



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

## CIVIL ENGINEERING

### TUTORIAL QUESTION BANK

<b>Course Name</b>	:	Rehabilitation & Retrofitting of structures
<b>Course Code</b>	:	BST214
<b>Class</b>	:	M. Tech, II-Sem
<b>Branch</b>	:	CE
<b>Year</b>	:	2017-18
<b>Course Coordinator</b>	:	Mr. N VenkatRao, Assistant Professor, CE
<b>Course Faculty</b>	:	Mr. N VenkatRao, Assistant Professor, CE

#### COURSE OBJECTIVES:

The course should enable the students to:

<b>I</b>	<b>Identify</b> the causes of deterioration in structures and suggest suitable remedial measures.
<b>II</b>	<b>Generalize</b> the types of damages and understand their mechanisms.
<b>III</b>	<b>Infer</b> the causes and prevention mechanisms of corrosion in steel reinforcement and fire induced damages.
<b>IV</b>	Learn to <b>inspect</b> and <b>assess</b> the structures using techniques of visual inspection and NDT.

#### COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

BST214.01	Understand deterioration and distress in structures
BST214.02	Identify the condition of structures.
BST214.03	Identify the type of deterioration and method of correction
BST214.04	Understand the general causes of distress
BST214.05	Evaluate causes and prevention methods
BST214.06	Understand the types of damage and damage mechanism
BST214.07	Understand how to handle hardened and fresh concrete
BST214.08	Understand corrosion of reinforcement
BST214.09	Identify the mechanism in corrosion
BST214.10	Analyze the importance of prevention of corrosion
BST214.11	Analyse inspection and testing of concrete
BST214.12	Identify symptoms and diagnosis of distress
BST214.13	Understand the damage assessment
BST214.14	Understand the working of NDT
BST214.15	Importance of repair of structures and common types of repairs
BST214.16	Understand the processes of Guniting, Shotcrete, Underpinning
BST214.17	Understand the strengthening methods
BST214.18	Recognize the difference between various methods
BST214.19	Understand health monitoring of structures
BST214.20	Analyse the use of sensors
BST214.21	Understand building instrumentation

BST214.22	Recognize the behaviour of sensors
BST214.23	Understand modern sensors and methods

S.No	QUESTIONS	Blooms taxonomy level	Course Learning Outcomes
<b>UNIT I</b>			
<b>DETERIORATION AND DISTRESS OF STRUCTURES</b>			
<b>Part - A (Short Answer Questions)</b>			
1	Define distress?	Remember	BST214.01
2	Name different types of distress?	Remember	BST214.01
3	What is renovation?	Remember	BST214.01
4	What is rehabilitation?	Remember	BST214.01
5	define restoration	Remember	BST214.01
6	define repair in a structure	Remember	BST214.01
7	What is retrofitting?	Remember	BST214.01
8	What is remodeling?	Remember	BST214.01
9	What is deterioration in a structure?	Remember	BST214.01
10	Write a short note on honey combing	Remember	BST214.01
11	Write a short note on cracking	Remember	BST214.01
12	Write a short note on settlement	Remember	BST214.04
13	Write a short note on spalling	Remember	BST214.04
14	Write a short note on causes of damages in fresh state	Remember	BST214.04
15	Write a short note on causes of damages after hardening	Remember	BST214.03
16	Write a short note on physical causes of damages after hardening	Remember	BST214.03
17	Write a short note on chemical causes of damages after hardening	Remember	BST214.01
18	Write a short note on thermal causes of damages after hardening	Remember	BST214.01
19	Write is setting shrinkage?	Remember	BST214.03
20	What is aggregate shrinkage?	Remember	BST214.01
21	Write a short note on temperature variation	Remember	BST214.03
22	Write a short note on effect of free-thaw cycles in fresh state	Remember	BST214.01
23	Write a short note on alkali-aggregate reaction	Remember	BST214.01
25	Write a short note on creep	Remember	BST214.03
<b>Part - B (Long Answer Questions)</b>			
1	What do you mean by deterioration? Explain the mechanism of deterioration in concrete structures?	Remember	BST214.01
2	Discuss in detail the various factors responsible for deterioration.	Understand	BST214.01
3	Discuss in detail various construction stage defects & their preventive measures?	Understand	BST214.01
4	What are the various pre-construction stage damages & how can it be rectified?	Remember	BST214.03
5	Explain the mechanism of various causes of deterioration in post-construction stage?	Understand	BST214.02
6	Explain the cracking phenomena in plastic concrete. Give the remedial measures.	Understand	BST214.02
7	What are settlement cracks? What are the factors affecting the settlement cracks?	Remember	BST214.03
8	Explain mechanism of crazing, causes of crazing. Give the remedial measures?	Remember	BST214.03
9	Write the different reasons for development of cracks due to errors in design and detailing. Give preventive measures.	Remember	BST214.04
10	Name various chemical attacks in concrete & explain their mechanism in detail. Give the preventive measures?	Remember	
11	Explain sulphate reaction in detail. Give various preventive measures?	Understand	BST214.01

