plate load test** - Bearing capacity from in-situ tests - SPT, SCPT and plate load test - methods of improving bearing capacity of soil - **Settlement**: total and differential settlements - causes and methods of minimizing settlement.

### UNIT 3 SHALLOW FOUNDATION

9 Hrs.

Types of foundation - contact pressure distribution below isolated footing - types and proportioning of combined footing - types and application of mat foundation - floating foundation - shell foundation - spread footing - codal provision

### UNIT 4 DEEP FOUNDATION

9 Hrs.

Types and function of pile - factors influencing the selection of pile - carrying capacity of single pile in cohesionless and cohesive soil - static formula - dynamic formulae (Engineering News and Hileys) - Capacity from in-situ tests (SPT and SCPT) - Negative skin friction - **Carrying capacity of Pile group** - Pile load test - Under-reamed piles - well foundation.

### UNIT 5 EARTH PRESSURE ON RETAINING WALLS

9 Hrs.

Plastic equilibrium in soils - **Earth pressure in soils**: Active and passive states - Rankine's theory - Cohesionless and cohesive soil - Coulomb's wedge theory - Condition for critical failure plane - Earth pressure on retaining walls of simple configurations - Culmann's Graphical method - Pressure on the wall due to line load - Stability analysis of retaining walls - Codal provisions.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Propose appropriate soil exploration methods for conducting site investigations
- CO2 - Determine bearing capacity of soil under different water table conditions
- CO3 - Design suitable shallow foundations for different soil conditions and loadings
- CO4 - Evaluate load carrying capacity of individual and group piles for different soil conditions and loadings
- CO5 - Determine active and passive earth pressure for different types of soil
- CO6 - Choose appropriate methods of slope protection for enhancing stability of structures

### TEXT / REFERENCE BOOKS

1. Bowles J.E., "Foundation analysis and design", McGraw Hill, 2001.
2. Murthy V.N.S., "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 2009.
3. Arora K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.
4. Punmia B.C., "Soil Mechanics and Foundations Engineering", Laxmi Publications Pvt. Ltd. New Delhi, 2005.
5. Das B.M., "Principles of Foundation Engineering", 5<sup>th</sup> Edition, Thomson Books, 2010.
6. Varghese P.C., "Foundation engineering", PHI Learning Pvt. Ltd., 2005

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1701 | RAILWAYS, AIRPORT AND HARBOUR<br>ENGINEERING | L | T | P | Credits | Total Marks |
|----------|----------------------------------------------|---|---|---|---------|-------------|
|          |                                              | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To expose the students to Railway planning, design, construction and maintenance
- To gain knowledge on planning and design principles of Airports and Harbours.

### UNIT 1 RAILWAY PLANNING

9 Hrs.

Development of railways in India - Comparison of roadways and railways - Components of a permanent way and its functions - Rails, Gauges and its selection, Sleepers, Ballast, Formation, Rail fittings and fastenings - Coning of wheels Defects in rails: creep and shift in rails, Track Stress - Gradient - Super elevation and Negative super elevation - Permissible speed on curve (Problems included) - Widening of gauge on curves.

### UNIT 2 RAILWAY CONSTRUCTION AND MAINTENANCE

9 Hrs.

Alignment surveys - Track construction - Calculation of Materials required for track laying - Stabilization of track on weak soil - Track maintenance - Track drainage - Types of stations and Types of station yards: Passenger, Goods, Marshalling and Locomotive - Station equipments - Introduction to Modern Developments in Railways.

### UNIT 3 POINTS AND CROSSINGS, URBAN RAILWAYS

7 Hrs.

Types of Points / Switches - Types of crossing - Design calculation of Turnout - Types of Track junctions - Types of signals and their location - Introduction to Railways in Metro Cities.

### UNIT 4 AIRPORT PLANNING AND DESIGN

10 Hrs.

Air transport characteristics - Classification of airports - Factors influencing the selection of new airport site and ICAO stipulations - Layout characteristics, Socio-economic characteristics of the catchment area - Components of Airport - Runway Orientation - Wind Rose Diagram - Problem on Basic and Actual runway length - Aircraft Parking system - Drainage - Airport Zones - Runway and Taxiway Markings and lighting - Design standards and planning of Airport as per Indian condition.

### UNIT 5 WATERWAYS

10 Hrs.

General terminologies - Ports: Classification, Requirements - Docks: Classification - Harbour: Classification, Requirements - Harbour Layout and Terminal Facilities - Coastal Protection Structures - Pier, Breakwaters, Wharves, Jetties, Quays, Fenders, Dolphins and Landing stage - Wave action on coastal structures - coastal protection and zone under coastal regulation - Inland Water Transport and Container transportation.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Assess the functions of various components of railway permanent way
- CO2 - Plan for construction, maintainance and drainage of railway track and the station yards
- CO3 - Determine the types of points, crossings and track junctions in railway and the functions of signals and interlocks.
- CO4 - Plan an airport layout with its componemts.
- CO5 - Analys the Requirements of sea port and harbour with its Coastal Protection Structures
- CO6 -Discuss the importance and present status of Inland water transport and container transportation

### TEXT / REFERENCE BOOKS

1. Arora S P and Saxena, "Railway Engineering", Dhanpat Rai Publishers, New Delhi, 2001.
2. Horren Jeff, "Airport, Planning & Design" Chapman Hall, London, 2000.
3. Khanna S.K., Arora M.G. and Jain S.S., "Airport Planning and Design", NemChand and Bros., Roorkee, 2012.
4. Mundrey J.S., "Railway Track Engineering", McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.
5. Oza H.P. and Oza G.H., "Dock and Harbour Engineering", Charotar Publishing House, 2013.
6. Rangawal S C "Railway Engineering" Charotar Publishers, Anand, 2002.
7. Satish Chandra and Agarwal M.M., "Railway Engineering", Oxford University Press, New Delhi, 2013.
8. Saxena Subhash C. and Satyapal Arora, "A course in Railway Engineering", 7<sup>th</sup> Edition, Dhanpat Rai & sons, Delhi, 2009.
9. Srinivasan R. and Rangwala S.C., "Harbours" Charotar Publishers, Anand, 1999.
10. Subramanian K.P. "Highways, Railways, Airport & Harbour Engineering", V Scitech Publications (India), Chennai, 2010.
11. Venkatramaiah C., "Transportation Engineering, Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press (India) Pvt. Ltd., Hyderabad, 2015.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1702 | ESTIMATION, COSTING AND VALUATION | L | T | P | Credits | Total Marks |
|----------|-----------------------------------|---|---|---|---------|-------------|
|          |                                   | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To understand the concepts types of estimation and types of contracts with valuation.
- To know about the rate analysis and bill preparations and to study about the specification writing.

### UNIT 1 ESTIMATION

9 Hrs.

Introduction - Purpose - Methods of estimation - Types of estimates - Approximate estimates - Detailed estimate - Estimation of quantities for buildings, roads, canals and hydraulic structures - field study.

### UNIT 2 RATE ANALYSIS AND COSTING

9 Hrs.

Standard Data - Rate analysis for earthwork, concrete works, D. P. C., Brickwork, stone masonry, plastering, pointing, road work, carriage of materials. - Schedule of rates - costing - cost control - construction, machineries - Tools and techniques.

### UNIT 3 SPECIFICATIONS AND TENDERS

9 Hrs.

Detailed and general specification - types of specification - Tender notices - types - tender procedures Drafting model Tenders.

### UNIT 4 CONTRACTS

9 Hrs.

Contract - Types of contracts - Formation of contract - Contract conditions - Contract for labour, material Earnest Money Deposit, Security Deposit, Measurement Book - Contract problems - Arbitration - ISO documentation.

### UNIT 5 VALUATION

9 Hrs.

Introduction - Types of valuation - Common terms used in valuation - Valuation methods - Valuation of land Buildings, Fixation of rent - problem - depreciation - mortgage - case study.

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Calculate the detailed estimate for Buildings, roads and hydraulic structures
- CO2 - Analyze the cost and its controlling in construction activities.
- CO3 - Prepare detailed specifications and tender documents for civil engineering projects.
- CO4 - Prepare contract document for civil engineering projects.
- CO5 - Value the land and buildings using various methods.
- CO6 - Conduct a case study on valuation, depreciation and mortgage of buildings.

### TEXT / REFERENCE BOOKS

1. Dutta, "Estimating and Costing in Civil Engineering", S. Datta & Co, 2002.
2. Bhasin P.L., "Quantity Surveying", 2<sup>nd</sup> Edition, S.Chand & Co., 2000.
3. Birdie G.S., "A Text book on Estimating and Costing", Dhanpat Rai and Sons, New Delhi, 2009
4. Chakraborti M., "Estimating and Costing", Published by the author 21 B, Bhabananda Road, Calcutta, 2002.
5. Standard Schedule of rates and standard data book by public works department.
6. Arbitration and Conciliation Act, 1996
7. Spence Gedder, "Building and Public Works Administration, Estimating and Costing", Newnes Publishers, London, UK, 1999.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA1703 | PRESTRESSED CONCRETE STRUCTURES | L | T | P | Credits | Total Marks |
|----------|---------------------------------|---|---|---|---------|-------------|
|          |                                 | 3 | * | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To impart the knowledge about design of pre stressed concrete members.

