Semester – V

Subject Name: Structure Design & Drawing – I (R.C.C.)

Subject Code: 09CI1501

Diploma Branches in which this subject is offered: Civil Engineering

Objective: Objectives of introducing this subject at third year level in Civil Engineering are:

- To analyse R.C.C. building structure or element for various application.
- To provide a design and detailed drawing of analysed structure or element using Limit State Method as per code of practice IS: 456-2000 and SP 16.

Credits Earned: 4

Course Outcomes:

On the completion of the course student will be able to:

- Understand basic principles of RCC design.
- Read and interpret structural drawings
- Use Indian Standard Codes IS: 456-2000 and SP 16
- Design of different RCC components (e.g. beam, column, slab, footing, etc.)
- Draw reinforcement details for above component members

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
2	0	4	4	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	**Introduction** • Introduction to Reinforced Cement Concrete (RCC) • Advantages and limitation of RCC • Necessity of steel as a reinforcing material • Various grades of concrete and steel • Introduction to IS codes & IS code requirements for design and detailing	**02**	**8**
2	**Introduction to Limit State Method** • Methods of analysis & design of RCC members • Characteristic Strength of Concrete and Steel, Partial Safety Factor for material and load • Stress-strain curve for concrete and steel • Types of loads & load combinations • Limit State, Limit State of Collapse – Flexure, Shear, Compression, Torsion, Limit State of Serviceability – Deflection, Cracking.	**03**	**10**
3	**Limit State of Collapse: Flexure** • Assumptions for Limit State of Collapse due to Flexure. • Concept of Balance Section, Under Reinforced Section, Over Reinforced Section. • General features of singly reinforced & doubly reinforced beams • Necessity of providing doubly reinforcements • Concept of moment of resistance for these sections (no derivations) • Calculation of moment resisting capacity for singly-reinforced & doubly reinforced beams • Design problems of singly-reinforced rectangular beams • Introduction to Flanged beams	**06**	**22**
4	**Limit State of Collapse: Shear** • Concept of shear force and shear stress, meaning of shear in RCC beams and slabs • IS code specifications • Various forms/sketches of shear reinforcement in beams	**03**	**10**

	• Design of shear reinforcement with and without bent up bars • Bond: Meaning of bond in RCC, IS code provisions Calculation of Development length of bar		
5	**Design of Slab** • Definition and classification of slabs as one-way and two-way slabs, support conditions, main and distribution steel • IS specifications regarding spacing and cover for reinforcement, effective span, minimum reinforcement • Design procedure on design of simply supported one way slab & one way continuous slab • Design procedure on design of simply supported two way slab with corners free to lift • Design of a flight of a dog-legged staircase	**05**	**20**
6	**Limit State of Serviceability** • Deflection • Control of deflection • Span to effective depth ratio, Modification factor • Cracks, limiting width of crack • Control of cracking	**03**	**10**
7	**Axially Loaded Short Column** • Assumptions for Limit State of Collapse due to compression. • Columns: Definition and classification, slenderness Limit for Short & Long Column, Minimum Eccentricity in column • IS specifications for Longitudinal and transverse reinforcement • Analysis and Design of axially loaded square, rectangular and circular columns with lateral ties	**03**	**10**
8	**Isolated Footing** • Footings: Introduction, Bearing Capacity of Soil, Types of Footings • Critical section for flexure and shear • Design procedure for axially loaded square pad footing with square and rectangular columns	**03**	**10**

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
20%	30%	30%	20%	0%	0%

Suggested List of Experiments / Practicals:

Sr. No.	Name of Topics	Contact Hours
1	Design of beams & Longitudinal and cross section elevation along Length of Singly & Doubly Reinforced Simply Supported Beam	6
2	Design for shear reinforcement & Longitudinal and cross section elevation along Length of Beam with shear reinforcement detailing	6
3	Design & plan, cross section elevation along shorter span of One Way Simply Supported Slab	4
4	Plan & Cross Section elevation of One-Way Continuous Slab	4
5	Design & plan, cross section elevation along shorter span & Longer span of Two Way Simply Supported Slab without torsion steel	4
6	Plan & Cross Section of Dog Legged Stair Case	4
7	Design of axially loaded short column	4
8	Plan & Cross Section elevation of RCC square, rectangular and circular column	4
9	Design & Cross section elevation of square pad footing	4
10	Collecting a set of Professional structural drawings including reinforcement detailing of the components slabs, beams, columns, footings and stair-case shall be collected from nearby local consultants	8
11	Introduction to various design software and analysis of any component	8
Total		**56**

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, videos, e-courses, Virtual Laboratory

Reference Books:

Sr. No.	Title of Book	Author	Publisher
1	RCC theory and design	M.G. Shah and Kale	Tata McGraw Hill Publisher Co. Ltd. New Delhi
2	Illustrated reinforced concrete design (IS: 456-2000)	Dr. V L Shah	Tata McGraw Hill Publisher Co. Ltd. New Delhi
3	Reinforced Concrete Design (IS: 456-2000)	N. Krishna Raju	Structures Publications, Pune
4	Limit State Design	Dr. A.K. Jain	Prentice – Hall of India Pvt. Ltd. New Delhi

IS, BIS & Other Standard Codes: *(should be permitted in examination)*

1. IS: 456-2000

2. IS: 875-1987 Part 1 to 5 Indian Standard Code for Loading Standards