

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK



VIII SEMESTER

**1903802 - MAINTENANCE, REPAIR AND REHABILITATION OF
STRUCTURES**

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Prepared by

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SUBJECT : 1903802-MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

SEM / YEAR: VIII/IV

UNIT 1- MAINTENANCE AND REPAIR STRATEGIES			
Definitions: Maintenance, Repair and Rehabilitation - Facets of Maintenance - Preventive measures based on various aspects of Inspection - Assessment procedure for evaluating damaged structure - Causes of deterioration and diagnosis.			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Define Maintenance.	BT-1	Remember
2.	List out the facets of maintenance.	BT-1	Remember
3.	Discuss about the scope of maintenance of concrete structures	BT-2	Remember
4.	What are the physical inspections performed on damaged structure?	BT-1	Remember
5.	List out the factors to be considered by the designer at the construction site.	BT-1	Remember
6.	Describe any four causes of deterioration of structures.	BT-1	Remember
7.	List out the steps involved in selecting a repair procedure.	BT-1	Remember
8.	Show the possible decisions that can be made after evaluating the strength of a structure.	BT-1	Remember
9.	Discuss about the environment effects which leads to deterioration of concrete structure.	BT-2	Understand
10.	Discuss about the effect of selecting poor quality material for construction.	BT-2	Understand
11.	Differentiate between preventive maintenance and remedial maintenance.	BT-2	Understand
12.	Discuss about the effect of rain on the service and durability of RCC structures	BT-2	Remember
13.	Differentiate between the terms maintenance and rehabilitation.	BT-2	Understand
14.	Discuss briefly about dormant crack and active crack	BT-2	Understand
15.	Write the importance of maintenance of structures.	BT-3	Application
16.	Classify the types of maintenance.	BT-3	Application
17.	Illustrate the causes of deterioration and explain how it occurs due to corrosion.	BT-3	Application
18.	Analyze the design and construction errors leading to deterioration of a Structure.	BT-1	Remember
19.	Assess the need for special maintenance of structures	BT-2	Understand
20.	Explain why inspection is needed for damaged structure.	BT-2	Understand
21.	How will you evaluate the cause for deterioration of concrete structure?	BT-1	Remember

22.	Criticize about weekly and monthly maintenance.	BT-2	Understand
23.	Explain about the requirements of period maintenance considering the monsoon season.	BT-2	Understand
24.	Assess the various aspects to be investigated during inspection of existing building.	BT-2	Understand
25.	Under what circumstance premature deterioration of concrete takes place? Summarize.	BT-3	Application
PART – B			
1.	What is maintenance? List out the importance of maintenance. Discuss about the necessity of maintenance.	BT-3	Application
2.	List out the various types of maintenance operations and explain it in detail.	BT-3	Application
3.	Describe the various repair strategies for RC buildings.	BT-2	Understanding
4.	i. Differentiate between repair and maintenance of building. ii. List out the causes which necessitate the maintenance.	BT-3	Application
5.	Describe about the inspection to be carried out during and after the construction of structure.	BT-2	Understanding
6.	Discuss about the various aspects of inspection. Classify the types of repair works.	BT-2	Understanding
7.	With graph explain the service life behavior of a concrete structure with respect to maintenance.	BT-3	Application
8.	Identify the various steps involved in the systematic approach of investigations and the factors to be ascertained.	BT-4	Analyze
9.	Discuss about the facets of maintenance. Write down the types of inspection carried out for concrete structure.	BT-3	Application
10.	Examine the various causes of distress in concrete structures mentioning its effects.	BT-4	Analyze
11.	As a site engineer examine what are the factors you would check during the day of concreting to assure quality in construction? Explain in detail.	BT-2	Understanding
12.	With the flow chart analyze the steps involved in the assessment procedure for evaluate damages in a structure and to carry out rehabilitation work.	BT-2	Understanding
13.	Criticize in detail about the preventive aspects of maintenance.	BT-3	Application
14.	Develop a flow chart for structural appraisal and economic appraisal of a building.	BT-3	Application
15.	What is Quality Assurance in concrete construction? Discuss quality assurance of concrete construction.	BT-3	Application
16.	What is meant by distressed concrete? What are the causes of distress in concrete? How it is treated?	BT-3	Application
17.	Explain in detail the repair works to be done on a distressed water tank.	BT-2	Understand

