**COURSE DELIVERY PLAN**

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| **DEPARTMENT OF CIVIL ENGINEERING** | **L****T** | : 3: 0 |
| **COURSE** | : CE | **P** | : 0 |
| **REGULATION** | : R-20  | **C** | : 3 |
| **COURSE CODE** | :  | **Date** | : |
| **COURSE NAME** | : GEOTECHNICAL ENGINEERING-II | **Rev. No** | : |
|  |
| **CLASS** | **COURSE COORDINATOR** | **SECTION** | **NAME OF THE FACULTY** |
| III B. Tech- II Sem | S. AVINASH | CE-A | S.AVINASH |
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| **COURSE OUTCOMES:** |
| After successful completion of the course, the student will be able to- |
| **CO-1** | **Understand** the soil exploration techniques and prepare investigation reports. |
| **CO-2** | **Compute** and **Apply** the principles of bearing capacities and stability of earth retaining structures. |
| **CO-3** | **Understand** the various types of shallow foundations and decide on their locations based on soil characteristics. |
| **CO-4** | **Compute** the magnitude of foundation settlement and decide on the size of the foundation accordingly. |
| **CO-5** | **Use** the field test data and arrive at the bearing capacity. |

Bridge Course:

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| **S No.** | **Topic Discussed** |
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| **1. Soil Exploration:** Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests –Pressure meter – planning of Programme and preparation of soil investigation report. |
| **OBJECTIVE:**To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **1.** | Introduction to soil exploration | T-4, Page-1  | PPT |
| **2.** | Need for soil exploration | T-4, Page-2 | Chalk & Talk |
| **3.** | Methods of soil exploration | T-4, Page-3 | Chalk & Talk |
| **4.** | Boring and sampling methods | T-4, Page-37-41 | Chalk & Talk |
| **5.** | Field tests on soil exploration | T-4, Page-44-46 | Chalk & Talk |
| **6.** | Soil exploration analysis using pressure meter | T-4, Page-59 | Chalk & Talk |
| **7.** | Planning of soil investigation programme | T-4, Page-111-115 | Chalk & Talk |
| **8.** | Preparation of soil investigation report | T-4, Page-115 | Chalk & Talk |
| **9.** | Evaluation of soil investigation report | T-4, Page-132 | Chalk & Talk |
| Content beyond syllabus covered (if any)1.2. |

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| **2. Earth And Earth-Retaining Structures:** Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Taylor’s Stability Number-Stability of slopes of dams and embankments - different conditions. Rankine’s & Coulomb’s theory of earth pressure – Culmann’s graphical method - earth pressures in layered soils. |
| **OBJECTIVE:**To enable the student to compute immediate and consolidation settlements of shallow foundations. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **10.** | Rankine’s & coulomb’s theory of earth pressure | T-4, Page-177 | PPT |
| **11.** | Rehbann’s graphical method | T-4, Page-177 | Chalk & Talk |
| **12.** | Culmann’s graphical method | T-4, Page-177  | Chalk & Talk |
| **13.** | Friction circle method | T-4, Page-183  | Chalk & Talk |
| **14.** | Earth pressure in layered soils |  | Chalk & Talk |
| **15.** | Problems | T-4, Page-184 | Chalk & Talk |
| **16.** | Types of retaining walls | T-4, Page-188  | Chalk & Talk |
| **17.** | Design approach of gravity retaining walls | T-4, Page-185  | Chalk & Talk |
| **18.** | Cantilever retaining walls | T-4, Page-189  | Chalk & Talk |
| **19.** | Bulk heads | T-4, Page-189  | Chalk & Talk |
| **20.** | Anchored bulk heads | T-4, Page-198 | Chalk & Talk |
| **21.** | Revision |  |  |
| **22.** | Revision |  |  |
| Content beyond syllabus covered (if any)1.2. |

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| **3. Shallow Foundations** – Bearing Capacity Criteria: Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity – factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi’s theory - IS Methods. |
| **OBJECTIVE:**To impart the principles of important field tests such as SPT and Plate bearing test. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **23.** | Bearing capacity | T-4, Page-295 | PPT |
| **24.** | Criteria for determination of bearing capacity | T-4, Page-296,316 | Chalk & Talk |
| **25.** | Factors influencing bearing capacity | T-4, Page-299 | Chalk & Talk |
| **26.** | Analytical methods to determine bearing capacity | T-4, Page-317 | Chalk & Talk |
| **27.** | Terzaghi bearing capacity equation | T-4, Page-317 | Chalk & Talk |
| **28.** | Meyerhoff and skempton and IS methods | T-4, Page-317 | Chalk & Talk |
| **29.** | Problems | T-4, Page-312 | Chalk & Talk |
| **30.** | Problems | T-4, Page-317 | Chalk & Talk |
| **31.** | Revision |  |  |
| **32.** | Revision |  |  |
| Content beyond syllabus covered (if any)1.2. |

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| **4. Shallow Foundations** – Settlement Criteria: Safe bearing pressure based on N- value – allowable bearing pressure; safebearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures. |
| **OBJECTIVE:**To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **33.** | Safe bearing pressure based on N-Value | T-4, Page-407 | PPT |
| **34.** | Allowable bearing pressure | T-4, Page-407 | Chalk & Talk |
| **35.** | Safe bearing capacity and settlement from plate load test | T-4, Page-407 | Chalk & Talk |
| **36.** | Allowable settlement of structures | T-4, Page-408 | Chalk & Talk |
| **37.** | Settlement analysis | T-4, Page-408 | Chalk & Talk |
| **38.** | Problems | T-4, Page-340 | Chalk & Talk |
| **39.** | Revision |  |  |
| **40.** | Revision |  |  |
| Content beyond syllabus covered (if any)1.2. |

