

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)
SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

M.E-STRUCTURAL ENGINEERING

QUESTION BANK



I SEMESTER / I YEAR

PST102- MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

Regulation 2023

Academic Year: 2026– 2027 (ODD SEM)

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SUBJECT : MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

SEM / YEAR: I/ I

UNIT I MAINTENANCE AND REPAIR STRATEGIES

Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures- Service life behaviour - importance of Maintenance, causes and effects of deterioration. Non-destructive Testing Techniques.

PART A

Q.No.	Questions	BT Level	Competence
1	Define maintenance of a structure.	BT1	Remember
2	Define repair in the context of concrete structures.	BT1	Remember
3	What is meant by rehabilitation of a structure?	BT1	Remember
4	List the objectives of structural maintenance.	BT1	Remember
5	What is retrofit?	BT1	Remember
6	Define structural strengthening.	BT1	Remember
7	State the meaning of service life of a structure.	BT1	Remember
8	List any four causes of deterioration in concrete structures.	BT1	Remember
9	Identify two environmental factors that cause structural deterioration.	BT1	Remember
10	Name any four non-destructive testing techniques used for concrete.	BT1	Remember
11	State the purpose of the rebound hammer test.	BT1	Remember
12	What is ultrasonic pulse velocity testing?	BT1	Remember
13	List the stages generally considered in the service life of a concrete structure.	BT1	Remember
14	State the importance of preventive maintenance.	BT1	Remember

15	List two differences between repair and rehabilitation.	BT2	Understand
16	Explain the need for rehabilitation of ageing structures.	BT2	Understand
17	Explain the role of retrofit in improving structural performance.	BT2	Understand
18	Describe the effect of poor maintenance on service life.	BT2	Understand
19	Explain how moisture contributes to deterioration of concrete.	BT2	Understand
20	Describe the basic principle of the rebound hammer test.	BT2	Understand
21	Explain the basic principle of ultrasonic pulse velocity testing.	BT2	Understand
22	Differentiate between destructive and non-destructive testing.	BT2	Understand
23	Explain why condition assessment is required before repair.	BT2	Understand
24	Describe the relationship between deterioration and loss of serviceability.	BT2	Understand
25	Explain the importance of a planned maintenance programme.	BT2	Understand

Part - B

Q. No.	Questions	BT Level	Competence
1	Apply a suitable maintenance strategy for a reinforced concrete building showing minor surface deterioration.	BT3	Apply
2	Apply the concept of service life to plan periodic inspection of a concrete structure.	BT3	Apply
3	Select an appropriate NDT technique for estimating the uniformity of concrete in a beam and justify the choice.	BT3	Apply
4	Demonstrate how a rebound hammer test can be used as part of a preliminary condition assessment.	BT3	Apply
5	Apply a systematic procedure for assessing a deteriorated reinforced concrete column before repair.	BT3	Apply
6	Use the principles of preventive maintenance to prepare a maintenance schedule for a small public building.	BT3	Apply
7	Apply appropriate repair, rehabilitation and strengthening measures to a structure with reduced load-carrying capacity.	BT3	Apply
8	Illustrate the sequence of activities involved in condition assessment and rehabilitation of an existing structure.	BT3	Apply

9	Apply suitable NDT methods to investigate suspected internal defects in a concrete member.	BT3	Apply
10	Use service-life concepts to recommend maintenance actions for a coastal concrete structure.	BT3	Apply
11	Analyze the lately causes of deterioration in a reinforced concrete structure exposed to continuous moisture.	BT4	Analyze
12	Analyze the effect of delayed maintenance on the performance and service life of a structure.	BT4	Analyze
13	Analyze a condition-assessment case in which rebound hammer and UPV results are inconsistent.	BT4	Analyze
14	Analyze the differences between repair, rehabilitation, retrofit and strengthening for an ageing structure.	BT4	Analyze
15	Analyze how environmental exposure and inadequate detailing can jointly accelerate deterioration.	BT4	Analyze
16	Analyze the information required before deciding whether an existing structure should be repaired or strengthened.	BT4	Analyze
17	Analyze the proposed maintenance programme and identify measures that could improve its effectiveness.	BT4	Analyze
18	Analyze how NDT results can be integrated with visual inspection to establish structural condition.	BT4	Analyze

