Design of Reinforced Concrete Structures
BEG451CI

Year: IV   **Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	2/2	3	3	80	-	-	20	25	125

Course Objective:

The main objective of this course is to impart the knowledge and skill for the design of different elements of buildings structure using reinforced concrete. This course specially focuses on limit state method of design and students will be able to perform structural analysis of different elements of building structure corresponding to the codal provision and detailing of reinforcement.

Course Contents:

1. Reinforced Concrete Structures   **(2 hrs)**
    1.1 Limitation of the Use of Plain Concrete
    1.2 Concept of Reinforced Concrete Structure
    1.3 Various Types of Loads and Stresses in Reinforced Concrete Structures
    1.4 Methods of Design

2. Working Stress Method   **(6 hrs)**
    2.1 Conception of Materials Strength and Loading and Modular Ratio
    2.2 Introduction to the Design of Beams: Singly Reinforced, Doubly Reinforced and T Beams

3. Limit State Method of Design   **(6 hrs)**
    3.1 Introduction of Limit State Method as a Probabilistic Approach
    3.2 Behavior of Concrete and Steel
    3.3 Strength and Serviceability Requirements
    3.4 Characteristic Strength of Materials and Partial Safety Factors
    3.5 Characteristics of Loads and Their Partial Safety Factors
    3.6 Limit State of Collapse: Flexure, Shear, Torsion, Compression
    3.7 Limit State of Serviceability: Deflection, Cracking

4.0 Reinforcement Detailing (5 hrs)

4.1 Spacing of Reinforcement and Concrete Cover
4.2 Minimum and Maximum Reinforcement in Beams, Slabs, Columns etc.
4.3 Minimum and Maximum Sizes of Reinforcing Bars
4.4 Minimum and Maximum Spacing of Reinforcing Bars
4.5 Curtailment of Reinforcements
4.6 Reinforcement Splices
4.7 Details of Reinforcement in Columns
4.8 Details of Beam - Column Connections
4.9 Bar Bending Schedule

5.0 Design by the Limit State Method (20 hrs)

5.1 Singly and Doubly Reinforced Concrete Continuous Beam
5.2 Flanged Beams
5.3 One-way and Two-way Slabs
5.4 Axially and Eccentrically Loaded Columns
5.5 Isolated and Combined Footings for Columns
5.6 Staircases

6.0 Pre-stressed Concrete Structure (8 hrs)

6.1 Introduction to Concept
6.2 Materials Used and Their Properties
6.3 Pre-stressing Systems and Anchorage
6.4 Losses of Pre-stress
6.5 Analysis and Design of Homogeneous Beam Section under Flexure: Flexural
   Approach, Load balancing Approach and Line of Thrust Approach
6.6 Cable Layout, Camber and Deflection
6.7 Limit State Design of Pre-stressed Concrete Beam
6.8 Design of a Pre-stressed Concrete Beam by Limit State Method

Laboratories:

(i) Test of RCC Beam in Pure Bending Failure (Record the Deflection and   for Various Loads and Cracking Patterns)
(ii) Test of RCC Beam in Shear Failure
(iii) Test of Beam under Combined Bending and Shear Failure
(iv) Test on Bond
(v) Investigate the Behaviour of Rectangular Beam with Double Reinforcement
(vi) Investigate the Behaviour of Reinforced Concrete Column till Failure

Course Project:

Two Storey RCC Framed Building with Design and Detailing of typical Slab, T- beam and I beam, Column, Staircase Footing (Isolated and Combined). Analysis of the Structure will be carried out by using any Software (i.e. Microfeap, SAP 90 Others)

References:

- A. K. Jain, Reinforced Concrete, Limit State Design, Nem Chand & Bros, Roorkee, Fifth Edition, 1999, P. 844.
- P. C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India. Pvt. Ltd., New Delhi, 1997, P. 541.
- Unnikrishna Pillai, Devdas Menon, Reinforced Concrete Design, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998. P. 762.
- Libby J. R. Modern Prestressed Concrete, Design Principles and Construction Methods, First Indian Edition, 1986, P. 635.
- N. Krishna Raju, Prestressed Concrete, Third edition, Tata McGraw-Hill Publishing Company Limited, New Delhi,, 1995, P. 797.
- Dr. Rajan Suwal, Design of Reinforced concrete Structures, Mark line Publications, 2013, P 208