GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code : 116AU01

Subject Name : Forensic Structural Engineering Studio

WEF Academic Year:	2023-24
Semester:	VI
Category of the Course:	Minor

Prerequisite :	**Basic Civil Engineering, Structural analysis, Design of concrete structures**
Rationale :	In light of the construction failures that are crippling the nation and world, investigation of the failures and getting to understand the root cause of failure has gained lot of importance. This subject will equip the students with skills and knowledge needed to investigate the damages in structures, understand nuances of preliminary and detailed investigation of distressed structures and develop the skill set to prepare a comprehensive report based on the observations and findings.

Course Scheme : Forensic Structural Engineering Studio

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
2	0	6	5	50	-	50	-	100

Course Content: Forensic Structural Engineering Studio

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Understanding of FSE, Structural audit:** Introduction to scope of structural audit, regulatory framework encompassing structural audit, qualification and expertise requirement of structural auditors, frequency of auditing and allied documentation.	4	10
2	**Damage assessment procedure:** General outline of damage assessment procedure comprising of visual inspection, Non-destructive testing methods, material sampling and field and laboratory testing, risk assessment to identify potential hazards and risks associated with observed damage	6	20
3	**Rapid visual screening/inspection of structures:**	6	20

	Need for rapid visual screening of structures, tools to be carried while inspecting, inventory of items to be looked for while RVS, mapping of distress in the Rapid Visual inspection format		
4	**Preliminary and detailed investigation:** Objective of preliminary and detailed investigation, scope and methodology of preliminary and detailed investigation i.e., review of records and condition survey, reporting of findings of preliminary and detailed investigations	6	25
5	**Damage Assessment allied Tests (Destructive, Semi-destructive, Non-destructive):** NDT tests methods for strength estimation of concrete such as Visual tactile / sounding methods, Rebound hammer test, Ultra-sonic pulse velocity test, Windsor Probe test, semi-destructive testing methods such as Pull-off test, Pull-out (LOK) test, Cut and Pull out (CAPO) test, Break-off test, Core test, Test for Carbonation of concrete and Test for chloride content of concrete, Tests for detection of cracks/ voids / delamination such as Acoustic Emission technique, Radar technique, Stress wave propagation methods and Infrared thermography. Tests to detect the corrosion potential of concrete such as Half-cell Potential measurements, Concrete resistivity measurements, Polarization resistance technique and Cover thickness measurement.	6	25
	Total	**28**	**100**

Reference Book :

1. Forensic Structural Engineering Handbook, Robert T. Ratay, McGraw-Hill Professional; 2nd edition (16 January 2010).
2. Forensic Engineering: Damage Assessments for Residential and Commercial Structures, Stephen E. Petty, CRC Press; 2nd edition (24 September 2021)
3. Structural Condition Assessment, Robert T. Ratay, John Wiley & Sons Inc; 1st edition (11 February 2005)
4. Repair And Rehabilitation Of Concrete Structures, Modi P.I. and Patel Chirag, PHI Learning Pvt Ltd (1 January 2016)

Course Outcome:

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	Identify the terminology related to structural audit and damage assessment, rapid visual inspection of distressed structures.	UN,RM
02	Apply the concepts of assessment and develop the investigation reports based on the findings.	AP, AN,EL
03	Determine the level of damage in the materials by inferring the results of the damage assessment tests.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List :

1. Perform a Rapid Visual survey of distressed RCC or masonry building and capture all the major and minor damages.
2. For the same distressed building that is surveyed in activity 1, prepare a short investigation report properly citing the test methods to be used to quantify the damage.
3. Prepare laboratory samples of concrete cubes, beams and subject these specimens to different types of distress and evaluate the loss in strength and quality using NDT methods.

List of Laboratory/Learning Resources Required:

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