

Branch Name:	Civil Engineering (Computer Aided Structural Analysis & Design)
Semester/Year:	Semester III/ Second Year
Subject Title:	Rehabilitation and Retrofitting of Structures (Elective -III)
Subject Code:	2ET2060301T
Pre-requisite:	Concrete Technology

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	4	0	0	4	24	60	16	40	00	00	00	00	100

Course Objective:

To learn all aspects of rehabilitation and retrofitting of buildings

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Durability of concrete: Factors affecting durability of concrete, Corrosion of reinforcements in concrete, Carbonation, Chloride ingress, Alkali-silica reaction, Freeze-thaw effects, Chemical attack, Abrasion, erosion and cavitation, Weathering and efflorescence	08	20	
2	Defects and deterioration in buildings, Survey and assessment of structural conditions in RCC structures. Damage/condition assessment and various methods (for quantification) for its evaluation, Rapid Visual Screening (RVS) and ways to do RVS of damaged/deteriorated structures, Overview of health monitoring techniques.	08	20	
3	Non-destructive testing of concrete quality, Non-destructive testing of connections in steel, Corrosion assessment in reinforcements in RCC elements and components in steel structures; Design principles, techniques and working mechanism various instruments used for NDT evaluations (for strength, durability etc.) like Rebound Hammer, UPV, impact echo etc.; Technology used in various advanced instruments like Imaging techniques, GPR, Thermography, Tomography etc.	11	25	
4	Materials for repairs, rehabilitation and retrofitting processes, Methods for repairs, rehabilitation and retrofitting including surface preparation, Study of failures of buildings and lesson learnt, Role of quality control in construction as Preventive Measures Maintenance of buildings.	11	25	
5	Strengthening of Earthquake-damaged buildings; Introduction to Push over analysis.	04	10	

List of Tutorials:

- Study of rehabilitation/retrofitting of RCC/Masonry buildings covering (a) damage assessment by visual inspection and using various techniques including NDT (b) one/two alternatives for rehabilitation/retrofitting (considering strength criteria & serviceability criteria).
- Case study of construction and design failures.
- Market survey for material for repairs.
- Case study of repairing/rehabilitation structures and retrofitting of EQ damage/deficit structure.
- Presentations / finding engineering applications /preparation of learning material based on the syllabus.

Course Outcome:

After learning the course, the students should be able to:

- Detect defects and deterioration in buildings,
- Survey and assess structural conditions in RCC structures,
- Understand and apply rehabilitation and retrofitting processes,
- Understand non-destructive testing and interpretation of the results for concrete and steel structures

List of Reference Books

1. Concrete Microstructures, properties and materials - P Kumar Mehta and Paulo J. M. Monterio, 2014.
2. Properties of concrete - A. M. Neville, 2014.
3. Materials for construction - Lai, James, S. 1997.
4. Structural condition assessment - Robert T. Ratay, 2005
5. Handbook of retrofitting earthquake damaged buildings, 2016

Learning website:

<http://nptel.ac.in/>

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Detect defects and deterioration in buildings,	L-5
CLO2	Survey and assess structural conditions in RCC structures	L-3 L-4 and L-5
CLO3	Understand and apply rehabilitation and retrofitting processes,	L-2
CL04	Understand non-destructive testing and interpretation of the results for concrete and steel structures	L-1 and L-2

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CLO1	M	M		M		M	M		M				M	H	M
CLO2	M	M		M		M			M				M		M
CLO3	M	M		M	H	M		M	M			H	M		M
CLO4	M	M		M	H	M		M				M	M	M	M

H: High, M: Medium, L: Low