SRM VALLIAMMAI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

I SEMESTER

1917104 MAINTENANCE AND REHABILITATION OF STRUCTURES

(M.E. STRUCTURAL ENGINEERING)

Regulation – 2019

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Prepared by

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SUBJECT CODE/NAME: 1917104 MAINTENANCE AND REHABILITATION OF STRUCTURES

SEM/YEAR: I / I

UNIT-I: INTRODUCTION			
General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal.			
PART A			
Q.NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Define distress in a structure?	BT-1	Remembering
2.	Identify the causes of distress in structure?	BT-3	Applying
3.	Define Structural Appraisal.	BT-1	Remembering
4.	What are the various causes of distress in concrete?	BT-1	Remembering
5.	Classify the types of maintenance?	BT-2	Understanding
6.	Illustrate the measures required to arrest decay?	BT-2	Understanding
7.	Identify the reasons for efflorescence?	BT-3	Applying
8.	Define Maintenance?	BT-1	Remembering
9.	List the importance of Maintenance.	BT-4	Analyzing
10.	Solve the causes for Repair?	BT-3	Applying
11.	What are the classifications of distress?	BT-1	Remembering
12.	Elaborate about quality assurance.	BT-6	Creating
13.	Examine the uses of economic appraisal.	BT-4	Analyzing
14.	Explain Rehabilitation.	BT-5	Evaluating
15.	Discuss the effect of climate in concrete structures.	BT-6	Creating
16.	Summarize the effects of chemicals in concrete structures.	BT-2	Understanding
17.	Illustrate the important aspects of rehabilitation.	BT-2	Understanding

18.	Demonstrate about the term strength of concrete.	BT-2	Understanding
19.	Relate the effects of wear and erosion in concrete.	BT-1	Remembering
20.	Criticize about the steps in maintenance.	BT-5	Evaluating
21.	Analyze the effects of structural appraisal.	BT-4	Analyzing
22.	Examine why quality assurance is needed?	BT-4	Analyzing
23.	Evaluate the types of maintenance	BT-5	Evaluating
24.	Conclude the concept of economic appraisal.	BT-5	Evaluating
25.	Illustrate the steps in selecting a repair procedure?	BT-2	Understanding
PART B			
1.	What is Quality Assurance in concrete construction? Discuss quality assurance of concrete construction	BT-1	Remembering
2.	Why Economic Appraisal should be carried out. Explain in detail about the Economic appraisal.	BT-1	Remembering
3.	Define maintenance. Discuss briefly the facets, importance and necessity of maintenance under various inspection periods of structures.	BT-1	Remembering
4.	Identify the effects of concrete structures under durability and serviceability due to chemicals, wear and erosion.	BT-3	Applying
5.	What is meant by distressed concrete? What are the causes of distress in concrete? How it is treated?	BT-1	Remembering
6.	Analyze the effect on building due to (i) Climate Change (4) (ii) Chemical action (3) (iii)Wear and Tear (3) (iv)Erosion (3)	BT-4	Analyzing
7.	Elaborate in detail about the facets of maintenance and its importance	BT-6	Creating
8.	Discuss in detail about structural appraisal and explain with a case study?	BT-6	Creating
9.	Classify the method of inspection? Discuss in detail.	BT-2	Understanding
10.	Explain any two non – destructive testing in concrete .	BT-4	Analyzing
11.	Summarize the types of defects in concrete, masonry structures, plastering and steel structures	BT-2	Understanding
12.	Illustrate the steps carried out in inspection?	BT-2	Understanding
13.	Analyze the assessment procedure for evaluating a damaged structure	BT-4	Analyzing
14.	Explain the causes of distresses and distress monitoring with suitable	BT-5	Evaluating
PART C			
1.	Explain the assessment procedure for evaluating a damaged structure with a flow chart.	BT-5	Evaluating

2.	List the importance of maintenance. Explain the service life behavior of structures with respect to maintenance.	BT-4	Analyzing
3.	Discuss in detail about causes and effects of any four defects in concrete.	BT-6	Creating
4.	Examine with a case study on distressed Highway Reinforced concrete bridge?	BT-4	Analyzing