#### UNIT 1 INTRODUCTION – THEORY AND BEHAVIOUR

9 Hrs.

Basic Concepts - Advantages - Material Required - Systems and **Methods of Prestressing** - Analysis of Sections by Stress Concepts, Strength concept and Load Balancing Concept - Losses due to Prestressing.

#### UNIT 2 DESIGN FOR FLEXURE

9 Hrs.

Definition of Type I, II & III Structures - Basic assumptions - Permissible stresses in steel and concrete as per IS : 1343 - **Design of Rectangular, I & T section** - Ultimate strength based on IS : 1343 - 1980.

#### UNIT 3 DEFLECTION

9 Hrs.

Short term deflection of uncracked members - Long term deflection - Deflection due to creep - **Code requirements of limit state deflection.**

#### UNIT 4 TRANSFER OF PRESTRESS AND INDETERMINATE STRUCTURES

9 Hrs.

Anchorage Zone - Stresses in post tensioned members - Calculation of bearing stress and bursting tensile forces & reinforcement in anchorage zones based on IS : 1343 method. Methods of achieving continuity - Assumptions in Elastic analysis - Continuous beams - Linear transformation- Concordant cables.

#### UNIT 5 MISCELLANEOUS STRUCTURES

9 Hrs.

**Design of tension and compression members** - Tanks, pipes and poles - Partial prestressing - Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing- **Composite Construction – methods, design principles, IS specifications** - Analysis of Stresses, Check for deflection, Flexural and Shear strength of Composite members

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Determine the basic properties of prestressed concrete materials and methods of prestressing
- CO2 - Design prestressed concrete beams to resist bending and shear
- CO3 - Determine the short term and long-term deflections in prestressed beams.
- CO4 - Evaluate the bursting tensile forces and reinforcement in anchorage zones
- CO5 - Determine the pressure line in continuous beam
- CO6 - Design of prestressed Tension and compression of members

### TEXT / REFERENCE BOOKS

1. Krishna Raju N., "Prestressed concrete", 6<sup>th</sup> Edition, Tata McGraw Hill Company, New Delhi, 2018
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributors Pvt. Ltd, 2012.
3. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
4. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013.
5. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3<sup>rd</sup> Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
6. IS1343:2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

| SCIA1704 | CONSTRUCTION MANAGEMENT | L | T | P | Credits | Total Marks |
|----------|-------------------------|---|---|---|---------|-------------|
|          |                         | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To impart the idea about planning and scheduling of construction activities.

#### UNIT 1 CONSTRUCTION PROJECT FORMULATION

9 Hrs.

Introduction to project- types of construction project- project organization- characteristics of project- **project life cycle** - Feasibility Study of project-Introduction to time value of money- Net present value- Benefit cost ratio- Internal Rate of Return- Payback period-Role of project managers

#### UNIT 2 PROJECT PLANNING AND SCHEDULING

9 Hrs.

Introduction -Defining Work tasks-Precedence relationship among activities-Basic concepts of network analysis - CPM and PERT - **Use of CPM and PERT Techniques** Problems, and prospects and applications of CPM and PERT - Crashing and Time / Cost Trade - off problems

#### UNIT 3 QUALITY AND SAFETY MANAGEMENT IN CONSTRUCTION

9 Hrs.

Introduction to quality - Importance - Types - Inspection - Control and enforcement-Tools and techniques for quality management - Inspection of materials and machinery - Quality audits-Statistical quality control - Tools - Control chart -- Site management with regard to safety

#### UNIT 4 CONSTRUCTION CONTRACTS

9 Hrs.

Indian Contracts Act - Elements of Contracts - Types of Contracts - Features - Suitability - Design of Contract Documents - International Contract Document - Standard Contract Document-Arbitration-Appointment of Arbitrators - Conditions of Arbitration - Powers and Duties of Arbitrator

#### UNIT 5 APPLICATION OF OPERATION RESEARCH TECHNIQUES IN CONSTRUCTION

9 Hrs.

Introduction -concepts in probability and statistics-linear programming by Graphical Method-Different types of LPP Solution-Transportation Problems- Assignment problems-Simulation Techniques- Introduction to Monte Carlo Method simulation-functions of random variables

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Apply different aspects of project management in construction.
- CO2 - Develop project planning, organizing, budgeting and controlling skills.
- CO3 - Formulate feasible projects based on preliminary analyses
- CO4 - Estimate the project duration and total cost using network analysis.
- CO5 - Apply softwares for construction project management and database information system.
- CO6 - Create a simulation model for a construction project using spreadsheet.

### TEXT / REFERENCE BOOKS

1. Kumar Neeraj Jha, "Construction project management", Dorling Kindersley, New Delhi, 2013.
2. Sengupta.B, Guha .H, "Construction management and planning", Tata McGraw Hill, NewDelhi,2001
3. Prasanna Chandra, "Planning, Analysis, Selection, Financing, Implementation and Review", 7<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2001.
4. Sharma.S.C, "Construction engineering and management", Khanna Publishers, New Delhi, 2008.
5. Panner Selvam, "Operation research", PHI India Pvt. Ltd., New Delhi, 2011.
6. Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 2002.
7. Punmia B.C., "Project Planning and Control with PERT and CPM", Laxmi Publications, New Delhi, 4<sup>th</sup> Edition, 2011.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

|          |                        |   |   |   |         |             |
|----------|------------------------|---|---|---|---------|-------------|
| SCIA3004 | SOLID WASTE MANAGEMENT | L | T | P | Credits | Total Marks |
|          |                        | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To provide an idea, method and management for handling, transporting, reuse of solid waste.

### UNIT 1 INTRODUCTION

10 Hrs.

Need for solid waste management - solid waste generation (municipal & hazardous)- Quantity - Factors affecting generation of solid waste; Characteristics - **Methods of sampling and characterization** - Effects of improper disposal of solid waste - Green House gases emission from solid wastes, Public health effects, Public **awareness; Salient features of Indian legislations on management & Role of NGOs**

### UNIT 2 ON-SITE STORAGE AND PROCESSING

8 Hrs.

**Solid waste segregation at source & On-site** - On-site storage methods - Materials used for containers -Public health and economic aspects of storage - Options under Indian conditions - Critical Evaluation of Options.

### UNIT 3 COLLECTION AND TRANSFER

9 Hrs.

Selection of collection points & routes - Collection methods - Types of vehicles - Manpower requirement-Transfer stations - **Selection of location, operation and maintenance** - Transportation Procedures - Options under Indian conditions.

### UNIT 4 OFF-SITE PROCESSING

9 Hrs.

**Processing techniques and Equipments, Segregation** - Resource recovery from solid waste - Biogas Generation - Pyrolysis, Incineration - Options under Indian conditions - Methods of composting - Vermicomposting.

### UNIT 5 DISPOSAL METHODS

9 Hrs.

Open dumping - Ocean disposal with Treatment - Classification, types and methods - **Site selection for disposal** - Design of Secured landfills, Design of Leachate collection and treatment methods - **management of biomedical waste**

Max. 45 Hrs.

### COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Analyse the characteristics of solid waste and role of NGOs.
- CO2 - Discuss the methods of onsite storage and its health aspects
- CO3 - Identify the routes for collection and the transportation procedures.
- CO4 - Develop the processing techniques for segregation and Biogas generation.
- CO5 - Apply the method of composting and vermicomposting.
- CO6 - Compare the solid waste disposal methods and management of biomedical waste.

### TEXT / REFERENCE BOOKS

- George Tchobanoglous et. al., "Integrated Solid Waste Management", Tata McGraw Hill Publishers, 1993.
- Bilitewski B., HardHe G., Marek K., Weissbach A. and Boeddicker H., "Waste Management", Springer, 1994.
- "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.
- Sasi Kumar K., "Solid Waste Management", PHI publishers, 2009.
- Ramachandran T.V., "Management of Municipal Solid Waste", Teri Publishers, 2009.
- Jayarama Reddy P., "Municipal Solid Waste Management: Processing - Energy Recovery - Global Examples", CRC press, 2011.
- Landreth R.E. and Rebers P.A., "Municipal Solid Wastes - Problems and Solutions", Lewis Publishers, 1997.
- Bhide A.D. and Sundaresan B.B., "Solid Waste Management in Developing Countries", INSDOC, 1993.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 10 Questions of 2 marks each - No choice

20 Marks

**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA3008 | TRAFFIC ENGINEERING | L | T | P | Credits | Total Marks |
|----------|---------------------|---|---|---|---------|-------------|
|          |                     | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To give an overview of traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

### UNIT 1 TRAFFIC CHARACTERISTICS AND FORECASTING

9 Hrs.

Scope of Traffic Engineering -Traffic characteristics: Vehicles, Road User and Road - Components of Traffic Engineering - Land Use and traffic interaction - Fundamentals of Traffic Flow - Traffic forecasting, Need, Methods and limitations - Urban traffic problems in India.

