



# INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

## CIVIL ENGINEERING

### TUTORIAL QUESTION BANK

<b>Course Title</b>	<b>Rehabilitation &amp; Retrofitting of structure</b>			
<b>Course Code</b>	<b>A80151</b>			
<b>Regulation</b>	R15 (JNTUH)			
<b>Course Structure</b>	<b>Lecturers</b>	<b>Tutorials</b>	<b>Practical's</b>	<b>Credit's</b>
	<b>5</b>	<b>-</b>	<b>-</b>	<b>4</b>
<b>Course Coordinator</b>	Mrs. Cici Jennifer, Assistant Professor, Civil Engineering			
<b>Team of Instructors</b>	Mrs. Cici Jennifer, Assistant Professor, Civil Engineering Mr. A Srinivas, Assistant Professor, Civil Engineering			

#### COURSE OBJECTIVES:

The course should enable the student to:

- I. Identify the causes of deterioration in structures and suggest suitable remedial measures.
- II. Generalize the types of damages and understand their mechanisms.
- III. Infer the causes and prevention mechanisms of corrosion in steel reinforcement and fire induced damages.
- IV. Learn to inspect and assess the structures using techniques of visual inspection and NDT.
- V. Evaluate a structural damage and recommend suitable repair and strengthening methods.
- VI. Identify the latest health monitoring and building instrumentation methods.

S. No.	Question	Blooms Taxonomy Level	Course Outcome
<b>UNIT-I</b>			
<b>(DETERIORATION OF STRUCTURES)</b>			
<b>PART- A (SHORT ANSWER QUESTIONS)</b>			
1	Define the term distress.	Remember	1
2	Name different types of distress.	Remember	1
3	What is meant by renovation?	Remember	1
4	What is meant by rehabilitation?	Remember	1
5	Define the term restoration.	Remember	1
6	Define repair in a structure.	Remember	1
7	What is retrofitting?	Remember	1
8	What is remodeling?	Remember	2
9	What is deterioration in a structure?	Remember	2
10	Write a short note on honey combing.	Understand	2
11	Write a short note on cracking.	Understand	2
12	Write a short note on settlement.	Understand	2
13	Write a short note on spalling.	Understand	2

14	Write a short note on causes of damages in fresh state.	Understand	3
15	Write a short note on causes of damages after hardening.	Understand	3
16	Write a short note on physical causes of damages after hardening.	Understand	3
17	Write a short note on chemical causes of damages after hardening.	Understand	3
18	Write a short note on thermal causes of damages after hardening.	Understand	3
19	Define setting shrinkage.	Understand	3
20	What is aggregate shrinkage?	Remember	3
21	Write a short note on temperature variation.	Understand	3
22	Write a short note on effect of free-thaw cycles in fresh state.	Understand	3
23	Write a short note on alkali-aggregate reaction.	Understand	3
24	Write a short note on creep.	Understand	3
25	Write a short note on deterioration due to abrasion, crystallization of salts.	Understand	3
<b>PART- B (LONG ANSWER QUESTIONS)</b>			
1	What do you mean by deterioration? Explain the mechanism of deterioration in concrete structures?	Understand	1
2	Discuss in detail the various factors responsible for deterioration.	Remember	1
3	Discuss in detail various construction stage defects & their preventive measures?	Remember	1
4	What are the various pre-construction stage damages and how can it be rectified?	Remember	1
6	Explain the mechanism of various causes of deterioration in post-construction stage?	Understand	1
7	Explain the cracking phenomena in plastic concrete. Give the remedial measures.	Remember	1
8	What are settlement cracks? What are the factors affecting the settlement cracks?	Remember	2
9	Explain mechanism of crazing, causes of crazing. Give the remedial measures.	Remember	2
10	Write the different reasons for development of cracks due to errors in design and detailing. Give preventive measures.	Understand	2
11	Name various chemical attacks in concrete & Explain their mechanism in detail. Give the preventive measures?	Remember	2
12	Explain sulphate reaction in detail. Give various preventive measures?	Remember	2
13	What is carbonation, factors effecting carbonation? Explain its mechanism in details, suggest suitable remedial measures.	Understand	2
14	What is distress? Give its classification.	Understand	2
15	Explain in detail various causes of damage in fresh state? Suggest the suitable remedial measures?	Remember	3
16	Explain in detail regarding mechanism of creep in concrete and their remedial measures?	Remember	3
17	Discuss the affects of freezing and thawing of structures and give remedial measures.	Remember	3
18	Explain in detail regarding mechanism of accidental overloads in concrete and their remedial measures.	Remember	3
19	Discuss in detail the cracking of hardened concrete.	Remember	3
20	Explain in detail regarding mechanism of temperature variation in concrete and their remedial measures.	Remember	3

