GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Forensic Structural Engineering

Course / Subject Code: BE040AU021

Course / Subject Name : Construction Failures

w. e. f. Academic Year:	**2025-26**
Semester:	4th
Category of the Course:	Core Courses

Prerequisite:	
Rationale:	Rapid economic development and fast-track modern construction practices can trigger catastrophic structural failures. To investigate structural failures scientifically, this program will become very useful. This program would help to understand Forensic Science & Law, appreciated and investigate construction failures along with Structural evaluation of existing structures, the experience of material testing and non-destructive testing, Prevention and resolution of Construction Disputes etc. Forensic Structural Engineering Studio will give opportunity to students to work on case studies as well as live projects.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Classify the different types of failures encountered in structures.
02	Distinguish the failures and repairs in Masonry and Concrete.
03	Relate the solution with the problem

Teaching and Examination Scheme:

Teaching – Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE I	PA (M)	PA/ (I)	PBL/ (I)	ESE (V)	
45	0	30	45	150	4	70	0	0	30	50	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Definition of error, defect, and failure – Causes of failures	10	10
2.	Masonry and Concrete Failures, Repairs	12	20
3.	Man-Made and Natural Failures, Rehabilitation	8	30
4.	Maintenance Problems and Their Solutions	7	20
5.	Lab - Case studies of construction failures	5	20
	Total	42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
40	**30**	**30**	**0**	**0**	**0**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

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)

(b) Open source software and website:

1. https://nptel.ac.in/courses

Suggested Course Practical List:

1. Prepare a presentation on the quality control and safety measures to be taken during construction in order to avoid construction failures. To supplement presentation with real life case-studies of live projects.
2. Prepare a detailed report on any famous "Case study of Failure of any structure"

List of Laboratory/Learning Resources Required: NA

Suggested Project List:

List of Suggested Activities for Problem based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Case study of famous Construction failure – Global level	Duration of study – 5 hrs Report preparation – 5 hrs Total = 10hrs.	Based on the report – Observations made regarding the cause of failure
2.	Site visit of a deteriorated Residential and Commercial buildings	Duration of the visit – 6 hrs (3hrs/each building) Report preparation – 4 hrs Total = 10hrs.	Based on the report – Checklist prepared as per the distress noted and mapped in the report
3.	Self-learning online course	Minimum duration of the course should be 10hrs. Total = 10hrs.	Examination based assessment at the end of course. Based on the certificate produced.
4.	Poster/chart/power point preparation on technical topics	Duration = 6 hrs.	Based on poster/chart Preparation and presentation skills
5.	Technical Video based learning related to the subject	Duration of video = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Report /presentation based on the video learning outcomes.
6.	Technical articles on Quality control and Quality assurance during and post construction to avoid construction failures	4 articles = 20 hrs. (5 hrs/each articles)	Summarize research paper and evaluation critical parameters

7	Group Discussion on Recent construction failure and its technical coverage	Duration = Min. 1 hr. per failure. Max. 3 hrs.	Based on performance in group discussion, technical depth, knowledge etc.
8	Working/non-working model on technical topics	Working = 12 hrs. Non- working = 8 hrs.	Based on inter department/external evaluation
9.	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/sustainability/any other issue	Duration = 15 hrs. for Industrial exposure Problem identification and tentative solution = 10 hrs. Total = 20 hrs.	Based on evaluation of critical problems and solutions
10	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Based on quiz/report submitted
11	Real world case studies-based learning	Duration of data collection/study = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Based on in-depth study, technical depth, data collected, fact finding, etc.
12	Application/Software	Duration = 10 hrs.	Depending on the complexity
13.	Assignment writing. Numerical based assignment is preferable.	5 assignments of 4hrs. each. Total = 20hrs.	Based on the correctness of submittedassignment.
14.	Identification and solution Of Complex problem	Maximum 2 problems. Study of the problem and solution finding, Total = 10hrs.	Based on the depth of the solution submitted.

Note:

- All the suggested activity should be related to the subject.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
- Rubrics for the evaluation can be prepared by the faculty.

- Subject teacher can add the relevant activities other than those listed above, with the consent of head of the department and DQAC.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record- keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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