**19CE31E1 –ADVANCED REINFORCED CONCRETE DESIGN**

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

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| **Course Objectives** | 1. To carry out the design of simple combined footings.
2. To carry out the design of various retaining walls.
3. To perform the design of liquid retaining structures resting on ground.
4. To carry out the design of elevated liquid retaining structures.
5. To comprehend the concept of yield line theory.
6. To explain the basic concepts of pre stressing systems and losses in prestressed members.
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| **Course Outcomes** | CO1 | Design rectangular and trapezoidal footings. |
| CO2 | Design cantilever and counterfort retaining walls for different loadings. |
| CO3 | Design liquid retaining structures resting on ground. |
| CO4 | Design elevated liquid retaining structures. |
| CO5 | Analyze slabs using yield line theory. |
| CO6 | Analyze pre-stressed rectangular sections for losses and stresses. |
| **Course Content** | **UNIT – I****DESIGN OF FOUNDATIONS:** Design of combined footings (Rectangular and Trapezoidal).**UNIT – II****DESIGN OF RETAINING WALLS:** Design of retaining walls – Cantilever and Counterfort types for different loadings.**UNIT – III****DESIGN OF WATER TANKS-I:** Review of working stress design method – Circular and rectangular tanks resting on ground – Circular tanks with IS code method and rectangular tanks with approximate method. **UNIT – IV****DESIGN OF WATER TANKS-II:** Spherical and Conical domes – Design of Intze tanks.**UNIT – V****YIELD LINE THEORY:** Introduction – Behavior of slab up to failure – Assumptions – Guidelines for predicting yield line pattern – Yield criterion – Methods of analysis and basic principles – Virtual work – Equilibrium method – Corner levers – Circular slabs.**UNIT – VI****PRESTRESSED CONCRETE:** Principles of prestressing – Materials used – Methods and Systems of prestressing – Losses of prestress – Analysis of rectangular sections for stresses. |
| **Textbooks****and****References** | **TEXTBOOKS:**1. Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, *LSD of Reinforced Concrete,* Laxmi Publications, 1st Edition, 2007.
2. S. Ramamrutham, *Design of Reinforced Concrete Structures*, Dhanpat Rai Publishing Company (P) Ltd., 1st Edition, 2016.
3. N. Krishna Raju, *Pre-stressed Concrete*, McGraw Hill Education, 6thEdition, 2018.

**REFERENCE BOOKS:**1. S. R. Karve & V. L. Shah., *Limit State Theory and Design of Reinforced Concrete*, Structures publications, 7th Edition, 2015.
2. C.K Wang, C.G. and J.A. Pincheira, *Reinforced Concrete Design*, Oxford university press, 8th edition, 2017.
3. N. Subramanian, *Design of Reinforced Concrete Structures*, Oxford university press, Illustrated edition, 2013.
4. Plain and Reinforced Cement Concrete – Code of practice (IS: 456-2000).
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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** | 2 | - | 3 | - | 1 | 1 | - | 1 | - | - | 1 | 1 |
| **CO2** | 3 | - | 3 | - | 2 | 1 | - | 1 | - | - | 1 | 1 |
| **CO3** | 3 | - | 3 | - | 1 | 1 | - | 1 | - | - | 1 | 1 |
| **CO4** | 3 | - | 3 | - | 2 | 1 | - | 1 | - | - | 1 | 1 |
| **CO5** | 2 | - | 1 | - | - | - | - | - | - | - | - | 2 |
| **CO6** | 3 | - | 1 | - | - | 1 |  - |  - | - | - | - | 2 |