UNIT II STRENGTH AND DURABILITY OF CONCRETE

Quality assurance for concrete based on Strength, Durability and Microstructure of concrete - NDT techniques- Cracks- different types, causes – Effects due to Environment, Fire, Earthquake, Corrosion of steel in concrete, Mechanism, quantification of corrosion damage.

PART A

Q.No.	Questions	BT Level	Competence
1	Define concrete strength.	BT1	Remember
2	Define durability of concrete.	BT1	Remember
3	What is meant by microstructure of concrete?	BT1	Remember

4	List the main factors affecting concrete durability.	BT1	Remember
5	Name two common non-destructive tests for concrete.	BT1	Remember
6	Define a cracking in concrete.	BT1	Remember
7	List any four common types of cracking in concrete.	BT1	Remember
8	State two causes of plastic shrinkage cracking.	BT1	Remember
9	What is thermal cracking ?	BT1	Remember
10	List two effects of fire on concrete.	BT1	Remember
11	List two effects of earthquake loading on concrete structures.	BT1	Remember
12	Define corrosion of reinforcement.	BT1	Remember
13	What is carbonation of concrete?	BT1	Remember
14	What is chloride-induced corrosion?	BT1	Remember
15	List the stages of the corrosion process in reinforced concrete.	BT1	Remember
16	Explain the relationship between water-cement ratio and durability.	BT2	Understand
17	Explain how concrete microstructure influences permeability.	BT2	Understand
18	Describe the causes and effects of corrosion-induced cracking.	BT2	Understand
19	Explain the difference between active and dormant cracking.	BT2	Understand
20	Describe how environmental exposure affects concrete durability.	BT2	Understand
21	Explain the effect of high temperature on concrete properties.	BT2	Understand
22	Explain how corrosion damage can reduce the serviceability of reinforced concrete.	BT2	Understand
23	Describe the purpose of quality assurance in concrete construction.	BT2	Understand
24	Explain the role of NDT in assessing concrete strength and quality.	BT2	Understand
25	Describe the mechanism by which carbonation can initiate reinforcement corrosion.	BT2	Understand

Part - B

Q. No.	Questions	BT Level	Competence
1	Apply suitable quality-control measures to improve the durability of concrete used in a marine environment.	BT3	Apply
2	Apply appropriate NDT techniques to assess the quality of concrete in an existing beam.	BT3	Apply
3	Classify observed cracks in a concrete slab and recommend suitable	BT3	Apply

	preliminary investigation methods.		
4	Apply the principles of durability design to select concrete characteristics for a chloride-exposed structure.	BT3	Apply
5	Use appropriate procedures to estimate the extent of corrosion damage in a reinforced concrete member.	BT3	Apply
6	Apply a systematic approach to investigate cracking in a concrete member exposed to high temperature.	BT3	Apply
7	Apply suitable inspection and testing methods to a reinforced concrete structure affected by earthquake loading.	BT3	Apply
8	Use the principles of carbonation and chloride ingress to propose an inspection plan for reinforcement corrosion.	BT3	Apply
9	Apply quality-assurance procedures to control concrete strength and durability during construction.	BT3	Apply
10	Demonstrate how NDT results can be used to identify zones of potentially poor-quality concrete.	BT3	Apply
11	Analyze the relationship between concrete microstructure, permeability and durability.	BT4	Analyze
12	Analyze the probable causes of cracking in a reinforced concrete slab subjected to environmental exposure.	BT4	Analyze
13	Analyze the deterioration mechanism of reinforcement subjected to carbonation and chloride ingress.	BT4	Analyze
14	Analyze the changes in concrete properties after exposure to elevated temperatures.	BT4	Analyze
15	Analyze the likely failure mechanisms of a deteriorated reinforced concrete member under earthquake loading.	BT4	Analyze
16	Analyze corrosion-damage measurements and identify their implications for structural performance.	BT4	Analyze
17	Analyze how inadequate concrete quality can accelerate cracking and reinforcement corrosion.	BT4	Analyze
18	Analyze a concrete quality-assurance programme and identify gaps that may compromise durability.	BT4	Analyze