<b>PART C (CRITICAL THINKING QUESTIONS)</b>			
1	Write short notes on division of maintenance.	Remember	1
2	What is distress? Give its classification.	Remember	1
3	Write short notes on division of maintenance.	Remember	1
4	What are the factors responsible for the deterioration of paints?	Remember	1
5	What are the various categories of deterioration?	Remember	1
6	Explain in detail regarding mechanism of freeze thaw disintegration in concrete and their remedial measures.	Understand	2
7	Explain in detail regarding mechanism of temperature variation in concrete and their remedial measures.	Understand	2
8	Explain in detail regarding mechanism of early thermal cracking in fresh concrete and their remedial measures.	Understand	2
9	Explain in detail regarding mechanism of accidental overloads in concrete and their remedial measures.	Understand	2
10	Explain in detail regarding mechanism of creep in concrete and their remedial measures.	Understand	3
11	What is drying shrinkage?	Remember	3
12	What is crazing in concrete?	Remember	3
13	Write a short note on chemical attack on concrete structures.	Understand	3
14	Write a short note on chemical attack aggregate alkali reaction.	Understand	3
15	Write a short note on cement carbonation.	Understand	3
16	What are the various causes of damage?	Remember	3
<b>UNIT-II (CORROSION OF STEEL REINFORCEMENT)</b>			
<b>PART- A (SHORT ANSWER QUESTIONS)</b>			
1	Write a short note on corrosion.	Understand	4
2	Discuss how the variation of pH affects the corrosion process.	Remember	4
3	What is importance of passivating film in RCC members?	Remember	4
4	What are corrosion promoters?	Remember	4
5	What are corrosion inhibitors?	Understand	4
6	What is meant by delamination?	Remember	4
7	What is meant by cracking?	Remember	4
8	What is meant by spalling?	Remember	4
9	Write the effect of cast in chlorides on corrosion.	Understand	5
10	What is carbonation?	Remember	5
11	What happens to concrete in fire?	Remember	5
12	Write about changes observed in concrete in fire.	Understand	5
13	Name few laboratory tests for fire safety.	Understand	5
14	Name few corrosion prevention techniques.	Remember	5
15	What is fire rating?	Remember	5
16	What is desiccation?	Remember	5
17	How does the strength of concrete vary due to rise in temperature?	Remember	5
18	How does the strength of steel vary due to rise in temperature?	Remember	5
19	Describe the behavior of masonry under fire.	Remember	5
20	Name various stages of repair of fire damaged elements.	Understand	5
<b>PART- B (LONG ANSWER QUESTIONS)</b>			
1	Discuss the factors affecting corrosion. What are its effects.	Understand	4
2	Explain the mechanism of corrosion; name the corrosion inhibitors and promoters.	Understand	4
3	What are the factors effecting chloride induced corrosion? Explain in detail mechanism of chloride induced corrosion and suggest suitable	Remember	4

