

## Question Bank

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### Unit I: Maintenance and Repair Strategies

**1. Define the terms maintenance, repair, and rehabilitation in the context of civil structures. Answer:**

- **Maintenance:** The routine actions taken to keep a structure in proper working condition, preventing deterioration and failure.
- **Repair:** The process of restoring a damaged structure to its original condition by fixing or replacing defective parts.
- **Rehabilitation:** A more comprehensive process that involves restoring or upgrading a deteriorated structure to improve its performance or extend its lifespan.

**2. What are the key facets of maintenance in civil structures? Answer:** Key facets of maintenance include preventive maintenance, corrective maintenance, and predictive maintenance. These involve regular inspections, timely repairs, and monitoring the condition of structures to predict potential issues before they lead to failure.

**3. Explain the common causes of deterioration in concrete structures. Answer:** Common causes include environmental factors such as exposure to chemicals, temperature variations, moisture, and corrosion of reinforcing steel. Other factors include poor construction practices, design errors, inadequate material quality, and mechanical wear and tear.

**4. Describe the general procedure for assessing a damaged structure. Answer:** The assessment procedure involves:

- **Visual Inspection:** Identifying visible signs of damage such as cracks, spalling, or corrosion.
- **Non-destructive Testing (NDT):** Using methods like ultrasonic testing, radiography, or infrared thermography to evaluate the internal condition without damaging the structure.
- **Load Testing:** Applying controlled loads to assess the structure's strength and performance.
- **Detailed Analysis:** Using engineering principles and calculations to determine the extent of damage and the appropriate repair strategy.

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### Unit II: Serviceability and Durability of Concrete

**1. Discuss the importance of quality assurance in concrete construction. Answer:** Quality assurance ensures that concrete structures meet the required strength, durability, and performance standards. It involves controlling the materials, mix design, and construction practices to prevent defects that could lead to premature deterioration or failure.

**2. What factors affect the durability of concrete structures? Answer:** Durability is influenced by factors such as:

- **Concrete properties:** Strength, permeability, and thermal properties.
- **Environmental conditions:** Climate, temperature, exposure to chemicals, and moisture.
- **Corrosion:** The corrosion of steel reinforcement due to exposure to moisture and salts.
- **Construction practices:** Errors in design and construction, including inadequate cover thickness and improper curing.

**3. Explain the effects of cover thickness and cracking on the durability of concrete structures. Answer:**

- **Cover Thickness:** Adequate cover thickness protects reinforcing steel from corrosion and reduces the ingress of harmful substances like chlorides and moisture. Insufficient cover increases the risk of corrosion.
- **Cracking:** Cracks in concrete allow water, chemicals, and air to penetrate the structure, accelerating corrosion and reducing durability. Proper design and construction practices are essential to minimize cracking.

**4. How do climate and temperature affect concrete structures? Answer:** Climate and temperature can cause expansion and contraction of concrete, leading to thermal stresses and cracking. High temperatures can increase the rate of chemical reactions, while freeze-thaw cycles can cause damage due to the expansion of water in pores. Proper design to accommodate these effects is crucial for durability.

### **Unit III: Materials for Repair**

**1. What are admixtures, and why are they used in concrete? Answer:** Admixtures are materials added to concrete during mixing to modify its properties. They are used to improve workability, increase strength, reduce water content, accelerate or retard setting time, and enhance durability.

**2. Describe the different types of fibres used in concrete repair and their purposes.**

**Answer:**

- **Steel Fibres:** Improve tensile strength, impact resistance, and crack control.
- **Glass Fibres:** Provide resistance to cracking and enhance durability.
- **Carbon Fibres:** Used in wraps for strengthening and retrofitting structures due to their high strength-to-weight ratio and corrosion resistance.

**3. Explain the role of glass and carbon fibre wraps in structural repair. Answer:** Glass and carbon fibre wraps are used to reinforce and strengthen structures, particularly in areas where additional tensile strength is needed. They are lightweight, easy to apply, and provide excellent resistance to corrosion and environmental degradation. These wraps are commonly used in the retrofitting of columns, beams, and slabs.

**4. Discuss the advantages and limitations of using steel plates in structural repair.**

**Answer:**

- **Advantages:** Steel plates provide high strength and stiffness, can be used to reinforce damaged areas, and are effective in retrofitting for increased load-carrying capacity.
  - **Limitations:** Steel plates are susceptible to corrosion, require skilled labor for installation, and add significant weight to the structure.
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## Unit IV: Techniques for Repair and Demolition

**1. What are rust eliminators, and how are they used in concrete repair? Answer:** Rust eliminators are chemicals used to treat corroded steel reinforcement by neutralizing the rust and forming a protective layer that prevents further corrosion. They are applied to the exposed steel before repair work to ensure the longevity of the repair.

**2. Describe the process of epoxy injection and its application in structural repair. Answer:** Epoxy injection is a method used to repair cracks in concrete by injecting a low-viscosity epoxy resin into the cracks. The epoxy bonds the cracked surfaces together, restoring the structural integrity and preventing water ingress. This technique is commonly used in repairing cracks in beams, slabs, and columns.

**3. Compare and contrast Guniting and Shotcrete in concrete repair. Answer:**

- **Guniting:** A dry-mix process where dry cement and aggregate are mixed and then hydrated at the nozzle before being sprayed onto a surface.
- **Shotcrete:** A wet-mix process where all ingredients are mixed together with water before being pumped and sprayed onto the surface.
- **Comparison:** Both are used for applying concrete to surfaces, but shotcrete generally provides better control over the mix and results in a more consistent application.

**4. What are the engineered demolition techniques for dilapidated structures? Answer:** Engineered demolition techniques include controlled explosions, mechanical demolition using heavy machinery, and deconstruction by dismantling the structure piece by piece. These methods are selected based on the structure's condition, location, and the surrounding environment. Safety and environmental impact are key considerations in choosing the appropriate technique.

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## Unit V: Investigation of Structures

**1. What are the preliminary test methods used in investigating distressed structures? Answer:** Preliminary test methods include:

- **Visual Inspection:** Identifying visible signs of distress such as cracks, spalling, and deformation.
- **Non-destructive Testing (NDT):** Methods like ultrasonic pulse velocity, rebound hammer test, and infrared thermography to assess the internal condition of the structure.
- **Load Testing:** Applying loads to determine the structural capacity.

- **Material Testing:** Sampling concrete or steel for laboratory testing to determine strength and composition.

**2. Explain the importance of case studies in understanding rehabilitation techniques.**

**Answer:** Case studies provide real-world examples of rehabilitation techniques, demonstrating the challenges faced and the solutions implemented. They offer valuable insights into the effectiveness of various repair methods and materials, helping engineers to learn from past experiences and apply best practices in future projects.

**3. Describe a typical case study involving the rehabilitation of a bridge pier. Answer:**

A typical case study might involve the rehabilitation of a corroded bridge pier where the concrete had deteriorated due to chloride attack. The rehabilitation process could include removing the damaged concrete, treating the exposed steel with rust eliminators, applying corrosion inhibitors, and then repairing the concrete using shotcrete or epoxy injection. The case study would detail the assessment, materials used, and the outcomes of the repair.

**4. How are heritage structures investigated and rehabilitated? Answer:** Heritage structures are investigated with care to preserve their historical value. Techniques include detailed visual inspections, material analysis, and structural assessments. Rehabilitation involves using materials and methods that are compatible with the original construction, such as lime-based mortars and traditional masonry techniques. The goal is to maintain the structure's integrity while preserving its historical significance.