INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**FOUNDATION ENGINEERING**			
Course Code	A60126			
Regulation	**R15 – JNTUH**			
Course Structure	**Lecturers**	**Tutorials**	**Practical's**	**Credit's**
	4	**-**	**-**	**4**
Course Coordinator	Mr. Y Ravi Kumar, Assistant Professor, Department of Civil Engineering.			
Team of Instructors	Mr. Y Ravi Kumar, Assistant Professor, Department of Civil Engineering.			

I. COURSE OVERVIEW:

It is the branch of civil engineering concerned with the design and construction of foundations, slopes, retaining walls, embankments, tunnels, levees, wharves, landfills and similar facilities; and with the engineering characterization and behavior of the ground and its constituent materials. Plays a key role in all civil engineering projects built on or in the ground. It plays a vital for the assessment of natural hazards such as earthquakes, liquefaction, sinkholes, rock falls and landslides.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Engineering Geology
UG	4	5	Geotechnical Engineering

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement	**75**	**100**

IV. EVALUATION SCHEME:

S. No.	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Identify the methods of soil exploration, different field tests, planning and preparation of soil investigation programme.
II. Understand and analyze finite and infinite earth slopes to analyze the stability of slopes of earth dams under different conditions.
III. Know earth pressure theory Rankine's theory of earth pressure Coulomb's earth pressure theory and Culmann's graphical method.
IV. Enhance the ability of students in understanding the types, choice of foundation, location of depth, and safe bearing capacity when considering shallow foundation.
V. Know the Indian standard methods for calculating safe bearing pressure based on N value, allowable bearing pressure and safe bearing capacity.
VI. Analysis of pile foundation, types of piles, load carrying capacity of piles based on static pile formulae and dynamic pile formulae.
VII. Understand the systems of well foundations, components of wells, functions and design criteria.

VI. COURSE OUTCOMES:

After completing this course, the student must demonstrate the knowledge and ability to:

1. Analyze the need and methods of soil exploration.
2. Analyze different types of soils using boring methods.
3. Students should be able to understanding preparation of soil investigation report.
4. Students should be able to understanding Stability analysis of infinite earth slopes.
5. Students should be able to understanding Stability analysis of finite earth slopes.
6. Learn the field test and soil investigation.
7. Apply knowledge for stability of slopes of earth dams under different conditions.
8. Students should be able to understanding earth pressure theories.
9. Students should be able to understanding and design of retaining walls.
10. Learn the theory of shallow foundation.
11. Learn the theory of deep foundation.
12. Students should be able to understanding the concept of allowable bearing pressure.
13. Students should be able to understanding the concept of safe bearing capacity.
14. Understanding the concept of pile foundation.
15. Understanding the concept and of well foundation.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Tutorials, Exams

PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	-	-
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Assignments, Tutorials, Exams
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	-	-
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Assignments, Tutorials, Exams
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	-	-
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	-
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	-	-
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	H	Assignments, Tutorials, Exams
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	-	-

S – Supportive **H-Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency Assessed by
PSO1	**ENGINEERING KNOWLEDGE:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	H	Assignment, Tutorials Exams

PSO2	**BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	H	Projects
PSO3	**SELF-LEARNING AND SERVICE:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	-	-

S - Supportive **H - Highly Related**

IX. SYLLABUS:

Unit –I:

SOIL EXPLORATION: Need and Methods of soil exploration- Boring and Sampling methods- Penetration tests - Plate load test- Pressure meter- planning of Programme and preparation of soil investigation report.

Unit –II:

SLOPE STABILITY: Infinite and finite earth slopes- types of failures- factor of safety of infinite slopes- stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method- Taylor's Stability Number- Stability of slopes of earth dams under different conditions.

Unit –III:

EARTH PRESSURE THEORIES: Rankine's theory of earth pressure- earth pressures in layered soils- Coulomb's earth pressure theory- Culmann's graphical method.

RETAINING WALLS: Types of retaining walls- stability of retaining walls against overturning, Sliding, bearing capacity and drainage from backfill.

Unit –IV:

SHALLOW FOUNDATIONS-Strength Criteria- Types, choice of foundation, Location of depth-, Safe Bearing Capacity, Terzaghi, Meyerhof, Skempton and IS Methods.

SHALLOW FOUNDATIONS-Settlement criteria: Safe bearing pressure based on N- value-allowable bearing pressure, safe bearing capacity, plate load test, allowable settlements of structures.

PILE FOUNDATION: Types of piles- Load carrying capacity of piles based on static pile formulae in Dynamic pile formulae, Pile load tests, Load carrying capacity of pile groups in sands and clays, Settlement of pile groups.

Unit –V:

WELL FOUNDATIONS: Types- Different shapes of wells- Components of wells- Sinking of well-Tilts and shifts.

Textbooks:

1. Soil Mechanics and Foundation Engineering by K.R.Arora, Standard publisher's distribution.
2. Geotechnical Engineering: Principles and practices of soils mechanics and foundation engineering by VNS Murthy, Taylor & Francis Group.
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd, (2004).

