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

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

Course: Soil Mechanics and Foundation Engineering — **Semester: VI**
Program: B. Tech — **Time 03 hrs.**
Course Code: GSEG 392 — **Max. Marks: 100**

Instructions: Calculators should not be borrowed or exchanged

SECTION A (4 X 5=20 marks)

S. No.	Answer all questions	Marks	CO
Q 1	Explain about oven drying method for water content determination	**4**	**CO1**
Q 2	Define Plasticity index, Liquidity Index, Consistency Index, Flow Index and shrinkage ratio with appropriate equations.	**4**	**CO2**
Q 3	Define consolidation, compaction, coefficient of compressibility, compression index and coefficient of consolidation with appropriate equations.	**4**	**CO3**
Q 4	Explain about coulomb's law and Mohr's theory with appropriate equations.	**4**	**CO3**
Q 5	Define the conditions for shallow and deep foundations ? and condition to be satisfied for the design of foundation.	**4**	**CO4**
	SECTION B (10 X 4=40 marks)		
Q 6	A dry sample of mass 50 gm is mixed with distilled water to prepare a suspension of 1000 ml for hydrometer analysis. The reading of the hydrometer taken after 5 minutes was 25 and depth of the center of the bulb below water surface when the hydrometer was in jar was 150 mm. The volume of the hydrometer was 62 ml and the area of the cross section of the jar was 55 cm^2 . Assume G= 2.68, viscosity = 9.81 milli poise, determine the coordinates of the point corresponding to the above observation.	**10**	**CO1**
Q 7	A soil profile consists of a surface layer of clay 4 m thick (Υ = 18.35 kN/m^3) over an impermeable rock. The water table is at ground surface, if the water level in a piezometer driven in to sand layer rises 2m above ground surface. Take Υ_w =10 kN/m^3, find (i) Effective stress at a depth 6m, (ii) The increase in effective stress at the top of the rock when the artesian head in the sand is reduced by 1m.	**10**	**CO2**
Q 8	A rectangular footing (3m x 2m) exerts a pressure of 100KN/m^2 on cohesive soil whose E_s= 5 x 104 KN/m^2 and poisons ratio=0.5. Determine the immediate settlement at the center, assume a) footing is rigid b) footing is flexible. OR	**10**	**CO3**

<table>
<tr><td></td><td>A following test results at failure conditions are obtained from consolidated undrained triaxial tests on soil samples from a saturated strata

<table><tr><td></td><td>σ_3 (kg/cm^2)</td><td>σ_d (kg/cm^2)</td><td>u (kg/cm^2)</td></tr><tr><td>Specimen 1</td><td>2.75</td><td>1.5</td><td>1.5</td></tr><tr><td>Specimen 2</td><td>4.25</td><td>2.2</td><td>2.0</td></tr></table>
Determine shear strength parameters</td><td></td><td></td></tr>
<tr><td>Q 9</td><td>Describe about classification of piles based on load transfer, function and installation.</td><td>10</td><td>CO4</td></tr>
<tr><td colspan="4">SECTION-C (20 X 2=40 marks)</td></tr>
<tr><td>Q 10</td><td>Un unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 37.5 mm and was 80mm long. The load at failure measured by the proving ring was 28N and the axial deformation of the sample at failure was 13 mm. Determine the unconfined compressive and the undrained shear strength of the clay.</td><td>20</td><td>CO3</td></tr>
<tr><td>Q11</td><td>Explain about Skempton’s Method and determine the safe bearing capacity of a rectangular footing 1m x 2m, placed at a depth of 2m in a saturated clay having unit weight 20 kN/m^3 and unconfined compression strength of 100 kN/m^2. Assume a factor of safety of 2.5.

