**Techno India NJR Institute of Technology**



Repair and Rehabilitation of Structures

**(Subject Code: 5CE5-14)**

Bhupendra purohit

(Assistant Professor)

**Department of CE**

Graphical user interface

Description automatically generated with low confidence

**Course Overview:**

Student will learn basics of RRH from this 28 hours course. They will be able to the process of restoring the structure to service level, once it had and now lost, strengthening consists in endowing the structure with a service level, higher than that initially planned by modifying the structure not necessarily damaged structure. Structural repairs and rehabilitation is a process of reconstruction and renewal of a facility or its structural elements. This involves determining the origin of distress, removing damaged materials and causes of distress, as well as selecting and applying appropriate repair materials that extend a structure's life

RRH is the basic requirement for the job role of Civil Engineer in the companies like L &T, NCC Ltd etc.

**Course Outcomes:**

|  |  |  |
| --- | --- | --- |
| **CO. NO.** | **Cognitive Level** | **Course Outcome** |
| 1 | Synthesis | Student will be able to Plan and understand the repair strategies for buildings and Rehabilitation of structure |
| 2 | Analysis | Student will be able to analyse the serviceability and Durability of concrete |
| 3 | Evaluation | Students will be able to Able to choose the materials and repair techniques or method. |
| 4 | Synthesis | Students will be able to Able to Develop of “DEMOLITION TECHNIQUES” Engineered demolition techniques for Dilapidated structures – case study |
| 5 | Application | Students will be able to apply method of repairs, rehabilitation and retrofitting of Structures. |

**Prerequisites:**

1. Analyze strength and materials deficiency in concrete structures.

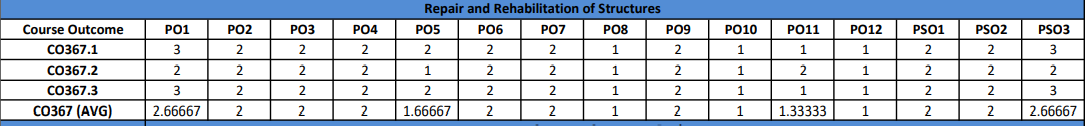
2. Suggest methods and techniques used in repairing / strengthening existing concrete structures.

3. Apply Non-Destructive Testing techniques to field problems.

4. Apply cost effective retrofitting strategies for repairs in buildings.

5. Estimate causes for distress and deterioration of structures

**Course Outcome Mapping with Program Outcome:**



**Course Coverage Module Wise:**

|  |  |  |
| --- | --- | --- |
| Lecture No. | Unit | Topic |
| 1 | **1** | **INTRODUCTION:** Objective, scope and outcome of the course |
| 2 | **2** | **DETERIORATION OF CONCRETE STRUCTURES:** Penetrability of  concrete- permeability |
| 3 | 2 | Sportively, diffusion. Physical processes- abrasion, erosion |
| 4 | 2 | Chemical - carbonation, chloride and sulfate attack |
| 5 | 2 | Alkali – Aggregate Reaction. Corrosion- mechanism. |
| 6 | 2 | Factors affecting and Preventive measures: for all the above |
| 7 | 2 | Water – proofing techniques for various conditions |
| 8 | 2 | Sacrificial anode, corrosion resistant steel |
| 9 | 2 | Corrosion inhibitors, protective coatings etc. |
| 10 | 3 | CRACKS in Concrete and Masonry Structures- Types of cracks |
| 11 | 3 | Patterns of cracks |
| 12 | 3 | Measurement and preventive measures |
| 13 | 4 | ASSESSMENT OF RISK/DAMAGE IN STRUCTURES: Preliminary  investigation- visual, history collection etc |
| 14 | 4 | Detailed Investigation: core cutting, rebar locator, corrosion meter, penetration resistance, |
| 15 | 4 | Pull out tests, half–cell potential, concrete resistivity etc |
| 16 | 4 | Interpretation of nondestructive test data from all the above tests as well as rebound hammer number and ultra-sonic pulse velocity |
| 17 | 4 | Destructive and chemical tests- on material samples from site. |
| 18 | 5 | MATERIALS FOR REPAIR: Polymers and resins |
| 19 | 5 | Self-curing compounds, FRP |
| 20 | 5 | Ferro-cement- properties, selection criterion |
| 21 | 5 | Cement based, and polymer modified mortars etc |
| 22 | 6 | REPAIR TECHNIQUES: Grouting |
| 23 | 6 | Jacketing |
| 24 | 6 | External bonded plates- processes, limitations |
| 25 | 6 | Design computations etc |
| 26 | 6 | Design computations etc. Including numerical problems |
| 27 | 6 | Under Water Repair: Processes |
| 28 | 7 | CASE STUDIES: Related to rehabilitation of bridge piers, heritage structures, masonry structures etc |

