

Roll No .....

**CE-6003 (CBGS)****B.E. VI Semester**

Examination, May 2019

**Choice Based Grading System (CBGS)****Geotechnical Engineering - I****Time : Three Hours****Maximum Marks : 70****Note:** i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Answer should be brief and accompanied by neat sketch.

iv) Assume suitable data wherever necessary. Take  $\gamma_w = 9.81 \text{ kN/m}^3$ .

1. a) Differentiate between Flow Index and Toughness Index Activity and sensitivity 4

- b) Two soils A and B are tested in the laboratory for the consistency limits. The data available are as follows. 5

Particulars	Soils A	Soils B
Plastic Limits ( $W_p$ )	25%	20%
Liquid Limit ( $W_L$ )	65%	32%
Specific gravity of solids (G)	2.70	2.65%
Moisture Content (W)	35%	25%
Degree of saturation (S)	100%	100%

Which of the two soils

- i) Contains more clay particles?  
 ii) Has greater bulk density?  
 iii) Has greater dry density?  
 iv) Has greater void ratio?  
 v) Has organic matter?

- c) A soil stratum is 10 m thick with pervious stratum on bottom only. Determine the time required for 50% consolidation. Given that coefficient of permeability =  $10^{-7} \text{ cm/s}$ . Coefficient of compression =  $0.0003 \text{ cm}^2/\text{gm}$ . Void ratio = 2; time factor = 0.197. 5
2. a) A 10 m thick layer of stiff saturated clay having unit weight  $20 \text{ kN/m}^3$  is underlain by a layer of sand. The sand is under an artesian pressure of 5 m. Calculate the maximum depth of the cut that can be made without causing a heave. 4
- b) Explain the Mohr-Coulomb theory in brief. 4
- c) Classify soils on the basis of the data provided, as per IS 1498-1970. Where additional information is required say what data is needed? 6

Soil	Liquid Limit	Plastic Limit	% passing 75 $\mu$ Sieve	% passing 4.75 mm Sieve	Coeff. of Uniformity	Coeff. of Curvature
A	25	12	35	90	7	1.7
B	46	20	55	98	3	0.8
C	11	8	12	48	4.2	2.1

3. a) A 4 m high vertical wall supports a saturated cohesive soil ( $\Phi = 0$ ) with horizontal surface. The top 2.5 m of the backfill has bulk density of  $17.6 \text{ kN/m}^3$  and apparent cohesion of  $15 \text{ kN/m}^2$ . The bulk density and apparent cohesion of the bottom 1.5 m is  $19.2 \text{ kN/m}^3$  and  $20 \text{ kN/m}^2$  respectively. If tension cracks develop, what would be the total active pressure on the wall? Also draw the pressure distribution diagram. 7
- b) What is stress isobar? Draw the isobar for 25% of vertical stress. 7
4. a) Briefly explain the Swedish slip circle method with neat sketch for the case of analysis of soil possessing both cohesion and friction. 7

- b) An elevated structure with a total weight of 10,000 kN is supported on a tower with 4 legs. The legs rest on piers located at the corners of a square 5 meter on a side. What is the vertical stress increment due to this loading at a point 5 meter beneath the center of the structure? 7
5. a) Two identical soil specimens were tested in a triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m<sup>2</sup> when the cell pressure was 200 kN/m<sup>2</sup>. Second specimen failed at a deviator stress of 1370 kN/m<sup>2</sup> under a cell pressure of 400 kN/m<sup>2</sup>. Determine the value of cohesion and angle of internal friction. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m<sup>2</sup>, estimate the shear stress at failure. 7
- b) What are the different modes of failure in finite slopes? Explain with neat diagram. What are the factors which control the specific modes of failure in the finite slopes? 7
6. a) A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of 260 kN/m<sup>2</sup> and the new construction increases the pressure by 100 kN/m<sup>2</sup>. If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.65. http://www.rgpvonline.com 6
- b) For a homogeneous earth dam 52 m high and 2 m free board, a flow net was constructed and following results were obtained.  
Number of equi-potential drops = 25; Number of flow channels = 4.  
The dam has a horizontal filter of 40 m length at its downstream end. Calculate the discharge per meter length of the dam if the co-efficient of permeability of the dam material is  $3 \times 10^{-3}$  cm/sec. 4

- c) What are the advantages and disadvantages of Direct shear test? 4
7. a) An unsupported excavation is made in a clay layer. If unit weight of soil is 18 kN/m<sup>3</sup>, cohesion 25 kN/m<sup>2</sup> and angle of internal friction 10° then calculate the depth of tension cracks and maximum possible unsupported depth. Draw the active pressure distribution diagram also. 7
- b) What are the three standard triaxial shear tests with respect to drainage conditions? Explain with reasons the situations for which each test is to be preferred. 7
8. a) What is Taylor's stability number? What is the use of this number in stability problems? 5
- b) What are the different conditions in which stability of slopes of an earth dam is tested? Explain any one condition in brief. 5
- c) A coarse grained soil has saturated unit weight 20 kN/m<sup>3</sup> and specific gravity as 2.7. Quick sand condition will occur or not? Specify reason also. 4

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