Reference Books:

1. Geotechnical Engineering by S. K. Gulhati & Manoj Datta – Tata Mc. Graw Hill publishing company New Delhi. 2005.
2. Principles of foundation Engineering- Cengage Learning by Das, B.M.,(2012).
3. Teng, W.C – Foundation Design, Prentice Hall, New Jersy.
4. Bowles, J.E., (1988) Foundation Analysis and Design- 4th Edition, McGraw-Hill Publishing Company, Newyork.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	References
1-2	Introduction to Soil Exploration	**Learn** how soil Exploration are performed	**T1:17.1 & T2:17.1**
3-5	Methods of soil Exploration	**Learn** how the soil exploration are done using different methods	**T1:17.7**
6-7	Types of Boring	**Understand** different types of boring methods	**T1:17.8 to 17.13 & T2:17.2**
8-10	Soil Sampling methods	**Analyze** Soil sampling methods for different types of soils	**T1:17.14 to 17.21 & T2:17.3**
11	Standard Penetration test (SPT)	**Learn** how to perform SPT	**T2:17.5 & T1:17.22**
12-13	Plate Load test	**Learn** how to perform Plate Load test for finding load bearing capacity, settlements of soils	**T2:17.8 & T1:23.33**
14	In-situ test using a pressure meter	**Learn** how to perform in-situ test using pressure meter	**T1:17.25**
15	Planning & Preparation of Soil investigation report	**Understand** how to prepare planning & preparation of Soil investigation	**T1:17.30 & T2:17.11 to 17.12**
16-17	Introduction to infinite and finite earth slopes	**Understand** basic concepts of earth slopes	**T1:18.1 to 18.3**
18	Types of failures	**Analyze** types of failures for infinite and finite slopes	**T1:18.4**
19-21	FOS of infinite slopes	**Learn** how to identify FOS for infinite slopes	**T1:18.5 to 18.6 & T2:16.4 to 16.5**
22-23	Stability Analysis by Swedish arc Method	**Learn** how to find Stability of slopes by Swedish arc Method	**T1:18.12 & T2:16.8**
24-25	Method of Slices for Analysis of finite slopes	**Learn** how to find Stability of slopes by using Method of Slices for Analysis of finite slopes	**T1:18.7 to 18.8 & T2:16.13**
26	Bishop's Simplified method	**Learn** how to find Stability of slopes by Bishop's Simplified method	**T1:18.16 & T2:16.14 to 16.15**
27-28	Taylor's Stability number	**Learn** how to find Stability of slopes by Taylor's Stability number	**T1:18.11 & T2:16.11**
29-30	Stability of slopes of earth dam under different conditions	**Understand** basic concepts of Stability of slopes of earth dam under different conditions	**T1:18.13 to 18.14**

31-33	Introduction to earth pressure theories	**Understand** concepts of earth pressure theories for stability of Retaining walls	**T1:19.1 to 19.3 & T2:14.1 to 14.3**
34-35	Rakine's earth pressure theories	**Learn** the concept of Rakine's earth pressure theories for stability of Retaining walls	**T1:19.4 to 19.6 & T2:14.4 to 14.10**
36-39	Columb's earth pressure theories	**Learn** the concept of Rakine's earth pressure theories for stability of Retaining walls	**T1:19.7 to 19.11 & T2:14.11 to 14.13**
40	Culman's graphical method	**Understand** the concept of Culman's graphical method for the stability of Retaining Structures	**T1:19.10 & T2:14.15**
41-42	Introduction and types of Retaining walls	**Learn** how to Analyze different types of Retaining Walls	**T1:20.1 to 20.2 & T2:25.1**
43-46	Stability of Retaining walls against overturning, Sliding, bearing capacity.	**Learn** how to find Stability of Retaining walls against overturning, Sliding, bearing capacity.	**T1:203 to 20.7**
47-48	Drainage for Backfill	**Learn** how drainage of Backfill soil play role for the stability slopes	**T1:20.8 & T2:26.2**
49-52	Introduction to Shallow foundations	**Understand** concepts of types of Foundations based on their depths	**T1:23.1 to 23.6**
53-55	Depth of foundation	**Learn** how the depth of foundation play a role in bearing capacity of soils	**T1:24.2**
56-58	Safe bearing capacity	**Learn** how to find safe bearing capacity of Soil	**T1:23.2 to 23.6**
59	Terzaghi Method	**Understand** the concept of how to find the bearing capacity of soil by Terzaghi Method	**T1:23.7 & T2:18.5**
60	Meyerhof Method	**Understand** the concept of how to find the bearing capacity of soil by Meyerhof Method	**T1:23.12**
61	Skempton Method	**Understand** the concept of how to find the bearing capacity of soil by Skempton Method	**T1:23.16 & T2:18.6**
62	IS Code methods for bearing capacity	**Learn** IS Code methods for finding bearing capacity of soils	**T1:23.17 & T2:18.11**
63	Safe bearing pressure based on N- Value	**Understand** the concept how to find the safe bearing pressure based on N- Value.	**T1:23.20**
64	Allowable bearing pressure & Settlements	**Understand** the concept how to find the allowable bearing pressure & Settlements	**T1:23**
65	Plate load test	**Learn** how to perform Plate Load test	**T1:23.33**
66	Introduction to Well foundation and there types	**Learn** different types of Well Foundation	**T1:27.1**
67	Different shapes of wells	**Understand** different shapes of wells	**T1:27.2**

68	Components of Wells	**Learn** the concept of components of Wells	**T1:27.9**
69	Sinking of Wells	**Learn** the concept of Sinking of Wells	**T1:27.10**
70-71	Measures for rectification of tilts and Silts	**Understand** the measures for rectification of tilts and Silts	**T1:27.11**

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S		H										H	H	
II			S								H			S	
III															
IV					H						S			S	
V	H		H												
VI	S										S		S	S	
VII	H		H										S	H	

S= Supportive **H = Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H				H						S		H	S	
2															
3															
4	H		S										H	S	
5											H				
6														H	
7			S		S										
8					H										
9	S														
10	H		S								S			S	
11	H		H										H	S	

12	H												S	S	
13															
14	H		S		S									S	
15	H				H								H	S	

S= Supportive **H = Highly Related**

Prepared by: Mr. Y Ravi Kumar, Assistant Professor, CE

HOD, CIVIL ENGINEERING