Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE301	**DESIGN OF CONCRETE STRUCTURES I**	**3-1-0-4**	**2016**

Pre-requisites: CE202 Structural Analysis I

Course objectives:

- To provide the students with the knowledge of the behavior of reinforced concrete structural elements in flexure, shear, compression and torsion
- To enable them to design essential elements such as beams, columns, slabs staircases and footings under various loads.

Syllabus:

Introduction- Limit State method of design- Analysis of singly reinforced rectangular beams- shear strength of RC beam-design of shear reinforcement-bond and development length- curtailment of reinforcement-design of singly reinforced beams-analysis and design of doubly reinforced beams – simply supported , cantilever- analysis of singly reinforced T-beams -design for torsion-design of one-way slab- cantilever slab- continuous slab (detailing only)- two way slabs- design using code coefficients- Limit State of Serviceability-deflection-cracking -Stair cases- design & detailing-Columns-effective length-design of axially loaded short columns with rectangular ties and helical reinforcement.

Expected Outcomes:

The students will be able to

    i.   Apply the fundamental concepts of limit state method
    ii.   Use IS code of practice for the design of concrete elements
    iii.   Understand the structural behavior of reinforced concrete elements in bending, shear, compression and torsion.
    iv.   Design beams, slab, stairs, columns and draw the reinforcement details.
    v.   Analyze and design for deflection and crack control of reinforced concrete members.

Text Books / References:

1. Pillai S.U & Menon D – Reinforced Concrete Design, Tata McGraw Hill Publishing Co ., 2005
2. Punmia, B. C, Jain A.K and, Jain A.K ,RCC Designs, Laxmi Publications Ltd., 10e, 2015
3. Varghese P.C, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt Ltd,, 2008
4. Relevant IS codes (I.S 456, I.S 875, SP 34)

COURSE PLAN			
Module	**Contents**	**Hours**	**Sem. Exam Marks %**
I	Introduction- Plain and Reinforced concrete- Properties of concrete and reinforcing steel-Objectives of design-Different design philosophies- Working Stress and Limit State methods-Limit State	9	15

	method of design-Introduction to BIS code- Types of limit states-characteristic and design values-partial safety factors-types of loads and their factors. Limit State of Collapse in Bending-assumptions-stress-strain relationship of steel and concrete- analysis of singly reinforced rectangular beams-balanced-under reinforced-over reinforced sections-moment of resistance codal provisions		
II	Limit state of collapse in shear and bond- shear stresses in beams-types of reinforcement-shear strength of RC beam-IS code recommendations for shear design-design of shear reinforcement-examples Bond and development length - anchorage for reinforcement bars - code recommendations regarding curtailment of reinforcement	9	15
FIRST INTERNAL EXAMINATION			
III	Design of Singly Reinforced Beams- basic rules for design- design example of simply supported beam- design of cantilever beam-detailing Analysis and design of doubly reinforced beams – detailing, T-beams- terminology- analysis of T beams- examples - Design for torsion-IS code approach- examples.	9	15
IV	Design of slabs- introduction- one-way and two-way action of slabs - load distribution in a slab- IS recommendations for design of slabs- design of one-way slab- cantilever slab- numerical problems – concepts of detailing of continuous slab –code coefficients.	9	15
SECOND INTERNAL EXAMINATION			
V	Two- way slabs- simply supported and restrained slabs – design using IS Code coefficients Reinforcement detailing Limit State of Serviceability- limit state of deflection- short term and long term deflection-IS code recommendations- limit state of cracking- estimation of crack width- simple numerical examples	10	20
VI	Stair cases- Types-proportioning-loads- distribution of loads – codal provisions - design and detailing of dog legged stair- Concepts of tread-riser type stairs (detailing only) Columns- introduction –classification- effective length- short column - long column - reinforcement-IS specifications regarding columns- limit state of collapse: compression -design of axially loaded short columns-design examples with rectangular ties and helical reinforcement	10	20
END SEMESTER EXAMINATION			

Note
1. All designs shall be done as per current IS specifications
2. Special importance shall be given to detailing in designs
3. During tutorial hours detailing practice shall be done.
4. SI units shall be followed.
5. IS 456-2000 shall be permitted for the End Semester Examination

QUESTION PAPER PATTERN (End semester exam)

Maximum Marks :100   **Exam Duration: 3 Hrs**

Part A -Module I & II   :   2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI :   2 questions out of 3 questions carrying 20 marks each

Note : 1. Each part should have at least one question from each module

2. Each question can have a maximum of 4 subdivisions (a, b, c, d)