Hall Ticket No | | | | | | | | | | | Question Paper Code:ACE018

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech VI Semester End Examinations (Regular), May- 2020

Regulations: R16

FOUNDATION ENGINEERING

(Civil Engineering)

Time: 3hours **Max. Marks:70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT– I

1. a) Explain briefly about various Geophysical methods used for soil investigation? **[7M]**

   b) Determine the area ratios for the following soil samplers and comment on the nature of samples obtained in each of the samplers. **[7M]**

Type of Sampler	Outer Diameter	Internal Diameter
Core Cutter	165 mm	150 mm
Split Barrel	51 mm	35 mm
Seamless tube (Shelby)	51 mm	48 mm

2. a) Explain briefly various methods of soil exploration techniques and also discuss in detail wash boring and percussion drilling methods. **[7M]**

   b) A SPT was conducted in a dense sand deposit of 22m, and a value of 48 was observed for N. the density of the sand was 15kN/m3. What is the value of N, corrected for overburden pressure? **[7M]**

UNIT – II

3. a) Explain the stability analysis by Swedish slip circle method and derive the factor of safety. **[7M]**

   b) An embankment 10m high is inclined at an angle of 36° to the horizontal. A stability analysis by the method of slices gives the following forces per running meter:
   Σ shearing forces = 450kN
   Σ normal forces = 900kN Σ neutral forces = 216kN
   The length of the failure arc is 27m. Laboratory tests on the soil indicate the effective values c' and φ' as 20kN/m2 and 18° respectively. **[7M]**
   Determine the factor of safety of the slope with respect to a) Shearing strength b) Cohesion

4. a) Explain stability of earthen dam in full reservoir condition, sudden drawn down condition and at the end of the construction. **[7M]**

4. b) It is proposed to construct a highway embankment using a c-ϕ soil having c = 25kPa, φ = 20°, γ = 17kN/m3. Determine the critical height up to which the embankment can be built with an inclination of 30° with a factor of safety of 1.50. Given the Taylor's stability number for these conditions as 0.0737. **[7M]**

UNIT – III

5. a) Derive the expression for coefficient of Active and passive earth pressure coefficients according to coulombs earth pressure theory. **[7M]**

b) A 9m high retaining wall is supporting a backfill consisting of two types of soils. The water table is located at a depth of 5m below the top. The properties of soil from 0 to 3m include c = 0 kN/m^2; φ = 33°; γ = 17kN/m^3 and those for soil from 3m to 9m include c= 0 kN/m^2; φ = 40°; γ = 18.50kN/m^3; γsub = 20.50kN/m^3.Plot the distribution of active and passive earth pressure and determine the magnitude and point of application of total active and passive earth pressure acting on the retaining wall. **[7M]**

6. a) Explain in detail various stability conditions that should be checked for the retaining wall. **[7M]**

b) A gravity retaining wall of height 3 m with uniform thickness (.i.e. rectangular in cross section) of 1.20m is constructed in RRM with a unit weight of 24 kN/m3. The average properties of soil from top to bottom of wall includes c = 0kN/m2; φ= 30°. Analyze the stability of wall against overturning when the entire backfill is Moist with a unit weight of 18 kN/m3.Submerged (consider the saturated unit weight in submerged conditions as 9.80kN/m^3) **[7M]**

UNIT – IV

7. a) Explain in detail about various failures mechanism of bearing capacity theory with neat sketch. **[7M]**

b) Determine the ultimate bearing capacity of a strip footing, 1.5 m wide, with its base at a depth of 1m, resting on a sand stratum take γd=17kN/m3, c'= 0 kPa and φ=32°. If GWT is located at a depth 0.5 m below G.S, At a depth 0.5 m below the base of footing γsat= 20 kN/m3 . Use Terzaghi theory. **[7M]**

8. a) Explain the static method for estimating the load carrying capacity of a single pile driven in cohesive soil. **[7M]**

b) A group of 16 piles of 50 cm diameter is arranged with a centre to centre spacing of 1.0 m. The piles are 9 m long and are embedded in soft clay with cohesion 30kN/m2. Bearing resistance may be neglected for the pile, Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group. **[7M]**

UNIT – V

9. a) Discuss the different shapes of Cross-sections of wells used in practice, giving the merits and demerits of each. **[7M]**

b) A circular well of 6m external diameter and 4m internal diameter is embedded to a depth of 15m below the maximum scour level in a sandy soil deposit. The well is subjected to a horizontal force of 800kN acting at a height of 8m above the scour level. Determine the allowable total equivalent resisting force due to the earth pressure assuming the rotation is about a point above the base. Take γsat = 30kN/m3, φ = 20°, factor of safety for passive resistance = 2. Use Terzaghi's analysis. **[7M]**

10. a) Explain the effect of water and earth pressure on well foundations and also discuss about tilt and shift in wells. **[7M]**

b) A circular well of 4.5 m external diameter and 0.75m steining thickness embedded to a depth of 12m in a sandy soil deposit. The properties of soil γsat = 30kN/m3, φ = 30°. The well is subjected to a resultant horizontal force of 500kN and a moment of 400 kN-m at the scour level. Determine the allowable total equivalent resisting force due to the earth pressure. A FOS = 2 may be adopted for soil resistance. Determine the magnitude and point of maximum Bending moment at well steining. **[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

I	Identify the methods of soil exploration, different field tests, planning.
II	Understand earth pressure by Rankine's theory, Coulomb's earth pressure theory and Culmann's graphical method.
III	Implement the Indian standard methods for calculating safe bearing pressure
IV	Analyze pile foundation, load carrying capacity of piles based on static and dynamic pile formulae.

