Assignments For

Retrofitting of Structures (2970602)

Professional Elective Course

PDDC Semester 7 (Civil)

Shantilal Shah
Engineering College

Directorate of Technical Education
Gandhinagar, Gujarat

Shantilal Shah Engineering College, Bhavnagar

Certificate

This is to certify that Mr./Ms. _____ _____ Enrollment No._____of B.E. Semester___Civil Engineering of this Institute (GTU Code:_____) has satisfactorily completed the Assignment for the subject Retrofitting of Structures (2970602) for the academic year 2022-23.

Place:_____
Date: _____

Name and Sign of Faculty member

Head of the Department

Preface

Retrofitting of Structures is a Professional Elective Course. This subject is designed with an aim to give the students an insight into the subject of deterioration of concrete structures, investigations to be carried out for Structural assessment, to make conversant with the various repair materials and strengthening techniques to salvage the distressed stock of structures.

The Assignments have been carefully curated so that the students will be encouraged to delve into a deeper reading of the subject. The set of questions for each module will encourage students to go through the References and prepare the most relevant answers to each question.

Utmost care has been taken while preparing these Assignments however always there are chances of improvement. Therefore, we welcome constructive suggestions for improvement and removal of errors if any.

Practical – Course Outcome matrix

Course Outcomes (COs):

CO1 - Identify and define all the terms and concepts associated with deterioration of concrete structures.

CO2 - Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.

CO3 - Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.

CO4 - Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

Sr. No.	Name of Assignment	CO 1	CO 2	CO 3	CO 4
1.	Introduction	√			
2.	Deterioration of Concrete Structures	√	√		
3.	Condition Assessment / Evaluation of Concrete Structures	√	√		
4.	Repair material, techniques and Retrofitting of Concrete Structures			√	
5.	Protection, maintenance & Quality control of Concrete Structures				√

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(Progressive Assessment Sheet)

Sr. No.	Objective(s) of Experiment	Page No.	Date of performance	Date of submission	Assessment Marks	Sign. of Teacher with date	Remarks
1							
2							
3							
4							
5							
Total							

Assignment No: 1
Introduction

Date:

Relevant CO:
CO1 - Identify and define all the terms and concepts associated with deterioration of Concrete Structures

Objectives: (a) To understand the process of deterioration of Concrete structures
(b) To assess the need for repair of structures
(c) To identify the steps for repairing of distressed structures

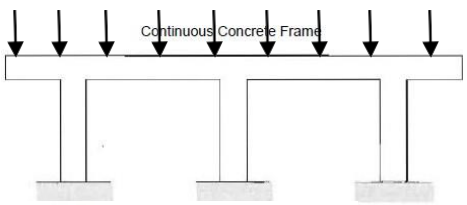
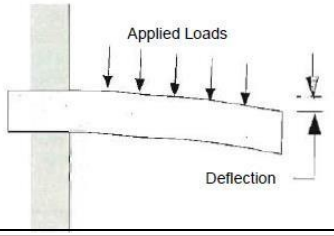
Q. NO	DESCRIPTION
1.1	What are various challenges faced by the existing structures and enlist effects of the same.
1.2	Cite at least 3 recent examples of failure of Structures with detailed information regarding the type of failure and reasons determined for the same. Give all the relevant references for the same.
1.3	Compare the construction of New structures vs the Repair of distressed structure
1.4	With the help of a Flow chart, clearly describe the Road map to carry out a sound repair/retrofitting work
1.5	Define the following terms: (i) Distress (ii) Defect (iii) Structural degradation
1.6	Capture at least 10 different types of distress you can in your surroundings. Put all pictures with proper caption stating the type of distress. This has to be an individual activity and not a group one.

Assignment No: 2
Deterioration of Concrete Structures

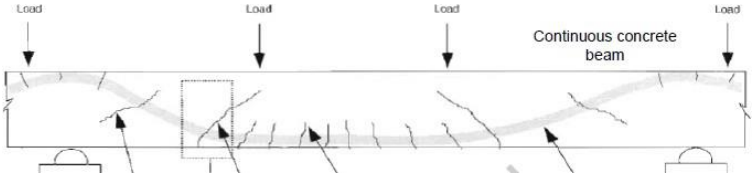
Date:

Relevant CO:
CO1 -Identify and define all the terms and concepts associated with deterioration of Concrete Structures
CO2 –Carry out the damage assessment and Rapid Visual Inspection of building showing signs of deterioration and thus should be able to detect the possible cause / source of deterioration

Objectives: (a) To understand the mechanism of various types of deterioration
(b) To develop a knowhow of the different terminologies associated with concrete deterioration.
(c) To enable to identify the different types and cause of distress by visual inspection

Q. NO	DESCRIPTION
2.1	Enlist various degradation factors that lead to deterioration in concrete structures.
2.2	Define 'Concrete deterioration". List down the various causes of deterioration in concrete structures
2.3	Explain in detail the relationship between the concept of concrete durability and performance.
2.4	Define Durability of concrete structures in accordance with IS 456. Explain various clauses as stated in IS 456 that ensure durability of concrete structures.
2.5	List down the various chemical causes of deterioration in concrete structures. Explain in the detail the (i) Corrossion of RCC structures (ii) Alkali aggregate reaction in this regard.
2.6	Enlist the various parameters/ aspects you would look for while diagnosing the cracks in RCC and masonry structures.
2.7	Differentiate between the following terms: (i) Porosity and Permeability (ii) Chloride induced corrosion and Carbonation induced corrosion (iii) Active crack and Passive Crack (iv) Spalling and Cracking (v) Deterioration due to Thermal stress and Moisture changes
2.8	Locate the possible location and types of cracks that shall occur in the following structural members under the effect of loads: (i)  (ii)  Cantilever span subjected to loading