12	What is carbonation, factors effecting carbonation? Explain its mechanism in details, suggest suitable remedial measures.	Understand	BST214.01
13	What is distress? Give its classification.	Remember	BST214.01
14	Explain in detail various causes of damage in fresh state? Suggest the suitable remedial measures?	Understand	BST214.02
15	What are the various pre-construction stage damages & how can it be rectified?	Remember	BST214.03
16	explain in detail regarding mechanism of creep in concrete and their remedial measures	Understand	BST214.01
17	Discuss the affects of freezing and thawing of structures and give remedial measures.	Understand	BST214.02
18	explain in detail regarding mechanism of accidental overloads in concrete and their remedial measures	Remember	BST214.03
19	Discuss in detail the cracking of hardened concrete.	Understand	BST214.01
20	explain in detail regarding mechanism of temperature variation in concrete and their remedial measures	Remember	BST214.02
<b>Part – C (Problem Solving and Critical Thinking)</b>			
1	Write short notes on division of maintenance.	Understand	BST214.02
2	What is distress? Give its classification.	Understand	BST214.02
3	Write short notes on division of maintenance.	Understand	BST214.02
4	What are the factors responsible for the deterioration of paints?	Understand	BST214.01
5	What are the various categories of deterioration?	Understand	BST214.02
6	explain in detail regarding mechanism of freeze thaw disintegration in concrete and their remedial measures	Understand	BST214.04
7	explain in detail regarding mechanism of temperature variation in concrete and their remedial measures	Understand	BST214.04
8	explain in detail regarding mechanism of early thermal cracking in fresh concrete and their remedial measures	Understand	BST214.04
9	explain in detail regarding mechanism of accidental overloads in concrete and their remedial measures	Understand	BST214.03
10	explain in detail regarding mechanism of creep in concrete and their remedial measures	Understand	BST214.02
11	What is drying shrinkage?	Understand	BST214.02
12	What is crazing in concrete?	Understand	BST214.04
13	Write a short note on chemical attack on concrete structures	Understand	BST214.02
14	Write a short note on chemical attack aggregate alkali reaction	Understand	BST214.01
15	Write a short note on cement carbonation	Understand	BST214.04
16	What are the various causes of damage?	Understand	BST214.04
<b>UNIT 2</b>			
<b>DAMAGE MECHANISM IN CONCRETE</b>			
<b>Part – A (Short Answer Questions)</b>			
1	Write a short note on corrosion	Remember	BST214.05
2	discuss how the variation of pH affects the corrosion process	Remember	BST214.05
3	What is importance of passivating film in RCC members?	Remember	BST214.05
4	what are corrosion promoters?	Remember	BST214.05
5	what are corrosion inhibitors?	Remember	BST214.07
6	What is delamination?	Remember	BST214.09
7	What is cracking?		BST214.10
8	What is spalling ?	Remember	BST214.05
9	Write the effect of cast in chlorides on corrosion	Remember	BST214.13
10	What is carbonation?	Remember	BST214.13
11	what happens to concrete in fire?	Understand	BST214.12
12	write about changes observed in concrete in fire	Remember	BST214.13
13	Name few laboratory tests for fire safety	Remember	BST214.13