### UNIT 2 TRAFFIC SURVEYS

10 Hrs.

Traffic Survey: speed and delay survey, journey time - Volume count Survey - Origin and Destination Survey - Parking Survey - Photographic Techniques - Capacity Studies - Statistical applications in traffic studies Level of Services - Concept, application and significance.

### UNIT 3 TRAFFIC REGULATORY MEASURES

10 Hrs.

Traffic signs - Road marking - Traffic signals - Design of Traffic signal and Signal Co-ordination - Principles and Elements of Intersection Design - Types and layout of at-grade and grade separated intersections - Conflicts at Intersections - Design of Rotary intersection - Criteria for recommending Grade Separated Intersection - Miscellaneous Traffic control Aids - Street Furniture - Design of parking facility

### UNIT 4 TRAFFIC SAFETY AND ENVIRONMENT

8 Hrs.

Accident Studies - Causes, effect and prevention of Road accidents - Human factors - Vehicles - Road and its condition - Environmental Studies - Road safety audit - Street lighting - Air and noise pollution, causes - Measures to promote public transport and non polluting transport

### UNIT 5 TRAFFIC MANAGEMENT

8 Hrs.

Scope of Traffic Management Measures - One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing, Cycle tracks and Exclusive bus lanes - Traffic System Management (TSM) and Travel Demand Management (TDM) -- Intelligence Transport System (ITS) and its functional areas - Principles of ATIS - Introduction to Software Applications in Traffic Engineering- Case studies.

Max. 45 Hrs.

### COURSE OUTCOME

On completion of the course, students will be able to

- CO1 - Examine the traffic characteristics and traffic forecasting
- CO2 - Interpret various traffic surveys and its statistical applications
- CO3 - Design the appropriate traffic control measures based on existing scenario
- CO4 - Assess the factors causing road accidents and safety auditing
- CO5 - Predict the suitable traffic management systems
- CO6- Examine the Intelligence Transport System and its applications

### TEXT / REFERENCE BOOKS

1. Kadiyali L.R., "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3. Salter. R.I and Hounsell N.B., "Highway Traffic Analysis and design", Macmillan Press Ltd. 1996.
4. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
5. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
6. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques for Urban Areas", 1994

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Employability



Entrepreneurship



Skill Development

| SCIA2201 | BUILDING PLANNING AND DRAWING LAB | L | T | P | Credits | Total Marks |
|----------|-----------------------------------|---|---|---|---------|-------------|
|          |                                   | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- To learn the details of the building elements

#### SUGGESTED LIST OF EXPERIMENTS

1. Section of Stepped wall footing and Isolated RCC column footing.
2. Elevation of paneled door, Single and Doubled Glazed window.
3. Plan and Elevation section of Dog-Legged staircase.
4. Elevation of King post and Queen Post Truss.
5. Plan, Elevation and Section of Residential Building with Double bed room.
6. Plan, Elevation and Section of one storey Building.
7. Plan, Elevation and Section of Hospital Building.
8. Plan, Elevation and Section of School Building.
9. Plan, Elevation and Section of Library Building.
10. Plan, Elevation and Section of Workshop.
11. Plan, Elevation and Section of Bank building.
12. Approval Drawing of Residential Building.

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the concept of National building code for building design
- CO2 - Plot plan and section of different footings and staircases
- CO3 - Plot plan and elevation of windows, doors and trusses
- CO4 - Plot plan, section and elevation for residential buildings
- CO5 - Plot plan, section and elevation for commercial buildings
- CO6 - Apply the regulations on planning the residential buildings



Employability



Entrepreneurship



Skill Development

| SCIA2301 | SURVEYING LAB - I | L | T | P | Credits | Total Marks |
|----------|-------------------|---|---|---|---------|-------------|
|          |                   | 0 | 0 | 4 | 2       | 100         |

### COURSE OBJECTIVE

- To understand the method of using surveying instrument for various civil engineering purpose.

### SUGGESTED LIST OF EXPERIMENTS

1. Determination of area of polygon by base line method using chain survey.
2. Setting out foundation marking of a double room building by offset method using chain survey
3. Determination of area by traversing using plane table survey.
4. Calculate the reduced level of points by rise and fall method and height of collimation method using dumpy level
5. Longitudinal and Cross Sectional leveling of a given road segment using dumpy level.
6. Determination of elevation of an object using single plane method when base is inaccessible.
7. Determination of distance and difference in elevation between two inaccessible points using double plane method.
8. Measurement of horizontal distance and vertical height with angle of elevation/depression with staff held vertical.  
(Stadia Tacheometry)
9. Measurement of horizontal distance and vertical height with angle of elevation /depression with staff held vertical.  
(Tangential Tacheometry).
10. Setting out simple curve using offsets from long chord using theodolite.
11. Setting out simple curve using Single Theodolite method (Rankin's Method)
12. Setting out simple curve using Double Theodolite method

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the area of land using suitable survey equipment
- CO2 - Invent the distance between inaccessible points using survey equipment
- CO3 - Develop an area map after locating the survey instrument station.
- CO4 - Detect the variation in the levels of different points with respect to a reference bench mark
- CO5 - Build a horizontal curve with suitable survey equipment
- CO6 - Measure the area and the reduced levels of a selected field using suitable survey equipment



Employability



Entrepreneurship



Skill Development

| SCIA2302 | STRENGTH OF MATERIALS LAB | L | T | P | Credits | Total Marks |
|----------|---------------------------|---|---|---|---------|-------------|
|          |                           | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

#### SUGGESTED LIST OF EXPERIMENTS

1. By conducting tension test, draw the stress-strain curve on mild steel.
2. Compression Test on bricks and Wood.
3. Deflection Test on mild steel beam - Verification of Maxwell theorem
4. Deflection Test on Aluminium beam - Verification of Maxwell theorem
5. Tension Test on closed coiled helical springs.
6. Compression Test on open coiled helical springs.
7. Impact test on metal specimen using a Charpy/Izod method.
8. Shear test on metal specimen by using U.T.M.
9. Hardness values of Steel, Copper and Aluminum by using Brinell hardness testing machine.
10. Hardness values of Steel, Copper and Aluminum by using Rockwell hardness testing machine.
11. Hardness values of Steel, Copper and Aluminum by using Vicker's hardness testing machines.
12. Torsion test on metal specimen by using Torsion Testing Machine.

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze stress strain curve of mild steel, thin wire and twisted rod.
- CO2 - Determine the hardness of aluminum, brass, steel and copper.
- CO3- Conduct deflection test on beam based on Maxwell theorem.
- CO4 - Conduct tension and compression test on springs.
- CO5 - Determine the compressive strength of brick and concrete blocks.
- CO6 - Determine the shear strength and toughness of steel.



Employability



Entrepreneurship



Skill Development

|          |                    |   |   |   |         |             |
|----------|--------------------|---|---|---|---------|-------------|
| SCIA2401 | SURVEYING LAB - II | L | T | P | Credits | Total Marks |
|          |                    | 0 | 0 | 4 | 2       | 100         |

### COURSE OBJECTIVE

- To understand the method of using surveying instrument for various civil engineering purpose.

### SUGGESTED LIST OF EXPERIMENTS

1. Determine the tacheometric constant.
2. Determining the tacheometric contouring - Rectangular method
3. Determining the tacheometric contouring - Radial method
4. Longitudinal and cross sectional leveling of a given road segment using theodolite.
5. Horizontal and vertical distance using Total Station
6. Traversing and area calculation using Total Station
7. Slope distance using Total Station
8. Determining the area of a given boundary using GPS Surveying (Co-ordinate Measurements)
9. Astronomical survey - Demonstration on Azimuth of a survey line by observations on the sun.
10. Import and Export of data from Auto-cad to Total Station with software interpretation.

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Evaluate the horizontal and vertical distance of elevated objects using suitable survey equipment.
- CO2 - Invent the reduced level of elevated and depressed objects using suitable survey equipment..
- CO3 - Develop contour lines of a selected field using suitable survey equipment
- CO4 - Invent the enclosed area of a larger field using total station
- CO5 - Assess the exact locational coordinates of given points using GPS survey.
- CO6 - Evaluate the sloping distance between two objects using Total station



Employability



Entrepreneurship



Skill Development

|          |                           |   |   |   |         |             |
|----------|---------------------------|---|---|---|---------|-------------|
| SCIA2402 | HYDRAULIC ENGINEERING LAB | L | T | P | Credits | Total Marks |
|          |                           | 0 | 0 | 4 | 2       | 100         |

### COURSE OBJECTIVE

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

### SUGGESTED LIST OF EXPERIMENTS

#### A) Flow Measurement

1. Determination of coefficient of flow through Venturimeter
2. Determination of coefficient of flow through Orificemeter
3. Determination of coefficient of flow through Orifice and Mouthpiece -Constant and variable head method.
4. Determination of coefficient of flow through Notches (Vnotch)

#### B) Losses in Pipes

5. Determination of friction coefficient in pipes
6. Determination of Manning's and Chezy's coefficients

#### C) Determination of Metacentric height

7. Determination of Meta centrich eight of ship model (Warship/Cargoship)

#### D) Pumps

8. Characteristics test on a Reciprocating pump
9. Characteristics test on Centrifugal pump.
10. Characteristics test on multistage Centrifugal pump.
11. Characteristics test on Submersible pump
12. Characteristics test on Gear oil pump

#### E) Turbines

13. Load test on Pelton wheel turbine
14. Load test on Francis turbine
15. Load test on Kaplan turbine

### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Explore the basic and fundamentals in fluid flow principles
- CO2 - Determine the discharge characteristics of flow through pipes
- CO3 - Determine the discharge characteristics of flow through channels
- CO4 - Analyze the static stability of floating bodies (Metacentric height)
- CO5 - Analyze a variety of practical fluid-flow devices and application
- CO6- Assess the efficiency of pumps and turbines

| SCIA2501 | SOIL MECHANICS LAB | L | T | P | Credits | Total Marks |
|----------|--------------------|---|---|---|---------|-------------|
|          |                    | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVES

- To learn about the lab tests and field tests for soil for various civil engineering purposes.
- To understand the basic physical and mechanical properties of soil.
- To gain necessary skill to perform standard field and laboratory tests.