PART-C			
1.	Describe in detail about the repair aspect of maintenance.	BT-4	Analyze
2.	Construct a flow diagram for repair and maintenance during material selection, construction and service life period of a structure.	BT-2	Understanding
3.	Analyze the work involved in rehabilitation work of a structure.	BT-4	Analyze
4.	Elaborate the steps involved in diagnosing the problem in a structure.	BT-2	Understanding
5.	Discuss in detail about causes and effects of any four defects in concrete.	BT-4	Analyze

UNIT II- STRENGTH AND DURABILITY OF CONCRETE			
Quality assurance for concrete – Strength, Durability - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion			
PART – A			
Q.No	Questions	BT Level	Competence
1.	Define the term “Quality assurance” in concrete structures.	BT-1	Remember
2.	List out the requirements of quality management system.	BT-1	Remember
3.	Discuss the importance of quality control.	BT-2	Understand
4.	How thermal variations affect the durability of structures?	BT-4	Analyze
5.	Discuss about the inspection checks performed during quality audit.	BT-4	Analyze
6.	Write note on structural cracks with examples.	BT-3	Application
7.	What are the factors affect the durability of concrete?	BT-1	Remember
8.	Classify the types of cracks based on its thickness.	BT-4	Analyze
9.	Discuss about segregation in concrete.	BT-2	Understand
10.	Explain the effect of bleeding on the durability of concrete	BT-3	Application
11.	Write down the result of poor construction practices.	BT-3	Application
12.	Distinguish between structural cracks and non-structural cracks.	BT-3	Application
13.	Define aggregate splitting.	BT-1	Remember
14.	Discuss about the freezing and thawing effect on concrete	BT-2	Understand
15.	Name the various types of spalling.	BT-1	Remember
16.	How does a concrete structure get affected by heat?	BT-2	Understand
17.	Discuss briefly the effect due to climate.	BT-2	Understand
18.	Tabulate the cover to be provided for various exposure conditions to concrete as per IS codes.	BT-1	Remember
19.	Define corrosion.	BT-1	Remember
20.	Discuss about the sustained elevated temperature.	BT-2	Understand
21.	How can we prevent the effect of freezing and thawing in concrete?	BT-2	Understand
22.	Examine the methods to control the cracks.	BT-2	Understand
23.	State the importance of cover thickness in concrete.	BT-1	Remember
24.	Define durability and name two tests to assess durability of concrete.	BT-1	Remember
25.	Define corrosion inhibitor. Give some examples for corrosion inhibitors.	BT-1	Remember