14	Name few corrosion prevention techniques?	Remember	BST214.13
15	what is fire rating?	Remember	BST214.05
16	What is desiccation?	Remember	BST214.06
17	how does the strength of concrete vary due to rise in temperature	Remember	BST214.06
18	how does the strength of steel vary due to rise in temperature	Remember	BST214.06
19	Behavior of masonry under fire?	Remember	BST214.08
20	Name various stages of repair of fire damaged elements	Remember	BST214.09

**Part - B (Long Answer Questions)**

1	Discuss the factors affecting corrosion. What are its effects?	Remember	BST214.07
2	Explain the mechanism of corrosion; name the corrosion inhibitors and promoters?	Remember	BST214.07
3	What are the factors effecting chloride induced corrosion, explain in detail mechanism of chloride induced corrosion and suggest suitable remedial measures?	Remember	BST214.06
4	Explain in detail mechanism of carbonation induced corrosion, suggest suitable remedial measures?	Remember	BST214.05
5	Explain in detail cathodic corrosion protection, electrochemical chloride extraction, galvanic protection system. Suggest its suitability depending on the problem?		BST214.12
6	Explain in detail the behavior of concrete at various temperatures when it is subjected to fire	Remember	BST214.08
7	write about the embedded metal corrosion and tolerable crack widths to avoid the rebar corrosion	Remember	BST214.08
8	write in detail about the factors influencing the cracking and spalling and mention regarding C/D ratio	Understand	BST214.05
9	Describe the method of protecting building against fire	Remember	BST214.05
10	Explain the phenomena of desiccation in structures.	Understand	BST214.05
11	Explain fire rating of structure?	Understand	BST214.10
12	Explain behavior of steel under fire? What is the effect of yield strength of steel with increase in temperature?	Understand	BST214.10
13	Explain the effect of steel manufacturing process, type of connections on the behavior of steel under fire?	Understand	BST214.11
14	Explain in the detail the assessment procedure to be followed in concrete structures subjected to fire?	Understand	BST214.13
15	Explain in detail differential thermal analysis (DTA) and thermo gravity analysis along with its merits & demerits?	Understand	BST214.05
16	Explain in detail repair of fire damaged elements?	Understand	BST214.10
17	Explain the procedure for fire rating of structure using ASTM E 119?	Understand	BST214.10
18	What is the effect of thickness & cover requirements on the fire rating of the structure or vice versa?	Understand	BST214.11
19	Explain the Effect of desiccation of concrete on the deterioration of concrete	Understand	BST214.11
20	Write different preventive measures of self-desiccation of concrete	Understand	BST214.13

**Part – C (Problem Solving and Critical Thinking)**

1	What are the various methods of locating in structural members? Discuss any one method in detail.	Understand	BST214.05
2	Write a notes on symptoms of corrosion.	Understand	BST214.06
3	Write about preventive measures that ensure good protection for new structures.	Understand	BST214.07
4	Explain the method of repairing corroded steel in R.C structure.	Understand	BST214.10
5	Explain the cathodic reaction in detailed.	Understand	BST214.11
6	write about the embedded metal corrosion and tolerable crack widths	Understand	BST214.11

