



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-2

Subject: Maintenance & Rehabilitation of Structures – DETCV14212

Type of course: Minor Stream

Prerequisite: Construction Material

Rationale: The work done to keep an existing building in a state where it can continue to carry out its intended functions is known as maintenance. In addition to increasing a building's or structure's useful and aesthetic value, proper maintenance also prolongs its lifespan and guarantees user safety. A normally built building only lasts 40 to 50 years before beginning to deteriorate if improperly maintained. A building's lifespan may be shortened by poor upkeep and a lack of repairs. However, the lifespan of typically designed buildings and structures can be increased to 100 years with routine inspection and maintenance that allows for the prompt identification of degraded elements and the implementation of suitable corrective procedures. The maintenance and preservation of historical monuments may benefit from the knowledge and abilities acquired in this course. As a result, this subject is crucial for civil engineers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
03	00	02	04	60	30	10	20	30	150

Legends: CI, Class Room Instructions; T – Tutorial; P, Practical; C – Credit; ESE, End Semester Examination; MSE, Mid Semester Examination; V – Viva; CA, Continuous Assessment; ALA, Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	Maintenance of Buildings Introduction, Importance of maintenance, Types of maintenance, daily, weekly, monthly, Annually, General Maintenance, Painting of Buildings, Home Electricity System	10	10
2	Repair Strategies durability and Serviceability of Concrete Causes of distress in structures, Construction and design failures,	12	25



	Condition assessment and distress-diagnostic techniques, Inspection and evaluating damaged structure., Quality assurance for concrete, construction based on concrete, properties like strength, Permeability, Thermal properties cracking, Effects due to climate, temperature, chemicals, corrosion, Design and construction errors, Effects of cover and cracks		
3	Materials and Techniques for Repair Materials for Repair, Special concretes and mortar, concrete chemicals, construction chemicals, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete, Rust eliminators and polymers coating for rebars, foamed concrete, dry pack, vacuum concrete, asphalt sheeting, Techniques for Repairs, Gunning, grouting and Shotcrete, Epoxy injection, Mortar-repair for cracks Jacketing, shoring and underpinning, Methods of corrosion, Protection, corrosion inhibitors, corrosion resistant steels, coating and cathodic protection	15	25
4	Repair, Retrofitting and Rehabilitation Repair of stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation etc.) Flooring, Roofs (sloping, flat, pitched, etc.), Concrete members due to Steel Corrosion, Lack of Bond, shear, tension, torsion, compression failure, Rainwater Leakage in Buildings, Leakage in Basement, toilet area, Control on Termites (White Ants) in Buildings, Fungus Decay of wood works in Buildings, Estimation of Repair and retrofitting.	12	20
5	Demolition and Dismantling Techniques Define: Demolition, Demolition techniques, Non Engineering Demolition, Manual Demolition, Engineering Demolition, Mechanical Method, Wrecking Ball Method, Pusher Arm technique, Thermic Lance Technique, Non -- Explosive Demolition, Concrete Sawing Method, Deliberate Collapse Method, Pressure Jetting, Implosion, Deconstruction Method, Safety measures during demolition operation, Dismantling of buildings and reuse of materials/fittings from environmental and financial point of view.	10	20

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
01	Case Study Preparation: Split the class into small groups. Give each group a different case study involving a real-world structure (e.g., bridges, buildings, roads) that requires maintenance or rehabilitation. The case should include details like the structure's current condition, identified issues (cracks, rust, misalignment, etc.), and a list of materials used.	10
02	Assessment Phase: Have students analyze the provided case study, identify potential causes of deterioration, and suggest appropriate inspection methods for the structure. Each group should prepare a list of necessary tools for inspection and	10



	recommend methods to assess the structural health (e.g., visual inspection, non-destructive testing, load testing).	
03	Propose Solutions: Based on their findings, each group should propose rehabilitation or repair strategies, including materials to be used, the process of rehabilitation, and potential challenges. Groups should calculate the cost of materials, labor, and expected time for completing the rehabilitation process.	10
Total		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30%	30%	30%	10%	,	,

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may lightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Assess the health condition of structures.
CO2	Inspect and evaluate damage structures.
CO3	Test the assess the condition of properties of existing concrete structures
CO4	Implement the techniques for repairing of concrete structures.
CO5	Dismantle and demolish structures which cannot be repaired in an environment friendly, with maximum saving of materials and in a safe way.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
01	Prepare a report on (based on internet search) a. Importance of Maintenance. b. Various routine maintenance works in building	01	02
02	Prepare a report on (based on internet search) a. Causes of distress in structures b. Points to be taken care of during inspection and evaluation of damaged structure	02	04
03	Study the maintenance of a nearby building/civil structure being carried out (or carried out recently) and prepare a case study on it including financial	02	08



	aspects. (this may include study of maintenance of cracks)		
04	Prepare sketches of equipment/tools for repair works. (Based on internet search and site visits)	03	04
05	Study the preservation work of a historical building being carried out by Archaeological department in nearby location and prepare a report on it.	04	04
06	Study the Demolition/dismantling work of a nearby building/civil structure being carried out (or carried out recently) and prepare a case study on it (including financial aspects and resale value of materials obtained in dismantling).	05	08
	Total		30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e, courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] The construction of Building Vol. I R. Barry
- [2] Building Construction by S. C. Rangwala
- [3] Repair and protection of concrete structures by Noel P. Mailvaganam, CRC Press, 1991.
- [4] Concrete repair and maintenance Illustrated by Peter H. Emmons, Galgotia publications Pvt. Ltd., 2001.
- [5] "Earthquake resistant design of structures" by Pankaj agarwal, Manish shrikande, PHI, 2006.

