**20CE31E4- ADVANCED FOUNDATION ENGINEERING**

**(Civil Engineering)**

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| **Course Category** | Professional Elective | **Credits** | 3 |
| **Course Type** | Theory | **Lecture-Tutorial-Practical** | 3-0-0 |
| **Prerequisite** | Geotechnical Engineering-II | **Sessional Evaluation** | 40 |
| **External Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Outcomes** | CO1 | Estimate the pressure distribution for bulk heads. |
| CO2 | Design anchored bulk head. |
| CO3 | Design various components of bracing. |
| CO4 | Design of mat foundations by conventional method. |
| CO5 | Evaluate design parameters for dynamic loading. |
| CO6 | Outline the design of foundation on problematic soils |
| **Course**  **Content** | **UNIT – I**  **BULKHEADS:** Uses of sheet piling walls – Common types of sheet piling walls – Common sheet pile sections – Cantilever sheet piling walls in cohesionless soils – cantilever sheet piling walls in cohesive soils (Approximate analysis only).  **UNIT – II**  **ANCHORED BULKHEADS:** Anchored bulkhead design by free earth support method – Anchored bulkhead design by fixed earth support method – Methods of reducing lateral pressure – Types of anchorage.  **UNIT – III**  **BRACED EXCAVATIONS:** Braced cut – Apparent pressure diagrams for cuts in both sands and clays – Types of bracing systems – Design of various components of bracing – Bottom heave of cuts in soft clays – Piping failure of cuts in sands.  **UNIT – IV**  **MAT FOUNDATIONS:** Allowable bearing pressure for mat foundations – conventional design of mat foundations – Modulus of sub-grade reaction.  **UNIT – V**  **SOIL DYNAMICS AND MACHINE FOUNDATIONS**: Introduction - Fundamentals of vibration – Fundamentals of soil dynamics - Machine Foundation –Special features - Vibration Analysis - Elastic Half-Space Theory - Mass-Spring-Dashpot Model - Foundations for reciprocating machines and impact machines - Vibration isolation and control- Construction aspects of machine foundations  **UNIT – VI**  **EXPANSIVE SOILS:** Identification and characteristics of Expansive soils, Free swell index and swell potential, Swell pressure – Factors –Test, Effect of swelling on building foundations, Fundamental design in expansive soil – CNS layer, Under reamed pile and other concepts, Problems. | |
| **Textbooks**  **& References** | **TEXTBOOKS:**   1. K.R. Arora, *Soil Mechanics and Foundation Engineering*, Standard publishers distributions, 6th edition, 2017. 2. A.S. Rao &GopalRanjan, *Basic and applied soil mechanics*, New Age International publishers, 3rd edition, 2016. 3. Swami saran, *Soil Dynamics and Machine Foundations*, Galgotia Publications Private Limited, 2nd edition, 1999.   **REFERENCE BOOKS:**   1. B. M. Das, *Principles of Geotechnical Engineering*, Cengage learning, 8th edition, 2017. 2. B.C. Punmia, A. K. Jain & A. K. Jain, *Soil Mechanics and Foundation Engineering,* Laxmi publications, 17th edition, 2018. 3. C. Venkatramaiah, *Geotechnical Engineering*, New Age International Private Limited, 4th edition, 2010. | |

**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** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | - | 2 | 1 | - | 1 | - | 1 | - | 1 | 1 | 1 | - | 2 | 2 |
| **CO2** | 2 | - | 3 | 2 | 1 | 1 | - | 1 | - | 1 | 1 | 1 | - | 2 | 2 |
| **CO3** | 2 | - | 2 | 1 | - | 1 | - | 1 | - | 1 | 1 | 1 | - | 2 | 2 |
| **CO4** | 2 | - | 3 | 2 | 1 | 1 | - | 1 | - | 1 | 1 | 1 | - | 2 | 2 |
| **CO5** | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | - | 1 | 1 | 1 | - | 3 | 2 |
| **CO6** | 2 | - | 2 | 2 | 1 | 1 | 1 | 1 | - | 1 | 1 | 1 | - | 3 | 2 |