#### SUGGESTED LIST OF EXPERIMENTS

1. Determination of Specific gravity of soil
2. Determination of Sieve analysis for Coarse-grained soil
3. Determination of Hydrometer analysis for Fine-grained soil
4. Determination of Liquid Limit and Plastic limit
5. Determination of Shrinkage limit
6. Determination of Standard Proctor Compaction test
7. Determination of Field density of soil by Core Cutter method
8. Determination of Field density of soil by Sand Replacement method
9. Determination of permeability of soil by constant head method
10. Determination of permeability of soil by variable head method
11. Determination of compressibility characteristics
12. Determination of shear parameter by Direct Shear test on sand
13. Determination of shear parameter by Unconfined Compression test for cohesive soil
14. Determination of shear parameter by Triaxial Compression test for cohesive soil
15. Determination of shear parameter by Vane shear test.

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the physical properties for characterization of soil
- CO2 - Assess the consistency limits of soil.
- CO3 - Compute the field density of soil using different method.
- CO4 - Determine the permeability of soil using constant and variable head method.
- CO5 - Assess the compressibility of soil using consolidation method
- CO6 - Evaluate the shear parameters of soil by different shear tests.

| SCIA2502 | ENVIRONMENTAL ENGINEERING LAB | L | T | P | Credits | Total Marks |
|----------|-------------------------------|---|---|---|---------|-------------|
|          |                               | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVES

- To analyze the physical, chemical and biological characteristics of water and wastewater.
- To quantify the dosage requirement for coagulation process.

#### SUGGESTED LIST OF EXPERIMENTS

1. Determination of pH
2. Determination of Conductivity
3. Determination of Alkalinity
4. Determination of Chlorides (Mohr's method)
5. Determination of Hardness (EDTA method)
6. Determination of Turbidity (NTU)
7. Determination of Total Solids
8. Determination of Total Dissolved Solids
9. Determination of Residual Chlorine
10. Determination of Optimum dosage of Coagulant (Jar Test)
11. Determination of Dissolved Oxygen (Winkler method)
12. Determination of Biochemical Oxygen Demand (BOD<sub>5</sub>)
13. Determination of Chemical Oxygen Demand (COD)
14. Determination of Total Organic Carbon (TOC)
15. Determination of colour and odour of water sample
16. Air quality monitoring (ambient, stack monitoring, indoor air pollution)

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine physical, chemical and biological characteristics of water
- CO2 - Determine optimum dosage of coagulant
- CO3 - Analyze the survival conditions for the microorganism and its growth rate.
- CO4 - Characterize water and conduct treatment studies.
- CO5 - Assess the quality of water
- CO6 - Recommend the degree of treatment required for the water



Employability



Entrepreneurship



Skill Development

|          |                         |   |   |   |         |             |
|----------|-------------------------|---|---|---|---------|-------------|
| SCIA2601 | CONCRETE TECHNOLOGY LAB | L | T | P | Credits | Total Marks |
|          |                         | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- To understand and perform various tests on cement, aggregates and concrete.

#### SUGGESTED LIST OF EXPERIMENTS

##### A) Tests on Cement

1. Standard consistency of cement
2. Initial and final setting time of cement
3. Compressive strength of cement
4. Fineness of cement

##### B) Tests on Aggregates (Fine Aggregate & Coarse Aggregate)

1. Particle size distribution
2. Fineness modulus, bulk density, void ratio
3. Bulking of fine aggregate
4. Specific gravity of aggregate
5. Impact Value
6. Crushing Strength

##### C) Tests on Fresh Concrete

1. Mix design
2. Slump test
3. Compaction factor test
4. Flow test

##### D) Tests on Hardened Concrete

1. Compressive strength of concrete
2. Flexural strength of concrete
3. Split tensile strength of concrete
4. Rebound hammer test

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the properties and strength of a given cement sample.
- CO2 - Classify the zone of the given fine aggregate sample based on sieve analysis.
- CO3 - Determine the physical properties and strength of the given coarse and fine aggregates samples.
- CO4 - Proportionate the ingredients of concrete of any grade using Indian Standard method of mix design.
- CO5 - Determine the workability properties of a fresh concrete for a given mix proportion.
- CO6 - Determine the mechanical properties of the given concrete sample.

| SCIA2602 | HIGHWAY ENGINEERING LAB | L | T | P | Credits | Total Marks |
|----------|-------------------------|---|---|---|---------|-------------|
|          |                         | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- To provide the students to hands on experience on the various testing procedures of pavement materials as per the IRC standards.

#### SUGGESTED LIST OF EXPERIMENTS

##### A) Test on Aggregate

1. Shape test
2. Los Angeles Abrasion test

##### B) Test on Bitumen

3. Penetration Test on Bitumen
4. Ductility test on bitumen
5. Softening point test on bitumen / tar
6. Flash and fire point test on bitumen - tar bitumen
7. Specific gravity test
8. Viscosity test on tar
9. Stripping test
10. Optimum Bitumen Content in bituminous mix by cold solvent extraction method – Demonstration

##### C) Test on Mix Design

11. Marshall Stability Test for bitumen with design consideration

##### D) Test on Subgrade Soil

12. California Bearing Ratio Test

##### E) Test on Pavement Evaluation

13. Benkelman Beam Method

#### COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Assess the quality of aggregates used in road construction
- CO2 - Predict the grade of bitumen by conducting Penetration and Viscosity test
- CO3 - Analyze the quality of bitumen using Softening Point, Flash and Fire Point and Ductility test
- CO4 - Determine the optimum bitumen content required for Bituminous Road mixes
- CO5 - Determine the bearing capacity of subgrade soil using California Bearing Ratio test
- CO6 - Understand the concept of Benkelmann Beam deflection for strengthening of pavements

| SCIA2701 | COMPUTER AIDED ANALYSIS AND DESIGN OF<br>STRUCTURAL ELEMENTS LAB | L | T | P | Credits | Total Marks |
|----------|------------------------------------------------------------------|---|---|---|---------|-------------|
|          |                                                                  | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- The overall idea of implementing this course is to prepare detailing drawings using AUTOCAD software
- To design steel and reinforced concrete structural elements using Staadpro software.

#### SUGGESTED LIST OF EXERCISES

##### A) AutoCADD

Introduction to AutoCADD Commands

1. Foundation Reinforcement Detailing
2. Flat Slab Reinforcement Detailing

##### B) STAAD.Pro

Introduction to STAAD - Pro., STAAD - Pre creation of input files by using the Text Editor and Graphical input Generator, STAAD - Post Graphical Post processing, Viewing and Printing the output files.

1. Analysis and Design of Continuous beam with fixed at both ends
2. Analysis and Design of Continuous beam with simply supported ends
3. Analysis and Design of Continuous beam with over hangings
4. Analysis and Design of Propped cantilever beam with different materials
5. Analysis and Design of Continuous beam with member moment
6. Analysis and Design of Plane frames
7. Analysis and Design of Trusses

#### COURSE OUTCOME

On completion of the course, students will be able to

CO1 - Draft the reinforcement detailing of various reinforced concrete elements like foundations, pile cap, beam, slab, beam-column joints and staircase using AUTOCAD software.

CO2 - Design cantilever and continuous beams based on all types of support conditions using staad.pro software

CO3 - Design the five types of portal frames using staad.pro software..

CO4 - Design any type of steel roof truss using staad.pro software.

CO5 - Design a G+2 Reinforced concrete building using staad.pro software.

CO6 - Design a G+2 Steel building using staad.pro software.

| SCIA5101 | ADVANCED REINFORCED CONCRETE STRUCTURES | L | T | P | Credits | Total Marks |
|----------|-----------------------------------------|---|---|---|---------|-------------|
|          |                                         | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVES

- To make the students be familiar with the limit state design of RCC beams.
- To design special structures, Shear walls, Bunkers, Silos and Earth quake Engineering.

#### UNIT 1 LIMIT STATE DESIGN OF BEAMS FOR FLEXURE

9 Hrs.

Review of Basic Concepts - Behaviour and Design of Reinforced Concrete members considering flexure, Torsion, combined with flexure and flexural shear, deflection and crack width as per IS456.

