

Course Code	Course Title	L	T	P	C
20SE008	REPAIR AND REHABILITATION OF STRUCTURES	4	0	0	4

PRE-REQUISITE COURSES: CONCRETE TECHNOLOGY

COURSE OBJECTIVES:

The aim of this course is to understand the causes of failure of structures. The objective of this course is to enable students to diagnose distress of structures and to expose students to modern techniques of retrofitting using case studies.

COURSE OUTCOMES:

At the end of the course student will be able to

CO's	Course Outcomes	PO's
1	Estimate the causes for distress and deterioration of structures.	1,2
2	Apply the NDT for condition assessment of structures, identify damages in RC structures.	2,4
3	Select repair material and retrofitting strategy suitable for distress.	1,2
4	Formulate guidelines for repair management of deteriorated structures.	4,5,7
5	Strengthening of Earthquake and Fire Damaged elements using various techniques.	3,4,6,7

SKILLS:

- ✓ Ability to judge the rate of corrosion in various exposure conditions.
- ✓ Ability to conduct Non Destructive Testing of Structural elements
- ✓ Developing the caliber to provide practical remedial solutions for distress.
- ✓ Ability to select a suitable bonding technique as per the requirements.
- ✓ Ability to judge the effect of fire and earthquake loads on discontinuities.

UNIT-I:

INTRODUCTION: Introduction - present repair practices, distress identification and repair management - Causes of distress in concrete structures-Holistic Models for deterioration of concrete, Permeability of concrete, aggressive chemical agents, durability aspects.

Condition Survey- objectives, different stages-Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy.

UNIT – II:

Non-Destructive evaluation tests- Rebound hammer test-Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing.

Chemical tests-Carbonation tests and chloride content, Corrosion potential assessment- cover meter survey, half-cell potentiometer test, resistivity measurement.

UNIT – III:

METHODS, MATERIALS & IDENTIFICATION OF REPAIR: Evaluation of reserve strength of existing structures, active and passive repairs, modeling of repaired composite structures - Selection of repair materials for concrete-Essential parameters for repair materials-Strength and durability aspects, cost and suitability aspects.

Materials for repair-Premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems, polyester resins, coatings.

Identifying a suitable repair option for certain damage in a structure - Repair stages, Repair methods-guniting, shotcreting, polymer concrete system, reinforcement replacement, strengthening concrete by surface impregnation, polymer and epoxy overlays.

UNIT – IV:

REPAIR METHODS & STRATEGIES: Repair methods - Resin/polymer modified slurry injection, plate bonding technique, ferrocement jacketing, RCC jacketing, propping and supporting - Repair methods- fiber wrap technique, foundation rehabilitation methods, chemical and electrochemical method of repair **Repair/Rehabilitation strategies-** Stress reduction technique, repair and strengthening of columns and beams - Rehabilitation strategies-Compressive strength of concrete, cracks/joints, masonry, foundation, base isolation.

UNIT – V:

REPAIR AND RETROFITTING OF FIRE AND EARTHQUAKE DAMAGED RC BUILDINGS AND CASE STUDIES: Schemes of temporary shuttering damages; Methods of repair and retrofitting, Evaluation and Retrofitting techniques for reinforced concrete elements using various strengthening techniques like External Bonding, NSM, TRM etc. Case studies RC buildings, masonry buildings, bridges, water tanks and gravity dams.

TEXT BOOKS:

1. Raikar, R. N., “Learning from Failures – Deficiencies in Design”, Construction and Service R&D Centre (SDCPL), Raikar Bhavan, 1987.
2. Raikar, R.N. “Diagnosis and Treatment of Structures in Distress”, published by R&D Centre of Structure Designers & Consultants Pvt. Ltd., Mumbai, 1994.

REFERENCES:

1. Raikar, R. N., “Learning from Failures – Deficiencies in Design”, Construction and Service R&D Centre (SDCPL), Raikar Bhavan, 1987.
2. Dov Kaminetzky, “Design and Construction Failures”, Galgotia Publication, New Delhi, 2001.
3. Santhakumar A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007.
4. Govt of India Press, “CPWD Handbook on Repair and Rehabilitation of RCC buildings” New Delhi, 2002.
5. Shen-En Chen, R. Janardhanam, C. Natarajan, “Forensic Practices - Investigation Techniques and Technology”, Ryan Schmidt, Ino-U.S. ASCE, U.S.A., 2010.