# SCHEME OF COURSE WORK

**Course Details:**

| | | | |
|---|---|---|---|
| **Course Title:** | **ADVANCED FOUNDATION ENGINEERING** | | |
| **Course Code:** | **13CE2211** | **L T P C** | **: 4 1 0 4** |
| **Program:** | **M. Tech.** | | |
| **Specialization:** | **Structural Engineering** | | |
| **Semester:** | **II** | | |
| **Prerequisites:** | **G.T.E-1,G.T.E-2** | | |
| **Courses to which it is a prerequisite:** | **Soil Dynamics and Machine foundations** | | |

**Course Outcomes (COs):**
At the end of the course, the student will be able to:

| | |
|---|---|
| 1 | Identify a suitable foundation system for a structure. |
| 2 | Evaluate the importance of raft foundation and principles of design for buildings and tower structures. |
| 3 | Analyse and design pile foundations. |
| 4 | Examine and discuss various machine foundations. |
| 5 | Analyse and design sheet piles and cofferdams. |

**Program Outcomes (POs):**
Post graduates will be able to:

| | |
|---|---|
| 1 | Synthesize existing and new knowledge in various sub areas of structural engineering |
| 2 | Analyse complex engineering problems critically with adequate theoretical background for practical applications. |
| 3 | Evaluate a wide range of feasible and optimal solutions after considering safety and environmental factors. |
| 4 | Demonstrate the ability to pursue research by conducting experiments and extract the relevant information through literature surveys. |
| 5 | Use state –of- the- art of modern tools for interpreting the behavior and modeling of complex engineering structures. |
| 6 | Attain the capability to work in multi-disciplinary teams to achieve common goals. |
| 7 | Demonstrate the knowledge to perform the projects efficiently in multi-disciplinary environments after consideration of economic and financial matters. |
| 8 | Communicate effectively on complex engineering activities to prepare reports and make presentations. |
| 9 | Engage in life-long learning independently to improve knowledge. |
| 10 | Understand the responsibility of carrying out professional practices ethically for sustainable development of society. |
| 11 | Examine critically and independently one's actions and take corrective measures by learning from mistakes. |

**Course Outcome versus Program Outcomes:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO-1** | S | S | S | M | | | | | | | | M |
| **CO-2** | S | S | S | S | M | | | | | | | M |
| **CO-3** | S | S | M | M | | | | | | | | M |
| **CO-4** | S | S | S | S | M | | | | | | | M |
| **CO-5** | S | S | S | M | S | | | | | | | M |

*S - Strongly correlated*, *M - Moderately* correlated, *Blank - No correlation*

| **Assessment Methods:** | Assignment / Seminar / Mid-Test / End Exam |
|---|---|

## Teaching-Learning and Evaluation

| Week No. | TOPIC / CONTENTS | Course Outcomes | Sample questions | TEACHING-LEARNING STRATEGY | Assessment Method & Schedule |
|---|---|---|---|---|---|
| 1 | **Foundation design basics:** Criteria for choice of foundation, bearing capacity. | CO-1 | 1. Explain the criteria for choice of foundation. | ▫ Lecture<br>▫ LCD projector | |
| 2 | Total and differential settlement tolerance for various types of structures. | CO-1 | 1. Discuss the tolerance values of total and differential settlement for various structures. | ▫ Lecture<br>▫ Problem solving | |
| 3 | Interpretation of soil profile from design parameters like modulus of compressibility, Modulus of sub grade reaction, Poisson's ratio, etc. | CO-1 | 1. Explain the procedure for determining the modulus of subgrade reaction.<br>2. Explain the procedure for determining the Poisson's ratio | ▫ Lecture<br>▫ Problem solving | |
| 4 | **Raft foundations:** Raft foundations for building and tower structures, including effects of soil-structure interaction and nonlinearity. | CO-2 | 1. Explain the situations where raft foundation is preferred. | ▫ Lecture<br>▫ Problem solving | Assignment |
| 5 | Different types of rafts | CO-2 | 1. Discuss various types of rafts. | ▫ Lecture<br>▫ Problem solving | |
| 6 | Pile foundation-types, methods of installation, codal practices for permissible load under vertical and lateral loads,<br>stresses during pile driving. | CO-3 | 1.Classification of piles<br>2.Detemine the lateral load carrying capacity of piles<br>3.Detemine the vertical load carrying capacity of piles | ▫ Lecture<br>▫ Problem solving | |
| 7 | Load carrying capacity of pile groups, negative skin friction, under-reamed piles | CO-3 | 1. Explain the Load carrying capacity of pile groups.<br>2. Explain negative skin friction of piles.<br>3.Write about under-reamed piles | ▫ Lecture<br>▫ Problem solving | Assignment |
| 8 | Foundation for heavy structures, well foundations, caisson<br>foundations, equipment used for construction of these foundation | CO-3 | 1.Write about Components of well foundations with neat sketches<br>2.Explain the equipment used for construction of well foundation | ▫ Lecture<br>▫ Problem solving | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | **MID TEST – I** | | | | |
| 10 | Theory of vibrations, free and forced vibrations with damping for a single degree freedom system | CO-4 | 1. Explain the free vibrations with damping for a single degree freedom system<br>2.Explain the forced vibrations with damping for a single degree freedom system | ▫ Lecture<br>▫ Problem solving | Assignment |
| 11 | Free and Forced vibrations without damping for a single degree freedom system | CO-4 | 1. Explain the free vibrations without damping for a single degree freedom system.<br>2.Explain the forced vibrations without damping for a single degree freedom system | ▫ Lecture<br>▫ Problem solving | |
| 12 | Types of machine foundations, their design criteria. | CO-4 | 1. Discuss various types of machine foundations with their design criteria. | ▫ Lecture<br>▫ Problem solving | |
| 13 | Permissible amplitudes and bearing pressure for various types of machine foundations | CO-4 | 1.Discuss the Permissible amplitudes for various types of machine foundations<br>2. Discuss the permissible bearing pressure values for various types of machine foundations. | ▫ Lecture | |
| 14 | **Cantilever sheet piles and anchored bulkheads:** Earth pressure diagram, determination of depth of embedment in sands and clays. | CO-5 | 1. Determine the Earth pressure expression and diagram for Cantilever sheet pile.<br>2. Determination of depth of embedment in sands and clays. | ▫ Lecture<br>▫ Problem solving | |
| 15 | Timbering of trenches, Earth pressure diagrams, forces in struts. | CO-5 | 1. Explain Timbering of trenches.<br>2. Deduce the Earth pressure expression for anchored bulk head. | ▫ Lecture<br>▫ Problem solving | Assignment |
| 16 | **Cofferdams:** Stability, bearing capacity, settlements (qualitative treatment only, no designs). | CO-5 | 1.Write about various types of coffer dams<br>2.Discuss the stability criteria for coffer dams<br>3. Discuss the settlement criteria for coffer dams.<br>4. Determine the bearing capacity of cofferdams | ▫ Lecture<br>▫ Problem solving | Assignment |
| 17 | **MID TEST – II** | | | | |
| | **END EXAM** | | | | |