#### UNIT 2 DESIGN OF SHEAR WALLS AND DEEP BEAMS

9 Hrs.

Shear walls - Types of shear walls - Design of shear walls. Simply Supported and Continuous Deep beams.

#### UNIT 3 DESIGN OF SPECIAL RCC MEMBERS

9 Hrs.

Flat slabs, Flat plates, Grid floor and Corbel.

#### UNIT 4 BUNKERS AND SILOS

9 Hrs.

Introduction to Limit state design of Bunkers and Silos - Rectangular and Circular types.

#### UNIT 5 DESIGN OF EARTHQUAKE ENGINEERING

9 Hrs.

Response of RCC buildings to seismic loads - Ductility and its importance - Rehabilitation of existing buildings.

Max. 45 Hrs.

#### Course Outcomes

At the end of the course, student will be able to:

- CO 1 - Design reinforced concrete slabs for bending, shear and torsion by Limit State Design method
- CO 2 - Calculate deflections and crack width for beams
- CO 3 - Evaluate the function of structural walls and design of shear walls and deep beams in buildings
- CO 4 - Carry out load calculation, analysis, design and detailing of flatslabs, grid floor as per IS codes of practice
- CO 5 - Design bunkers and silos
- CO 6 - Perform retrofitting and rehabilitation for existing damaged buildings

#### TEXT / REFERENCE BOOKS

1. Ashok. K. Jain, "Reinforced concrete - Limit state design", Nemchand & Bros, Roorkee, 1983.
2. Park and Pauley. T. "Reinforced concrete structures", John Wiley & Sons, Newyork, 1975.
3. Varghese, P.C. "Limit State Design of Reinforced Concrete", Prentice Hall of India Ltd, New Delhi, 2007.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2005.
5. IS 456 -2000 - Code of practice for plain and reinforced concrete.
6. SP 16 (1980) - Design Aids for Reinforced concrete.
7. SP 34(1987) - Hand book on Concrete reinforcement and Detailing.
8. IS 1893:2002 - Indian Standard criteria for earthquake resistant design of structures.
9. IS 13920:1993 Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.
10. IS 4326:1993 - Code of practice for earthquake resistant design and construction of buildings.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA7001 | ADVANCED CONCRETE TECHNOLOGY | L | T | P | Credits | Total Marks |
|----------|------------------------------|---|---|---|---------|-------------|
|          |                              | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

#### UNIT 1 CONCRETE MAKING MATERIALS

9 Hrs.

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, Mineral admixture.

#### UNIT 2 CONCRETE

9 Hrs.

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength, durability of concrete.

#### UNIT 3 MIX DESIGN

9 Hrs.

Principles of concrete mix design, Methods of concrete mix design, testing of Concrete. Statistical quality control- sampling and acceptance criteria.

#### UNIT 4 SPECIAL CONCRETE

9 Hrs.

Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Sulphur impregnated concrete, Polymer Concrete, Super plasticized concrete, hyper plasticized concrete, Epoxy resins and screeds for rehabilitation - properties and applications - high performance concrete. High performance fiber reinforced concrete, self- compacting-concrete.

#### UNIT 5 CONCRETING METHODS

9 Hrs.

Process of manufacturing of concrete, methods of transportation, placing and curing. Extreme weather concreting, special concreting methods. Vacuum dewatering - underwater concrete, special form work.

Max. 45 Hrs.

### COURSE OUTCOME

On the end of the course, student will be able to:

- CO 1 - Understand the properties of different concrete materials.
- CO 2 - Determine the properties of fresh and hardened concrete.
- CO 3 - Design the mix proportions of concrete as per Indian standards.
- CO 4 - Apply different types of concrete in structures.
- CO 5 - Understand the process of manufacturing of concrete.
- CO 6 - Control the quality the concrete as per acceptance criteria.

### TEXT / REFERENCE BOOKS

1. Neville, A.M., "Properties of Concrete", Prentice Hall, 1995, London.
2. Shetty M.S., "Concrete Technology", S.Chand and Company Ltd., New Delhi, 2003.
3. Santhakumar, A.R., "Concrete Technology", Oxford University Press, 2007.
4. Rudhani G., "Light Weight Concrete Academic Kiado", Publishing Home of Hungarian Academy of Sciences, 1963.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

|          |                       |   |   |   |         |             |
|----------|-----------------------|---|---|---|---------|-------------|
| SCIA7014 | INDUSTRIAL STRUCTURES | L | T | P | Credits | Total Marks |
|          |                       | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVE

- To study the requirements, planning and design of Industrial structures.

#### UNIT 1 PLANNING AND FUNCTIONAL REQUIREMENTS

9 Hrs.

Classification of Industries and industrial structures - planning for layout requirements regarding Lightening, Ventilation and Fire safety - Protection against Noise and Vibration - Guidelines from Factories Act.

#### UNIT 2 INDUSTRIAL BUILDINGS

9 Hrs.

Components of Industrial Structure -Roofs for Industrial buildings - Design of Gantry girder - Design of Corbels.

#### UNIT 3 POWER PLANT STRUCTURES

9 Hrs.

Chimneys and Cooling Towers - high-pressure boilers and piping design - Nuclear Contaminant structures.

#### UNIT 4 POWER TRANSMISSION STRUCTURES

9 Hrs.

Cables - Transmission Line Towers - Substation structures - Tower foundations - Testing Towers.

#### UNIT 5 MACHINE FOUNDATIONS

9 Hrs.

Types - Design Principles - Foundation for Turbo generators.

Max. 45 Hrs.

#### Course Outcomes

At the end of the course, student will be able to:

- CO 1 - Discuss the planning and functional requirements of Industrial structures
- CO 2 - Discover the need to learn about the design concepts, and constructional aspects of Industrial structure
- CO 3 - Design of gantry girder, corbels and nibs
- CO 4 - Design of various structures such as bunkers, silos and chimney
- CO 5 - Knowledge about tower foundations
- CO 6 - Knowledge about foundation for turbo generators

#### TEXT / REFERENCE BOOKS

1. Process of Advanced course on Industrial structures, Structural Engineering Research Centre, Chennai 1982.
2. Srinivasalu P. and Vaidyanathan C.V., "Handbook on foundations", Tata McGraw Hill 1976.
3. Manohar S.N., "Tall Chimneys - Design and Construction", Tata McGraw Hill 1985.
4. Santhakumar A.R. and S.S. Murthy, "Transmission Line Structures", Tata McGraw Hill, 1992.
5. Jakkula & Stephenson, "Fundamentals of Structural Analysis", Von Nostrand, East West Press, 1953.
6. Arya & Ajmani, "Design of Steel Structures", Nemchand Publishers, 1974.

#### CODE BOOKS

1. IS 4998 (PART 1) : 1992 Criteria For Design of Reinforced Concrete Chimneys.
2. IS 2974 (PART 1 to PART 5) : Design and Construction of Machine Foundations.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

Employability

Entrepreneurship

Skill Development

| SCIA7001 | ADVANCED CONCRETE TECHNOLOGY | L | T | P | Credits | Total Marks |
|----------|------------------------------|---|---|---|---------|-------------|
|          |                              | 3 | 0 | 0 | 3       | 100         |

## COURSE OBJECTIVE

- To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

### UNIT 1 CONCRETE MAKING MATERIALS

9 Hrs.

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, Mineral admixture.

### UNIT 2 CONCRETE

9 Hrs.

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength, durability of concrete.

### UNIT 3 MIX DESIGN

9 Hrs.

Principles of concrete mix design, Methods of concrete mix design, testing of Concrete. Statistical quality control-sampling and acceptance criteria.

### UNIT 4 SPECIAL CONCRETE

9 Hrs.

Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Sulphur impregnated concrete, Polymer Concrete, Super plasticised concrete, hyper plasticized concrete, Epoxy resins and screeds for rehabilitation - properties and applications - high performance concrete. High performance fiber reinforced concrete, self-compacting-concrete.

### UNIT 5 CONCRETING METHODS

9 Hrs.

Process of manufacturing of concrete, methods of transportation, placing and curing. Extreme weather concreting, special concreting methods. Vacuum dewatering - underwater concrete, special form work.

Max. 45 Hrs.

## COURSE OUTCOME

On the end of the course, student will be able to:

- CO 1 - Understand the properties of different concrete materials.
- CO 2 - Determine the properties of fresh and hardened concrete.
- CO 3 - Design the mix proportions of concrete as per Indian standards.
- CO 4 - Apply different types of concrete in structures.
- CO 5 - Understand the process of manufacturing of concrete.
- CO 6 - Control the quality the concrete as per acceptance criteria.

### TEXT / REFERENCE BOOKS

1. Neville, A.M., "Properties of Concrete", Prentice Hall, 1995, London.
2. Shetty M.S., "Concrete Technology", S.Chand and Company Ltd., New Delhi, 2003.
3. Santhakumar, A.R., "Concrete Technology", Oxford University Press, 2007.
4. Rudhani G., "Light Weight Concrete Academic Kiado", Publishing Home of Hungarian Academy of Sciences, 1963.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA7007 | DESIGN OF SUB STRUCTURES | L | T | P | Credits | Total Marks |
|----------|--------------------------|---|---|---|---------|-------------|
|          |                          | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVES

- To gain familiarity and design of different types of foundation like shallow foundations and deep foundations.
- To understand the concept of designing well, machine and special foundations.