UNIT-II: BUILDING CRACKS

Causes – diagnosis – Thermal and Shrinkage cracks – unequal loading – Vegetation and trees - Chemical action – Foundation movements – Remedial measures - Techniques for repair – Epoxy injection.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Define active cracks.	BT-1	Remembering
2.	Identify the effects of unequal loading in concrete structures ?	BT-3	Applying
3.	What are the symptoms of damaged structures ?	BT-1	Remembering
4.	Analyze how the cover thickness does make an important in the concrete design ?	BT-4	Analyzing
5.	Summarize short note on thermal cracks.	BT-2	Understanding
6.	Categorize how cracks are classified according to their width?	BT-4	Analyzing
7.	Define cracking	BT-1	Remembering
8.	Interpret a few words about dormant cracks.	BT-5	Evaluating
9.	List the techniques for repairing cracks.	BT-4	Analyzing
10.	Define carbonation.	BT-1	Remembering
11.	Discuss about thermal conductivity.	BT-6	Creating
12.	Elaborate stitching.	BT-6	Creating
13.	Explain about overlays and blanketing.	BT-5	Evaluating
14.	Summarize routing and sealing.	BT-2	Understanding
15.	Illustrate what is thermal diffusivity.	BT-2	Understanding
16.	Interpret the causes of cracks.	BT-5	Evaluating
17.	Demonstrate the characteristics of thermal crack.	BT-2	Understanding
18.	Examine remedial measures for cracks in buildings.	BT-4	Analyzing
19.	Identify how can we prevent the effect of freezing and thawing in concrete?	BT-3	Applying
20.	Justify how the foundation movement results in cracks.	BT-5	Evaluating
21.	Select and suggest the remedial measure to reduce the effects of vegetation and trees.	BT-3	Applying
22.	Conclude how epoxy injection will be effective to arrest building	BT-5	Evaluating

	cracks.		
23.	Distinguish thermal conductivity and thermal diffusivity	BT-4	Analyzing
24.	What are the factor affecting chemical attacks on concrete?	BT-1	Remembering
25.	What is drying shrinkage?	BT-1	Remembering
PART B			
1.	(i) Explain in detail about thermal and shrinkage cracks. (10) (ii) Summarize the classification of cracks based on width. (3)	BT-5	Evaluating
2.	Identify the checks you will make on the day of concreting to assure quality of concrete	BT-3	Applying
3.	Define cracks. Explain about the Building cracks and its remedial measures with neat sketches.	BT-1	Remembering
4.	Discuss in detail the possible cracks developed due to thermal and shrinkage properties. Explain the remedial measures requited to overcome these types of cracks.	BT-6	Creating
5.	(i) Explain about un-equal loading on structures. (7) (ii) Discuss in detail about movement of foundation structure. (6)	BT-5	Evaluating
6.	Elaborate about the techniques for repairing cracks	BT-6	Creating
7.	(i) List out the circumstances where grouting technique is warranted? (6) (ii) Explain epoxy injection technique employed in building repair? (7)	BT-4	Analyzing
8.	Tell in detail about Routing and Sealing.	BT-1	Remembering
9.	Explain the causes of cracks and how it is minimize it?	BT-5	Evaluating
10.	Identify the causes of shrinkage cracks and remedial measures for the same.	BT-3	Applying
11.	Illustrate briefly about epoxy injection process?	BT-2	Understanding
12.	Classify the reasons for the formation of cracks due to chemical and foundation movement.	BT-2	Understanding
13.	List out the durability properties of concrete and describe it in detail.	BT-4	Analyzing
14.	Find the indications of foundation settlement and suggest suitable precautionary measures to control this problem.	BT-1	Remembering
PART C			
1.	Explain with a case study of leakage of concrete slabs and how will you control the leakage.	BT-5	Evaluating
2.	Analyze an RCC building is under distress due to rebar corrosion. Column beams and slabs are under cracks. The age of the building is 20 years. Give the flowchart for diagnosis and suitable repair scheme.	BT-4	Analyzing
3.	Classify different crack patterns in a reinforced concrete beam and	BT-2	Understanding

	with a neat sketch and explain their causes and remedial measures.		
4.	Design with detailed sketches, the cracking effects in concrete structures due to wear, erosion, temperature and chemicals.	BT-6	Creating

