

T.E. Civil - V

C

29.11.23

105

Time: 3 Hours

Marks: 80

- NB: 1) Question No. 1 is compulsory  
 2) Attempt any 3 of the remaining 5 questions  
 3) Assume suitable data wherever necessary  
 4) Numbers to right indicate full marks.

1. Answer any 4:
- Write a short note on methods of borehole logs. 05
  - What are the effects of permeability on various properties of soil? 05
  - Explain the factors affecting compaction of soil. 05
  - What are the uses of particle size distribution curve. 05
  - Write a short note on Atterberg limits. 05
2. a) Using three phase diagram, derive the expression for submerged density in terms of porosity. 05  
 b) For the construction of an embankment, the soil is transported from the borrow area using a truck which can carry  $8 \text{ m}^3$  soil at a time. Determine i) the volume of soil to be excavated from the borrow pit and ii) the number of truck loads required to obtain  $120 \text{ m}^3$  compacted earth fill from the following details: 10

Property	Borrow Area	Truck	Field
Bulk Unit Wt.	$20 \text{ kN/m}^3$	$15 \text{ kN/m}^3$	$22 \text{ kN/m}^3$
Water Content	10.5%	8.5%	16.5%

- c) Write a short note on thixotropy of clays. 05
3. a) The following observations were recorded in a liquid limit test: 10

No. of blows N	w %
28	68
22	70
36	67
19	75
16	77

Determine liquid limit & flow index. If  $w_p = 46\%$ , find plasticity index

- b) Enlist the limitations of sedimentation analysis. 05  
 c) Two clays A and B have the following properties:

	Clay A	Clay B
Liquid limit $W_L$ %	45	56
Plastic limit $W_p$ %	21	36
Natural water content $W_N$ %	31	51

Which of the clays, A or B, would experience larger settlement under identical loads? Which of the soil is more plastic? Which of them is softer in consistency?



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4. a) Write a short note on relative density. 05
- b) In a falling head permeability test on a soil sample of length 120 mm, the head of water in the stand pipe takes 15 seconds to fall from 950 mm to 200 mm above the tail-water level. Then another soil of length 80 mm is placed on top of the first soil. The time taken for the head to fall between the same limit is 20 seconds. The permeameter has a cross-sectional area of 5000 mm<sup>2</sup> and a stand pipe area of 150 mm<sup>2</sup>. Calculate the permeability of the 2<sup>nd</sup> soil. 10
- c) For a homogeneous earth dam 30 m high and 2 m free board, a flow net was constructed with four flow channels. The number of potential drops was 20. The dam has a horizontal filter at the base near the toe. The coefficient of permeability of the soil was  $9 \times 10^{-2}$  mm/s. Determine the anticipated seepage, if the length of the dam is 110 metres. 05
5. a) A test well 0.6 m in diameter penetrates through a saturated aquifer 11 m thick overlying an impervious layer. The steady discharge of the well is 20.72 m<sup>3</sup>/hr. The drawdown at a distance of  $R_1 = 25$  m from the centre of test well is found to be 2 m. What will be the drawdown at a distance of  $R_2 = 55$  m, if the permeability of soil is  $4 \times 10^{-4}$  m/sec? Estimate approximate drawdown at the test well also. 10
- b) In a site reclamation project 3.5 m of graded soil with  $\gamma = 23 \text{ kN/m}^3$  were laid in compacted layers over existing layers of silty clay with  $\gamma = 19 \text{ kN/m}^3$  which was 4m thick. This was underlain by a 3 m thick layer of gravel ( $\gamma = 21 \text{ kN/m}^3$ ). Assuming that the water table remains at the surface of the silty clay, draw the effective stress profile for the soil profile: a) before the fill is placed and b) after the fill has been placed. 10
6. a) The results of an IS Standard Proctor Test are as follows: 10

Trial No.	1	2	3	4	5	6
Moisture content (%)	6.02	7.81	12.25	14.05	15.40	20.25
Weight of container and compacted soil (N)	35.8	37.3	39.3	40.0	40.1	39.1

The specific gravity of soil particle is 2.65. Plot the following: a) moisture content - dry density curve, b) zero air voids curve and c) 10% air content curve. Determine the optimum moisture content and the corresponding maximum dry density. Assume suitable data, if required.

- b) Explain static cone penetration test. 05
- c) Write a short note on number, spacing and depth of boreholes. 05

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