#### UNIT 1 SITE INVESTIGATION, SELECTION OF FOUNDATION AND BEARING CAPACITY

9 Hrs.

Objectives - **Methods of exploration** - Depth of exploration - Sample disturbance - Factors governing location and depth of foundation - Insitu testing of Soils - Plate load test - Geophysical methods - Selection of foundation - Bearing capacity of shallow foundations by Terzaghi's theory, Meyerhof's theory, and codal provisions - Bearing capacity of footing subjected to inclined and eccentric loading - problems - Types of shear failure - General principles of foundation design.

#### UNIT 2 DESIGN OF SHALLOW FOUNDATIONS

9 Hrs.

Types of shallow foundations - **General principles of design of reinforced concrete shallow foundations** - Structural design of isolated and combined footing - Structural design of rafts by conventional method - Principles of design of buoyancy raft and basement (no design problems).

#### UNIT 3 PILE FOUNDATION

9 Hrs.

Pile foundations - Types - **General principles of design - Estimation of load capacity of piles by static and dynamic formulae** **Detailing of reinforcement as per IS 2911 - Design of pile caps - Settlement analysis of pile groups - Negative skin friction Pile load tests.**

#### UNIT 4 WELL AND CAISSON FOUNDATIONS

9 Hrs.

Well and caisson foundations - Structural elements of Caisson and Well foundations - Elements of well foundation - Forces acting on Caisson and well foundations - Design of individual components of Caisson and well foundation (only forces acting and design principles) - Sinking of well - Shifts and tilts in Well foundations - Preventive measures.

#### UNIT 5 TOWER FOUNDATION

9 Hrs.

Types of Foundations - **Design of foundation for transmission towers.**

Max. 45 Hrs.

#### COURSE OUTCOME

On the end of the course, student will be able to:

CO 1 - Understand the procedures of Site investigation and Soil Exploration methods

CO 2 - Compute the Bearing Capacity of Foundations, Types of shear failure and general principles of design of foundation

CO 3 - Understand the Types and general principles of design of reinforced concrete shallow foundations, design of isolated, combined footing and Raft Foundation

CO 4 - Estimate the Load carrying capacity of piles, Negative skin friction and Settlement of pile group, Design of Pile cap

CO 5 - Comprehend the Types, forces acting and the design principles of structural components of well and caisson foundations

CO 6 - Compute the design of foundation for Transmission Towers

#### TEXT / REFERENCE BOOKS

1. Tomlinson M.J. and Boorman R., "Foundation design and construction", 6th Edition, ELBS Longman, 1995.
2. Nayak N.V., "Foundation design manual for practicing engineers", Dhanpat Rai and Sons, 1982.
3. Arora, K.R., "Soil Mechanics & Foundation Engineering", Standard Publishers & Distributors, 2005.
4. Winterkorn. H.F. and Fang H.Y., "Foundation Engineering Hand Book, Van Nostrand, Reinhold, 1976.
5. Swami Saran, "Analysis and Design of Substructures Limit State Design", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2010.
6. Barken, "Dynamics of Bases and Foundations", McGraw Hill Company, 1962.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA7017 | PREFABRICATED STRUCTURES | L | T | P | Credits | Total Marks |
|----------|--------------------------|---|---|---|---------|-------------|
|          |                          | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVE

- To Study the design principles, analysis and design of elements.

#### UNIT 1 GENERAL PRINCIPLES OF FABRICATION

9 Hrs.

Comparison with monolithic construction - Types of prefabrication - site and plant prefabrication - Economy of prefabrication - Modular coordination - Standardization - Planning for Components of prefabricated structures - Disuniting of structures - Design of simple rectangular beams and I beams - Handling and erection stresses - Elimination of erection stresses - Beams, columns - Symmetrical frames.

#### UNIT 2 PREFABRICATED ELEMENTS

9 Hrs.

Roof and floor panels, ribbed floor panels - wall panels - footings - Joints for different structural connections - Effective sealing of joints for water proofing - Provisions for non-structural fastenings - Expansion joints in pre- cast construction.

#### UNIT 3 PRODUCTION TECHNOLOGY

9 Hrs.

Choice of production setup - Manufacturing methods - Stationary and mobile production - Planning of production setup - Storage of precast elements - Dimensional tolerances - Acceleration of concrete hardening.

#### UNIT 4 HOISTING TECHNOLOGY

9 Hrs.

Equipments for hoisting and erection - Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns - Vacuum lifting pads.

#### UNIT 5 MAINTENANCE

9 Hrs.

Designing and detailing of precast unit for factory structures - Purlins, Principal rafters, roof trusses, lattice girders, gable frames - Single span single storeyed frames - Single storeyed buildings - slabs, beams and columns.

Max. 45 Hrs.

#### Course Outcomes:

At the end of the course, student will be able to:

- CO 1 - Understand general principles of pre-fabrication.
- CO 2 - Plan simple buildings using various types of prefabricated elements.
- CO 3 - Design simple prefabricated elements
- CO 4 - Knowledge about types of connections and design of abnormal loads.
- CO 5 - Outline the various phases involved in precast/pre-fabricated technology
- CO 6 - Distinguish pre-engineered buildings from conventional units

#### TEXT / REFERENCE BOOKS

1. Makk L., "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 1964.
2. Glover C.W., "Structural Precast Concrete", Asia Publishing House, India, 1965.
3. Koncz I.T., "Manual of Precast Concrete Construction", Vol.I,II,III & IV, Berlin, 1968.
4. Lewicki B., "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam/London/New York, 1966.
5. "Structural Design Manual, Precast Concrete Connection Details", Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 1978.

#### CODE BOOKS

6. IS 4998 (PART 1) : 1992 Criteria For Design Of Reinforced Concrete Chimneys.
7. IS 2974 (PART 1 to PART 5): Design And Construction of Machine Foundations.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA5104 | EXPERIMENTAL STRESS ANALYSIS AND TECHNIQUES | L | T | P | Credits | Total Marks |
|----------|---------------------------------------------|---|---|---|---------|-------------|
|          |                                             | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVE

- To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.

#### UNIT 1 STRAIN MEASUREMENT

9 Hrs.

Methods of Measurement -Calibration-Load calibration of testing machines-I.S. Code provisions - Measurement system - Strain measurement - Strain gauges - Principle, Types, Performance, Uses - Strain Rosettes- Wheatstone Bridge- Photo elasticity- Principle, Application-Moire fringe- Electronic load cells-Proving rings.

#### UNIT 2 MEASUREMENT OF VIBRATION AND WIND FLOW

9 Hrs.

Measurement of Vibration- Vibration Galvanometers- Vibrometer-Characteristics of Structural vibration- Pressure gauges- Velocity transducers- Seismic transducers - Linear Variable Differential Transformer- Cathode ray oscilloscope - X Y Plotter- Wind Tunnels-Flow meters- Venturimeter- Digital Data Acquisition systems.

#### UNIT 3 DISTRESS MEASUREMENT AND CONTROL

9 Hrs.

Diagnosis of distress in structures-Cracks in structures-Formation of cracks- Types of cracks-Causes of cracks- Crack measurement- Monitoring and measurement of crack movement- Corrosion of reinforcement in RCC- Half cell-Construction and use-Damage assessment-Controlled blasting for demolition.

#### UNIT 4 N.D.T.METHODS

9 Hrs.

Load testing on structures-In situ load testing-Ultimate load testing-Rebound hammer-Principle and Applications- Limitations- Ultrasonic testing- Principles and Applications- Brittle coating- Principle and Applications- Stress coat- All Temp- Comparison of brittle coatings- Evaluation of the coating.

#### UNIT 5 MODEL ANALYSIS

9 Hrs.

Model laws- Laws of similitude-Model materials- Model testing- Necessity for Model analysis-Advantages- Applications- Types of similitude- Scale effect in Models- Indirect model study- Direct model study- Limitations of model investigations- Structural problems that may demand model studies- Usage of influence lines in model studies.

Max. 45 Hrs.

#### Course Outcomes

At the end of the course, student will be able to:

- CO1 - Understanding the working principle of strain gauges.
- CO2 - Measurement of strains
- CO3 - Perform the model analysis using different theorems.
- CO4 - Know the strategies of maintenance and repair
- CO5 - Assess the strength of existing structures using NDT
- CO6 - Understand the different patterns of Cracks

#### TEXT / REFERENCE BOOKS

1. Dally J.W. and Riley W.F., "Experimental stress Analysis", McGraw Hill, Inc. New York, 1991.
2. Srinath L.S. et al, "Experimental Stress Analysis", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1984.
3. Rangan C.S., "Instrumentation - Devices and Systems", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1983.
4. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.
5. Sirohi R.S., Radhakrishna H.C., "Mechanical Measurements", New Age International Pvt. Ltd., 1997.
6. Bray D.E. and Stanley R.K., "Course Material on Non-destructive Evaluation", McGraw Hill Publishing Company, New York, 1989.
7. Ravisankar K. and Chellappan A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.
8. Ganesan T.P., "Model Analysis of Structures", University Press, India, 2000.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

Employability

Entrepreneurship

Skill Development

| SCIA5201 | FINITE ELEMENT ANALYSIS | L | T | P | Credits | Total Marks |
|----------|-------------------------|---|---|---|---------|-------------|
|          |                         | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVE

- To study the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems.