UNIT-III: MOISTURE PENETRATION

Sources of dampness – Moisture movement from ground – Reasons for ineffective DPC – Roof leakage –Leakage of Concrete slabs – Dampness in solid walls – condensation – hygroscopic salts – remedial treatments – Ferro cement overlay Chemical coatings – Flexible and rigid coatings.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Identify suitable materials for DPC.	BT-3	Applying
2.	What is meant by Ferro-cement?	BT-1	Remembering
3.	Define the role of Dampness in concrete structures.	BT-1	Remembering
4.	Demonstrate the methods of corrosion protection techniques in RC structures.	BT-2	Understanding
5.	What are the characteristics of coatings to concrete?	BT-1	Remembering
6.	What is Ferro cement?	BT-1	Remembering
7.	Define Overlay.	BT-1	Remembering
8.	List out the chemicals used for coatings?	BT-4	Analyzing
9.	Examine the remedial treatments for moisture penetration?	BT-4	Analyzing
10.	Where do we use sealants?	BT-1	Remembering
11.	Describe how we can prevent the effect of freezing and thawing in	BT-3	Applying
12.	Conclude the importance of cover to reinforcement steel in RCC.	BT-5	Evaluating
13.	Elaborate about raising Dampness.	BT-6	Creating
14.	Summarize the method of waterproofing of RCC roof.	BT-2	Understanding
15.	Discuss about the characteristics of good coating.	BT-6	Creating
16.	Classify the application of Ferro cement.	BT-2	Understanding
17.	Classify some concrete materials used to overcome weathering action on.	BT-2	Understanding
18.	Choose some materials that can be used as protective surface coatings.	BT-3	Applying
19.	Criticize the causes and effects of dampness in building? Explain the remedies.	BT-5	Evaluating
20.	Describe the source of dampness.	BT-3	Applying
21.	Distinguish between flexible and rigid coatings.	BT-4	Analyzing
22.	Explain the use of anti-fungus admixtures.	BT-5	Evaluating
23.	Illustrate a list of suitable materials for DPC	BT-2	Understanding
24.	Evaluate the use of curing compounds.	BT-5	Evaluating

25.	Summarize any two tests for assessment of frost damage?	BT-2	Understanding
PART B			
1.	What are the ill effects of moisture movement into the bricks walls? How will you restore the ineffective DPC?	BT-1	Remembering
2.	What are the causes and effects of dampness in building? Explain the remedies.	BT-1	Remembering
3.	Define Leakage. Explain the remedial measures on roof leakages and concrete slab leakages with neat sketches.	BT-1	Remembering
4.	Write short notes on the following: a) Chemical coatings b) Flexible and Rigid coatings.	BT-3	Applying
5.	Demonstrate the sources of dampness. What are the methods available to arrest dampness? Explain them in detail with sketches.	BT-2	Understanding
6.	Explain the leakages in pitched roof and Madras Terrace roofs. What are the precautions required to avoid these kind of leakages?	BT-5	Evaluating
7.	Tell about the ill effects of moisture movement into the brick walls? How will you restore ineffective DPC?	BT-1	Remembering
8.	Describe flexible and rigid coatings with case study	BT-3	Applying
9.	Classify how to control the leakage of concrete slabs With a case study.	BT-2	Understanding
10.	Identify the different type of fibers used in concrete? Explain briefly their merits and demerits.	BT-3	Applying
11.	(i) Solve with chemical equation how will you evaluate the mechanism of corrosion? (8) (ii) Discuss the various factors influencing the corrosion. (5)	BT-3	Applying
12.	Demonstrate the method of waterproofing of RCC roof.	BT-2	Understanding
13.	Illustrate in detail about the weathering action on concrete.	BT-2	Understanding
14.	List the various components of quality control and explain it in detail.	BT-4	Analyzing
PART C			
1.	Discuss about the possible roof leakages in a deteriorated building.	BT-6	Creating
2.	Select a RCC bridge is under distress showing wide cracks of more than 1 cm, due to some causes such as freezing- thaw effect, poor design and detailing , improper cover for rebars, drying, shrinkage etc.,. As an engineer how would you repair the bridge and make it functional. Justify your recommendation for the suggestion of remedies.	BT-3	Applying
3.	Evaluate a dam structure which is having cracks due to F.S.L and suggest methods to rectify.	BT-5	Evaluating
4.	Explain with a case study on Moisture penetration and suggest suitable methods to avoid the same.	BT-2	Understanding

UNIT-IV: DISTRESSES AND REMEDIES

Concrete Structures: Introduction – Causes of deterioration – Diagnosis of causes – Flow charts for diagnosis – Materials and methods of repair – repairing, Spalling and disintegration – Repairing of concrete floors and pavements.