UNIT III REPAIR MATERIALS AND SPECIAL CONCRETES

Repair materials - Various repair materials, Criteria for material selection, Methodology of selection, Special mortars and concretes- Polymer Concrete and Grouting materials- Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets.

PART A

Q.No.	Questions	BT Level	Competence
1	Define repair material.	BT1	Remember
2	List of any four commonly used repair materials.	BT1	Remember
3	What is polymer concrete?	BT1	Remember
4	Define grouting material.	BT1	Remember
5	What is a bonding agent?	BT1	Remember
6	What is a latex emulsion?	BT1	Remember
7	What is an epoxy bonding agent?	BT1	Remember
8	List of two types of protective coatings used for concrete.	BT1	Remember
9	List of two types of protective coatings used for steel.	BT1	Remember
10	What are FRP sheets?	BT1	Remember
11	State two criteria for selecting a repair material.	BT1	Remember
12	List of two properties required for a durable repair material.	BT1	Remember
13	Name two applications of grouting.	BT1	Remember
14	List two advantages of epoxy bonding agents.	BT1	Remember
15	List of two applications of polymer concrete.	BT1	Remember
16	Explain the importance of compatibility between repair material and substrate.	BT2	Understand
17	Explain the criteria used for selecting repair materials.	BT2	Understand
18	Describe the basic purpose of grouting in structural repair.	BT2	Understand
19	Explain the function of bonding agents in concrete repair.	BT2	Understand
20	Differentiate between latex-based and epoxy-based bonding agents.	BT2	Understand
21	Explain the role of protective coatings in extending service life.	BT2	Understand
22	Describe the basic mechanism of polymer concrete.	BT2	Understand
23	Explain the advantages of FRP sheets for strengthening concrete	BT2	Understand

	members.		
24	Describe factors affecting the performance of repair materials.	BT2	Understand
25	Explain why surface preparation is important before applying repair materials.	BT2	Understand
Part - B			
Q. No.	Questions	BT Level	Competence
1	Apply suitable criteria to select a repair mortar for a deteriorated concrete surface.	BT3	Apply
2	Select appropriate grouting material for filling voids in a reinforced concrete member and justify the choice.	BT3	Apply
3	Apply a suitable bonding-agent system for joining new concrete to an existing concrete surface.	BT3	Apply
4	Use polymer concrete to develop a repair solution for a localized concrete defect.	BT3	Apply
5	Apply appropriate protective coating requirements for reinforced concrete exposed to aggressive environmental conditions.	BT3	Apply
6	Select a suitable protective coating system for structural steel exposed to a corrosive environment.	BT3	Apply
7	Apply FRP sheets to strengthen a deficient reinforced concrete beam and outline the installation sequence.	BT3	Apply
8	Demonstrate a procedure for preparing a concrete substrate before applying to an epoxy bonding agent.	BT3	Apply
9	Apply a material-selection methodology to choose between cementitious, polymer-modified and epoxy repair systems.	BT3	Apply
10	Use the properties of special mortars to select a repair material for a thin damaged concrete section.	BT3	Apply
11	Analyze the compatibility requirements between an existing concrete substrate and a proposed repair material.	BT4	Analyze
12	Analyze the factors governing the selection of grouting materials for structural repair.	BT4	Analyze
13	Analyze the expected performance of latex and epoxy bonding	BT4	Analyze

	agents under different exposure conditions.		
14	Analyze the suitability of polymer concrete for repairing a heavily deteriorated concrete member.	BT4	Analyze
15	Analyze the causes of poor bond between repair material and existing concrete.	BT4	Analyze
16	Analyze the advantages and limitations of different protective coating systems for concrete and steel.	BT4	Analyze
17	Analyze the factors that influence the effectiveness of FRP sheet strengthening.	BT4	Analyze
18	Analyze a proposed repair-material selection and identify technical reasons for rejecting an incompatible material.	BT4	Analyze

UNIT IV PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING

Concrete protection methods – reinforcement protection methods- cathodic protection - Sacrificial anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, Structural health monitoring.