### UNIT 1 INTRODUCTION

9 Hrs.

Boundary Value Problems - Approximate Solutions - Variational and Weighed Residual Methods - Ritz and Galerkin Formulations - Concept of Piecewise Approximation and Finite Element - Displacement and Shape Functions -Weak Formulation - Minimum Potential Energy - Generation of Stiffness Matrix and Load Vector.

### UNIT 2 STRESS ANALYSIS

9 Hrs.

Two Dimensional problems - Plane Stress, Plane Strain and Axisymmetric Problems - Triangular and Quadrilateral Elements - Natural Coordinates - Isoparametric Formulation - Numerical Integration - Plate Bending and Shell Elements – Brick Elements - Elements for Fracture Analysis.

### UNIT 3 MESHING AND SOLUTION PROBLEMS

9 Hrs.

Higher Order Elements - p and h Methods of Mesh Refinement - ill conditioned Elements - Discretisation Errors - Auto and Adaptive Mesh Generation Techniques -Error Evaluation.

### UNIT 4 NONLINEAR, VIBRATION AND THERMAL PROBLEMS

9 Hrs.

Material and Geometric Nonlinearity - Methods of Treatment - Consistent System Matrices - Dynamic Condensation - Eigen Value Extraction - thermal analysis.

### UNIT 5 DYNAMIC ANALYSIS AND SOFTWARE APPLICATION

9 Hrs.

Dynamic equations - Consistent and lumped mass matrices - 1-D bar element - Formulation of element stiffness, mass and force matrices - Example problems. Natural frequencies - 1-D bar element - Formulation of element stiffness, mass matrices. Modeling and analysis using recent softwares.

Max. 45 Hrs.

### COURSE OUTCOME

On the end of the course, student will be able to:

- CO 1 -Understand to apply the various types of approximate methods in Boundary value problems
- CO 2 - Analysis of stress using finite element concept for Two dimensional problems.
- CO 3 - Understand the concept of meshing techniques for higher order elements and error evaluations.
- CO 4 - Study of Non linear, vibration and thermal problems using finite element methods.
- CO 5 - Analysis of structures using dynamic equations for one dimensional problem.
- CO 6 - Formulation of element stiffness matrix and modeling analysis using recent software.

### TEXT / REFERENCE BOOKS

1. Bhavikatti S.S., "Finite Element Analysis", New Age Publishers, 2007.
2. Krishnamoorthy C.S., "Finite Element Analysis: Theory and Programming", Tata McGraw-Hill, 1995.
3. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
4. Bathe, K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall Inc., 1996.
5. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", McGraw Hill, 1987.
6. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 1997..
7. Moaveni, S., "Finite Element Analysis Theory and Application with ANSYS", Prentice Hall Inc., 1999.
8. <http://www.mech.port.ac.uk/sdalby/mbm/CTFRProg.htm>.
9. <http://www.me.mtu.edu/~bettig/MEEM4405>.

### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks



Employability



Entrepreneurship



Skill Development

|          |                     |   |   |   |         |             |
|----------|---------------------|---|---|---|---------|-------------|
| SCIA5202 | STRUCTURAL DYNAMICS | L | T | P | Credits | Total Marks |
|          |                     | 3 | 0 | 0 | 3       | 100         |

#### COURSE OBJECTIVES

- To expose the students the principles and methods of dynamic analysis of structures.
- To prepare them for designing the structures for wind, earthquake and other dynamic loads.

#### UNIT 1 INTRODUCTION TO STRUCTURAL DYNAMICS

9 Hrs.

Formulation of equation of motion by different methods - Single degree of freedom - Free vibration - Forced response to harmonic - Periodic and impulsive loads - Response to general dynamic loading - Effect of damping - Methods of evaluation of damping.

#### UNIT 2 MUTI-DEGREE-OF FREEDOM SYSTEMS

9 Hrs.

Formulation of MDOF equations of motion - Evaluation of structural property matrices - Analysis of vibration frequency of motion - orthogonality conditions - approximate methods of extraction of eigen values.

#### UNIT 3 DYNAMIC RESPONSE OF MDOF SYSTEMS

9 Hrs.

Normal co-ordinates - Mode super position technique - Numerical integration process.

#### UNIT 4 CONTINUOUS SYSTEMS

9 Hrs.

Modeling - Analysis of free and forced response of beams and bars.

#### UNIT 5 APPLICATIONS

9 Hrs.

Idealization and mathematical model of multistory building frames, towers, examples of wind, earthquake and impact excitations.

Max. 45 Hrs.

#### COURSE OUTCOME

On the end of the course, student will be able to:

CO 1 - Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.

CO 2 - Apply knowledge of mathematics, science, and engineering by developing the equations of motion for multiple degrees of freedom systems.

CO 3 - Illustrates the concepts of dynamic loading and to study the dynamic response of MDOF systems subjected to different types of dynamic loads.

CO 4 - Develop mathematical models representing real time problems of discrete and continuous vibratory systems

CO 5 - Apply dynamic analysis methods to practical problems in structural engineering and other disciplines

CO 6 - Evaluate the dynamic susceptibility of structures and the limitations of modelling techniques.

#### TEXT / REFERENCE BOOKS

1. MarioPaz, "Structural dynamics", Academic Press, 1985.
2. Anderson R.A., "Fundamentals of vibration", Amerind Publishing Co., 1972.
3. Ray W. Clough and Joseph Penzien, "Dynamics of structures", McGraw Hill, New York, 1993.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

 Employability

 Entrepreneurship

 Skill Development

| SCIA5203 | ADVANCED DESIGN OF STEEL STRUCTURES | L | T | P | Credits | Total Marks |
|----------|-------------------------------------|---|---|---|---------|-------------|
|          |                                     | 3 | 0 | 0 | 3       | 100         |

### COURSE OBJECTIVES

- To study the behaviour of members and connections, analysis and design of Industrial buildings and roofs, chimneys.
- To Study the design of with cold formed steel and plastic analysis of structures.

### UNIT 1 STRUCTURAL CONNECTIONS

9 Hrs.

Types of connections- Bolted and welded connections - Seated Connections - Unstiffened and Stiffened - Moment Resistant Connections - Clip angle Connections - Split beam Connections - Framed Connections.

### UNIT 2 PRE ENGINEERED INDUSTRIAL BUILDING

9 Hrs.

Design of members subjected to lateral loads and axial loads, Analysis and design of Industrial Buildings and bents, Sway and non-sway frames, Design of Purlins, Louver rails, Gable column and Gable wind girder - Design of Moment Resisting Base Plates - Analysis of Gable Frames.

### UNIT 3 PLASTIC ANALYSIS OF STRUCTURES

9 Hrs.

Introduction, Shape factor, Moment redistribution, Combined mechanisms, Analysis of portal frames, Effect of axial force - Effect of shear force on plastic moment, Connections - Requirement - Moment resisting connections. Design of Straight Corner Connections - Haunched Connections - Design of continuous beams.

### UNIT 4 ANALYSIS AND DESIGN OF SPECIAL STRUCTURES

9 Hrs.

Design of self supporting chimney and guyed steel stacks- Stresses due to wind and earthquake forces - Design of foundation - Gust factor method. Towers- Basic structural configurations - free standing and guyed towers - loads on towers - wind loads - foundation design.

### UNIT 5 DESIGN OF COLD FORMED STEEL STRUCTURES

9 Hrs.

Behaviour of Compression Elements - Effective width for load and deflection determination - Behaviour of Unstiffened and Stiffened Elements - Design of webs of beams - Flexural members - Lateral buckling of beams - Shear Lag - Flange Curling - Design of Compression Members - Wall Studs.

Max. 45 Hrs.

### Course Outcomes

At the end of the course, student will be able to:

- CO1 - Design the connections of steel beam and columns.
- CO2 - Design the connections of steel beam and columns.
- CO3 - Analyze and design the industrial structures and special structures.
- CO4 - Incorporate the necessary design parameters from Indian standard code books.
- CO5 - Conduct the plastic analysis of steel structures.
- CO6 - Design the beams and columns using cold formed steel sections.
- CO7 - Differentiate between the limit state method and working stress method.

### TEXT / REFERENCE BOOKS

- Owens G.W. and Cheal B.D., "Structural Steelwork Connections", Butterworths, London, 1989.
- Dayaratnam P., "Design of Steel Structures", A.H. Wheeler & Co. Ltd., Allahabad, 1996.
- Subramanian N., "Design of Steel Structures", Oxford University Press, 2008.
- Murthy S.S. and Santhakumar A.R., "Transmission Line Structures", McGraw Hill Publishing Co. Ltd., 1990.
- Wie Wen Yu, "Design of Cold Formed Steel Structures", McGraw Hill Book Company, New York, 1996.
- Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Design of Steel Structures" Vol. I and II, Arihant Publications, Mumbai, 1998.
- Duggal S.K., "Limit State design of steel structures", Tata McGraw Hill Publishing Company, New Delhi, 2010.
- IS: 800-2007, Indian Standard for General Construction in Steel, Code of Practice.
- IS:801-1975, : Code of practice for use of cold - formed light gauge steel structural members in general building construction.
- SP 6(1) - 1964 Hand book for Structures Engineers.
- IS 811 - 1987, "Specification for cold formed light gauge structural steel sections.
- IS 875-1987 part 3 Code of practice for design loads.