Steel Structures : Types and causes for deterioration – preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Design of protect against corrosion – Design and fabrication errors – Distress during erection.

Masonry Structures: Discoloration and weakening of stones – Biotical treatments – Preservation - Chemical preservatives – Brick masonry structures – Distresses and remedial measures.

PART – A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What are the causes of deterioration?	BT-1	Remembering
2.	Write about the chemical preservatives used in masonry structure to avoid discoloration?	BT-3	Applying
3.	What is the role of FRP material in repair?	BT-1	Remembering
4.	Estimate the techniques used to repair compression members.	BT-5	Evaluating
5.	Identify the use of expansive cement?	BT-3	Applying
6.	What is cancer in brick work?	BT-1	Remembering
7.	Identify the causes of deterioration.	BT-3	Applying
8.	List out any two possible reasons for spalling of cover concrete	BT-4	Analyzing
9.	Summarize the cover to be provided for various exposure conditions as per IS code.	BT-2	Understanding
10.	List some chemical preservatives used in masonry structures to avoid	BT-4	Analyzing
11.	Define corrosion inhibitors and corrosion.	BT-1	Remembering
12.	When and where is the corrosion inhibiting chemicals used?	BT-1	Remembering
13.	Explain how deterioration occurs due to corrosion?	BT-5	Evaluating
14.	What is the role of FRP material in repair?	BT-1	Remembering
15.	Classify any two atmospheric agents responsible for corrosion.	BT-2	Understanding
16.	Summarize the reason for efflorescence.	BT-2	Understanding
17.	Illustrate under what circumstances stones will discolour.	BT-2	Understanding
18.	Discuss with a neat sketch about the mechanism of cathodic protection.	BT-6	Creating
19.	Interpret the concept - weathering corrosion.	BT-5	Evaluating
20.	Classify the types of deterioration in steel structures.	BT-2	Understanding

21.	Examine and explain what you know about deterioration.	BT-4	Analyzing
22.	Estimate the techniques used to repair compression members.	BT-5	Evaluating
23.	Execute how cover to reinforcement steel in RCC is important.	BT-3	Applying
24.	Analyze "Design and construction errors leads to deterioration of structure". Is this statement true?	BT-4	Analyzing
25.	Design an equation explaining the mechanism of corrosion.	BT-6	Creating
	PART – B		
1.	(i) Write briefly about biotical treatments. (4) (ii) Discuss about the mechanism of corrosion in steel structures (9)	BT-3	Applying
2.	Explain briefly about the techniques for repairing of concrete floors and pavements.	BT-5	Evaluating
3.	How do evaluate the damaged structures? Explain the damage assessment procedure with flow chart diagram.	BT-1	Remembering
4.	Define defects in concrete with symptoms and also explain the various causing agents and remedial measures for it with sketches.	BT-1	Remembering
5.	Illustrate the materials used in the various methods of repair concrete and steel structures. What are the factors in flouncing it?	BT-2	Understanding
6.	Explain various types of distress in steel structures. Write down the preventive measures to be adopted to avoid distress. Briefly explain about the repair procedure available.	BT-5	Evaluating
7.	Describe the preventive and repair procedure for deterioration in (i) Concrete and (6) (ii) Steel structures. (7)	BT-3	Applying
8.	Tell about distress and its remedial measures in masonry structures.	BT-4	Analyzing
9.	Examine the various corrosion protection methods.	BT-6	Creating
10.	Discuss about design and construction errors leading to deterioration of structures.	BT-2	Understanding
11.	Classify the various causes of deterioration in concrete structures.	BT-2	Understanding
12.	Analyze "Design and construction errors leads to deterioration of structure". Is this statement true? (i) What are the defects in welded joints? (7) (ii) Under what circumstances stones will discolour in masonry structures. (6)	BT-4	Analyzing
13.	Illustrate the role of FRP in corrosion resistant in RCC structures.	BT-2	Understanding
14.	Select a steel structure is to be erected in a place with corrosion ambience. Sketch a suitable preventive measure to keep the corrosion problem in control.	BT-3	Applying
	PART C		

1.	What are the distress occurs due to an earthquake in structures? AIso explain the repair techniques for beam-column joint faiiure.	BT-1	Remembering
2.	Explain in detail the repair works to be done on a distressed water tank.	BT-5	Evaluating
3.	Examine a Steel column is in deteriorated state which holds the truss of the roof. Give the reasons for deteriorated & solutions for the same	BT-4	Analyzing
4.	Write a case study on the evaluation of deteriorated concrete slab & column. Suggest how to rectify.	BT-3	Applying

UNIT-V: STRENGTHENING OF EXISTING STRUCTURES

General principle – relieving loads – Strengthening super structures – plating – Conversation to composite construction – post stressing – Jacketing – bonded overlays – Reinforcement addition –strengthening substructures – under pining – Enhancing the load capacity of footing.

