Lok Jagruti Kendra University
University with a Difference

Diploma in Civil Engineering

LJ Polytechnic

Course Code:025050501

Design of Reinforced Concrete Structures

Programme / Branch Name			Diploma in Civil Engineering			
Course Name	Design of Reinforced Concrete Structures				**Course Code**	025050501
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
4	0	2	5	50	50	100	200

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Structural Mechanics

3. Rationale

Infrastructure sector is a key driver for the Indian economy. Most of the residential buildings, commercial and public buildings are designed using reinforced cement concrete due to their long durability and flexibility in size and shape of structures and its members. Students will gain an experience in the implementation of designing on engineering concepts which are applied in field of structural engineering. Students in this course will learn the basic elements governed by bending, shear, axial forces or combination of them are identified and are considered as building blocks of the whole structure. Different methods of design will be briefly described before introducing the limit states of collapse and serviceability. By learning this subject students will be able to do basic R.C.C designs of components of building.

4. Objectives

- ✓ To learn limit state method for design and use of IS Codes for design of reinforces concrete structures.
- ✓ To study the design of Singly R.C. beam, Doubly R.C. beam and Tee beam.
- ✓ To learn the theory of short and long columns and apply it for design.
- ✓ To understand pad footing and sloped footing with its design.
- ✓ To study the concept of one way and two way slabs for design.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcomes	% Weightage	Hours
1.	**Design for Flexure-Fundamentals**	1.1. Introduction 1.2. Size of Beam 1.3. Spacing of Bars 1.4. Classification of beams 1.5. Balanced, Under-reinforced and Over-reinforced Design 1.6. Design Methods	• Explain the Importance and Basic Terms of Design of Reinforced Concrete Structures in Civil Engineering.	10	4
2.	**Limit State Method**	2.1. Singly Reinforced Rectangular beams 2.1.1. Derivation of Formulae 2.1.2. General Values 2.1.3. Types of Problems 2.1.4. Examples	• Classify the Reinforced Beams and Study the Design of Singly R.C. Beams.	25	14
		2.2. Doubly Reinforced beams 2.2.1. Derivation of Formulae 2.2.2. Types of Problems 2.2.3. Examples	• To Study the Necessity and Design of Doubly R.C. Beams.		
		2.3. Flanged beams 2.3.1 Position of Neutral Axis 2.3.2 Derivation of Formulae 2.3.3 Examples	• Explain the Design of Flanged Beam such as Tee Beam.		
3.	**Columns and Isolated Footings**	3.1. Columns 3.1.1. Short and Long Columns 3.1.2. Minimum Eccentricity 3.1.3. Assumptions made for Design 3.1.4. Axially Loaded Tied Columns 3.1.5. Axially Loaded Spiral Columns 3.1.6. Examples	• Knowledge About Short and Long Columns. • Explain the Design of Tied and Spiral Columns.	25	14
		3.2. Isolated Footings 3.2.1. Wall Footings 3.2.2. Axially Loaded Pad Footing 3.2.3. Axially Loaded Sloped Footing 3.2.4. Examples	• Understand the Types of Footing. • Explain the Design of Pad and Sloped Footing.		

4.	**Shear and Development Length**	4.1. Shear in Structural Members 4.2. Flexure and Shear in homogeneous beam 4.3. Design Shear Strength of Concrete 4.4. Shear Reinforcement in Beams. 4.5. Practical Considerations 4.6. Development Length – Pull Out Test 4.7. Code Provision 4.8. Examples	• Understand the Concept of Shear. • Knowledge About Importance of Development Length.	20	10
5.	**Simply Supported Slab**	5.1. Introductory 5.2. Analysis 5.3. One-way Spanning Slab 5.4. Two-way Slab 5.5. Simply Supported Two-way Slab	• Identify the Type of Slab for any Building. • Study the Design Requirements of One-way and Two-way Slabs.	20	14
				Total Hours	**56**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/programme outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	**Sketch Work:** Singly reinforced beam and doubly reinforced beam stress strain diagram, Types of slabs, Tied column and Spiral column , Isolated footing, One way slab,Two way slab.	Develop the Skill of Detailing of Drawing of Reinforced Structures.	6
2.	Solve six examples based on singly R.C beam, Doubly R C beam and Tee beam in excel sheet.	Calculate and Understand Design of Beams and the Use of Excel.	4
3.	Solve six examples based on column and footing.	Calculate and Understand Design of Columns.	4
4.	Solve six examples based on simply supported one-way and two-way slabs.	Calculate and Understand Design of Slabs.	6
5.	Prepare a report on the steel bars,stirrups available in market with size and rate.	Knowledge of Current Market Rates.	2
6.	Visit a construction site for residential & commercial buildings to show reinforcement, cutting and laying and prepare a report on it.	Knowledge about the Reinforcement Binding, Cutting and Laying.	4
7.	Collect typical photographs of building under different stage of construction.	Idea about the Construction Phases of Structure.	2
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1.	Design for Flexure-Fundamentals	40	30	20	0	10	0
2.	Limit State Method	40	30	0	0	0	30
3.	Columns and Isolated Footings	30	40	0	0	0	30
4.	Shear and Development Length	40	20	20	0	0	20
5.	Simply Supported Slabs	30	40	0	0	0	30

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Reinforced Concrete Vol.1 by Dr. H.J. Shah, Charotar Publishing House Pvt. Ltd.

9. Reference Books

1) Limit State Design of Reinforce Concrete by Dr. B. C. Punamiya, A K Jain, Laxmi publications.
2) R.C.C. Design and Drawing by Neelam Sharma, S K Kataria and Sons Publications.
3) Reinforced Concrete Design by Devdas Menon, Mc Graw Hill Publication.
4) Design of Reinforced Concrete Structure by N Krishna Raju,New Age International Publications.

10. List of Publications

1) IS-456 – 2000 by Bureau of Indian Standard.
2) Design aid SP–16 by Bureau of Indian Standard.

11. Open Sources (Website, Video, Movie)

1) www.nptel.ac.in
2) LJP-Civil-Design of Reinforced Concrete Structures (YouTube)