Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

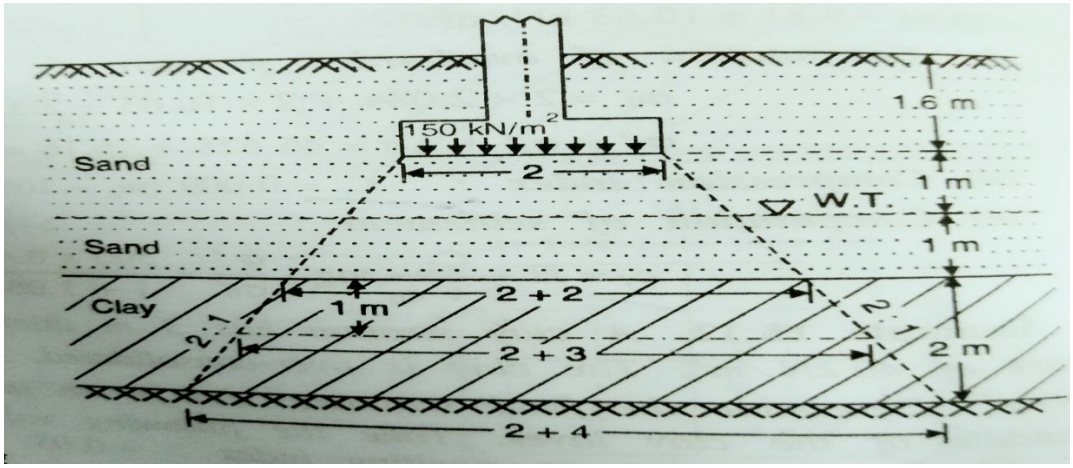
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Soil Mechanics **Semester: IVth**
Program: B.Tech (Civil Engineering) **Time 03 hrs.**
Course Code: CIVL 2009 **Max. Marks: 100**

Instructions: All questions are compulsory to attempt **SET A**

SECTION A

S. No.		Marks	CO
Q 1	Discuss the term "Group Index" and also explain its relevance in soil classification.	**04**	**CO1**
Q 2	What do you understand by zero air voids line in a compaction curve. Also write the equation for the same.	**04**	**CO2**
Q 3	Explain briefly the pre-consolidated, normally consolidated and under consolidated soil deposits.	**04**	**CO3**
Q 4	Enumerate the different shear tests based on the drainage conditions with their critical points.	**04**	**CO4**
Q 5	State the essential differences between active and passive earth pressure.	**04**	**CO4**
	SECTION B		
Q 1	The apparent specific gravity of a soil sample equals 1.52. The specific gravity of solids is 2.59. Determine the voids ratio under the assumption that the soil is perfectly dry. What would be the voids ratio, if the sample is assumed to have a water content of 9%.	**10**	**CO1**
Q 2	A cylinder of soil falls under an axial vertical stress of 180 kN/m^2, when it is laterally unconfined. The failure plane makes an angle of 55^0 with the horizontal. Determine the value of cohesion and the angle of internal friction of the soil. OR Explain the process for shear strength determination of soil through Unconfined compression test.	**10**	**CO4**
Q 3	Due to a rise of a temperature, the viscosity and unit weight of the percolating fluid are reduced to 78% and 95% respectively. Other things being constant, determine the percentage change in coefficient of permeability.	**10**	**CO2**
Q 4	What do you understand by consolidation process in soil. Also, explain the laboratory consolidation test generally conducted for consolidation study on soil samples.	**10**	**CO3**
	SECTION-C		
Q 1	Suppose there is an infinite slope (cohesive soil) inclined at an angle i to the horizontal in a hilly region, derive an expression for the critical depth and stability number for the same. Calculate the factor of safety and critical height (with respect to cohesion) of a clay	**20**	**CO5**

