Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE364	**ADVANCED FOUNDATION ENGINEERING**	**3-0-0-3**	**2016**

Prerequisite: CE305 Geotechnical Engineering - II

Course objectives:
- To impart to the students, the advanced topics in foundation engineering
- To enable the students to acquire proper knowledge about the design and analysis in real life situations.

Syllabus :
Advanced topics in shallow foundations- bearing capacity, settlement and allowable bearing pressure. Allowable bearing pressure from penetration test data. Consolidation settlement of footings. Raft foundations and combined footings. Problems of excavations. Deep foundations – need. Types. Classification of piles. static equation – Single piles -– Critical depth concept. Pile capacity in clay and sand by the I.S. code method . Piles in layered soils. Piles with enlarged base in clays (under reamed piles). Pile capacity from SPT and CPT values. Piles for resisting uplift – straight shaft and under reamed piles in clays and sands – Dynamic formulae . Different types of pile load tests. ultimate load from pile load tests. Pile groups –Negative skin friction of single piles and pile groups – Settlement of pile groups in clays and sands –Equivalent raft approach –-Skempton's and Meyerhof's methods- Drilled piers with enlarged base. Well foundations

Expected Outcomes:
  i. The students will be equipped to design foundations for field situations.
  ii. The students will gain **d**etailed knowledge of shallow foundations and deep foundations.

Text Books:
  1. Murthy, V.N. S. Advanced Foundation Engineering, CBS Publishers, New Delhi, 2007
  2. Ranjan G. and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2002.

References:
  1. Gulhati, S. K. and Datta, M. Geotechnical Engineering, Tata McGraw Hill Education, 2005
  2. Tomlinson, M. J. and Booman, R. Foundation Design and Construction, Prentice Hall Publishing, 2001.
  3. Tomlinson, M. J. and Woodwrd, J. Pile Design and Construction Practice. CRS Press, 2015.
  4. Kurien, N. P. Design of foundation systems: principles and practices. Alpha Science International, 2005

COURSE PLAN			
Module	**Contents**	**Hours**	**Sem. Exam Marks %**
I	Shallow foundations- estimating bearing capacity- Meyerhof's, Hansen's and I.S code methods- Effect of water table, eccentricity, and inclination of load on Bearing Capacity – Numerical problems using IS method Elastic settlement –Effect of size of footing on settlement. Steinbrenner's method of calculating settlement– Numerical problems.	7	15

II	Allowable bearing pressure from penetration test data – Meyerhoff's and Teng's expressions. Consolidation settlement of footings - Combined footings and raft foundations (only concepts)– brief discussions on methods of analysis of raft, concept of floating raft, excavations.	6	15

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FIRST INTERNAL EXAMINATION

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III	Deep foundations –need. Types. Classification of piles. static equation – Single piles -– Critical depth concept. Pile capacity in clay and sand by the I.S. code method . Piles in layered soils. Piles with enlarged base in clays (under reamed piles). Problems. Pile capacity from SPT and CPT values. problems	6	15
IV	Piles for resisting uplift – straight shaft and under reamed piles in clays and sands – Dynamic formulae – Engineering News formula – Modified Hiley formula – Different types of pile load tests –initial and routine tests maintained load test, CRP test, pullout test, lateral load test and cyclic pile load test. Separation of skin friction and end bearing. – ultimate load from pile load tests.	7	15

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SECOND INTERNAL EXAMINATION

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V	Pile groups – Efficiency of pile groups- Group capacity in clays– Minimum spacing of piles in a group – Negative skin friction of single piles and pile groups –Settlement of pile groups in clays – Equivalent raft approach – Settlement of pile groups in sands - Skempton's and Meyerhof's methods- Drilled piers with enlarged base.	8	20
VI	Well foundations– Components of a well foundation–Procedure for construction and sinking of wells–Thickness of well steining for sinking under self weight - Grip length- Problems encountered in well sinking–Tilts and Shifts– Causes – Permissible tilts and shifts - Methods to rectify tilts and shifts – Forces acting on a well foundation –Allowable bearing pressure – Lateral stability of well foundations - Terzaghi's analysis	8	20

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END SEMESTER EXAMINATION

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QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100   **Exam Duration: 3 Hrs**

 Part A -Module I & II   :   2 questions out of 3 questions carrying 15 marks each

 Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

 Part C - Module V & VI :   2 questions out of 3 questions carrying 20 marks each

 Note : 1.Each part should have at least one question from each module

        2. Each question can have a maximum of 4 subdivisions (a, b, c, d)