**TEXT/REFERENCE BOOKS**

1. Properties of Concrete by A.M. Neville, Pearson.
2. Concrete Technology by M.S. Shetty, S. Chand & Comp.
3. Handbook of Analytical Techniques in Concrete Tech by V.S. Ram Chandran, Standard Publishers.

**Course Level Problems (Test Items):**

|  |  |
| --- | --- |
| **CO.NO.** | **Problem description** |
| **1** | 1)Explain in detail the penetrability and permeability of concrete  2)Write a note on Physical process of concrete  3) Write a note on Chemical process of concrete  4) Explain in detail about water proofing techniques  5) Write about Corrosion Resistance steel |
| **2** | 1) Write a note on Masonry structures  2) Explain in detail Different types of cracks in concrete  3) Explain in detail different types of patterns of crack  4) Write a note on Measurement and preventive measures for cracks |
| **3** | 1)Explain detail preliminary Investigations.  2) Write a note on Core cutting investigations  3) Explain in detail the method of corrosion meter and rebar locaters  4)Explain in detail Ultra sonic pulse velocity test.  5)Write about Chemical test on material sample |
| **4** | 1. Write about different types of polymers 2. Write about self-Curing Compounds 3. Write about Ferro cement Properties in detail 4. Explain in detail Cement based materials 5. Write a note on Resistivity method of Investigation |
| **5** | 1)Write about Grouting in detail  2) Explain use of External bonded plates and processes  3)Explain in detail Underwater Repair techniques  4)Write about Repairing of bridges |

**Assessment Methodology**

1. Assignments one from each unit.
2. Midterm subjective paper where they have to write about subject. (Twice during the semester)
3. Final paper at the end of the semester subjective.

**Teaching and Learning resources unit-wise:**

**Unit-1**

**Deterioration of concrete Structures**

Video Tutorials: <https://www.youtube.com/watch?v=xlmiCWaYHXk>

Theory concepts: <https://www.researchgate.net/publication/267422589_Deterioration_and_rehabilitation_of_concrete_structures_in_hot_and_arid_regions>

Sample Quiz: <https://www.discountpdh.com/evaluation-and-repair-of-concrete-structures-quiz>

**Unit-2**

**Cracks in concrete**

Video Tutorials: <https://www.youtube.com/watch?v=gkG_a60IvOE>

Theory concepts: <https://www.researchgate.net/publication/286601793_STUDY_ON_DIFFERENT_TYPES_OF_CRACKS_IN_PLAIN_AND_REINFORCED_CONCRETE>

Sample Quiz: <https://www.concreteconstruction.net/how-to/repair/some-questions-and-answers-on-the-mechanism-of-cracking_o>

**Unit-3**

**Assessment of risk / Damage in structure**

Video Tutorials: <https://www.youtube.com/watch?v=NdLwHk-A0hc>

Theory concepts: <http://webarchiv.ethz.ch/ibk/emeritus/fa/education/ws_safety/Safety07/Script_secure.pdf>

Sample Quiz: <https://www.discountpdh.com/how-to-avoid-earthquake-damage-in-new-buildings-quiz>

**Unit-4**

**Material for Repair**

Video Tutorials: <https://www.digimat.in/nptel/courses/video/105102088/L09.html>

Theory concepts: <https://bie.tg.nic.in/Pdf/BuildingMaterialsConstruction.pdf>

Sample Quiz: <https://www.indiabix.com/civil-engineering/building-materials/>

**Unit-5**

**Repair Techniques**

Video Tutorials: <https://www.youtube.com/watch?v=fikRPFpbgVo>

Theory concepts: <https://nptel.ac.in/courses/105/106/105106202/>

Sample Quiz: <https://www.discountpdh.com/evaluation-and-repair-of-concrete-structures-quiz>

**Previous Year Question Papers:**

Table

Description automatically generated with medium confidence

Text

Description automatically generated with medium confidence