PART - B			
1.	Why quality assurance for structure is needed? List out the components of quality assurance for building and explain it in detail.	BT-2	Understanding
2.	List the various parameters affecting the quality of concrete construction. Explain any three in detail.	BT-2	Understanding
3.	Explain different types of cracks found in concrete structures. Also list the remedial measures.	BT-2	Understanding
4.	Discuss in detail about the various design errors effecting the quality of concrete structures.	BT-5	Evaluate
5.	Give a detailed note on the property "strength" of concrete discussing its influencing factors and discuss any two methods to enhance it.	BT-4	Analyze
6.	What is crack? Explain the classification and causes of cracks.	BT-2	Understand
7.	Identify the checks you will make on the day of concreting to assure quality of concrete.	BT-3	Application
8.	Explain about the design and constructional errors for concrete building.	BT-2	Understand
9.	i. Illustrate the significance of the carbonation of concrete, passivity of steel and state of oxidation of iron with respect to the corrosion of steel in concrete. (6) ii. What are the effects of corrosion and give the preventive measures for corrosion? (7)	BT-3	Application
10.	i. Write a brief note on permeability of concrete. (7) ii. Discuss the various factors influencing the corrosion. (6)	BT-3	Application
11.	Elaborately explain about the effect of temperature on concrete.	BT-2	Understanding
12.	Analyse the various methods of corrosion in protection of rebar.	BT-2	Understanding
13.	Explain in detail the effects on durability and strength of concrete due to Climate and Chemical.	BT-2	Understanding
14.	Write short note on structural cracks .With chemical equation how will you evaluate the mechanism of corrosion.	BT-3	Application
15.	Elaborate about the techniques for repairing cracks	BT-1	Remember
16.	Illustrate briefly about epoxy injection process?	BT-1	Remember
17.	List out the durability properties of concrete and describe it in detail.	BT-3	Application
PART-C			
1.	Explain in detail about the requirements, mechanism and components of quality management system.	BT-4	Analyze
2.	i. Ideally, from the standpoint of crack resistance, a concrete should have low shrinkage and high extensibility. Give examples to show why this may not be possible to achieve in practice. (8) ii. Illustrate the significance of the carbonation of concrete, Passivity	BT-4	Analyze

	of steel and state of oxidation of iron with respect to the corrosion of steel in concrete. (7)		
3.	List the various types of corrosion in concrete discussing its phenomena, causes and effects. Also suggest any one method of protection against each types of corrosion	BT-2	Understanding
4.	Discuss about the effect of sustained elevated temperature on concrete and steel	BT-4	Analyze
5.	Classify different crack patterns in a reinforced concrete beam and with a neat sketch and explain their causes and remedial measures.	BT-2	Understanding

UNIT III- SPECIAL CONCRETES AND MATERIALS

Mortar - Expansive cement – Ferro cement - Polymer concrete - Sulphur infiltrated concrete Fibre reinforced concrete - High strength concrete - High performance concrete - Geopolymer concrete - Reactive powder concrete - Concrete made with industrial wastes.

PART - A

Q.No	Questions	BT Level	Competence
1.	Mention a salient feature and an application of polymer concrete.	BT-1	Remember
2.	Name the various monomers used in polymer impregnated concrete.	BT-1	Remember
3.	List the various monomers used in polymer cement concrete	BT-1	Remember
4.	List the various types of polymer concrete.	BT-1	Remember
5.	List out the applications of Sulphur infiltrated concrete.	BT-1	Remember
6.	Define aspect ratio.	BT-1	Remember
7.	What do you mean by critical length of fibre.	BT-1	Remember
8.	Discuss about the disadvantages of FRP.	BT-2	Understand
9.	Describe the various types fibres used in FRC.	BT-2	Understand
10.	What is mean by Geopolymer concrete? List the materials used for making geopolymer concrete.	BT-2	Understand
11.	Discuss about FRC.	BT-2	Understand
12.	Differentiate filling ability and passing ability of self-compacting concrete.	BT-3	Application
13.	List out the fields in which polymer impregnated concrete has a wide application.	BT-1	Remember
14.	Interpret for which precast units are sulphur infiltrated concrete best suited?	BT-2	Understand
15.	Write notes on concrete made with industrial wastes.	BT-3	Application
16.	Write notes on vacuum concrete and self-compacting concrete.	BT-3	Application
17.	Discuss in short about SIFCON	BT-2	Understand
18.	Differentiate between polymer impregnated concrete and Polymer partially impregnated concrete.	BT-2	Understand
19.	Write about the characteristics and application of polypropylene fibre	BT-3	Application
20.	What are the applications of special concretes.	BT-2	Understand
21.	Give short notes about the reactive powder concrete.	BT-1	Remember

