Second Semester Syllabus

Advanced Structural Design

SCE201

L-T-P: 4-0-0

Credits: 4

Pre-requisite: Design of RC Structures, Foundation Engineering.

Introduction: This course examines the basic concepts of advanced structural design which includes the design of cylinders and shells. Also the structures for handling materials like silo and bunkers are taken into consideration.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Design Flat slab, Grid slab, Deep beam, Shear wall, Frame shear wall interaction, Cylindrical shell, silo and bunkers, Liquid retaining structures, Pile and Pile cap.

CO2: Use relevant IS codes for design of industrial structures.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓		✓	✓	
CO2	✓	✓		✓	✓	

Course Contents:

Module 1: Flat slab, Grid slab, Deep beam, Shear wall, Frame shear wall interaction, Cylindrical shell, Structures for handing materials like silo and bunkers, Liquid retaining structures, Pile and Pile cap.

Module 2: Design provisions as envisaged in various Indian Standards.

Text Book:

1) Design of Reinforce Concrete Structures A. K. Gupta.
2) Limit State Design of RCC A.K. Jain.
3) Limit State Design of RCC Structure by Pillai &Menon.

Structural Dynamics & Earthquake Engineering

SCE202

L-T-P: 4-0-0

Credits: 4

Pre-requisite: Fundamental ideas of Solid mechanics, Basic knowledge of Engineering Mechanics, Structural Analysis.

Introduction: This course introduces the students to the analysis of the dynamic response of structures and structural components to transient loads and foundation excitation; single-degree-of-freedom and multi-degree-of-freedom systems; response spectrum concepts; simple inelastic structural systems; and introduction to systems with distributed mass and flexibility.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Student will develop knowledge in the simulation and mathematical model development.

CO2: Students will be trained to identify, formulate and solve complicated problem.

CO3: Students will be able to understand the role of earthquake in the damage of structures.

CO4: Students will be able to develop the skill to analyse data and to apply the same in the practical problems.

CO5: Students will be able to apply the developed methodologies for the safe and stable design of structures.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		

Course Contents:

Module 1: Theory of vibrations: Degrees of freedom, Un-damped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system.

Module 2: Response of single degree freedom system due to harmonic loading: Undamped harmonic excitation, Damped Harmonic excitation

Module 3: Response due to Transient loading: Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.

Module 4: Elements of seismology: Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems.

Unit 5: Principles of earthquake resistant design: Terminology, General principles and Design criteria, Methods of Analysis, Equivalent lateral force method of Analysis for multistoried building as per Indian Standard Code of Practice, Introduction to Response Spectrum Method, Fundamental concepts of Ductile detailing.

Text Books:

1. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

References:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.
3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986
4. Humar.J.L, Dynamics of Structures, Prentice Hall Inc., 1990.
5. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
6. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.
7. IS13920-1993 Ductile detailing of reinforced concrete structures subjected to seismic forces – Code of practice.
8. IS 1893 part 1 2002 Indian standard criteria for earthquake resistant design of structures.
9. IS 4326-1993 Earthquake Resistant Design and Construction of Buildings–Code of Practice (Second Revision)

Theory of Elasticity & Plasticity

SCE203

L-T-P: 4-0-0

Credits: 4

Pre-requisite: Fundamental ideas of Solid mechanics, Basic knowledge of Engineering Mechanics, Structural Analysis.

Introduction: This course aimed towards providing strong conceptual foundations to understand the elastic as well as the plastic behavior of solids under given applied loads. **Outcomes (CO):** Upon successful completion of this course, students should

be able to:

CO1: To apply linear elasticity in the design and analysis of structures such as beams, plates, shells and sandwich composites.

CO2: Understand Yield criterion and associated flow rules, slip line filed theory. Further, the.

CO3: To analyze the structural sections subjected to torsion.

CO4: To understand application of plasticity in the analysis of metal forming processes will be discussed.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓		✓	✓		
CO2	✓		✓	✓		
CO3	✓		✓	✓		
CO4	✓		✓	✓		

Course Contents:

Module 1: Elasticity: Introduction to tensor analysis; three-dimensional stress and strain analysis. Two dimensional problems in cartesian, polar and curvilinear co-ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions.

Module 2: Torsion of rectangular bars including hollow sections, bending problems. Energy principles, variational methods and numerical methods.

Module 3: Plasticity: basic concepts and yield criteria. Equations of plasticity, elasto-plastic analysis of torsion and bending problems, torsion of a bar of oval section (Sokoloskey's method), problems of spherical and axial symmetry, slip lines and plastic flow, strain hardening.

Text Books

1) Theory of Plasticity by Chakraborty.
2) Theory of Elasticity by Timoshenko S.P. and Goodier.
3) Theory of Elasticity and Plasticity by Timoshenko S.P. and Woinowsky-Kreiger
4) 4) Plasticity Theory by Jacob Lubliner.
5) Theory of Elasticity and Plasticity by Harold Malcolm Westergaard (HUP).

