Reg. No. :

Question Paper Code: 31412

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Fourth Semester

Civil Engineering

01UCE402 - SOIL MECHANICS

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Derive the relationship between air content and degree of saturation.

2. Estimate void ratio of a fully saturated soil, if the water content is 32% and specific gravity is 2.66.

3. State Darcy's law.

4. List the applications of flow net.

5. Differentiate compaction and consolidation.

6. Find the intensity of vertical stress at a point 6m below the vertical load of 30 *kN*.

7. How liquefaction of sands can be prevented?

8. Draw Mohr's circle at failure and strength envelope corresponding to unconfined compression test.

9. What are the types of slope failures?

10. The factor of safety of an infinite slope made of sandy soil is independent of the height of the embankment. Justify your answer.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) In an undisturbed soil sampling, 650 g of wet soil occupies a volume of 300 cc. On oven drying, the weight of soil reduced to 590 g. If the specific gravity of soil is 2.68. Determine (1) Bulk unit weight (2) Dry unit weight (3) Water content (4) Void ratio (5) Degree of saturation. (10)

(ii) Compare the Standard Proctor and Modified Proctor compaction test. (6)

Or

(b) (i) Classify the soil as per IS classification system. Where additional information is required, say what data is needed. (12)

Soil	Liquid limit	Plastic limit	% passing through 75 micron sieve	% Gravel >4.75 mm	% of sand
A	450	50	100	0	0
B	34	20	80	0	20
C	60	30	90	0	10
D	-	Non plastic	100	0	0

(ii) Describe about field compaction methods. (4)

12. (a) (i) Derive an equation for the determination of coefficient of permeability for fine grained soils. (12)

(ii) What will be the ratio of average permeability in the horizontal to that in vertical for a soil deposits consists of 3 horizontal layer if the thickness and permeability of second layer are twice of the first, and those of third layer twice of second. (4)

Or

(b) (i) In a site reclamation project, 2.5 m of graded fill ($\gamma = 22$ kN/m^3) were laid in compacted layers over an existing layer of silty clay ($\gamma = 18$ kN/m^3) which was 3 m thick. This was underlain by a 2 m thick layer of gravel ($\gamma = 20$ kN/m^3). Assuming that the water table remains at the surface of the silty clay draw the effective stress profiles for case (1) before the fill is placed and case, (2) after the fill has been placed. (8)

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(ii) Derive that q= kH $\frac{Nf}{Nd}$. (8)

13. (a) (i) Discuss Terzaghi's theory of consolidation, stating the various assumptions and validity. (10)

(ii) A 6 *m* thick bed of clay is overlain by 9 *m* thick layer of sand with water table at 4 *m* below ground surface. For the clay layer specific gravity of soil particles is 2.7, average liquid limit 45% and natural water content 40%. For the sand layer the bulk unit weights above and below water table are 18 kN/m^3 and 20.5 kN/m^3 respectively. Calculate the settlement of a building constructed on sand layer if it causes an increase in effective vertical stress of 100 kN/m^2 at the middle of clay layer. (8)

Or

(b) (i) An elevated structure with a total weight of 10,000 *kN* is supported on a tower with 4 legs. The legs rests on piers located at corners of a square 6 *m* on a side. What is a vertical stress increment due to this loading at a point 7 *m* beneath the centre of the structure? (8)

(ii) Describe the construction procedure of Newmarks influence chart. (8)

14. (a) (i) Undrained triaxial tests are carried out on three identical samples and the following results are obtained. Estimate the shear strength parameters based on total and effective stress and failure envelope by Mohr circle. (12)

Description	Test 1	Test 2	Test 3
Cell Pressure kN/m^2	200	400	600
Deviator stress kN/m^2	118	240	352
Pore Pressure kN/m^2	110	220	320

(ii) In a vane shear test conducted in a soft clay deposit failure occurred at a torque of 42 *Nm*. Afterwards the vane was allowed to rotate rapidly and the test was repeated in the remoulded soil. The torque at failure in the remoulded soil was 17 *Nm*. Calculate the sensitivity of soil. In the both cases the vane was pushed completely inside the soil. The height of vane and diameter across blades are 100 *mm* and 80 *mm*. (4)

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Or

(b) (i) Explain Mohr-Coulomb failure theory. (6)

(ii) Explain with neat sketches the procedure of conducting Direct Shear Test. (10)

15. (a) Discuss the friction circle method for the stability analysis of slopes. What are its advantages over conventional method? (16)

Or

(b) (i) Describe about slope protection measures. (4)

(ii) Stability analysis by Swedish method of slices gave the following values per running metre for a 10 m high embankment.

(1) Total shearing force = 480 kN

(2) Total normal force = 1950 kN

(3) Total neutral force = 250 kN

(4) Length of arc = 22m

If the properties of soil are c = 24 kN/m^2 and angle of internal friction 6^0, calculate the factor of safety with respect to shear strength. (12)

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