**17CE32E5 - ADVANCED FOUNDATION ENGINEERING**

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

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| **Course****Objectives** | 1. To analyse the pressure distribution for bulk heads.
2. To understand the design of anchored bulk heads by various methods.
3. To demonstrate the design of various components of bracing.
4. To analyse the design of mat foundation by conventional method.
5. To study the behaviour of laterally loaded vertical and batter piles.
6. To explain the concept of ground improvement for expansive soils.
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| **Course Outcomes** | CO1 | Estimate the pressure distribution for bulk heads. |
| CO2 | Design anchored bulk heads by various methods. |
| CO3 | Design various components of bracing.  |
| CO4 | Design of mat foundations by conventional method. |
| CO5 | Analyse laterally loaded pile and batter piles. |
| CO6 | Understand the concept of ground improvement for expansive 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****BEHAVIOUR OF LATERALLY LOADED VERTICAL BATTER PILES:** Introduction – Winkler’s Hypothesis – Differential equation – Non-dimensional solutions for vertical piles subjected to lateral loads – P-Y curves – Broom’s solutions – Case studies for laterally loaded vertical piles in sand and clay – Behavior of laterally loaded batter piles in sand.**UNIT – VI****EXPANSIVE SOILS**: Problems of expansive soils – Tests for identification – methods of determination of swell pressure – Improvement of expansive soils – Foundation techniques in expansive soils – Under reamed piles. |
| **Textbooks****& References**  | **TEXTBOOKS:** 1. Soil mechanics and Foundation Engineering by V.N.S. Murthy.
2. Modern geotechnical engineering by Alam Singh.
3. Foundation Engineering by Brahma. S.P.
4. Analysis and Design of Foundation and Retaining Structures by Shamsher Prakash, Gopal Ranjan and Swami Saran.
5. Basic and Applied Soil Mechanics by Gopal Ranjan& A.S.R. Rao.
6. Geotechnical Engineering by C. Venkatramaiah.

**REFERENCE BOOKS:**1. Foundation Analysis and design by Bowles. J.E.
2. Foundation Engineering by Teng. W.C.
3. Foundation Engineering by Peck, Honson, Thornburn.
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