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Question Paper Code : 51248

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

Fourth Semester

Civil Engineering

CE 2251/CE 42/CE 1251/080100018/10111 CE 402 – SOIL MECHANICS

(Regulations 2008/2010)

(Common to PTCE 2251/10111 CE 402 – Soil Mechanics for B.E. (Part-Time)

Third Semester – Civil Engineering – Regulations 2009/2010)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is the relationship between degree of saturation and air content ?
2. What is consistency index ? State approximate value of consistency index for very soft clay.
3. Estimate the coefficient of permeability for a uniform sand with effective diameter of 0.18 mm.
4. Define critical hydraulic gradient.
5. Define isobar and pressure bulb.
6. Define coefficient of consolidation and compression index.
7. What is the effect of pore pressure in strength of soils ?
8. Differentiate between unconsolidated undrained test and a drained test.

9. Differentiate between slope failure and base failure. When does each of the above type occur ?
10. What is the maximum depth to which a trench of vertical sides can be excavated in a clay stratum with cohesion of 50 kN/m^2 and unit weight of 16 kN/m^3 ? Assume the clay to be saturated.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) A cubic metre of soil in its natural state weighs 17.75 kN ; after being dried it weighs 15.08 kN . The specific gravity of the soil is 2.70 . Determine the degree of saturation, void ratio, porosity and water content of the original soil sample. (8)
- (ii) A soil sample is a mixture of cohesionless and cohesive soils. Explain the method of determining the grain size distribution curve of the soil. (8)

OR

- (b) (i) Discuss various factors influencing compaction behaviour of soils. (8)
- (ii) A soil sample has a liquid limit of 22% and plastic limit of 14% . The following data are also available from sieve analysis :

Sieve size, mm	2.032	0.422	0.075
% passing	100	84	39

Classify the soil according to IS classification. (8)

12. (a) At a construction site, a 3 m thick clay layer is followed by a 4 m thick gravel layer, which is resting on impervious rock. A load of 25 kN/m^2 is applied suddenly at the surface. The saturated unit weights of the soils are 19 kN/m^3 and 20 kN/m^3 for the clay and gravel layers respectively. The water table is at the surface. Draw the diagram showing variation of effective stress in the layers with depth. (16)

OR

- (b) (i) A falling head permeability test was performed on a sample of clean uniform sand. The initial hydraulic head was 900 mm , the final head was 400 mm , and 60 sec were required for the water level in the stand pipe to fall. The cross-sectional area of the stand pipe was 100 mm^2 . The sample was of 40 mm diameter, and had a length of 180 mm . Determine the coefficient of permeability. (10)
- (ii) What are the principles of a flow net ? List the various uses of flow net. (6)

13. (a) (i) A circular foundation rests on the horizontal upper surface of a semi infinite soil mass and carries a load of 1000 kN. The diameter of the foundation is 3 m. Determine the vertical stress distribution on horizontal planes along the central axis of the foundation to a depth of 10 m below the surface. (8)
- (ii) Write Terzaghi's one dimensional consolidation equation stating clearly the assumptions made and explain the terms involved. (8)

OR

- (b) (i) Explain the process of consolidation of clay and differentiate between primary and secondary consolidation. (8)
- (ii) A building is constructed over a 12 m thick clay layer. On either side of the clay layer, there are sand layers. Calculate the time required for 80% settlement. Time factor for 80% consolidation is 0.60 and coefficient of consolidation of clay sample is $0.015 \text{ cm}^2/\text{minute}$. What additional time will be required for the same settlement if the bottom of the clay rested on impervious rock? (8)
14. (a) Two undrained triaxial tests were conducted on identical specimens of a soil. The first specimen failed at a deviator stress of 500 kPa when the cell pressure was 150 kPa, while the second specimen failed at a deviator stress of 800 kPa under a cell pressure of 300 kPa. Determine the shear strength parameters. If the same soil is tested in a direct shear apparatus, estimate the shear stress at which the sample will fail under a normal stress of 600 kPa. (16)

OR

- (b) The following results were obtained from shear box test on specimens of sandy clay of cross-section $6 \text{ cm} \times 6 \text{ cm}$:

Normal load in N	280	560	1080
Shear force at failure in N	140	300	460

Find the shear strength parameters. If the triaxial test is carried out in a specimen of the same soil with a cell pressure of 120 kN/m^2 , find the total axial stress at which failure would be expected. (16)

15. (a) Explain modified Bishop's method for the analysis of stability of finite slopes. (16)

OR

- (b) Discuss the stability analysis of slopes by friction circle method. (16)