
	<b>SRI VIDYA COLLEGE OF ENGINEERING &amp; TECHNOLOGY</b> <b>COURSE PLAN (THEORY)</b>	
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ACADEMIC YEAR: 2018-19 (EVEN)

Subject Code	CE6021	L	P	T	C
Subject Title	REPAIR & REHABILITATION OF STRUCTURES	3	0	0	3
Year / Dept / Semester	IV-B /CIVIL/VIII	Regulation Year	2013		
Faculty Name / Designa / Dept	R.AMUTHA SELVA KUMAR/AP/CIVIL				
Course Prerequisite	1. The student should be Knowledge about concrete structures on various types of building. 2. The student should be awareness on various construction techniques. 3. The student has more concepts of behavior on concrete.				

**CE6021****REPAIR AND REHABILITATION OF STRUCTURES L T P****3 0 3****OBJECTIVES:**

□ To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

**UNIT I MAINTENANCE AND REPAIR STRATEGIES****9**

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

**UNIT II STRENGTH AND DURABILITY OF CONCRETE****9**

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness.

**UNIT III SPECIAL CONCRETES****9**

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

**UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS****9**

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

**UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES****9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – DEMOLITION TECHNIQUES - Engineered demolition methods - Case studies.

**TOTAL: 45 PERIODS****OUTCOMES:**

□ Students must gained knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

**TEXT BOOKS:**

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987

**REFERENCES:**

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
2. Dov Kominetzky.M.S., " Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
6. Dr.M.V.V.Thirumurugapoiya Mozhi., " Repair and Rehabilitation of structures" , Sri Krishna publication

Course Objectives (CO)	CO1: To gain the knowledge on quality of concrete, durability aspects, causes of deterioration. CO2: To gain the knowledge on assessment of distressed structures. CO3: To gain the knowledge on repairing methodology of structures and demolition procedures. CO4: To get more practice on behavior of concrete elements and quality assurance for concrete. CO5: Able to know about special concrete. CO6: To obtain more knowledge about corrosion protection methods.
Expected Course Outcomes (ECO)	At the end of the course, the students should be able to: ECO1: knowledge on quality of concrete, durability aspects causes of deterioration, assessment of distressed structures. ECO2: practiced various techniques on construction fields.

### Programme Outcomes

- Graduates of Civil Engineering program will be able to apply the fundamental knowledge of mathematics, science and engineering to solve problems pertaining to Civil Engineering.
- Graduates of Civil Engineering program will be able to identify, analyze, formulate, and solve civil Engineering problems in accordance with Indian Standard codes of practice.
- Graduates of Civil Engineering program will be able to design a system component, or process to meet desired needs within realistic constraint such as economic, environmental, social, political, ethical, health safety, manufacturability, and sustainability.
- Graduates of Civil Engineering program will be able to design and conduct experiments, as well as to analyze and interpret data.
- Graduates of Civil Engineering will be able to use the techniques, skills, and modern civil engineering tools, necessary for engineering practice.
- Graduates of Civil Engineering program will be able to incorporate specific contemporary issues into the identification, formulation, and solution of specific civil engineering problems.
- Graduates of Civil Engineering program will be able to work on the basis of broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- Graduates of Civil Engineering program will be able to understand the role of Civil Engineers and ethical responsibility.
- Graduates of Civil Engineering program will be able to function on multidisciplinary teams.
- Graduates of Civil Engineering program will be able to deliver effective verbal, written, and graphical communications.
- Graduates of Civil Engineering program will be able to recognize the need for, and an ability to engage in life-long learning.
- Graduates of Civil Engineering program will be able to perform economic analysis, quality checks, time/labour management and cost estimates related to design, construction, operations and maintenance of systems in the civil technical specialties.

### Mapping of CO & PO(Specify the PO's) - *(Fill the col.s with the legend given below)*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	2	-	-	-	-	-	2	-	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	2	-	-	-	-	3	3

