Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Soil Mechanics (CEEG 241) **Semester: IVth**
Program: B.Tech (Civil Engineering)
Time: 03 hrs. **Max. Marks: 100**

Instructions: All questions are compulsory to attempt.

SECTION A

S. No.		Marks	CO
Q1.	What do you understand by effective pressure and pore pressure in a soil mass. Illustrate them with one suitable example.	**05**	**CO1**
Q2.	Analyze the term "quick sand phenomenon" in soil and also explain its relevance.	**05**	**CO1**
Q3.	Enlist the factors affecting permeability of soil and their effects.	**05**	**CO2**
Q4.	Explain the different components/parameters responsible for the shearing resistance/shear strength of soil.	**05**	**CO4**

SECTION B

Q1.	A cube of dried clay having sides 4 cm long has a mass of 110 g .The same cube of soil, when saturated at unchanged volume, has a mass of 135 g. Draw the soil element showing the volumes and weights of the constituents, and then determine the specific gravity of soil solids and the voids ratio.	**10**	**CO1**
Q2.	A cylindrical specimen of saturated clay, 3 cm in diameter and 7 cm in average length is tested in an unconfined compression tester. Determine the unconfined compressive strength of clay, if the specimen fails under an axial load of 47 N. The change in the length of specimen at failure is 1 cm. OR Explain the process for shear strength determination of soil through Triaxial compression test	**10**	**CO4**
Q3.	Mention the essential differences between compaction and consolidation process of soil. Also, explain how Standard Proctor compaction test determines the water-density relationship of soil in laboratory..	**10**	**CO2**
Q4.	Determine the coefficient of permeability of a soil sample, 5 cm in height and 60 cm^2 in cross-sectional area, if a quantity of water equal to 400 ml passed down in 8 minutes, under an effective constant head of 35 cm. On oven drying, the test specimen has mass of 465g. Taking specific gravity of soil solids as 2.65, determine the seepage velocity of water during the test.	**10**	**CO2**

SECTION-C			
Q1.	A soil profile consists of four layers (two layers of sand and two layers of clay) which are completely submerged. The soil profile is as follows (from the ground surface): The first layer consist of sand (5m depth) The second layer consist of clay (2m depth) The third layer consist of sand (7m depth) The fourth layer consist of clay (2m depth) Compute the total settlement under a uniform load of 150 kN/m^2 well distributed over a larger area. Properties of the soil are as follows: a. Sand layers, y_{sat} = 20.86 kN/m^3 b. Clay layers, w = 38%, Cc = 0.26 and G = 2.72	**20**	**CO3**
Q2.	A 6m high vertical wall supports a saturated, cohesive backfill with horizontal surface. The top 3m of the backfill weighs 18 kN/m^3 and has an apparent cohesion of 18 kN/m^2.The bulk unit weight and apparent cohesion of the bottom 3m of the backfill are respectively 20 kN/m^3 and 24 kN/m^2. What is the likely depth of tension cracks behind the wall. If tension cracks develop, what will be the total active pressure. Draw the pressure distribution diagram and determine the point of application of the resultant pressure. OR Derive an expression for factor of safety against sliding in case of an infinite slope (cohesionless soil) inclined at an angle i to the horizontal. Determine the factor of safety with respect to cohesion of a clay slope laid at 1 in 2 to a height of 10m, if angle of internal friction is 10^o, c= 25 kN/m^2 and unit weight of soil= 19 kN/m^3. Also determine the critical height of the slope in this soil.	**20** **20**	**CO4** **CO5**

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SECTION A

S. No.		Marks	CO
Q1.	What do you understand by sedimentation analysis in particle size analysis of soil. Also state its relevance.	**05**	**CO1**
Q2.	Enlist and explain the broad classification of soil water.	**05**	**CO1**
Q3.	Analyze the terms: Discharge and Seepage velocity of flow through soil mass. Also state the relation between them.	**05**	**CO2**
Q4.	Explain the different types of shear tests based on .the drainage conditions.	**05**	**CO4**

SECTION B

Q1.	Calculate the coefficient of permeability of a soil sample, 6cm in height and 50 cm^2 in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. On oven drying, the test specimen has mass of 498 g. Taking specific gravity of soil solids as 2.65, determine the seepage velocity of water during the test.	**10**	**CO2**
Q2.	What do you understand by compaction process in soil. Also, explain the compaction test generally used for determination of water-density relationship of soil in laboratory.	**10**	**CO2**
Q3.	A soil sample is partially saturated. Its natural moisture content was found to be 22% and bulk density 2g/cm^3. If the specific gravity of solid particles is 2.65 and the density of water be taken as 1g/cm^3, find out the degree of saturation and the void ratio.	**10**	**CO1**
Q4.	A cylinder of soil falls under an axial stress of 150 kN/m^2, when it is laterally confined. The failure plane makes an angle of 50^0 with the horizontal. Calculate the value of cohesion and the angle of internal friction of the soil. OR Explain the process for shear strength determination of soil through Direct shear test.	**10**	**CO4**

SECTION-C			
Q1.	Determine the factor of safety and critical height (with respect to cohesion) of a clay slope laid at 1 in 3 to a height of 12m, if angle of internal friction is 15^o, c= 30 kN/m^2 and unit weight of soil= 20 kN/m^3. Derive an expression for the critical depth and stability number in case of an infinite slope (cohesive soil) inclined at an angle i to the horizontal. OR A retaining wall 5 m high, has a smooth vertical back. The backfill has a horizontal surface in level with the top of the wall. There is uniformly distributed surcharge load of 40 kN/m^2 intensity over the backfill. The unit weight of the backfill is 20 kN/m^3, its angle of shearing resistance is 30^0 and cohesion is zero. Determine the magnitude and point of application of active pressure per meter length of the wall.	**20**	**CO5** **CO4**
Q2.	A soil profile consists of four layers (two layers of sand and two layers of clay) which are completely submerged. The soil profile is as follows (from the ground surface): The first layer consist of sand (6m depth) The second layer consist of clay (3m depth) The third layer consist of sand (5m depth) The fourth layer consist of clay (3m depth) Calculate the total settlement under a uniform load of 180 kN/m^2 well distributed over a larger area. Properties of the soil are as follows: a. Sand layers, y_{sat} = 20 kN/m^3 b. Clay layers, w = 40%, Cc = 0.24 and G = 2.73	**20**	**CO3**