22.	Enumerate the methods of producing high strength concrete.	BT-1	Remember
23.	Formulate the properties of ferro cement.	BT-2	Understand
24.	List two industrial wastes used as an alternative ingredient in concrete.	BT-1	Remember
25.	Write down the uses of ferro cement.	BT-3	Application
PART – B			
1.	How polymerization is achieved in polymer concrete? Explain in detail.	BT-3	Application
2.	Describe the following type of concrete i. High strength concrete (7) ii. Sulphur infiltrated concrete (6)	BT-1	Remember
3.	i. Explain the behavior of steel fibre reinforced concrete as a repair material. Discuss about the aspect ratio and critical length of fibre.	BT-2	Understanding
4.	How Ferro cement can be used as a material for repair. List out the properties and uses of Ferro cement.	BT-3	Application
5.	With respect to fibre reinforced concrete explain aspect ratio and volume fraction. Also explain their effects on fresh and hardened concrete properties. Explain with its stress-strain curve.	BT-2	Understanding
6.	Explain in detail foamed concrete and vacuum concrete?	BT-2	Understand
7.	Explain the types of fibres used in concrete with its advantages and disadvantages.	BT-4	Analyze
8.	Write short notes on Self compacting concrete and its applications.	BT-3	Application
9.	Write short notes on Sulphur infiltrated concrete and its applications.	BT-3	Application
10.	Explain the manufacturing process, properties and uses of High Performance concrete.	BT-2	Understand
11.	Write short notes on Geopolymer concrete.	BT-3	Application
12.	Illustrate about Fiber reinforced concrete.	BT-2	Understanding
13.	Describe in detail the properties and applications of polymer concrete.	BT-1	Remember
14.	i. Describe in detail about the reactive powder concrete. (7) ii. Write a note on polymer impregnated concrete. (6)	BT-1	Remember
15.	Explain polymer concrete and types of polymer concrete?	BT-2	Understand
16.	Explain high performance concrete and what are the advantages of high performance concrete over conventional concrete?	BT-2	Understand
17.	Explain self-healing concrete and bacterial concrete?	BT-2	Understand
PART - C			
1.	Explain in detail about special material manufacturing procedure and application of polymer modified concrete	BT-2	Understanding

2.	List the methods of testing self compacting concrete and explain the methods in detail.	BT-4	Analyze
3.	Why it is advantage to use fiber reinforced concrete for the following construction works: (i) Water retaining structures (3) (ii) Blast resistant structures (3) (iii) Precast products (3) (iv) Pavement and floors (3) (v) Repair and rehabilitation works (3)	BT-3	Application
4.	Illustrate the behaviour of vacuum concrete and Geopolymer concrete by comparing the properties on uses, manufacturing processes and its advantages.	BT-3	Application
5.	What is light weight concrete? How is it produced? What are the light weight aggregate concrete?	BT-2	Understanding

UNIT IV- TECHNIQUES FOR REPAIR AND PROTECTION METHODS

Non-destructive Testing Techniques, Load Test for Stability - Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

PART – A

Q.No	Questions	BT Level	Competence
1.	Define shoring and write its purpose.	BT-1	Remember
2.	What is the fundamental principle behind rebound hammer test?	BT-1	Remember
3.	Explain stitching methods of repairing crack.	BT-2	Understand
4.	List out some of the corrosion protection methods.	BT-1	Remember
5.	Classify the types of shoring.	BT-1	Remember
6.	Brief the mechanism of cathodic protection.	BT-1	Remember
7.	List out the types of corrosion inhibitors.	BT-1	Remember
8.	What are the various purposes for which ultrasonic pulse method could be adopted?	BT-2	Understand
9.	Name two non-destructive tests used for assessing the quality of concrete.	BT-1	Remember
10.	Discuss about the process of gunite and shotcrete.	BT-2	Understand
11.	Explain the types of corrosion resistant steel.	BT-2	Understand
12.	Describe the properties of coating materials.	BT-2	Understand
13.	Discuss about stitching.	BT-2	Understand