CO4	2	-	3	2.	-	3	-	3	-	-	-	-
CO5	3	-	-	-	2	2	2	-	2	-	-	-
CO6	3	-	2	-	3	-	3	-	3	-	-	3
Bridging the Curriculum Gap (Additional Topics beyond syllabus/Seminars/Assignments)				BCG1: Various advanced methods on durability properties. BCG2: Various advanced methods on corrosion properties. BCG3: Various advanced methods on demolition techniques.								
Related Website URLs				W1: <a href="https://fenix.tecnico.ulisboa.pt">https://fenix.tecnico.ulisboa.pt</a> >download W2: <a href="https://www.thebalance.com">https://www.thebalance.com</a> >corrosion W3: <a href="http://nidm.gov.in">nidm.gov.in</a> >safety>earthquake>link13								
Related Video Course Materials (min. 3 no.s)				V1: <a href="https://youtu.be/so6JynDXFf4">https://youtu.be/so6JynDXFf4</a> V2: <a href="https://youtu.be/j3vyIHsAsKc">https://youtu.be/j3vyIHsAsKc</a> V3: <a href="https://youtu.be/gvoQdRScZWY">https://youtu.be/gvoQdRScZWY</a>								

S.No	Topic Name	Book – P. No	Teaching Aids	No of hrs	Cumulative hrs
<b>UNIT I</b>					
<b>MAINTENANCE AND REPAIR STRATEGIES</b>					
1.	Maintenance,	R6-1.1	B.B	1	1
2.	Facets of Maintenance,	R6-1.2	B.B	1	2
3.	Importance of Maintenance	R6-1.3	B.B	1	3
4.	Various aspects of Inspection	R6-1.7	B.B	2	5
5.	Assessment procedure for evaluating a damaged structure	R6-1.10	LCD	2	7
6.	causes of deterioration	R6-1.12	LCD	1	8
7.	Repair and Rehabilitation	R6-1.24	LCD	1	9
<b>UNIT II</b>					
<b>STRENGTH AND DURABILITY OF CONCRETE</b>					
8.	Quality assurance for concrete	R6-2.1	B.B	1	10
9.	Strength, Durability of the concrete	R6-2.16	LCD	1	11
10.	Thermal properties of concrete	R6-2.16	B.B	1	12
11.	Cracks of concrete, different types of cracks	R6-2.39	LCD	2	14
12.	Causes – Effects due to climate	R6-2.47	B.B	1	15
13.	Effects due to temperature, Corrosion	R6-2.44	LCD	1	16
14.	Effects due to Sustained elevated temperature	R6-2.44	B.B	1	17
15.	Effects of cover thickness	R6-2.45	B.B	1	18
<b>UNIT III</b>					
<b>SPECIAL CONCRETES</b>					
16.	Polymer concrete, Sulphur infiltrated concrete	R6-3.1	B.B	2	20
17.	Fibre reinforced concrete, High strength concrete	R6-3.15	LCD	2	22
18.	High performance concrete, Vacuum concrete, Self compacting concrete	R6-3.25	LCD	2	24
19.	Geo polymer concrete, Reactive powder concrete	R6-3.36	B.B	2	26

20.	Concrete made with industrial wastes	R6-3.41	B.B	1	27
<b>UNIT IV</b>					
<b>TECHNIQUES FOR REPAIR AND PROTECTION METHODS</b>					
21.	Non-destructive Testing Techniques	R6-4.1	LCD	2	29
22.	Epoxy injection, Shoring, Underpinning	R6-4.21	B.B	1	30
23.	Corrosion protection techniques	R6-4.36	LCD	2	32
24.	Corrosion inhibitors	R6-4.42	B.B	1	33
25.	Corrosion resistant steels, Coatings to reinforcement,	R6-4.52	B.B	2	35
	Cathodic protection	R6-4.56	B.B	1	36
<b>UNIT V</b>					
<b>REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES</b>					
26.	Strengthening of Structural elements	R6-5.1	B.B	1	37
27.	Repair of structures distressed due to corrosion and fire	R6-5.10	B.B	2	39
28.	Repair of structures distressed due to Leakage, earthquake	R6-5.16	LCD	2	41
29.	Demolition Techniques	R6-5.20	B.B	1	42
30.	Engineered demolition methods	R6-5.27	B.B	1	43
31.	Case studies	R6-5.53	VIDEOS	2	45

	<i>Prepared by</i>	<i>Approved by</i>
Signature		
Name	R.AMUTHA SELVA KUMAR	Prof.P.GANESAN
Designation	Assistant Professor / CIVIL	HOD /CIVIL
Signed date		

**LEGEND:****METHODOLOGY TO MAP OBJECTIVE WITH OUTCOME**

Course outcomes are achieved through

- a. Suitable Analogies.
- b. Class room teaching.
- c. Assignments.
- d. Tutorials
- e. Weekly, monthly and model exams.
- f. Brain storming.
- g. Group discussion and role play.
- h. Seminars