

6.3.2 REPAIR AND MAINTENANCE OF CIVIL INFRASTRUCTURE

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RATIONALE

One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject in proper perspective has arisen making students aware of importance of maintenance of buildings.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- CO1 State various factors causing deterioration to buildings
- CO2 Investigate/diagnose various defects in buildings
- CO3 Explain main causes of defects in buildings
- CO4 Select the materials for repair and maintenance of buildings
- CO5 Carry out repairs for various types of building defects

DETAILED CONTENTS

UNIT-I

- 1.1 Concept of repair and maintenance of buildings
 - 1.1.1 Need and objective of repair and maintenance of buildings
 - 1.1.2 Importance and significance of repair and maintenance of buildings
 - 1.1.2 Factors influencing the repair and maintenance
- 1.2 Agencies Causing Deterioration (Sources, Causes, Effects)
 - 1.2.1 Definition of deterioration/decay
 - 1.2.2 Factors causing deterioration, their classification
 - a) Human factors causing deterioration

- b) Chemical factors causing deterioration
- c) Environmental conditions causing deterioration
- d) Miscellaneous factors

1.2.3 Effects of various agencies of deterioration on various building materials

i.e. bricks, timber, concrete, paints, metals, plastics, stones

UNIT-II

2.1 Investigation and Diagnosis of Defects

2.1.1 Concept of Investigation and Diagnosis of Defects

2.1.2 Systematic approach/procedure of investigation

2.1.3 Sequence of detailed steps for diagnosis of building defects/problems

2.1.4 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests.

2.2 Defects and their root causes

2.2.1 Define defects in buildings

2.2.2 Classification of defects

2.2.3 Main causes of building defects in various building elements: -

- a) Foundations, Walls
- b) Basements and DPC
- c) Column and Beams
- d) Roof and Terraces, Joinery
- e) Decorative and protective finishes, Services,

2.3 Defects caused by dampness.

UNIT-III

3.1 Materials for Repair, maintenance and protection

3.2 Compatibility aspects of repair materials

3.3 State application of following materials in repairs:

3.1.1 Anti corrosion coatings

3.1.2 Adhesives/bonding aids

3.1.3 Repair mortars

3.1.4 Curing compounds

3.1.5 Joints sealants

3.1.6 Waterproofing systems for roofs

3.1.7 Protective coatings

UNIT-IV

- 4.1 Remedial Measures for Building Defects
- 4.2 Preventive maintenance considerations
- 4.3 Surface preparation techniques for repair
- 4.4 Crack repair methods- Epoxy injection, Grooving and sealing, Stitching, Adding reinforcement and grouting, Flexible sealing by sealant
- 4.5 Repair of surface defects of concrete: - Bug holes, Form tie holes, Honey comb and larger voids
- 4.6 Repair of corrosion in RCC elements
- 4.7 Steps used in repairing of RCC elements
- 4.8 Prevention of corrosion in reinforcement

UNIT-V

- 5.1 Material placement techniques with sketches
 - 5.1.1 Pneumatically applied (The gunite techniques)
 - 5.1.2 Open top placement
 - 5.1.3 Pouring from the top to repair bottom face
 - 5.1.4 Birds mouth, Dry packing
 - 5.1.5 Form and pump, Preplaced – aggregate concrete
 - 5.1.6 Trowel applied method
- 5.2 Repair of DPC against Rising Dampness: - Physical methods Electrical methods, Chemical methods
- 5.3. Repair of walls: - Repair of mortar joints against leakage, Efflorescence removal
- 5.4 Waterproofing of wet areas, flat RCC roofs, Various water proofing systems and their characteristics
- 5.5 Repair of joints in buildings: - Techniques for repair of joints
- 5.6 Types of sealing joints with different types of sealants
- 5.7 Repair of overhead and underground water tanks

RECOMMENDED BOOKS

1. "Building Defects and Maintenance Management" by Gahlot P.S. and Sanjay Sharma; CBS Publishers, New Delhi
2. "Maintenance Engineering for Civil Engineers" by Nayak, BS; Khanna Publishers, Delhi
3. "Building Failures - Diagnosis and Avoidance" by Ransom; WH Publishing
4. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR..

RECOMMENDED WEBSITES

1. <https://swayam.gov.in/>
2. <https://www.udemy.com/>
3. <https://www.upgrad.com/>
4. <https://www.khanacademy.org/>

INSTRUCTIONAL STRATEGY

This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market. This subject contains five units of equal weightage.