### **REPAIR, REHABILITATION AND RETROFITTING OF CONCRETE STRUCTURES**

### (Professional Elective- IV)

### Course code: 20CE1165

# LTPC 3003

Pre-requisites: Building Materials and Concrete Technology

### **Course Outcomes:**

At the end of the course, the student will be able to:

**CO1:** Estimate the causes for distress and deterioration of structures.

CO2: Explain the NDT techniques for condition assessment of structures

**CO3:** Evaluate the structural properties

CO4: Discuss the properties of repair material and identify a suitable repair option

**CO5:** Explain about the repair and rehabilitation strategies

### UNIT-I

### **INTRODUCTION TO REHABILITATION:**

An overview of present repair practices, distress identification and repair management, Causes of distress in concrete structures-Holistic Models for deterioration of concrete, Permeability of concrete, aggressive chemical agents, durability aspects, Condition Survey-Definition, objectives, different stages-Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy.

### Learning outcomes:

- 1. Explain the different distress in structures (L2)
- 2. Explain the durable aspects in deterioration of structures (L2)
- 3. Evaluate the quality control for repair strategy in structures (L2)

### UNIT-II

# NON DESTRUCTIVE TESTING METHODS:

Non-Destructive evaluation tests - Concrete strength assessment - Rebound hammer test - Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing, Chemical tests - Carbonation tests and chloride content, Corrosion potential assessment, half-cellpotentiometer test, resistivity measurement, Identification and estimation of damage.

### Learning outcomes:

- 1. Explain about concrete strength assessment tests (L2)
- 2. Compare about penetration and pull out test used in NDT (L2)
- 3. Examine the chemical tests used for estimation of damage in a structure (L2)

### UNIT-III

### **EVALUATION OF STRUCTURAL PROPERTIES:**

Fire damage assessment, structural integrity and soundness assessment, interpretation and evaluation of results, Evaluation of reserve strength of existing structures, analysis necessary to identify critical sections, active and passive repairs, modeling of repaired composite structures.

### (10 Lectures)

(10 Lectures)

# (10 Lectures)

### Learning outcomes:

- 1. Discuss about fire damage assessment in structures (L2)
- 2. Evaluate structural integrity and modelling of repaired composite structures (L4)
- 3. Analyse the critical sections for active and passive repairs (L4)

### UNIT-IV

### **REPAIR MATERIALS AND RETROFITTING TECHNIQUES:**

Selection of repair materials for concrete-Essential parameters for repair materials-Strength and durability aspects, cost and suitability aspects, Materials for repair, Identifying a suitable repair option for certain damage in a structure.

Retrofitting techniques to the member strength, deflection, cracking, chemical disruption, weather corrosion, wear, fire, leakage and marine exposure.

### Learning outcomes:

- 1. Discuss about the selection of repair material from strength and durability aspects (L2)
- 2. Describe a suitable repair option for damage in a building (L2)
- 3. Discuss about retrofitting techniques of a building (L2)

### UNIT-V

# **REPAIR/ REHABILITATION METHODS AND STRATEGIES:**

Rehabilitation and retrofitting methods-repair options, performance requirements of repair systems, factors for selection of repair methods, Repair stages, Methods of repair including foundation rehabilitation methods, chemical and electrochemical method.

Repair/Rehabilitation strategies- Stress reduction technique, repair and strengthening of columnsand beams, Compressive strength of concrete, cracks/joints, masonry, foundation, base isolation. Guidelines for repair and rehabilitation works: Guidelines for framing terms and conditions forrepair and rehabilitation work contracts.

### Learning outcomes:

- 1. Identify the retrofitting strategy for distress in a structure (L2)
- 2. Categorize different methods of repairs in a structure (L4)
- 3. Interpret the guidelines for repair management of deteriorated structure (L2)

# **TEXT BOOKS:**

- 1. Raikar, R.N., "Learning from failures Deficiencies in Design, Construction and Service" R&D Centre (SDCPL), RaikarBhavan, Bombay, 1987.
- 2. Denison Campbell, Allen and Harold Roper, "Concrete Structures Materials, Maintenanceand Repair", Longman Scientific and Technical, UK, 1991.
- 3. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt of India Press, New Delhi.

# **REFERENCES:**

- 1. Shetty, M.S, "Concrete Technology Theory and Practice", S.Chand and Company, NewDelhi, 1992.
- 2. Vidivelli, B,"Rehabilitation of Concrete Structures", Standard Publishers Distributors, New Delhi, 2008
- 3. P.K.Guha, "Maintenance and Repairs of Buildings", New Central Book Agency (P) Ltd,Kolkata.

### (10 Lectures)

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