PART A

Q.No.	Questions	BT Level	Competence
1	Define concrete protection.	BT1	Remember
2	What is reinforcement protection?	BT1	Remember
3	Define cathodic protection.	BT1	Remember
4	What is a sacrificial anode?	BT1	Remember
5	List two corrosion-protection techniques.	BT1	Remember
6	Define corrosion inhibitor.	BT1	Remember
7	List two types of concrete coatings used for corrosion protection.	BT1	Remember
8	What is corrosion-resistant steel?	BT1	Remember
9	What is meant by reinforcement coating?	BT1	Remember
10	Define structural health monitoring.	BT1	Remember
11	List two parameters commonly monitored in structural health monitoring.	BT1	Remember
12	State the purpose of cathodic protection.	BT1	Remember

13	List two advantages of sacrificial-anode systems.	BT1	Remember
14	Name two methods of protecting reinforcement from corrosion.	BT1	Remember
15	List of two applications of structural health monitoring.	BT1	Remember
16	Explain the basic principle of cathodic protection.	BT2	Understand
17	Explain the working principle of a sacrificial anode system.	BT2	Understand
18	Describe the role of corrosion inhibitors in reinforced concrete.	BT2	Understand
19	Explain how concrete coatings reduce corrosion risk.	BT2	Understand
20	Describe the purpose of corrosion-resistant reinforcement.	BT2	Understand
21	Explain the importance of reinforcement coatings.	BT2	Understand
22	Explain the role of sensors in structural health monitoring.	BT2	Understand
23	Differentiate between active and passive corrosion-protection methods.	BT2	Understand
24	Explain how structural health monitoring supports maintenance decisions.	BT2	Understand
25	Describe the factors affecting the selection of a corrosion-protection system.	BT2	Understand

Part - B

Q. No.	Questions	BT Level	Competence
1	Apply a suitable corrosion-protection method for a reinforced concrete structure exposed to marine conditions.	BT3	Apply
2	Select an appropriate cathodic-protection approach for an existing reinforced concrete structure and outline its implementation.	BT3	Apply
3	Apply a sacrificial-anode system to a corrosion-damaged reinforced concrete member and describe the installation procedure.	BT3	Apply
4	Use corrosion inhibitors as part of a protection strategy for a new reinforced concrete structure.	BT3	Apply
5	Apply a concrete-coating system to reduce ingress of aggressive agents into an existing structure.	BT3	Apply
6	Select a suitable reinforcement-protection method for a structure exposed to chloride-rich conditions.	BT3	Apply
7	Apply corrosion-resistant steel to a new structural member and state	BT3	Apply

	the expected benefits.		
8	Develop a basic structural health monitoring plan for an ageing reinforced concrete bridge.	BT3	Apply
9	Apply suitable sensors to monitor strain, vibration and crack development in a structural member.	BT3	Apply
10	Use inspection data to recommend an appropriate corrosion-protection treatment for an existing structure.	BT3	Apply
11	Analyze the suitability of cathodic protection and sacrificial anodes for different corrosion conditions.	BT4	Analyze
12	Analyze the factors governing the effectiveness of corrosion inhibitors in concrete.	BT4	Analyze
13	Analyze the performance requirements of concrete coatings under severe environmental exposure.	BT4	Analyze
14	Analyze the advantages and limitations of corrosion-resistant steel compared with conventional reinforcement.	BT4	Analyze
15	Analyze how reinforcement coatings can influence long-term corrosion protection and bond performance.	BT4	Analyze
16	Analyze structural health monitoring data to identify possible changes in structural condition.	BT4	Analyze
17	Analyze a proposed corrosion-protection system and identify factors that may cause premature failure.	BT4	Analyze
18	Analyze how structural health monitoring can be integrated with inspection and maintenance planning.	BT4	Analyze

UNIT V REPAIR, RETROFITTING AND DEMOLITION OF STRUCTURES

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Repair to active cracks, Repair to dormant cracks. Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing Techniques, Strengthening Methods for Structural Elements. Engineered Demolition Case studies.