PART – A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What are the two types of process in Shot-crete ?	BT-1	Remembering
2.	How will you ensure bonding between a new layer of concrete over the existing old concrete ?	BT-1	Remembering
3.	State the general principles of strengthen	BT-2	Understanding
4.	Name any four rehabilitation techniques of existing structures.	BT-2	Understanding
5.	Define Under pinning	BT-2	Understanding
6.	List out some strengthening techniques.	BT-4	Analyzing
7.	Define Stitching.	BT-1	Remembering
8.	Tell about Jacketing.	BT-1	Remembering
9.	Describe about Blanketing.	BT-3	Applying
10.	Recall what Guniting techniques?	BT-1	Remembering
11.	List out the major uses of plating to strengthen existing structure.	BT-4	Analyzing
12.	Define Grouting.	BT-1	Remembering
13.	Explain dry pack.	BT-5	Evaluating
14.	Classify the types of process in Shotcrete.	BT-2	Understanding
15.	Discuss about ferro cement	BT-6	Creating
16.	Write a report on Shotcrete.	BT-3	Applying
17.	Show how bonding can be ensured between new layers of concrete over an existing old concrete?	BT-2	Understanding
18.	Illustrate the stages in dry mix process in Shotcrete.		
19.	Write a short note on epoxy coatings.	BT-2	Understanding

20.	Analyse the demerits of plating techniques used in strengthening RC structural elements.	BT-3	Applying
21.	Criticize on shoring and underpinning.	BT-4	Analyzing
22.	Examine the concept of post stressing.	BT-2	Understanding
23.	Evaluate the methods to overcome low member strength in concrete	BT-4	Analyzing
24.	Justify the need of various techniques for soil improvement.	BT-5	Evaluating
25.	Design how metal bonding is done on concrete member.	BT-5	Evaluating
PART – B			
1.	Illustrate in detail the (i) Causes for strengthening the structures. (7) (ii) Methods to strengthen damaged steel members (6)	BT-2	Understanding
2.	Explain in detail about the various methods of increasing the load carrying capacity of footing.	BT-5	Evaluating
3.	When an RCC beam needs to be strengthened to take additional load. Suggest necessary strengthening method and materials.	BT-1	Remembering
4.	Explain Repair materials and methods for Rehabilitation of damaged Masonry structures.	BT-5	Evaluating
5.	Write about the following with neat sketches on plate bonding techrriques and jacketing techniques.	BT-3	Applying
6.	What are the methods available to improve the load carrying capacity of columns. Explain.	BT-1	Remembering
7.	Explain the techniques for repair in reinforced concrete structures.	BT-5	Evaluating
8.	(i) Identify the importance of adding external reinforcement for strengthening in buildings. (5) (ii) Explain the above technique in detail. (8)	BT-5	Evaluating
9.	Describe in detail about underpinning and its methods.	BT-3	Applying
10.	Examine the various techniques to repair spalling and disintegration of concrete.	BT-4	Analyzing
11.	Classify the advanced techniques available to strengthen the existing structure.	BT-2	Understanding
12.	Discuss with an example how underpinning is to be done if the client wants to increase the number of floors in his building?	BT-6	Creating
13.	Summarize the measure to be taken during construction to minimize the damages due to earthquake.	BT-2	Understanding
14.	Relate with simple sketch explain the methods of improving the strength of existing RC columns and beams	BT-1	Remembering
PART – C			
1.	What are the different types of plates / laminates used for strengthening of structural elements? Discuss the different strengthening techniques and their relative merits.	BT-1	Remembering

2.	Explain the advance technique available to strengthen the existing structures.	BT-5	Evaluating
3.	Choose a 25 years old building has to withstand the load after considering the economical aspect suggest what should be done for the building, whether to strengthen or to demolish. Justify your statement	BT-3	Applying
4.	Assume the pamban bridge has to be strengthened in the normal working condition (i.e.) should not affect the transportation. Suggest suitable methods to strengthen.	BT-4	Analyzing