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| **5. Deep Foundations:****Pile Foundation:** Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests - Load carrying capacity of pile groups in sands and clays.**Well Foundations:** Types – Different shapes of well – Types of cassions – Components of well - functions – forces acting on well foundations - Design Criteria – Determination of steining thickness and plug – construction and Sinking of wells – Tilt and shift. |
| **OBJECTIVE:**The students are to be able to identify the types of foundations and their design criterias. |
| **Session No.** | **Topics to be Covered** | **Reference** | **Teaching Aids/ Class Methods** |
| **41.** | PILE FOUNDATIONS | T-4, Page-427 | PPT |
| **42.** | Types of piles | T-4, Page-428 | Chalk & Talk |
| **43.** | Load carrying capacity of piles basd on static pile formulae | T-4, Page-430 | Chalk & Talk |
| **44.** | Dynamic pile formulae | T-4, Page-431 | Chalk & Talk |
| **45.** | Pile load tests | T-4, Page-432 | Chalk & Talk |
| **46.** | Load carrying capacity of pile groups in sands & clay | T-4, Page-455 | Chalk & Talk |
| **47.** | Settlement of pile groups | T-4, Page-461 | Chalk & Talk |
| **48.** | Problems | T-4, Page-470 | Chalk & Talk |
| **49.** | WELL FOUNDATIONS | T-4, Page-472 | Chalk & Talk |
| **50.** | Types | T-4, Page-473 |  |
| **51.** | Different shapes of wells | T-4, Page-478 |  |
| **52.** | Components of wells | T-4, Page-492 |  |
| **53.** | Functions | T-4, Page-372 |  |
| **54.** | Forces acting on well foundations | T-4, Page-378 |  |
| **55.** | Design criteria | T-4, Page-340 |  |
| **56.** | Construction & sinking of wells | T-4, Page-341 |  |
| **57.** | Tilt &shift | T-4, Page-342 |  |
| **58.** | Problems |  |  |
| **59.** | Revision |  |  |
| **60.** | Revision |  |  |
| Content beyond syllabus covered (if any)1.2. |

Session Duration: 50 Minutes

Total No. of Sessions Required: 65

**COURSE OUTCOMES:**

Student must be able to:

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| **CO-1** | **Understand** the soil exploration techniques and prepare investigation reports. | **Analyze** | **K4** |
| **CO-2** | **Compute** and **Apply** the principles of bearing capacities and stability of earth retaining structures. | **Apply** | **K3** |
| **CO-3** | **Understand** the various types of shallow foundations and decide on their locations based on soil characteristics. | **Apply** | **K3** |
| **CO-4** | **Compute** the magnitude of foundation settlement and decide on the size of the foundation accordingly. | **Apply** | **K3** |
| **CO-5** | **Use** the field test data and arrive at the bearing capacity. | **Apply** | **K3** |

**PROGRAM OUTCOMES:**

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| S No. | Graduate Attributes | Action Verbs | Level |
| 1. | Engineering Knowledge | APPLY | K3 |
| 2. | Problem Analysis | ANALYZE | K4 |
| 3. | Design Development of Solutions | EVALUATE | K5 |
| 4. | Investigation of Complex Problems | APPLY,ANALYZE,EVALUATE | K3,K4,K5 |
| 5. | Modern Tool Usage | APPLY, EVALUATE | K3,K5 |
| 6. | Engineer and Society |  |  |
| 7. | Environment and Sustainability |  |  |
| 8. | Ethics |  |  |
| 9. | Individuals and Team Work |  |  |
| 10. | Communication |  |  |
| 11.  | Life Long Learning | APPLY | K3 |
| 12. | Project Management and Finance | CREATE | K6 |

**PROGRAM SPECIFIC OUTCOMES:**

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| **PSO1** | Carry out projects in the field of real estate and infrastructural engineering. |
| **PSO2** | Provide solution for environmental and social issues through sustainable approach. |
| **PSO3** | Substantiate professionalism through leadership qualities and moral values. |

**MAPPING OF CO-PO-PSO:**

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | **2** | **3** | **1** | **3** | **2** | **1** |  |  | **2** | **1** |  |  | **2** | **1** | **2** |
| **CO2** | **2** | **2** |  |  | **1** |  |  |  | **1** | **2** |  |  | **1** |  | **1** |
| **CO3** | **2** | **2** |  |  | **1** |  |  |  |  | **1** |  |  | **1** |  |  |
| **CO4** | **2** | **2** | **1** | **1** | **2** |  |  |  | **1** | **2** |  |  | **1** | **1** | **1** |
| **CO5** | **2** | **3** | **1** |  |  |  |  |  |  | **1** |  |  | **1** |  |  |

1. **Weekly Mapped 2. Mapped 3. Strongly Mapped**

**REFERENCES:**

**TEXT BOOKS:**

1. Principles of Foundation Engineering, Das, B.M., (2011), 6th edition Cengage learning.

 2. Basicand Applied Soil Mechanics, Gopal Ranjan & A.S.R. Rao, New Age International Pvt. Ltd, (2004).

**REFERENCES:**

1. Foundation Analysis and Design, Bowles, J.E., (1988), 4th Edition, McGraw-Hill Publishing Company, Newyork.
2. Analysis and Design of Substructures by Swami Saran, Sarita Prakashan, Meerut.

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| **Prepared By** | **Signatures** | **Approved By** | **Signature** |
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|  |  | PRINCIPAL |  |