Advanced Foundation Engineering

SCE204A

L-T-P: 4-0-0

Credits: 4

Pre-requisite: Soil Mechanic, Foundation Engineering

Introduction: The topics broadly covered under this course includes design and settlement analysis of various types of footings and foundation on slopes.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Understand bearing capacity of shallow foundation in layered soils

CO2: Learn about Settlement Analysis of shallow foundations in sand, clay, and layered deposits and Reliability of settlement calculations

CO3: Design of rectangular footings, combined footings and mat foundations

CO4: Learn about pile foundations under vertical and lateral loads, Negative skin friction of piles, Uplift capacity of piles and anchors

CO5: Introduction to soil dynamics and machine foundation

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					
CO2	✓		✓		✓	
CO3	✓				✓	
CO4	✓	✓	✓	✓		
CO5	✓		✓	✓		

Course Contents:

Module 1: Bearing capacity: Bearing capacity of shallow foundation in layered soils, Footings on slopes, Foundation with uplift forces.

Module 2: Settlements: Settlement Analysis of shallow foundations in sand, clay, and layered deposits, Reliability of settlement calculations, Structural tolerances.

Module 3: Design of rectangular footings, combined footings and mat foundations.

Module 4: Deep foundations: Pile foundations under vertical and lateral loads, Negative skin friction of piles; Uplift capacity of piles and anchors, Well foundations.

Module 5: Foundations on expansive soils; Introduction to soil dynamics and machine foundation.

Text Books

1) Foundation Analysis & Design By J.E. Bowels (McGraw Hill).
2) Principles of Foundation Engg. By B.M. Das (PWS Publishing
3) Pile Foundation- Analysis & Design Poulus& Davis.
4) Constructional methods in Foundation Engineering Koener.
5) Foundation design and construction by Tomlinson.M.J.

6) Raft foundation design and analysis with practical approach by Gupta.s.c.

Prestressed Concrete Structures

SCE204B

L-T-P: 4-0-0

Credits: 4

Pre-requisite: Completion of the course Concrete Structures or equivalent. Familiarity with design standards for structural engineering.

Introduction: This subject explores the concept of Pre-Stressed Concrete which broadly covers the following aspects: Introduction to pre stressed concrete, Limit State Design Criteria, Anchorage Zone Stresses in post tensioned members, Composite construction of Pre-Stressed and In Situ Concrete and also pre stressed concrete poles and sleepers.

Course Outcomes (CO): Upon successful completion of this course, students should be able to:

CO1: Evaluate the behavior and design of pre-stressed concrete beams and slabs (including statically indeterminate beams and slabs) and design tendon layout, which satisfy the strength and serviceability limit states as required by design standards;

CO2: Analyze the stresses in anchorage zones and design end anchorages for pre-stressed concrete beams and slabs;

CO3: Evaluate the short-term and long-term losses in pre-stressing and design pre-stressed structures considering these losses;

CO4: Discuss and appraise the recent advances in the pre-stressed concrete technology including the use of advanced materials and application of new technologies.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓					
CO2	✓				✓	
CO3	✓					
CO4	✓	✓	✓	✓	✓	✓

Course Contents:

Module 1: Introduction of Pre-stressed concrete: Materials, pre-stressing system, analysis of pre-stress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of pre-stressed concrete members: Importance, factors, short term and long term deflection.

Module 2: Limit state design criteria: Inadequacy of elastic and ultimate load method, criteria for limit states, strength and serviceability. Design of sections for flexure: methods by Lin and Magnel.

Module 3: Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement.

Module 4: Composite construction of pre-stressed and in-situ concrete: Types, analysis of stresses, Statically Indeterminate structures: advantages of continuous member, effect of pre stressing, methods of achieving continuity and method of analysis of secondary moments.

Module 5: Pre-stressed concrete poles and sleepers: Design of sections for compression and bending.

Text Books:

1. Prestressed Concrete, Fourth Edition, N Krishna Raju McGraw Hill.

2. Design of Prestressed Structures, T.Y.Lin and N.H.Burns, Wiley Eastern Ltd.

3. Fundamentals of Prestressed Concrete, N.C.Sinha and S.K.Roy.

4. Prestressed Concrete, S.Ramamurthan.

Composite Materials & Structures

SCE204C

L-T-P: 4-0-0

Credits: 4

Course Contents:

Module 1: FRP composites, Types, Mechanics, behavior, properties, application.

Module 2: Steel: Concrete composite structures, design philosophy, shear connectors, beams, girders and slabs, Concrete: Prestressed concrete composite structures.

Text Books

1) Composite structure of steel and concrete (by Johnson).
2) Mechanics of composite material and structure by M. Mukhopadhay (university press).
3) An Introduction to Composite Material by D. Hull (Cambridge University Press).
4) Engineering Mechanics of Composite Material by Isaac M. Daniel & OriIshai (OUP).
5) Steel Concrete and Composite Design of Tall Building by Bungate Taranath (McGraw Hill).

