Repair and Rehabilitation of Structures

(SYLLABUS)

Course Code	23CE4601B	Year	III	Semester	II
Course Category	Professional Elective-II	Branch	CIVIL	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	SoM, CT, DDRCS
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks:	100

Course Objectives:

The objective of this course is:

- Familiarize students with the mechanisms of deterioration in concrete structures and the importance of designing durable concrete systems.
- Equip students with knowledge of materials used for repair and rehabilitation, including admixtures, fibers, FRP composites, and steel plates.
- Introduce students to various field monitoring and non-destructive evaluation (NDT) techniques for assessing the condition of concrete structures.
- Develop the ability to design and suggest appropriate repair and strengthening strategies for deteriorated structures, including composite-based repairs.
- Enable students to understand serviceability assessment, residual life estimation, and performance evaluation of structures through visual inspection and in-situ tests.

Course Outcomes:

Course will enable the student to:

CO	Statement	BL
CO 1	Explain the mechanisms of deterioration in concrete structures and evaluate principles for designing durable concrete systems.	L4
CO 2	Apply appropriate field monitoring techniques and interpret results obtained from non-destructive evaluation (NDE) methods.	L3
CO 3	Develop suitable repair strategies for damaged concrete structures, including the use of composite repair systems.	L4
CO 4	Examine and select suitable strengthening techniques for reinforced concrete structural components	L4
CO 5	Assess serviceability and estimate residual life of concrete structures using visual inspection and in-situ testing.	L4

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	–	1	–	–	1	1	3	2
CO2	3	3	2	2	2	–	–	–	1	1	1	3	2
CO3	3	3	3	2	1	–	1	–	1	1	1	3	3
CO4	3	3	3	2	2	–	–	–	1	1	1	3	3
CO5	3	3	2	3	1	–	1	–	1	1	1	3	2

Syllabus

Unit No	Content	Mapped COs
I	Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation-Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.	**CO1, CO2, CO5**
II	Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.	**CO4**
III	Bonded installation techniques-Externally bonded FRP-Wetlay upsheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDC debonding-plate end de bonding-strengthening of floor of structures post grout tests. Introduction to Liquefaction & its effects & applications.	**CO3, CO4**
IV	Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes	**CO1**
V	High performance concretes-Introduction-Development of high-performance concretes- Materials of high-performance concretes-Properties of high-performance concretes-Self Consolidating concrete-properties-qualifications.	**CO1, CO5**

Learning Resource(s)

Text Book(s)

1. Maintenance Repair Rehabilitation & Minor works of Buildings -P.C.Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures–P.I.Modi,C.N.Patel,PHI Publications
3. Rehabilitation of Concrete Structures-B.Vidivelli,Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors

Reference Book(s)

1. Concrete Technology Theory and Practice-M.S.Shetty, S.Chand and Company
2. Concrete Repair and Maintenance illustrated-Peter H Emmons
3. Concrete Chemical Theory and Applications-Santa Kumar A.R.,Indian Society for Construction Engineering and Technology, Madras
4. Hand book on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

Web Materials:

1. Maintenance and Repair of Concrete Structures: https://nptel.ac.in/courses/105106202
2. Retrofitting and Rehabilitation of Civil Infrastructure: https://nptel.ac.in/courses/105105213

Faculty **HoD-CE**