**19CE41E4 – REPAIR AND REHABILITATION OF STRUCTURES**

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| **Course Category**  | Professional Elective | **Credits**  | 3 |
| **Course Type**  | Theory | **Lecture - Tutorial - Practical**  | 3 - 0 - 0 |
| **Prerequisite**  | Concrete Technology | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks**  | 100 |

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| **Course Objectives** | 1. Discuss various repair and maintenance strategies.
2. Study strength and durability aspects of concrete.
3. Explore types of special concretes.
4. Discuss various protection methods of deteriorated structures.
5. Discuss repair and demolition techniques for RC structures.
6. Explain repair techniques for deteriorated structures due to corrosion.
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| **Course Outcomes** | CO1 | Apply maintenance and repair strategies to evaluate damaged structures. |
| CO2 | Evaluate strength and durability characteristics of concrete. |
| CO3 | Identify various special concretes and their applications. |
| CO4 | Apply non-destructive testing techniques and protective methods to field problems. |
| CO5 | Recommend repair and demolition procedures of structures. |
| CO6 | Assess corrosion of embedded steel in concrete and suggest repair techniques. |
| **Course****Content** | **UNIT I** **MAINTENANCE AND REPAIR STRATEGIES:** 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:** 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:** 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** **PROTECTION METHODS**: Non-Destructive testing techniques – Epoxy injection – Shoring – Underpinning – Corrosion protection techniques – Corrosion inhibitors – Corrosion resistant steels – Coatings to reinforcement – Cathodic protection.**UNIT V****REPAIR AND DEMOLITION TECHNIQUES OF STRUCTURES**: Strengthening of structural elements – Repair of structures distressed due to corrosion – fire – Leakage and earthquake – Demolition techniques – Engineered demolition methods – Case studies.**UNIT VI****CORROSION OF EMBEDDED STEEL IN CONCRETE:** Corrosion of embedded steel in concrete – Mechanism – Stages of corrosion damage – Repair of various corrosion damaged of structural elements (slab, beam and columns).**JACKETING:** Jacketing – Column jacketing – Beam jacketing – Beam column joint jacketing – Reinforced concrete jackets – Steel jacketing – FRP jacketing. **STRENGTHENING**: Strengthening of beam - Shear strengthening - Flexural strengthening. |
| **Textbooks****and****References** | **TEXTBOOKS:**1. Poonam I. Modi and Chirag N. Patel, *Repair and Rehabilitation of Structures*, PHI learning Pvt. Ltd, Eastern Economy Edition, 2016.
2. Denison Campbell, Allen and Harold Roper, *Concrete Structures, Materials Maintenance and Repair*, Longman Scientific and Technical, Illustrated edition, 1991.
3. R.T. Allen and S.C Edwards, *Repair of Concrete Structures*, Blakie and Sons, 2nd edition, 1992.

**REFERENCES:**1. M.S Dov Kominetzky, *Design and Construction Failures*, Galgotia Publications Pvt. Ltd., 2001.
2. K. Ravi Shankar and T.S Krishna Moorthy, *Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*, Allied Publishers, 2004.
3. M. L. Gambhir., *Concrete Technology*, McGraw Hill Publication, 5th edition 2013.
4. CPWD and Indian Buildings Congress, *Hand Book on Seismic Retrofit of Buildings,* Narosa Publishers, 2008.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|   | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | - | - | 1 | - | 1 | - | - | - | - | 1 | - |
| **CO2** | 1 | - | - | 1 | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | - | 1 | - | - | - | - | - | 1 | 1 |
| **CO4** | 2 | 1 | - | - | 3 | - | - | - | - | - | 2 | 2 |
| **CO5** | 1 | - | 1 | 1 | 2 | - | - | - | - | - | 2 | - |
| **CO6** | 1 | - | - | - | 2 | - | - | - | - | - | 1 | 1 |