

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	Applied Mechanics
Class, Semester	Third Year B. Tech. Semester VI
Course Code	6OE322
Course Name	Open Elective 2 – Maintenance and Rehabilitation of Structures
Desired Requisites:	Concrete Technology

Teaching Scheme

Examination Scheme (Marks)

Lecture	3 Hrs/week	MSE	ISE	ESE	Total
Tutorial	-	30	20	50	100

Credits: 3

Course Objectives

1	The Degree holder enables to inspect and identifies the damages of civil engineering structures.
2	To make conversant with the techniques for Retrofitting and strengthening of structures.
3	Prepare the plan for maintenance, rehabilitation and strengthening of structure.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Distinguish between different types of causes of damage and decide the appropriate technique of repair according to failure.	Analyzing
CO2	Assess the concrete structure cracks and deteriorations according to essential parameters.	Evaluating
CO3	Select suitable rehabilitation and repair systems and materials that are currently in use, how they work, their limitations and why some are more effective than others	Creating

Module	Module Contents	Hours
I	Introduction to Maintenance Repairs, Rehabilitation & Retrofitting of Structures Introduction to Maintenance, repair and rehabilitation, Distress Identification, Repair Management, causes of deterioration and durability aspects, Holistic Model of Deterioration of RCC: Model I, Model II, Model III, Permeability of concrete Durability Aspects, Intrinsic & extrinsic causes and stages of distress.	7
II	Condition Survey & Non-Destructive Evaluation Condition survey: objective, stages, flow chart, preliminary inspection, planning stage, visual inspection, field/laboratory testing, principal test methods, considerations for repair strategy.	6
III	Structural Deterioration Analysis Requirement of analysis, residual strength, reserve strength, Identification of Critical Section, Active and Passive Repair, Modeling of Repaired Composite Structure, Structural System & Its Validation, Mechanical Properties of Materials, Evaluation of Damage to Concrete/Reinforcement, Evaluation of Building Configuration, Load Tests	6
IV	Repair Materials Essential parameters for repair materials, materials for surface preparation, premixed cement concrete/mortars (modified with non-polymeric admixtures/additives), polymer modified mortars and concrete, properties of polymer latexes, fields of application, epoxies and epoxy systems including epoxy mortars/concretes, surface coatings.	6

V	Rehabilitation and Retrofitting Methods Grouting & crack repair, patch repair, replacement of structurally weak concrete, replacement of spalled, and/or delaminated concrete, replacement of carbonated concrete surrounding steel reinforcement, concrete removal and surface preparation, form work, repairs using mortars, portland cement mortars, polymer modified cement mortars, epoxy mortars, dry pack and epoxy bonded dry pack, pre-placed aggregate concrete, shotcrete, concrete replacement epoxy bonded concrete, silica fume concrete, polymer concrete system.	7
VI	Corrosion Protection for Reinforcement Mechanism of corrosion, preventive measures, types of corrosion resistant reinforcement, repair methods, materials. Repair of damaged water retaining structures, hydraulic structures, underwater repair.	7

Textbooks

1	P.K. Guha, "Maintenance and Repairs of Buildings", New Central book Agencies Publications, 5 th Edition, 2015.
2	Nayak B. S., "Maintenance Engineering For Civil Engineers" Khanna Publication, 2 nd Edition, 2011.
3	Hutchin B. D., "Maintenance and Repairs of Buildings", Newnes Butterworth Publications, 6 th edition, 1975.

References

1	Allen R. T. and Edwards S. C., Repair of Concrete Structures, Blakie and Sons, UK, 1987.
2	Raikar R. N., Learning from Failures Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
3	Campbell D., Allen and Roper H., Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
4	Santhakumar A. R., Training Course notes on Damage Assessment and Repair in Low Cost Housing , RHDC-NBO, Anna University, July 1992.
5	CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG (Works), CPWD, Government of India (Nirman Bhawan),

Useful Links

1	https://archive.nptel.ac.in/courses/105/106/105106202/#
2	https://iitb.vlabs.co.in/discipline.html?discipline=Civil_Engineering

CO-PO Mapping

	Programme Outcomes (PO)												PS O	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1		1									2
CO2			2	2	2									2
CO3			2		2									2

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)