OR

a) How do you determine group capacity of piles
b) A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of the piles were 30 cm and 10 m respectively. If the unconfined compression strength of clay is 8 t/m^2 and the pile spacing is 90 cm, what is the capacity of the group? Assume a factor of safety of 2.50 and adhesion factor of 0.75.</td><td>20

8+12</td><td>CO4</td></tr>
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SECTION A (4 X 5=20 marks)

S. No.		Marks	CO
Q 1	Explain about the importance of three phase diagram in deriving void ratio and porosity	**4**	**CO1**
Q 2	Define flow index and shrinkage ratio with equations	**4**	**CO2**
Q 3	Explain about new marks influence chart with suitable diagram	**4**	**CO3**
Q 4	What are different types of shear failures? Explain about them.	**4**	**CO4**
Q 5	Explain about different types of pile driving hammers	**4**	**CO4**
	SECTION B (10 X 4=40 marks)		
Q 6	In a soil compaction test, the wet soil mass when compacted in the mould is 1.855 kg, the water content is 16% and volume of the mould is 0.945 litre, Find the dry density, void ratio, degree of saturation and percentage of air voids.	**10**	**CO1**
Q 7	What is seepage pressure and quick sand condition? How to prevent the quick sand condition, explain with appropriate equations and diagrams. OR A footing is shown in Figure 1. Determine the vertical stress at Point "C" shown in Figure at a depth of 3m. Use the following coefficients m: 2.67, 2.67 — n: 0.5, 1 — I: 0.1365, 0.2028	**10**	**CO2**
Q 8	A soil profile at a building site consist of dense sand up to 2 m depth, normally loaded soft clay from 2 m to 6 m depth and stiff impervious rock below 6 m depth. The ground water table is at ground level. The sand has density 1.9 t/m^3 below water table. For the clay natural water content is 50% and liquid limit is 65 % and grain specific gravity is 2.65. Calculate the probable ultimate settlement resulting from a	**10**	**CO3**

	uniformly distributed surface load of 4t/m^2 applied over an extensive area of the site.		
Q 9	What is bearing capacity? Why and where plate load test is used, explain about plate load test and its limitations and effect of size of plate on settelements.	**3 + 7**	**CO4**
SECTION-C (20 X 2=40 marks)			
Q 10	A footing for a water tower carries a load of 900 tons and is 3.6 m^2. It rests in dense sand of 9m thickness overlying a clay layer of 3m depth. The depth of foundation is 1.5m. The clay layer overlies hard rock. The liquid limit of clay is 54% and void ratio is 1.08. The saturated unit weight of sand and clay are 1.89 t/m^3 and 1.79 t/m^3 respectively. Assume the load distribution as 2 Vertical to 1 Horizontal and site is flooded. (i) Determine ultimate settlement due to consolidation of clay layer and (ii) The maximum effective stress at the center of clay layer at the end of consolidation. **OR** A vane 10 cm long and 8 cm diameter was pressed into soft clay at the bottom of a bore hole. Torque was applied and gradually increased to 450 kg/cm^2, when failure took place. Subsequently, the vane was rotated rapidly so as to completely remould the soil. The remoulded soil was sheared at a torque of 180kg-cm. Calculate the cohesion of the clay in the natural and remoulded states and also the sensitivity.	**15+5** **20**	**CO3**
Q11	A 3.0 square footing is located in a dense sand at a depth of 2 m. Determine the ultimate bearing capacity for the following water table positions (i) At ground surface (ii) At footing level (iii) At 1 m below footing level (iv) At 1m below the ground level The moist unit weight of sand above the water table is 18 kN/m^3 and the saturated unit weight is 20 kN/m^3, ø = 35°, C_T = 0 and N_q = 33 and N_r = 34	**20**	**CO4**

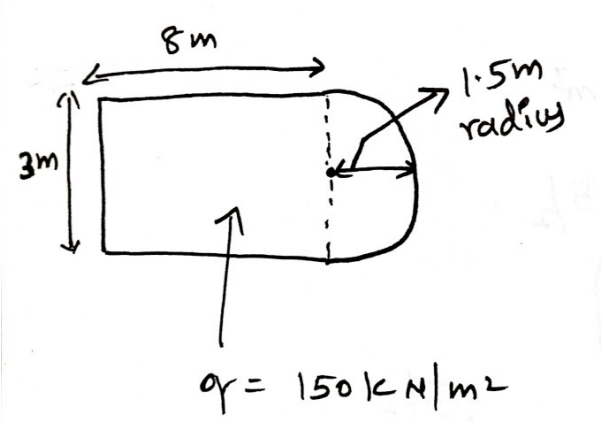

Figure 1