Environmental Impact Assessment

SCE205A

L-T-P: 4-0-0

Credits: 4

Course Contents:

Module 1: Legal Aspects of EIA, Objectives of EIA, General Methodology of EIA, Base line Studies, Screening, Scoping.

Module 2: Public Consultation, Data Collection, Environmental Impact Analysis, Mitigation and Impact Management, Case Studies, Environmental Audit.

Text Books

1) Environmental Impact Assessment by Bartwal R. R. (New Age).
2) Introduction to Environmental Impact Assessment by John Glasson, Riki Therivel, Andrew Chadwick (Taylors &Francis).
3) Environmental Impact Assessment Practice & Participation by Fevin Stuart Hanna (OUP).
4) Methods of Environmental Impact Assessment by Peter Morris (Taylor & Francis).
5) Environmental Impact Assessment by Alan Gilpin (CUP).

Advanced Concrete Technology

SCE205B

L-T-P: 4-0-0

Credits: 4

Course Contents:

Module 1: Microstructural aspects of cement paste; Models of hydrated Portland cement gel; Mechanism,
application and specification of chemical admixtures, mineral admixtures and other cement replacement
materials; Special cementitious systems, viz., phosphate cement, magnesium oxy-chloride cement,
regulated set cement, high alumina cement etc.

Module 2: Concrete- environment interaction; Marine concrete; Resistance of concrete to Fire and influence
of temperature; Extreme weather concreting.

Module 3: Properties and mix proportioning of flyash concrete, silica fume concrete, fibre reinforced
concrete, sprayed concrete, high performance concrete, self-compacting concrete and geopolymer
concrete.

Text Books

1) Design of Concrete Mixes by Krishna Raju.
2) Concrete Microstructure, Properties and Material by P.kumar Mehta &Paulo J. M. Monteiro.
3) Concrete Technology by M.S. Shetty (S. Chand).

Construction Technology & Management

SCE205C

L-T-P: 4-0-0

Credits: 4

Course Contents:

Module 1: Different Construction techniques — equipments used — new technologies;Network scheduling
CPM, PERT, Planning &Scheduling of activity Networks.

Module 2: Scheduling with limited resource, Resource Planning, Resource Allocation, Project Schedule
Compression, ProjectScheduling, Estimation of Project Cost, Monitoring Project Progress, ProjectAppraisal & Selection, Recent Trends inProject Management.

Text Books

1) Construction and project management for Engineer—Krishnamurthy.
2) Urban Construction Project Management (McGraw-Hill Construction Series) by Richard Lambeck, John Eschemuller.
3) Construction Management Fundamentals By: Kraig Knutson, Clifford J. Schexnayder, Christine
   M. Fiori, Richard Mayo.
   Construction Method and Management by Stephens W. Nunnally (Prentice Hall).

Theory of Elastic Stability & Behaviour of Metal Structures

SCE205D

L-T-P: 4-0-0

Credits: 4

Course Contents:

Module 1: Introduction; Fundamental principles and models for elastic stability, stability of column; classification of dynamics systems, linear and nonlinear eigen value problems.

Module 2: Stability of plates, frames, beams and arches Lateral buckling of beams, combined bending and axial force, combined bending and torsion.

Module 3: Buckling of thin elements Torsional buckling of thin-walled structures and open sections Column strength curves. Buckling and post-buckling strength of plate elements with special references to the codal provisions. Behaviour of light gauge steel structures.

Text Books

1) Fundamental of Structural Stability by Simitses.
2) Stability Analysis and Design of Structures, New Delhi by Gambhir M.L.
3) Stability of structure by Banzant.
4) Structural Stabilty of steel- Concepts and Applications for structural engineers- Galambos Theodore V.
5) Advanced Design in Structural Steel – Lothers – Prentice – Hall.

Structural Lab-II

SCE292

L-T-P: 0-0-3

Credits: 2

Pre-requisite: Design of RC structures, Design of steel Structures

Introduction: This subject will equip students to develop the concepts of Computer Aided Design of Structures.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to
CO1: Develop a clear understanding of the analysis and design of a multi-storeyed buildings using software.
CO2: The students will be able to prepare the detailed drawings of different structural elements including the ductility detailing of RCC slab, beam, column and footing design.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓		✓	✓	
CO2	✓	✓		✓	✓	

Course Content:
Exercises that must be done in this course are listed below:

1. Introduction and important features of a software dealing with analysis and design of structures.
2. Analysis and design of a multi storied building using software, Preparation of detailed drawings of different structural elements including ductility detailing RCC Slab, beam, column and footing design.

Seminar-Term Paper Leading to Project

SCE281

L-T-P: 0-2-0

Credits: 1

Introduction:
The overall aim of the seminar is to show the ongoing work of thesis/dissertation.
Course Objectives

- To explore new research from a range of academic disciplines which sheds light on the questions outlined above
- To showcase cutting edge research on education and culture from outstanding academic researchers.
- To get introductory idea of future research problem.