COURSE OUTCOMES (COs):

CO 1	Understand the need and various methods of soil exploration, planning and preparation of soil investigation report
CO 2	Analyze the stability of slopes by various methods
CO 3	Understand various earth pressure theories and stability of retaining walls at various conditions
CO 4	Understand shallow and deep foundations according to various bearing capacity theories and analyze Pile foundations in various different soils
CO 5	Understand various shapes and components of wells and analyze, design according to IRC guidelines

COURSE LEARNING OUTCOMES (CLOs):

ACE018.01	Understand the need and methods of soil exploration.
ACE018.02	Understand various methods of sampling and boring.
ACE018.03	Learn how to perform field tests such as SPT, DCPT, CPT.
ACE018.04	Learn how to perform Plate Load test for finding load bearing capacity, settlements of Soils.
ACE018.05	Learn how to perform in-situ test using pressure meter.
ACE018.06	Understand the importance of geophysical methods.
ACE018.07	Learn how to prepare Soil investigation report.
ACE018.08	Understand basic concepts of earth slopes.
ACE018.09	Analyze failure of infinite slopes.
ACE018.10	Analyze types of failures for finite slopes.
ACE018.11	Learn how to find Stability of slopes by Swedish arc method.
ACE018.12	Learn how to find Stability of slopes by method of slices for slopes.
ACE018.13	Find Stability of slopes by Taylor's stability number.
ACE018.14	Understand basic concepts of Stability of slopes of earth dam under different conditions.
ACE018.15	Understand concepts of earth pressure theories for stability of retaining walls.
ACE018.16	Calculate active and passive earth pressures from Rakine's earth pressure theories
ACE018.17	Calculate active and passive earth pressures from Coulomb's &Culmann's method.
ACE018.18	Asses the stability of retaining wall against overturning, sliding, bearing capacity.

ACE018.19	Understand the concepts of safe bearing capacity, ultimate bearing capacity etc.,
ACE018.20	Calculate the bearing capacity of shallow foundation using Terzaghi, Meyerhof, Skempton and IS methods.
ACE018.21	Calculate the load carrying capacity of pile using static, dynamic pile formula and pile Load test.
ACE018.22	Calculate load carrying capacity of pile group in sands and clay and settlement of pile Group.
ACE018.23	Learn different shapes of well & components of Well foundation.
ACE018.24	Understand the principle of analysis and design of wells, Seismic analysis and IRC Guidelines.

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No.	Course Learning Outcomes			Course Outcomes	Bloom's Taxonomy Level
1	a	ACE018.06	Understand the importance of geophysical methods	CO 1	Remember
	b	ACE018.02	Understand various methods of sampling and boring	CO 1	Understand
2	a	ACE018.01	Understand the need and methods of Soil Exploration	CO 1	Understand
	b	ACE018.03	Learn how to perform field tests such as SPT, DCPT, CPT	CO 1	Remember
3	a	ACE018.11	Learn how to find Stability of slopes by Swedish arc Method	CO 2	Remember
	b	ACE018.10	Analyze types of failures for finite slopes	CO 2	Understand
4	a	ACE018.14	Understand basic concepts of Stability of slopes of earth dam under different conditions	CO 2	Understand
	b	ACE018.13	Find Stability of slopes by Taylor's Stability number	CO 2	Understand
5	a	ACE018.17	Calculate active and passive earth pressures from Coulomb's & Culmann's Method	CO 3	Remember
	b	ACE018.16	Calculate active and passive earth pressures from Rankine's earth pressure theories	CO 3	Understand
6	a	ACE018.18	Asses the stability of retaining wall against overturning, sliding, bearing capacity	CO 3	Understand
	b	ACE018.15	Understand concepts of earth pressure theories for stability of Retaining walls	CO 3	Understand
7	a	ACE018.20	Calculate the bearing capacity of shallow foundation using Terzaghi, Meyerhof, Skempton and IS Methods.	CO 4	Remember
	b	ACE018.19	Understand the concepts of safe bearing capacity, ultimate bearing capacity etc.,	CO 4	Understand
8	a	ACE018.21	Calculate the load carrying capacity of pile using static, dynamic pile formula and pile load test	CO 4	Remember
	b	ACE018.22	Calculate load carrying capacity of pile group in sands and clay & settlement of pile group	CO 4	Understand
9	a	ACE018.23	Learn different shapes of well & components of Well foundation	CO 5	Remember
	b	ACE018.24	Understand the principle of analysis and design of wells, Seismic analysis and IRC guidelines	CO 5	Understand
10	a	ACE018.24	Understand the principle of analysis and design of wells, Seismic analysis and IRC guidelines	CO 5	Understand
	b	ACE018.24	Understand the principle of analysis and design of wells, Seismic analysis and IRC guidelines	CO 5	Understand

Signature of Course Coordinator **HOD,CE**