PART A

Q.No.	Questions	BT Level	Competence
1	Define crack repair.	BT1	Remember
2	What is grouting in crack repair?	BT1	Remember
3	Define routes and sealing.	BT1	Remember
4	What is crack stitching?	BT1	Remember
5	Define dry packing.	BT1	Remember
6	What is autogenous healing?	BT1	Remember
7	Differentiate active and dormant cracks.	BT2	Understand
8	List two methods used for repairing cracks.	BT1	Remember
9	State the purpose of routing before sealing a crack.	BT1	Remember
10	List two applications of crack stitching.	BT1	Remember
11	List two situations where dry packing may be used.	BT1	Remember
12	Define jacketing.	BT1	Remember
13	List three structural elements that can be jacketed.	BT1	Remember
14	What is structural strengthening?	BT1	Remember
15	Define engineered demolition.	BT1	Remember
16	List two methods of strengthening reinforced concrete beams.	BT1	Remember
17	List two methods of strengthening reinforced concrete columns.	BT1	Remember
18	Explain the difference between active-crack and dormant-crack repair.	BT2	Understand
19	Explain the purpose of grouting in structural repair.	BT2	Understand
20	Describe the procedure of routing and sealing.	BT2	Understand
21	Explain the basic principle of crack stitching.	BT2	Understand
22	Describe the concept of autogenous healing.	BT2	Understand
23	Explain the purpose of jacketing for reinforced concrete columns.	BT2	Understand
24	Describe the factors considered in selecting a strengthening method.	BT2	Understand

25	Explain the importance of engineering assessment before demolition.	BT2	Understand
Part - B			
Q. No.	Questions	BT Level	Competence
1	Apply a suitable repair method for a dormant crack in a reinforced concrete slab.	BT3	Apply
2	Apply an appropriate repair method for an active crack and explain the sequence of work.	BT3	Apply
3	Use routing and sealing to repair a suitable surface crack and outline the procedure.	BT3	Apply
4	Apply crack stitching to a cracked masonry or concrete element and describe the installation sequence.	BT3	Apply
5	Select a suitable grouting technique for repairing voids in a structural member.	BT3	Apply
6	Apply dry packing to a localized concrete defect and describe the required surface preparation.	BT3	Apply
7	Apply a suitable repair strategy to corrosion-damaged reinforced concrete slab.	BT3	Apply
8	Apply a suitable repair and strengthening sequence for a corrosion-damaged reinforced concrete beam.	BT3	Apply
9	Select an appropriate jacketing technique for a deficient reinforced concrete column.	BT3	Apply
10	Apply a strengthening method to improve the load-carrying capacity of an existing beam.	BT3	Apply
11	Analyze the causes of cracking in a reinforced concrete member and select the most appropriate repair approach.	BT4	Analyze
12	Analyze the suitability of different crack-repair techniques for active and dormant cracks.	BT4	Analyze
13	Analyze the repair requirements of a corrosion-damaged slab, beam and column.	BT4	Analyze
14	Analyze the effectiveness and limitations of reinforced concrete jacketing for structural strengthening.	BT4	Analyze
15	Analyze alternative strengthening methods for a beam with inadequate flexural capacity.	BT4	Analyze

16	Analyze the factors that should be considered before selecting a demolition method.	BT4	Analyze
17	Analyze an engineered-demolition case and identify the major safety and structural-control requirements.	BT4	Analyze
18	Analyze how repair, retrofitting and demolition decisions should be made based on structural condition and future use.	BT4	Analyze