	to avoid the rebar corrosion		
7	write about the chloride penetration and factors on which the it depends	Understand	BST214.06
8	write in detail about the factors influencing the cracking and spalling and mention regarding C/D ratio	Understand	BST214.07
9	Explain the phenomena of desiccation in structures.	Understand	BST214.11
10	Describe the method of protecting building against fire.	Understand	BST214.08
11	On what basis is a structure designed to withstand fire.	Understand	BST214.13
12	Give description about fire damaged structures.	Understand	BST214.11
13	What is meant by cementitious spray fire proofing?	Understand	BST214.09
14	Describe the concrete encasement method of protecting building against fire.	Understand	BST214.06
<b>UNIT 3</b>			
<b>INSPECTION AND TESTING OF CONCRETE</b>			
<b>Part – A (Short Answer Questions)</b>			
1	Explain the need for evaluation of structures.	Understand	BST214.14
2	Briefly describe of preliminary investigation & Detailed investigation.	Remember	BST214.14
3	Classify the damage based on preliminary investigation	Remember	BST214.14
4	Explain the Pull-out test with figure.	Remember	BST214.15
5	Explain the Flexure test with figure.	Understand	BST214.14
6	Explain the Splitting test with figure.	Remember	BST214.14
7	Write names of different NDT tests for strength estimation of concrete	Remember	BST214.14
8	write about rebound hammer test	Remember	BST214.15
9	write names of different NDT tests for assessing corrosion potential of concrete	Remember	BST214.15
10	Write about half-cell potential method	Remember	BST214.14
11	Describe ultrasonic pulse velocity test with figure.	Remember	BST214.14
12	Names different semi-destructive tests for strength estimation of concrete	Remember	BST214.16
13	Write names of different NDT tests for assessing carbonation depth?	Remember	BST214.16
14	Explain Phenolphthalein solution method to measure the depth of carbonation?	Understand	BST214.16
15	What is petrographic analysis?	Understand	BST214.17
16	Write about chloride test for chloride content measurement?	Remember	BST214.17
17	Name different testing methods used for embedded metal detection?	Remember	BST214.17
18	Explain initial surface absorption test?	Remember	BST214.17
19	Name different testing methods used for detection of cracks/voids/delamination?	Remember	BST214.17
20	Explain Windsor probe test?	Remember	BST214.17
21	Explain polarization resistance technique?	Understand	BST214.17
22	Explain acoustic emission technique?	Understand	BST214.17
23	Name common types of distress in concrete structures?	Remember	BST214.17
24	Explain stress wave propagation method	Remember	BST214.17
<b>Part - B (Long Answer Questions)</b>			
1	Explain the Compression test & Tension Test	Remember	BST214.14
2	Explain carbonation test & cathodic protection test.	Remember	BST214.15
3	Describe the occurrence of distress Due to Pre-construction stage, Construction stage and Post construction stage	Remember	BST214.14
4	Write a note on cracking, Spalling, Staining, Disintegration, Scaling.	Remember	BST214.16
5	Give a brief description about the factors that influence the investigation plan	Remember	BST214.16
6	Describe Electrical Resistivity Method and its influencing factors	Remember	BST214.17

7	Explain petrographic analysis and its application in civil engineering structures.	Remember	BST214.17
8	Briefly describe various voids detection tests along with their merits and demerits	Remember	BST214.17
9	Explain commonly used NDT tests and write its advantages over other tests	Remember	BST214.17
10	Explain Initial Surface absorption test & brief its demerits	Remember	BST214.17
<b>Part – C (Problem Solving and Critical Thinking)</b>			
1	Briefly describe of Recommendation for retrofit work.	Understand	BST214.17
2	Describe in detail the damage assessment procedure in Structure.	Understand	BST214.14
3	Differentiate non-destructive testing methods & semi-destructive testing methods	Understand	BST214.14
4	Give a Short notes on Inspection of structures.	Understand	BST214.15
5	Explain the 6figg's test.	Understand	BST214.17
6	What is the effect of aluminum in hydration process	Understand	BST214.17
7	Influence of silicates on hydration	Understand	BST214.14
8	Examine the role of chemical compounds on the durability of concrete	Understand	BST214.15
9	What is the effect of temperature on the strength of concrete examine critically?	Understand	BST214.17
10	Explain various methods of crack detection	Understand	BST214.16
<b>UNIT 4</b>			
<b>REPAIR AND RETROFITTING OF STRUCTURES</b>			
<b>Part – A (Short Answer Questions)</b>			
1	Enumerate the various cracks repairs techniques and other repair techniques for structures.	Remember	BST214.18
2	How bridge Decks are repaired? Discuss briefly.	Remember	BST214.18
3	What are underwater repairs? Mention its special features.	Remember	BST214.18
4	What are the various types of surface coatings?	Remember	BST214.18
5	Discuss in brief the methods of grout injection.	Remember	BST214.18
6	Define epoxy resins.	Remember	BST214.19
7	Write short notes on member replacement.		BST214.18
8	Define overlays. What are the materials generally used for overlays?	Remember	BST214.19
9	How erosion control can be done.	Remember	BST214.19
10	What is slope protection?	Remember	BST214.19
<b>Part - B (Long Answer Questions)</b>			
1	Explain the process of guniting in detail with figure.	Remember	BST214.18
2	Discuss the method of underpinning in detail.	Remember	BST214.19
3	Discuss the various types of blanket repair techniques.	Remember	BST214.19
4	Enumerate the different methods available for repairs of concrete works. Discuss the any one in detail.	Remember	BST214.18
5	Write short notes on Deep dump bucket method and pre-placed aggregate method.	Remember	BST214.19
6	What is jacketing? What are the different types of jacketing?	Remember	BST214.18
7	Explain the concrete column in detail with figure	Remember	BST214.18
8	Explain the column strengthening and strengthening flexural members.		BST214.18
9	Explain strengthening and stiffening of beams and girders.	Remember	BST214.18
10	Explain the application of erosion control.	Remember	BST214.19
<b>Part – C (Problem Solving and Critical Thinking)</b>			