14.	Write the typical ranges of Thermal conductivity, Thermal diffusivity, Specific heat, coefficient of thermal expansion of ordinary concrete.	BT-3	Application
15.	Illustrate an example for corrosion inhibitor and corrosion coating.	BT-3	Application
16.	Write short note on dry pack.	BT-3	Application
17.	Write short note on galvanizing of steel	BT-3	Application
18.	Differentiate between shoring and underpinning.	BT-2	Understand
19.	Distinguish between gunite and shotcrete.	BT-2	Understand
20.	What do you mean by weathering corrosion?	BT-2	Understand
21.	Write about autogenous healing in concrete	BT-3	Application
22.	Evaluate the types of surface protection methods.	BT-3	Application
23.	Write note on jacketing.	BT-3	Application
24.	What are the factors which accelerate corrosion process	BT-2	Understand
25.	Summarize the characteristics of good coatings.	BT-1	Remember
PART - B			
1.	Identify the Non-destructive testing equipment's and describe in detail.	BT-1	Remember
2.	State the uses of surface hardness method and explain it with neat Sketch.	BT-3	Application
3.	Define shoring and explain the types of shoring with neat sketch.	BT-3	Application
4.	State the purpose of underpinning and explain its method with neat sketch.	BT-3	Application
5.	Explain the various methods of polymer coating applied on the surface of rebar.	BT-2	Understand
6.	Discuss about (i) Impact echo test (7) (ii) Carbonation test (6)	BT-2	Understanding
7.	Describe the procedure of fusion bonded epoxy coating of rebars with a simple sketch. Also give the advantages and disadvantages.	BT-1	Remember
8.	Estimate the following NDT techniques as per IS (i) Rebound hammer test. (7) (ii) Ultrasonic pulse velocity. (6)	BT-3	Application
9.	Write short notes on: (i) Protective coatings for reinforcement (7) (ii) Types of corrosion resistant steels (6)	BT-3	Application
10.	Analyse the mechanism of the following corrosion protection methods. (i) Corrosion inhibitors (7) (ii) Cathodic protection (6)	BT-2	Understanding
11.	Examine the method of preventing corrosion in the structure.	BT-2	Understanding
12.	Explain in detail about the different types of shoring.	BT-2	Understanding
13.	Explain in detail the types of corrosion protection methods.	BT-2	Understanding
14.	Summarize the process of epoxy injection. Also explain routing and sealing with sketches.	BT-1	Remember

15.	Briefly the following steps are involved in the protective coating process with merits and demerits of the system.	BT-2	Understanding
16.	Explain the process of Guniting?	BT-2	Understand
17.	Explain Shotcrete in Detail?	BT-2	Understand
PART-C			
1.	Explain in detail about the in-situ load test performed to assess an existing structure.	BT-4	Analyze
2.	Write notes on the following Epoxy injection technique and Polymer coating for rebars.	BT-3	Application
3.	Define the term underpinning. Discuss any two of its methods mentioning its applicability.	BT-4	Analyze
4.	(i) List the significance of performance and integrity test on concrete and explain any one method in detail. (7) (ii) How to estimate the strength of concrete in existing structure? Explain the method in which the longitudinal pulse velocity (km/s) is used to predict the quality of concrete. (8)	BT-4	Analyze
5.	Explain in detail the repair works to be done on a distressed water tank.	BT-5	Evaluate

UNIT V- REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

Strengthening of Structural elements - Repair of structures distressed due to fire, leakage, earthquake - Transportation of Structures from one place to other - Structural Health Monitoring - Demolition of structures using engineered and non-engineered techniques - Case studies

PART - A

Q.No	Questions	BT Level	Competence
1.	List the methods to overcome low member strength in concrete structures.	BT-1	Remember
2.	State the need of accelerated strength.	BT-1	Remember
3.	List the pre-planning activities to be done before demolition of a structure.	BT-1	Remember
4.	List out types of demolition techniques.	BT-1	Remember
5.	Name any two atmospheric agents responsible for corrosion.	BT-1	Remember
6.	List out the repairing methods of excessive deflection of beams.	BT-1	Remember
7.	Discuss about the external post tensioning.	BT-2	Understand
8.	Describe the types of crack repairing techniques.	BT-2	Understand
9.	With a simple curve discuss the effect of temperature on compressive strength of concrete.	BT-2	Understand
10.	What are the effects of fire on concrete?	BT-2	Understand