	remedial measures?		
4	Explain in detail mechanism of carbonation induced corrosion, suggest suitable remedial measures.	Understand	4
5	Explain in detail cathodic corrosion protection, electrochemical chloride extraction, galvanic protection system. Suggest its suitability depending on the problem.	Understand	4
6	Explain in detail the behavior of concrete at various temperatures when it is subjected to fire.	Understand	4
7	Write about the embedded metal corrosion and tolerable crack widths to avoid the rebar corrosion.	Understand	4
8	Write in detail about the factors influencing the cracking and spalling and mention regarding C/D ratio.	Remember	4
9	Describe the method of protecting building against fire.	Remember	5
10	Explain the phenomena of desiccation in structures.	Remember	5
11	Explain fire rating of structure.	Remember	5
12	Explain behavior of steel under fire? What is the effect of yield strength of steel with increase in temperature.	Remember	5
13	Explain the effect of steel manufacturing process, type of connections on the behavior of steel under fire.	Remember	5
14	Explain in the detail the assessment procedure to be followed in concrete structures subjected to fire.	Understand	5
15	Explain in detail differential thermal analysis (DTA) and thermo gravity analysis along with its merits & demerits.	Remember	5
16	Explain in detail repair of fire damaged elements.	Remember	5
17	Explain the procedure for fire rating of structure using ASTM E 119.	Remember	5
18	What is the effect of thickness & cover requirements on the fire rating of the structure or vice versa.	Remember	5
19	Explain the Effect of desiccation of concrete on the deterioration of concrete.	Remember	5
20	Write different preventive measures of self-desiccation of concrete.	Remember	5
<b>PART- C (CRITICAL THINKING QUESTIONS)</b>			
1	What are the various methods of locating in structural members? Discuss any one method in detail.	Understand	4
2	Writenotes on symptoms of corrosion.	Remember	4
3	Write about preventive measures that ensure good protection for new structures.	Remember	4
4	Explain the method of repairing corroded steel in R.C structure.	Remember	4
5	Explain the cathodic reaction in detailed.	Remember	4
6	Write about the embedded metal corrosion and tolerable crack widths to avoid the rebar corrosion.	Remember	4
7	Write about the chloride penetration and factors on which their it depends.	Remember	4
8	Write in detail about the factors influencing the cracking and spalling and mention regarding C/D ratio.	Remember	5
9	Explain the phenomena of desiccation in structures.	Remember	5
10	Describe the method of protecting building against fire.	Understand	5
11	On What basis is a structure designed to withstand fire.	Understand	5
12	Give description about fire damaged structures.	Remember	5
13	What is meant by cementitious spray fire proofing?	Understand	5

14	Describe the concrete encasement method of protecting building against fire.	Remember	5
<b>UNIT-III</b>			
<b>(INSPECTION AND TESTING OF DISTRESS IN STRUCTURE)</b>			
<b>PART- A (SHORT ANSWER QUESTIONS)</b>			
1	Explain the need for evaluation of structures.	Remember	6
2	Briefly describe of preliminary investigation and detailed investigation.	Understand	6
3	Classify the damage based on preliminary investigation.	Remember	6
4	Explain the Pull-out test with figure.	Remember	6
5	Explain the Flexure test with figure.	Understand	6
6	Explain the Splitting test with figure.	Understand	6
7	Write names of different NDT tests for strength estimation of concrete.	Remember	6
8	Write about rebound hammer test.	Remember	6
9	Write names of different NDT tests for assessing corrosion potential of concrete.	Remember	6
10	Write about half-cell potential method.	Remember	6
11	Describe ultrasonic pulse velocity test with figure.	Remember	6
12	Names different semi-destructive tests for strength estimation of concrete.	Understand	6
13	Define disintegration and spalling.	Understand	6
14	What are the stages of conditional assessment?	Remember	6
15	What is pulling out test?	Remember	6
16	Define the term UPSV.	Understand	6
17	Explain cover thickness measurements?	Understand	6
18	Write the equipments used to repair of cracks in concrete.	Remember	6
19	Write the purpose of NDT.	Remember	6
20	Write the purpose of semi destructive testing.	Remember	6
21	Write clear note on poor construction practices.	Remember	6
22	Write short note on impact echo methods.	Remember	6
23	List out the non destructive testing methods.	Remember	6
24	List out the semi-destructive testing methods.	Understand	6
25	Write names of different NDT tests for assessing carbonation depth?	Remember	7
26	Explain Phenolphthalein solution method to measure the depth of carbonation.	Remember	7
27	What is petrographic analysis?	Remember	7
28	Write about chloride test for chloride content measurement?	Understand	7
29	Name different testing methods used for embedded metal detection.	Remember	7
30	Explain initial surface absorption test.	Remember	7
31	Name different testing methods used for detection of cracks/voids/delamination?	Remember	7
32	Explain Windsor probe test.	Understand	7
33	Explain polarization resistance technique.	Remember	7
34	Explain acoustic emission technique.	Remember	7

