

B.Tech III Year I Semester (R20) Regular & Supplementary Examinations January 2024

GEOTECHNICAL ENGINEERING

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- (a) Define: (i) Degree of Saturation (ii) Voids ratio. 2M
 - (b) Define the consistency limits. 2M
 - (c) Define the Capillary phenomenon in soils. 2M
 - (d) Mention the uses of flow nets. 2M
 - (e) Mention the uses of Newmark's influence charts. 2M
 - (f) What are Boussinesq's and Westergaard's theories? 2M
 - (g) Mention the types of compressibility. 2M
 - (h) Differentiate between primary consolidation and secondary consolidation. 2M
 - (i) What are principal stresses and principal planes? 2M
 - (j) Define: (i) Liquefaction and (ii) Critical voids ratio. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

- 2 Define the consistency limits and the following indices: 10M
(i) Consistency Index (ii) Liquidity index (iii) Flow index and (iv) Toughness index.
- OR**
- 3 Explain briefly the formation of soils. With the help of the phase diagram, define the following terms. 10M
(i) Air content (ii) Percentage air voids (iii) Plastic limit and (iv) Shrinkage limit.
- 4 (a) Explain the factors affecting permeability in soils. 5M
(b) State Darcy's law of Permeability. What are the assumptions involved in it? 5M
- OR**
- 5 During a constant head permeability test, a flow of 180 cc is measured in 6 minutes under a constant head of 18cm. The specimen is 8 cm long and has a sectional area of 60 cm². The porosity of the specimen is 43%. Determine the permeability, the discharge velocity and seepage velocity. Also estimate the permeability of the same soil if porosity reduces to 36%. 10M
- 6 Explain the effect of Compaction on soil properties. Write the differences between Standard and Modified proctor's compaction tests. 10M
- OR**
- 7 The following observations were made in a Standard proctor test. Volume of mould= 1000 cc, G=2.67. 10M
- | Trial No | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------------------|------|-------|-------|-------|-------|------|
| Mass of wet soil (kg) | 1.75 | 1.89 | 2.01 | 2.08 | 2.03 | 1.99 |
| Water content | 8.48 | 12.54 | 13.80 | 15.59 | 18.98 | 21.2 |
- Determine the maximum dry unit weight and optimum moisture content. Also plot the zero air voids line. Also, calculate the degree of saturation and % air voids at Maximum dry density.
- 8 List the assumptions made in deriving 'Terzaghi's one dimensional consolidated theory'. 10M
- OR**

- 9 (a) How do you determine co-efficient of consolidation by square root of time fitting method? 5M
(b) An undisturbed sample of clay, 24 mm thick consolidated 50% in 20 minutes, when tested in laboratory with drainage allowed at top & bottom. The clay layer from which the sample was obtained is 4 m thick in the field. How much time will it take to consolidate 90% with single drainage subjected to same as laboratory loading condition? 5M
- 10 Explain the methods of preparing conventional and modified failure envelopes. In which condition, the modified failure envelope will be plotted? How the shear strength parameters are estimated using modified failure envelope? 10M
- OR**
- 11 Differentiate drained and undrained shear tests. Also write the importance of shear strength in geotechnical applications. 10M

B.Tech III Year I Semester (R20) Supplementary Examinations August 2023

GEOTECHNICAL ENGINEERING

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- | | |
|---|----|
| (a) Write the soil deposit formed due to: | 2M |
| (i) Transportation by rivers and streams. | |
| (ii) Transportation by wind. | |
| (b) Define the terms: | 2M |
| (i) Liquidity index. | |
| (ii) Consistency index. | |
| (c) State Darcy's Law. | 2M |
| (d) Define Seepage velocity and hydraulic gradient. | 2M |
| (e) List the assumptions of Boussinesq's theory of stress distribution. | 2M |
| (f) Define "Optimum moisture content of a soil" and state on what factors it depends. | 2M |
| (g) Differentiate between over-consolidated soil and under consolidated soil. | 2M |
| (h) List the assumptions of Terzaghi's theory of one-dimensional consolidation. | 2M |
| (i) Explain the advantages and disadvantages of triaxial test. | 2M |
| (j) List the factors affecting shear strength of the soil. | 2M |

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

- 2 (a) Draw plasticity chart for the classification of fine-grained soil as per IS soil classification. 4M
- (b) A dry soil has a void ratio of 0.60 and its specific gravity is 2.80. Determine the dry density. 6M
- (i) Water is added to the sample so that its degree of saturation is 50% without any change in void ratio. Determine the water content and unit weight.
- (ii) The sample is next placed below water. Determine the unit weight of soil.
- OR**
- 3 (a) Briefly explain the method for the determination of in-situ unit weight of the soft cohesive soil. 4M
- (b) A soil has a plastic limit of 25% and a plasticity index of 30%. If the natural water content of the soil is 34%, what is the liquidity index and consistency index. How do describe the consistency? 6M
- 4 (a) Define neutral and effective stresses in soil. 4M
- (b) A falling head permeability test is to be performed on a soil sample whose permeability is estimated to be about 3×10^{-5} cm/s. What diameter of the stand pipe should be used if the head is to drop from 27.5 cm to 20.0 cm in 5 minutes and if the cross-sectional area and length of the sample are respectively 15 cm² and 8.5 cm? Will it take the same time for the head to drop from 37.7 cm to 30.0 cm? 6M
- OR**
- 5 (a) List the characteristics and uses of flow nets. 4M
- (b) What is quick sand condition? What are the assumptions made in Laplace theory and derive the equation? 6M

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- 6 (a) Explain the concept of pressure bulb and isobar. 5M
(b) A load 1000 kN acts as a point load at the surface of a soil mass. Estimate the stress at a point 3 m below and 4 m away from the point of action of the load by Boussinesq's formula and Westergaard's formula. 5M
- OR**
- 7 (a) Write brief note on 'compaction' and 'consolidation' of soils differentiating the two. 5M
(b) Describe how quality control is ensured in constructing an earth embankment. 5M
- 8 (a) Explain the method to evaluate coefficient of consolidation by 'Square root of' time fitting method (Taylor's method). 6M
(b) Briefly explain the different types of compressibility. 4M
- OR**
- 9 (a) Explain the Terzaghi's one dimensional consolidation theory with neat sketch. 5M
(b) How to determine the pre-consolidation pressure of a soil? Discuss in detail. 5M
- 10 (a) Write the applications of shear strength of the soil. 4M
(b) Explain direct shear test with neat sketch. Also, write the advantages and disadvantages of the direct shear test. 6M
- OR**
- 11 (a) Explain vane shear test with a neat sketch. 4M
(b) The effective stress shear strength parameters of a completely saturated clay are: $c' = 20 \text{ kN/m}^2$, $\phi' = 25^\circ$. A sample of this clay was tested in an unconsolidated undrained test under a cell pressure of 200 kN/m^2 and the principal stress difference at failure was 110 kN/m^2 . What was the value of pore water pressure at failure? 6M