11.	Illustrate the term weathering corrosion.	BT-3	Application
12.	Write short notes on leakage in structure.	BT-3	Application
13.	Illustrate the term dilapidated structures.	BT-3	Application
14.	Demonstrate crack repair by routing and sealing with neat sketch.	BT-3	Application
15.	Differentiate between dormant cracks and active cracks.	BT-2	Understand
16.	Explain the major factors in selecting the demolition procedure.	BT-2	Understand
17.	How do you determine the temperature attained by concrete during fire?	BT-1	Remember
18.	Suggest the guidelines for construction in different seismic zones.	BT-3	Application
19.	Explain the preventive measure to be adopted to make the structure stable against marine exposure.	BT-2	Understand
20.	When do you demolish a building?	BT-2	Understand
21.	Identify the factors to be considered while transporting a structure from one place to another?	BT-2	Understand
22.	Why is structural health monitoring important?	BT-3	Application
23.	List out various techniques to repair spalling and disintegration of concrete.	BT-1	Remember
24.	What is meant by structural health monitoring?	BT-1	Remember
25.	Discuss about hydro-demolition technique.	BT-2	Understand
PART - B			
1.	With simple sketch explain the methods of improving the load carrying capacity of existing column and beams.	BT-3	Application
2.	State and explain the various options for strengthening a concrete with low member strength.	BT-3	Application
3.	Briefly explain the measure to be taken during construction to minimize the damages due to earthquake.	BT-2	Understand
4.	Illustrate how the building is affected by, (i) High Temperature (7) (ii) Marine exposure (6)	BT-2	Understand
5.	How do you repair a structure distressed due to corrosion. Explain in detail.	BT-2	Understand
6.	Write notes on: i) Non-explosive demolition agents(3) ii) Saw cutting(3) iii)Water jet (3) iv)Explosive(4)	BT-3	Application
7.	How do you repair a structure distressed due to marine exposure?	BT-3	Application
8.	Explain different methods of strengthening the concrete structures against earthquake.	BT-2	Understanding
9.	With simple sketches explain the methods of improving the strength of existing columns and beams.	BT-2	Understanding
10.	Discuss the following methods of crack repair. (i) concrete replacement (5)	BT-2	Understanding

	(ii) mortar replacement (4) (iii) Resin based repairs. (4)		
11.	How do you repair and rehabilitate a structure distressed due to fire?	BT-3	Application
12.	Describe the types of crack repairing techniques with neat sketch.	BT-2	Understand
13.	Explain briefly about the demolition techniques.	BT-2	Understand
14.	Under what condition strengthening of foundation is required? Explain how columns strengthened by section enlargement technique with the help of neat sketch.	BT-3	Application
15.	Describe the various strengthening techniques to overcome low member strength.	BT-2	Understanding
16.	Describe in detail about the weathering action on concrete.	BT-2	Understanding
17.	Explain the various techniques to repair spalling and disintegration of concrete.	BT-2	Understand

PART-C

1.	(i) How cracked reinforced concrete elements are repaired by providing additional steel? (8) (ii) Illustrate the stitching procedure to repair the flexural cracks in slab and beam with help of neat sketch. (7)	BT-5	Evaluate
2.	Discuss the different methods of strengthening the concrete structures against earthquake.	BT-5	Evaluate
3.	Demonstrate a case study of a building affected by fire and discuss its various effects. Also suggest suitable methods of remedy.	BT-4	Analyze
4.	Explain the procedure for demolishing main structural members like columns, beams and slabs with the help of neat sketch. What are the allied activities accompanying the demolition process?	BT-4	Analyze
5.	Discuss the various rehabilitation measures to be adopted to overcome the distress due to excessive deflection and cracking of structures.	BT-4	Analyze