35	Name common types of distress in concrete structures.	Understand	7
36	Explain stress wave propagation method.	Understand	7
37	Write the durability tests which performed on concrete.	Understand	7
38	What is rapid visual investigation?	Remember	7
39	Write the chemical tests of concrete.	Remember	7
40	Define carbonation test.	Understand	7
41	Explain Initial Surface absorption test.	Understand	7
42	What is detailed investigation?	Remember	7
43	Define Cosmetic repairs.	Remember	7
44	What are the Limitations of rebound hammer testing?	Remember	7
45	What are the applications of rebound hammer testing?	Remember	7
46	What is the Limitations of Ultra sonic pulse velocity?	Remember	7
47	Write the Factors affecting rebound number readings.	Understand	7
48	What are the applications of Ultra sonic pulse velocity?	Remember	7
<b>PART- B (LONG ANSWER QUESTIONS)</b>			
1	Explain the Compression test & Tension Test.	Understand	6
2	Explain carbonation test and cathodic protection test.	Remember	6
3	Describe the occurrence of distress Due to Pre-construction stage, Construction stage and Post construction stage.	Remember	6
4	Write a note on cracking, Spalling, Staining, Disintegration and Scaling.	Remember	6
5	Give a brief description about the factors that influence the investigation plan.	Understand	6
6	What are the various aspects that will be covered during inspection of damaged buildings?	Understand	6
7	Elaborate the factors influencing electrical resistivity measurements.	Remember	6
8	What is the role of NDT in qualifying the structure after retrofitting?	Remember	6
9	Explain the 6figg's test.	Remember	6
10	Explain the procedure to perform Pull-out test with figure.	Understand	6
6	Describe Electrical Resistivity method and its influencing factors.	Remember	7
7	Explain petro graphic analysis and its application in civil engineering structures.	Remember	7
8	Briefly describe various voids detection tests along with their merits and demerits.	Remember	7
9	Explain commonly used NDT tests and Write its advantages over other tests.	Understand	7
10	Explain Initial Surface absorption test & brief its demerits.	Remember	7
11	What is the methodology for the investigations of failures in buildings and explain any one method?	Understand	7
12	Describe briefly about Damage classification based on preliminary investigation.	Remember	7
13	What is detailed investigation? Explain Scope and methodology of detailed investigation.	Remember	7
14	Write about preliminary investigations any type of structure failure.	Remember	7
15	Describe ultrasonic pulse velocity test of concrete members with sketch.	Understand	7

16	List the various tests used and types of tests undertaken preliminary assessment of damages.	Remember	7
17	Explain the testing procedure of rebound hammer method clearly.	Understand	7
18	Write the procedure and limitations of rebound hammer method.	Remember	7
19	Explain the testing procedure of ultra sonic pulse velocity clearly.	Remember	7
20	Evaluate the test method vulnerability of reinforced concrete structure.	Understand	7
<b>PART- C (CRITICAL THINKING QUESTIONS)</b>			
1	Briefly describe of Recommendation for retrofit work.	Understand	6
2	Describe in detail the damage assessment procedure in structure.	Remember	6
3	Differentiate non-destructive testing methods and semi-destructive testing methods.	Understand	6
4	Give Short notes on Inspection of structures.	Understand	6
5	Explain the damage classification of the structural members based on the output of preliminary investigation.	Understand	6
6	What is the effect of aluminum in hydration process?	Understand	7
7	Demonstrate the ultrasonic pulse velocity test of concrete members with sketch and write applications.	Remember	7
8	Examine the role of chemical compounds on the durability of concrete.	Remember	7
9	What is the effect of temperature on the strength of concrete examined critically?	Remember	7
10	Explain various methods of crack detection?	Remember	7
<b>UNIT-IV (REPAIR OF STRUCTURES)</b>			
<b>PART- A (SHORT ANSWER QUESTIONS)</b>			
1	Enumerate the various cracks repairs techniques and other repair techniques for structures.	Understand	8
2	How bridge Decks are repaired? Discuss briefly.	Remember	8
3	What are underwater repairs? Mention its special features.	Remember	8
4	What are the various types of surface coatings?	Remember	8
5	Discuss in brief the methods of grout injection.	Understand	8
6	Define epoxy resins.	Remember	9
7	Write short notes on member replacement.	Remember	9
8	Define overlays. What are the materials generally used for overlays?	Remember	9
9	How erosion control can be done?	Understand	9
10	What is slope protection?	Remember	9
<b>PART - B (LONG ANSWER QUESTIONS)</b>			
1	Explain the process of guniting in detail with figure.	Remember	8
2	Discuss the method of underpinning in detail.	Understand	8
3	Discuss the various types of blanket repair techniques.	Remember	8
4	Enumerate the different methods available for repairs of concrete works. Discuss the any one in detail.	Remember	8
5	Write short notes on Deep dump bucket method and pre-placed aggregate method.	Remember	8
6	What is jacketing? What are the different types of jacketing?	Understand	9
7	Explain the concrete column in detail with figure.	Remember	9