1	Enumerate the different methods available for repairs of concrete works. Discuss the any one in detail	Understand	BST214.19
2	Explain the methods of stitching in crack repair.	Understand	BST214.18
3	Explain the steps involved in underwater repair of structures	Understand	BST214.18
4	Enumerate the various methods of placing concrete in underwater structures. Discuss the tremie pipe method in detail	Understand	BST214.18
5	What do you mean by leak sealing? Discuss the various methods of leak sealing.	Understand	BST214.19
6	What are the protective surface treatments for structures?	Understand	BST214.18
7	Discuss the replacement of concrete.	Understand	BST214.18
8	Differentiate strengthening and stiffening of members.	Understand	BST214.19
9	Discuss the slope protection with detail.	Understand	BST214.19
10	What are the prevention for erosion control.	Understand	BST214.19
<b>UNIT V</b>			
<b>HEALTH MONITORING OF STRUCTURES</b>			
<b>Part – A (Short Answer Questions)</b>			
1	Explain the Acquisition data in detailed	Understand	BST214.20
2	Explain the communication data in detailed	Remember	BST214.21
3	What is smart sensor?	Remember	BST214.21
4	What is sensor?	Remember	BST214.21
5	Explain the Communication of data in health monitoring of structures.	Remember	BST214.21
6	How the structural health monitoring process is divided into various components	Remember	BST214.21
7	How does sensing technology is used in structural health monitoring system	Remember	BST214.22
8	What is the role of signal processing in health monitoring	Understand	BST214.20
9	What is damage identification analysis	Understand	BST214.20
10	What are the various structural evaluation methods	Remember	BST214.21
<b>Part - B (Long Answer Questions)</b>			
1	Explain the use of Smart sensor for monitoring civil engineering infrastructures.	Remember	BST214.21
2	Explain the methodology of health monitoring of structures and how is it monitored.	Remember	BST214.20
3	Explain the components of health monitoring of structures.	Remember	BST214.21
4	What are sensors? At what locations are they used.	Remember	BST214.21
5	Where Building Instrumentation are located ?&How ?	Remember	BST214.20
6	Explain active and passive structural health monitoring of structures and differentiate between them	Remember	BST214.21
7	Explain various smart materials and its application in structural health monitoring system.	Understand	BST214.21
8	What is fiber optic sensors how they are used in health monitoring with suitable merits and demerits	Remember	BST214.20
9	explain in detail regarding the criteria for damage classification, mention the class of damage and repair requirements	Remember	BST214.22
10	explain in detail regarding effects of fire on concrete structures and its behavior with temperature change	Remember	BST214.20
<b>Part – C (Problem Solving and Critical Thinking)</b>			
1	What do you understand by health monitoring of structures?	Understand	BST214.21
2	Explain the advantages for health monitoring of structures	Understand	BST214.21
3	What are the advantages and disadvantages of smart sensor?	Understand	BST214.21
4	Explain the Advantages of Structures health monitoring.	Understand	BST214.20

5	Explain the Disadvantages of Structures health monitoring.	Understand	BST214.21
6	Explain Diagnostic signal generation	Understand	BST214.21
7	Explain various types of sensors	Understand	BST214.20
8	Which type of sensors are used to detect seismic vibrations	Understand	BST214.20
9	What are the recent innovations in structural health monitoring system	Understand	BST214.21
10	What are the green materials explain in detail	Understand	BST214.20

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