GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (STRUCTURAL ENGINEERING) (20)

REHABILITATION AND RETROFITTING OF STRUCTURES

SUBJECT CODE: 2732004

M.E. SEM-III

Type of course: Elective

Prerequisite: Concrete Technology .

Rationale: Concrete buildings have certain useful life depending on the specifications adopted. The large numbers concrete buildings have shown sign of distress due to age, aggressive natural environment/ industrial pollution, overloading/misuse of buildings etc. Further, some of the buildings also got damaged due to natural disaster like earthquake. Such buildings need minor and major repair. However, simple and superficial repair to buildings does not restore the lost strength; it only hides the cracks, leaving the building in a weakened state. Thus, rehabilitation and retrofitting of buildings are of vital importance.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Course Content:

Sr. No.	Course Content	Total Hrs	% 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	04	10

	analysis.		

Reference Books:

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

Course Outcome:

After learning the course the students should be able to:

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

List of Experiments:

1. 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).
2. Retrofitting of EQ damaged/deficit building with pushover analysis using computer software like SAP/ETABS/MIDAS etc.
3. Case study of construction and design failures.
4. Market survey for material for repairs.
5. Case study of repairing/rehabilitation structures and retrofitting of EQ damage/deficit structure.
6. Presentations / finding engineering applications /preparation of learning material based on the syllabus.

Design based Problems (DP)/Open Ended Problem:

Major Equipments: --

List of Open Source Software/learning website: http://nptel.ac.in/

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.