	slope laid at 1 in 2.5 to a height of 11m, if angle of internal friction is 18^o, c= 25 kN/ m^2 and unit weight of soil= 19 kN/m^3.		
Q 2	A building column has a footing area of 2m x 3m and transmits a pressure increment of 150 kN/m^2 at its base embedded 1.6 m below ground level as shown in figure. Assuming a pressure distribution of 2 vertical to 1 horizontal, determine the consolidation settlement at the middle of clay layer. Consider the pressure variation across the thickness of clay layer also. Given the following: a. Sand layers, y = 16.5 kN/m^3 and y_{sat} = 18.5 kN/m^3 b. Clay layers, y_{sat} = 16 kN/m^3, Cc = 0.26 and e_o = 0.95  OR A retaining wall with a smooth vertical back has a height of 6m. The backfill has a horizontal surface in level with the top of the wall. There is uniformly distributed surcharge load of 42 kN/m^2 intensity over the backfill. The unit weight of the backfill is 19 kN/m^3, its angle of shearing resistance is 35^0 and cohesion is zero. Calculate the magnitude and point of application of active pressure per meter length of the wall.	**20** **20**	**CO3** **C04**

Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Soil Mechanics **Semester: IVth**
Program: B.Tech (Civil Engineering) **Time 03 hrs.**
Course Code: CIVL 2009 **Max. Marks: 100**

Instructions: All questions are compulsory to attempt **SET B**

SECTION A

S. No.		Marks	CO
Q 1	Enumerate the different components responsible for the shearing resistance/shear strength of soil	**04**	**CO4**
Q 2	What do you understand by active earth pressure and passive earth pressure	**04**	**CO4**
Q 3	Explain briefly the Modified Proctor Test for compaction along with its key points.	**04**	**CO2**
Q 4	Discuss the Highway Research Board (HRB) soil classification system with critical points	**04**	**CO1**
Q 5	What do you understand by coefficient of compressibility and coefficient of volume change in consolidation of soil.	**04**	**CO3**
	SECTION B		
Q 1	An undisturbed soil sample of soil has a volume of 70 cm^3 and mass of 170 g. On oven drying for 24 hours, the mass is reduced to 130 g. If G=2.66, determine the water content, voids ratio and degree of saturation of the soil.	**10**	**CO1**
Q 2	The viscosity and unit weight of the percolating fluid are reduced to 72% and 93% respectively due to increase in temperature. Other things being constant, calculate the percentage change in coefficient of permeability	**10**	**CO2**
Q 3	A cylindrical specimen of saturated clay, 2.5 cm in diameter and 7.5 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 48 N. The change in the length of specimen at failure is 1.2 cm. OR Explain the process for shear strength determination of soil through Direct shear test	**10**	**CO4**
Q 4	Explain in detail the mechanics of consolidation process in soil by means of spring analogy.	**10**	**CO3**
	SECTION-C		
Q 1	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 (4m depth) The second layer consist of clay (2m depth) The third layer consist of sand (6m depth)	**20**	**CO3**

	The fourth layer consist of clay (2m depth) Compute the total settlement under a uniform load of 160 kN/m^2 well distributed over a larger area. Properties of the soil are as follows: a. Sand layers, y_{sat} = 20.65 kN/m^3 b. Clay layers, w = 36%, Cc = 0.25 and G = 2.70 OR A 5m high vertical wall supports a saturated, cohesive backfill with horizontal surface. The top 2.5m of the backfill weighs 18.5 kN/m^3 and has an apparent cohesion of 19 kN/m^2.The bulk unit weight and apparent cohesion of the bottom 2.5m of the backfill are respectively 21 kN/m^3 and 25 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 calculate the point of application of the resultant pressure.	**20**	**CO4**
Q 2	Suppose there is an infinite slope (cohesionless soil) inclined at an angle i to the horizontal in a hilly region, derive an expression for factor of safety against sliding. Calculate the factor of safety with respect to cohesion of a clay slope laid at 1 in 3 to a height of 13m, if angle of internal friction is 12^o, c= 24 kN/m^2 and unit weight of soil= 18 kN/m^3. Also determine the critical height of the slope in this soil.	**20**	**CO5**