(iii)



(iv)

Column under axial load

2.9 Match the following cause and the distress related with it:

Cause	Distress
[a] Inadequate curing	[i] Chemical attack leading to corrosion
[b] Inadequate compaction	[ii] Shrinkage cracking
[c] High w/c ratio	[iii] Fatigue cracks
[d] Repeated loading	[iv] Reduction in strength
[e] Inadequate cover thickness	[v] Results in porous behavior due to presence of air voids

Assignment No: 3
Condition Assessment / Evaluation of Concrete Structures

Date:

Relevant CO:
CO2 –Carry out the damage assessment and Rapid Visual Inspection of building showing signs of deterioration and thus should be able to detect the possible cause / source of deterioration

Objectives: (a) To understand the condition assessment of distressed structures
(b) To get conversant with the Methodology of conducting Preliminary Structural inspection and preparing report for the same.
(c) To have a better understanding of various field and laboratory tests to assess the strength of concrete structure.

<table>
<tr><th>Q. NO</th><th>DESCRIPTION</th></tr>
<tr><td>3.1</td><td>Mention the various circumstances under which a Structural assessment or Structural appraisal of concrete structure becomes a necessity.</td></tr>
<tr><td>3.2</td><td>Enlist the various items that you will carry with you for making a preliminary visual inspection of the distressed structure.</td></tr>
<tr><td>3.3</td><td>Give a detailed classification of the damage of structural members based on the Output/observations based on Preliminary Investigation.</td></tr>
<tr><td>3.4</td><td>Mention the underlying Principle of the following Non-Destructive test methods:
(i) Rebound Hammer
(ii) Ultra-sonic Pulse Velocity Test
(iii) Core-test
(iv) Pull-out test</td></tr>
<tr><td>3.5</td><td>Relate the following readings/observation with the most potential activity that it indicates:
<table>
<tr><th>Reading / Observation</th><th>Potential activity indicated</th></tr>
<tr><td>[a] Water sorptivity -10-15 mm/√h</td><td>[i] High corrosion risk</td></tr>
<tr><td>[b] Pulse velocity above 4.5 km/s</td><td>[ii] Very poor concrete quality</td></tr>
<tr><td>[c] Half cell potential vs Silver –silver chloride less than -4-4 mv</td><td>[iii] Excellent quality grade of concrete</td></tr>
<tr><td>[d] Concrete resistivity 5000-10000 ohm cm</td><td>[iv] Very poor concrete quality</td></tr>
<tr><td>[e] Oxygen permeability index < 9</td><td>[v] Chances of severe corrosion</td></tr>
</table></td></tr>
<tr><td>3.6</td><td>Make a comprehensive list of various types of signs of distress, deformation or deterioration you would look for while carrying out the Rapid visual inspection of a distressed RCC building.</td></tr>
</table>

Assignment No: 4
Repair material, techniques and Retrofitting of Concrete Structures

Date:

Relevant CO:
CO3 –Develop a Know-how of the concrete repair industry equipped with variety of repair materials and techniques

Objectives:
(a) To get conversant with different types of repair materials and techniques available for repair of distressed structures.
(b) To develop an understanding of factors that influences the choice of repair materials & techniques
(c) To develop a know-how of various techniques for strengthening of structural components.

Q. NO	DESCRIPTION
4.1	Enlist the important stages/steps that identify an effective concrete repair system or repair methodology.
4.2	State the importance of the surface preparation before carrying out the repairs. Also explain the general surface preparation procedure.
4.3	Make a list of all the desirable properties expected from the repair materials.
4.4	Explain in detail the appropriate repair solution for corrosion induced cracking.
4.5	Describe step wise the Grouting procedure used for grouting of cracks.
4.6	Explain the best repair technique used to carry out the under-water repairs.
4.7	Under which situations you would suggest Column strengthening. Enlist various methods/techniques for column strengthening and explain any 2 methods in detail with neat sketches.
4.8	Explain neatly with proper steps and figure to strengthen the deflected one-way slab.

Assignment No: 5
Protection, maintenance & Quality control of Concrete Structures

Date:

Relevant CO:
CO4 –Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures

Objectives: (a) To entrust with the importance of the quality control and maintenance of concrete structures

Q. NO	DESCRIPTION
5.1	Define the following terms: (i) Quality control (ii) Quality assurance (iii) Quality system (iv) Quality Audit
5.2	Compare Preventive, Corrective and Observational maintenance
5.3	Explain various attributes of Construction Quality control system.
5.4	What are the major aims of quality control during concrete construction.
5.5	Enlist various methods of Corrosion Mitigation. Explain cathodic Corrosion protection methods in this regard.
5.6	Make a list of items you would inspect during and after construction to ensure Quality maintenance and adherence.