Lok Jagruti Kendra University
University with a Difference

Diploma in Civil Engineering

LJ Polytechnic

Course Code:025050603

Maintenance & Rehabilitation of Structures

Programme / Branch Name	Diploma in Civil Engineering					
Course Name	Maintenance & Rehabilitation of Structures				**Course Code**	025050603
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**
3	0	2	4	50	50	50	150

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

- ✓ Building Materials
- ✓ Construction Technology
- ✓ Concrete Technology

3. Rationale

One of the major concerns of a civil engineer is to take care of the structures, which are already constructed, in order to keep these buildings in utmost workable conditions. Proper building maintenance ensures that the building and the environment remain healthy, clean and safe place to work or reside. Therefore, regular maintenance is necessary for timely identification of deteriorated building elements. The course deals with the maintenance of buildings, concrete repair techniques and materials, special repair techniques and materials used for rehabilitation of various parts of buildings. After completion of this course student will get sound knowledge about maintenance and rehabilitation of structures.

4. Objectives

- ✓ To gain knowledge about various factors causing deterioration to structures.
- ✓ To understand the necessity and importance of maintenance in structures.
- ✓ To learn investigation or diagnosis of various defects in masonry and R.C.C. structures.
- ✓ To learn the selection of relevant materials for any types of repairs in buildings.
- ✓ To get knowledge of rehabilitation of damage in structures.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1.	**Introduction to Maintenance and Repairs**	1.1. Introduction 1.2. Definitions 1.3. Objectives of Maintenance 1.4. Factors Influencing the Maintenance 1.5. Classification of Maintenance 1.6. Mechanism of Deterioration 1.7. Factors Responsible for the Initiation of the Process of Deterioration 1.8. Division of Maintenance	• Understand the Objectives of Building Maintenance. • Understand the Factors Responsible for Deterioration of Buildings.	15	6
2.	**Maintenance and Repair of Finishes**	2.1. Definitions 2.2. Defects in Plastering 2.3. Common Defects Noticed in Painting Works 2.4. Remedial Measures of Paint Defects 2.5. Maintenance and Repair of Bitumen Mastic Surfaces 2.6. Common Defects in Concrete Floors 2.7. Removal of Different Types of Stains	• Identification of Defects in Finishes. • Knowledge of Remedial Measures in Finishes. • Understand Removal of Different Types of Stains.	15	6
3.	**Maintenance and Repair Techniques for Masonry Structures**	3.1. Introduction 3.2. Classification of Cracks 3.3. Nature of Cracks 3.4. Causes of Cracks in Masonry Structures 3.5. Investigations of Cracks 3.6. Cracks in Load Bearing Walls 3.7. R.C.C. Framed Structures 3.8. General Measures of Repairing Masonry Wall Cracks 3.9. Surface Cracks	• Knowledge of Investigation of Cracks in Masonry Structures. • Understand the Procedure to Repair Techniques of Masonry Structures.	20	8

4.	**Maintenance and Repair Techniques for R.C.C. Structures**	4.1. Introduction 4.2. Causes of Damages 4.3. Controlling Measures for Production Stage Defects 4.4. Assessment of Cracks 4.5. Type of Cracking 4.6. Cracking of Hardened Concrete 4.7. Cracking due to Chemical Reaction 4.8. Cracking Due to Weathering 4.9. Cracking Due to Corrosion of Reinforcement 4.10. Thermal Cracking 4.11. Evaluation of Cracks 4.12. Selection of Repair Procedure 4.13. Treatment of Cracks 4.14. Repair Procedures 4.15. Application of Materials 4.16. Polymer Based Repairs 4.17. Resin Based Repairs 4.18. Steps Involved in Epoxy Injection 4.19. Repair and maintenance of Concrete 4.20. Repair of Concrete Floor and Slab System 4.21. Overlays and Surface Treatments 4.22. Leak Sealing	• Knowledge of Causes of Damages in R.C.C. Structures. • Evaluation of Crack, Patterns and amount of Damage. • Selection of Repair Material for Cracks. • Procedure for Repair of Concrete by using Special Materials.	35	15
5.	**Dilapidation of Buildings and their Rehabilitation**	5.1. Life of a Building 5.2. Causes of Dilapidation of Buildings 5.3. Damages of Different Types of Structures 5.4. Failure of R.C.C. Framed Structures 5.5. Assessment of Damage and Repair Methodology 5.6. Method of Sealing 5.7. Providing Additional Steel	• Knowledge of Dilapidation of Buildings. • Assessment of Damage in Structures. • Adoption of Suitable Repair Methodology and Repair Material. • Safety measures Considered in Dismantling and Demolition.	15	7

		5.8. Stitching of Cracks 5.9. Safety Measures in Dismantling of Building			
				Total Hours	**42**

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.	Prepare a report on importance, objectives and types of building maintenance.	Knowledge of Building Maintenance.	2
2.	Prepare a report on causes of distress in a building and point to be keep in mind while inspection of deteriorate structure.	Causes of Distress in Structures.	2
3.	Draw sketches of types of cracks patterns in masonry and R.C.C. structures.	Identification of Crack Patterns.	4
4.	Determine the surface hardness of R.C.C. components of more than 10 year old building by using rebound hammer.	Understand Process of Rebound Hammer Test.	4
5.	Prepare a report on guidelines given by R & B Department or AMC for declaring a building unsafe use or living.	Awareness of Guidelines for an Unsafe Old Building.	4
6.	Draw sketches of equipments and tools used for repair work. (Based on internet and site visits).	Knowledge of Equipments and Tools used in Repair Works.	4
7.	Visit a 30 year old building in a group of students, prepare a report of damage assessment in building. Also show the methods or technique to repair that damage.	Damage Assessment of Building.	4
8.	Seminar- The topic of the seminar shall be given to a group of students.	Microsoft PowerPoint Skills.	4
		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.	Introduction to Maintenance and Repairs	45	55	0	0	0	0
2.	Maintenance and Repair of Finishes	30	35	35	0	0	0
3.	Maintenance and Repair Techniques for Masonry Structures	15	40	35	0	10	0
4.	Maintenance and Repair Techniques for R.C.C. Structures	25	30	35	0	10	0
5.	Dilapidation of Buildings and their Rehabilitation	20	35	30	0	15	0

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

8. Textbook

1) Maintenance & Repair of Civil Structures by B. L. Gupta and Amit Gupta, Standard Publishers Distributors, New Dehli.

9. Reference Books

1) Maintenance, Repair & Rehabilitation and Minor Works of Buildings by P. C. Varghese, PHI Publication.
2) Maintenance and Repairs of Buildings by P.K. Guha, New Central book Agencies, New Dehli.
3) Building Repair and Maintenance Management by P. S. Gahlot, CBS Publishers and Distributors Pvt. Ltd.

10. Open Sources (Website, Video, Movie)

1) www.nptel.ac.in