Employability

Entrepreneurship

Skill Development

|          |                             |   |   |   |         |             |
|----------|-----------------------------|---|---|---|---------|-------------|
| SCIA6101 | STRUCTURAL ANALYSIS LAB - I | L | T | P | Credits | Total Marks |
|          |                             | 0 | 0 | 4 | 3       | 100         |

### COURSE OBJECTIVES

- To learn analysis and design of RCC, Steel Structures by using software.

### SUGGESTED LIST OF EXERCISES

1. Carryout the analysis and design of RCC structures & Steel structures (single storey & Multi storey buildings).
2. Analysis of truss
3. Typical modeling of berthing structure( IS 4651)
4. P-delta analysis of G+12 building.
5. Bridge modeling
  - i) Modeling of road bridges (load calculation as per IRC )
  - ii) Modeling of railway bridges using load calculation as per IRS

### Course Outcomes

The students will be able to

- CO1 - Apply dead, live and wind loads on the structure using the software.
- CO2 - Model railway and highway bridges using Staad.pro software
- CO3 - Incorporate design parameters from Indian Standard Codes into STAAD Pro
- CO4 - Analyze the RCC and Steel structures.
- CO5 - Design the single and multi-storey structures.
- CO6 - Generate various reports from the software.

| SCIA6201 | STRUCTURAL ANALYSIS LAB – II | L | T | P | Credits | Total Marks |
|----------|------------------------------|---|---|---|---------|-------------|
|          |                              | 0 | 0 | 4 | 2       | 100         |

#### COURSE OBJECTIVE

- To learn Advanced analysis of Structures by using software.

#### SUGGESTED LIST OF EXERCISES

1. Analysis of Structures using Finite element Package - ANSYS.
2. Problem Formulation - input parameters - modeling - material properties - boundary conditions.
3. Mesh generation - Solution and post processing.
4. Modal Analysis, Buckling Analysis, Non-linear analysis, Non-linear material analysis and Contact Analysis of beam, column, beam-column, frames and plate elements.

#### COURSE OUTCOME

On the end of the course, student will be able to:

- CO 1 - Learn the basics of Finite element theory
- CO 2 - Gain insight on how to create and analyze models that produce accurate results
- CO 3 - Create meshes To apply load conditions and boundary conditions
- CO 4 - perform Linear and Non-linear analysis
- CO 5 - Perform static structural finite element analysis and modal analysis
- CO 6 - perform Static and Dynamic analysis



Employability



Entrepreneurship



Skill Development

|          |                            |   |   |   |         |             |
|----------|----------------------------|---|---|---|---------|-------------|
| SCIA6301 | STRUCTURAL ENGINEERING LAB | L | T | P | Credits | Total Marks |
|          |                            | 0 | 0 | 4 | 2       | 100         |

## COURSE OBJECTIVE

- To learn about various tests on RC Beams and Steel Beams

## SUGGESTED LIST OF EXPERIMENTS

1. Fabrication, casting and testing of simply supported reinforced concrete beam for Strength and deflection behavior.
2. Testing of simply supported steel beam for strength and deflection behavior.
3. Testing of Reinforcement using Mechanical and electrical strain gauges.
4. Bending test of steel Flat
5. Determination of Young's modulus of concrete
6. Determination of Tensile and flexural strength of concrete.
7. Determination of in-situ strength and quality of concrete using i) rebound hammer ii) Ultrasonic Pulse Velocity Tester
8. Torsion on open and closed sections
9. Lateral torsional buckling of beams.

## Course Outcomes

Upon completion of the course the student should be able to:

- CO 1 - design a concrete mix using IS code
- CO 2 - perform non destructive and durability tests and predict the strength of concrete
- CO 3 - Explain the behavior of beams and columns under flexure and shear
- CO 4 - Ability to install strain gauges on steel structural components and systems and collect data from strain gauges
- CO 5 - Ability to perform column buckling tests

| SCIA7003 | MAINTENANCE AND REHABILITATION OF STRUCTURES | L | T | P | Credits | Total Marks |
|----------|----------------------------------------------|---|---|---|---------|-------------|
|          |                                              | 3 | 0 | 0 | 3       | 100         |

## COURSE OBJECTIVE

- To study the damages, repair and rehabilitation of structures.

### UNIT 1 MAINTENANCE AND REPAIR STRATEGIES

9 Hrs.

Maintenance, repair and rehabilitation, facets of maintenance and importance of maintenance, various aspects of inspection, Assessment procedures for evaluating damaged structures, causes of deterioration – Testing techniques, NDT, Rebound Hammer, types of failures in foundation, floors, roofs, walls etc., Safety evaluation of existing buildings.

### UNIT 2 SERVICEABILITY AND DURABILITY OF CONCRETE

9 Hrs.

Quality assurance for concrete construction, concrete properties strength, workability, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, effects of cover thickness and cracking of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection. Acoustical emission methods

### UNIT 3 MATERIALS AND TECHNIQUES FOR REPAIR

9 Hrs.

Special concrete and mortars, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro-cement, fibre reinforced concrete, water-proofing materials, Admixtures, Concrete made with industrial wastes Polymer coating for rebars, vacuum concrete, gunite, shotcrete, Epoxy injection, Mortar repairs of cracks, Shoring & Underpinning.

### UNIT 4 REPAIR OF STRUCTURES

9 Hrs.

Repair of structures distressed due to Earthquake, Strengthening using FRP, Strengthening and Stabilization techniques for repair. Strengthening of bridge pier. Strengthening of dams, canals – Strengthening of Heritage Buildings – Corrosion and erosion damaged structures - Demolition Techniques – Engineered Demolition Methods – Case Studies.

### UNIT 5 NDT OF STEEL

9 Hrs.

Correlating ASTM tensile test (or IS:1608) for rebar with chemical composition results with respect to IS:2062, use of digital thickness gauges and weld gauges, use of hardness testers – Correlation with fire damaged and virgin specimens simple surface NDT tests – Penetration tests, Magnetic particle tests, use of coating gauges for metallic and Non-Metallic coating and identification of details for corrosion (durability aspects) simple techniques in visual inspection of weldments.

Max. 45 Hrs.

## COURSE OUTCOME

On the end of the course, student will be able to:

- CO1 – Understand the importance and assessment procedure of Maintenance of structures
- CO2 - Learn the various distress and damages on Concrete and Reinforced concrete structures
- CO3 – Study the various types and properties of repair materials
- CO4 – Learn various repair techniques of damaged and corroded structures
- CO5 – Learn the strengthening techniques of bridge pier
- CO6 - Understand the procedure of Non-destructive testing of steel

## TEXT / REFERENCE BOOKS

- Denison Campbell, Allen and Harold Roper, "Concrete Structures: Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
- R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
- Shetty, M.S., "Concrete Technology – Theory and Practice", S. Chand and Company, New Delhi, sixth edition, 2008.
- Santhakumar, A.R., "Training Courses notes and damage assessment and repair in low cost housing", "RHDC-NBO" Anna University, 1992.
- Raikaar, R.N. "Learning from Failures – Deficiencies in Design, Construction and Service (SDCPL)", Raikaar Bhavan, Bombay, 1987.
- B.Raj, T.Jayakumar and M.Thavasimuthu, "Practical Non-destructive testing", Wood Head Publishing Ltd., 2002.
- IS:1608(1995) Mechanical Testing of metals and IS: 2062(1999) Steel for general structural purposes.

## END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

**PART A:** 5 Questions of 6 Marks each - No choice

30 Marks

**PART B:** 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Mark

Employability

Entrepreneurship

Skill Development

| SCCA9501 | INDUSTRY 4.0 FOR STRUCTURAL ENGINEERS | L | T | P | Credits | Total Marks |
|----------|---------------------------------------|---|---|---|---------|-------------|
|          |                                       | 2 | 0 | 2 | 2       | 100         |

#### UNIT 1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING

9 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

#### UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

9 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

#### UNIT 3 SMART MANUFACTURING

9 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies- Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

#### UNIT 4 SMART WORLD

9 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

#### UNIT 5 CYBER PHYSICAL SYSTEMS

9 Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hrs.

#### TEXT / REFERENCE BOOKS

1. William D. Callister, "Materials Science and Engineering, An Introduction", John Wiley and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice", Prentice Hall India Pvt. Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, 2019.
4. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
5. Oliver Grunow, "Smart Factory and Industry 4.0. The current state of Application Technologies", Studylab Publications, 2016.
6. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
7. Sang C. Suh, U. John Tanik, John N. Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

#### END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 5 Questions of 6 Marks each - No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

Employability

Entrepreneurship

Skill Development