8	Explain the column strengthening and strengthening flexural members.	Remember	9
9	Explain strengthening and stiffening of beams and girders.	Remember	9
10	Explain the application of erosion control.	Understand	9
<b>PART- C (CRITICAL THINKING QUESTIONS)</b>			
1	Enumerate the different methods available for repairs of concrete works. Discuss the any one in detail.	Understand	8
2	Explain the methods of stitching in crack repair.	Remember	8
3	Explain the steps involved in underwater repair of structures.	Understand	8
4	Enumerate the various methods of placing concrete in underwater structures. Discuss the tremie pipe method in detail.	Understand	9
5	What do you mean by leak sealing? Discuss the various methods of leak sealing.	Understand	9
6	What are the protective surface treatments for structures?	Understand	9
7	Discuss the replacement of concrete.	Remember	9
8	Differentiate strengthening and stiffening of members.	Remember	9
9	Discuss the slope protection with detail.	Remember	9
10	What is the prevention for erosion control?	Remember	9
<b>UNIT-V (HEALTH MONITORING OF STRUCTURES)</b>			
<b>PART- A (SHORT ANSWER QUESTIONS)</b>			
1	Explain the Acquisition data in detailed.	Understand	10
2	Explain the communication data in detailed.	Remember	10
3	What is smart sensor?	Remember	10
4	What is sensor?	Remember	11
5	Explain the communication of data in health monitoring of structures.	Understand	11
6	How the structural health monitoring process is divided into various components.	Remember	11
7	How sensing technology does is used in structural health monitoring system.	Remember	12
8	What is the role of signal processing in health monitoring?	Remember	12
9	What is damage identification analysis?	Understand	12
10	What are the various structural evaluation methods?	Remember	12
<b>PART- B (LONG ANSWER QUESTIONS)</b>			
1	Explain the use of Smart sensor for monitoring civil engineering infrastructures.	Remember	10
2	Explain the methodology of health monitoring of structures and How is it monitored.	Understand	10
3	Explain the components of health monitoring of structures.	Remember	10
4	What are sensors? At What locations are they used?	Remember	11
5	Where Building Instrumentation is located? And how.	Remember	11
6	Explain active and passive structural health monitoring of structures and differentiate between them.	Understand	11
7	Explain various smart materials and its application in structural health monitoring system.	Remember	12



8	What is fiber optic sensors How they are used in health monitoring with suitable merits and demerits?	Remember	12
9	Explain in detail regarding the criteria for damage classification, mention the class of damage and repair requirements.	Remember	12
10	Explain in detail regarding effects of fire on concrete structures and its behavior with temperature change.	Understand	12
<b>PART- C (CRITICAL THINKING QUESTIONS)</b>			
1	What do you understand by health monitoring of structures?	Understand	10
2	Explain the advantages for health monitoring of structures.	Remember	10
3	What are the advantages and disadvantages of smart sensor?	Understand	10
4	Explain the Advantages of Structures health monitoring.	Understand	11
5	Explain the Disadvantages of Structures health monitoring.	Understand	11
6	Explain Diagnostic signal generation.	Understand	11
7	Explain various types of sensors.	Remember	12
8	Which type of sensors is used to detect seismic vibrations?	Remember	12
9	What are the recent innovations in structural health monitoring system?	Remember	12
10	What are the green materials? Explain in detail.	Remember	12

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