

Branch Name:	Civil engineering
Program Code:	ET401
Course Name:	Repair & Maintenance of Structure
Course Code:	2ET4010604
Pre-requisite Course:	---

COURSE OBJECTIVE:

After completing this course, student will be able to:

1. To learn about types of maintenance techniques.
2. To understand causes of various types of damages.
3. To know about relevant materials for repair.
4. To learn methods of retrofitting for different structures.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
03	-	02	04	60	40	20	30

DETAILS OF COURSE CONTENTS:

Sr. NO.	TOPIC	Total Hrs.	WEIGHTAGE
1	Basics of maintenance 1.1 Types of Maintenances-repair, retrofitting, re-strengthening, rehabilitation and restoration 1.2 Necessity, objectives and importance of maintenance 1.3 Approach of effective management for maintenance 1.4 Periodical maintenance: check list, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, corrective maintenance procedures and sources 1.5 Pre- and post- monsoon maintenance	06	18%
2	Causes and detection of damages 2.1 Causes of distress in structures 2.2 Construction and design failures 2.3 Condition assessment and distress-diagnostic techniques 2.4 Inspection and evaluating damaged structure	05	18%
3	Materials for maintenance and repairs 3.1 Materials for Repair: Special concretes and mortar, concrete chemicals, construction chemicals, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete, foamed concrete, dry pack, vacuum concrete, asphalt sheeting 3.2 Techniques for Repairs	11	22%

	Gunniting, grouting, Shotcrete, Epoxy injection and Jacketing 3.3 Methods of corrosion protection		
4	Maintenance and repair methods for masonry Construction 4.1 Causes of cracks in walls - bulging of wall, shrinkage, bonding, shear, tensile, vegetation 4.2 Probable crack location: junction of main and cross wall, junction of slab and wall, cracks in masonry joints 4.3 Repair methods based on crack type 4.4 Remedial measures for dampness & efflorescence in wall	10	20%
5	Maintenance and repair methods for RCC Construction 5.1 Repair stages such as concrete removal and surface preparation, fixing suitable formwork, various methods of surface preparation 5.2 Repair options such as grouting, patch repairs, carbonated concrete, cleaning the corroded steel, concrete overlays 5.3 Building cracks and its prevention, common methods for dormant crack repairs 5.4 Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars etc.	10	22%

COURSE OUTCOME:

After completing this course, student will be able to:

1. Decide which type of maintenance is needed for a given damaged structure.
2. Assess causes of damages various types of structures.
3. Select the relevant material for repair of the given structure.
4. Apply relevant method of retrofitting for re-strengthening of structures.
5. Suggest relevant technique to restore the damages of the given structural elements.

LIST OF PRACTICAL:

Sr. No.	Practical / Exercise
1	Prepare a report on (based on internet search) 1. Importance of Maintenance. 2. Various routine maintenance works in building.
2	Prepare a report on (based on internet search) 1. Causes of distress in structures 2. Points to be taken care of during inspection and evaluation of damaged structure
3	Study the maintenance of a nearby building/civil structure being carried out (Or carried out recently) and prepare a case study on it including financial aspects. (this may include study of maintenance of cracks)
4	Study the guide lines of the Municipal Corporation or R& B department, BIS standards etc. regarding declaring buildings/structure are safe for living/use and based on this identify buildings/structures if any in your locality and prepare a case study on it.
5	Seminar(Present case studies and reports prepared in above practical's in seminar)

LIST OF REFERENCES:

Sr.No.	Title	Author
1	Maintenance & Repair Of Civil Structures	B .L.Gupta
2	Maintenance, Repair & Rehabilitation of Buildings	P. C. Varghese
3	Building Repair and Maintenance Management	P. S. Gahlot
4	Repair of Concrete structures	R.T.Allen and S.C.Edwards
5	Maintenance of Buildings	A.C. Panchdhari
6	Handbook on Repairs and Rehabilitation of RCC structure	CPWD, Delhi

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Decide which type of maintenance is needed for a given damaged structure.	2 Understanding 5 Evaluate 4 Analyze
CLO2	Assess causes of damages various types of structures.	1 Remembering
CLO3	Select the relevant material for repair of the given structure.	2 Understanding, 3 Applying
CLO4	Apply relevant method of retrofitting for re-strengthening of structures.	3 Applying, 2 Understanding
CLO5	Suggest relevant technique to restore the damages of the given structural elements.	3Applying,

Course Learning Outcomes	Program Outcomes(Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO1	L											
CLO2	H	M										
CLO3	I				H		H					
CLO4	M					I						H
CLO5	H	I		L			L		H	H		
CLO6	L	L		L								L

H:High, M:Medium, L:Low