

**20CE4501A– REPAIR AND REHABILITATION OF STRUCTURES**

<b>Offering Branches</b>	CE		
Course Category:	Program Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	20ES1301- Construction Materials and Concrete Technology	Continuous Evaluation:	30
		Semester End Evaluation:	70
		Total Marks:	100

**Course Outcomes**

Upon successful completion of the course, the student will be able to:

<b>CO1</b>	<b>Examine</b> the physical causes for deterioration of concrete and damages due to corrosion	K4
<b>CO2</b>	<b>Assess</b> the damage through semi destructive and Non-destructive testing methods	K2
<b>CO3</b>	<b>Apply</b> the suitable repair materials.	K3
<b>CO4</b>	<b>Analyse</b> various cracks and its repair techniques.	K4
<b>CO5</b>	<b>Identify</b> the various rehabilitation and strengthening techniques	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2		2									2	3
<b>CO2</b>	2	2		2	2	2							2	2
<b>CO3</b>	3	3		3									3	3
<b>CO4</b>	2	2		2	2								2	3
<b>CO5</b>	2	2		2	2	2							2	2
<b>Avg.</b>	<b>2</b>	<b>2</b>		<b>2</b>	<b>2</b>	<b>2</b>							<b>2</b>	<b>3</b>

**1- Low**

**2-Medium**

**3-High**

**Course Content**

<b>UNIT-1</b>	<p><b>Durability and Deterioration of Concrete</b>  <b>Physical causes:</b>                      Durability of concrete, causes of distress in concrete structures, Shrinkage in concrete, honeycombing in concrete, creep of concrete, Temperature changes – Internally generated temperature differences, externally generated temperature differences, Fire on concrete, Thermal movement in concrete,  <b>Corrosion:</b>                      Corrosion process, Damages due to corrosion</p>	<b>CO1</b>
<b>UNIT-2</b>	<p><b>Damage Assessment</b>                      Investigation of Damage- Observation, Assessment Procedure                      Non-Destructive Testing Methods: Introduction, Non-Destructive Testing Methods, Surface Hardness Test, Ultrasonic Pulse velocity test,                      Semi-Destructive Testing Systems: Core Sampling and Testing, Half -Cell potential survey</p>	<b>CO2</b>
<b>UNIT-3</b>	<p><b>Repair Materials</b>                      Polymeric repair materials, Polymeric coatings, Polymer concrete/mortar composites, Fibre reinforced concrete, Glass fibre reinforced concrete, Polypropene fibre, Carbon fibres, fibre reinforced polymer composites, Concrete made with industrial wastes, Bacterial concrete.</p>	<b>CO3</b>
<b>UNIT-4</b>	<p><b>Evaluation and Repair Techniques:</b>                      Symptoms and Diagnosis of Distress, Evaluation of cracks, Selection of Repair Procedure, Repair of cracks-Preparation of Surface, Repair Techniques, Common types of repairs: Sealing of cracks, Flexible sealing, providing additional steel, Stitching of cracks, Repair by jacketing, Autogenous Healing.</p>	<b>CO4</b>
<b>UNIT-5</b>	<b>Rehabilitation and Strengthening Techniques</b>	<b>CO5</b>

	<p><b>Rehabilitation Techniques:</b>  <b>Replacement Mortar- Epoxy bonded epoxy mortar,</b>  Replacement Concrete- Epoxy-bonded Replacement concrete,  Application, Shotcrete or Gunitite, Grouting- Portland Cement Grouts, Polymer  Grouts, Epoxy Grouting, Resin injection, Sprayed concrete, Slab jacking  technique, Cathodic Protection</p> <p><b>Strengthening methods:</b>  Introduction-Need for strengthening, Structural Concrete Strengthening, Column  Strengthening, Strengthening with external reinforcement, External Post-  tensioning, Section Enlargement, Guidelines for Seismic rehabilitation of existing  buildings.</p>	
<b>Learning Resources</b>		
<b>Text Books</b>	1. B.Vidivelli, Rehabilitation of Concrete Structures, 1/e, Standard Publishers Distributors, 2018. 2. M.L.Gambhir, Concrete Technology: Theory and Practice, 4/e, Tata McGraw Hill Education Private Limited, 2013. .	
<b>Reference Books</b>	1. Peter.H.Emmons and Gajanan.M.Sabnis, Concrete Repair and Maintainence, 2/e, Galgotia Publications Pvt Ltd, 1992. 2. S.Mahaboob Basha, A textbook of Concrete Technology, 1/e, Anuradha Publications, 2011. 3. J.Bhattacharjee, Concrete Structures Repair Rehabilitation and Retrofitting, 1/e, CBS, 2017. 4. P.C.Varghese, Maintenance Repair and Rehabilitation and Minor works of Buildings, 1/e, Prentice Hall India Learning Private Limited, 2014.	
<b>e-Resources&amp; other digital material</b>	1. <a href="https://nptel.ac.in/courses/105/106/105106202/">https://nptel.ac.in/courses/105/106/105106202/</a> - 2. <a href="https://freevideolectures.com/course/3489/ocean-structures-and-materials/16">https://freevideolectures.com/course/3489/ocean-structures-and-materials/16</a> 3. <a href="https://www.rilem.net/agenda/repair-and-rehabilitation-of-concrete-structures-1242">https://www.rilem.net/agenda/repair-and-rehabilitation-of-concrete-structures-1242</a>	