

BACHELOR OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2019(Old)

(3rd YEAR 1st SEMESTER - Old)

(1st / 2nd Semester/Repeat/Supplementary/Spl. Supplementary/Old/Annual/Biannual)

SUBJECT: SOIL MECHANICS I

(Name in full)

Full Marks 30/100

Time: Two hours/Three hours/Four hours/Six hours

No. of
Questions

Marks

Answer all questions

- Q1 (a) A soil has liquid limit = 58%, plastic limit = 27%, clay content = 28% and natural moisture content = 38%.
Compute its plasticity index, liquidity index and activity. Classify the soil using plasticity chart. Comment on its consistency, strength, compressibility, permeability and shrinkage / swelling characteristics. 10+6+4 = 20
- (b) For a given soil, $G = 2.7$, Bulk density = 17.5 kN/m^3 and moisture content = 15%. Determine
- Dry density
 - Void ratio
 - Porosity
 - Degree of saturation
- (c) Write a short note on different types of clay minerals found in nature.
- Q2 (a) What are total stress, effective stress and pore water pressure in a soil deposit? 8+10+7 = 25
- (b) Subsoil deposit at a particular location consists of a top 5 m thick sand ($w=22\%$, $G=2.67$) followed by a layer of medium silty clay / clayey silt ($w = 28\%$, $G=2.66$) down to a depth of 15m below existing ground level. Ground water table is at a depth of 4m below G.L. Draw the total stress, pore water pressure and effective stress distribution down to a depth of 15m for the soil deposit. What will be the increase in effective stress if ground water table rises to ground level?
- (c) What is capillary rise in soil? Discuss with neat sketches how it increases the effective stresses in a soil deposit.
- Q3 (a) What are the various methods of determination of coefficient of permeability in the field? Discuss with neat sketches. Also highlight why they are different from that obtained from laboratory tests. 10+10 = 20
- (b) Draw the flownet for seepage analysis through the foundation soil of a typical gravity dam of height 40m and base width 30m. Thickness of foundation soil is 8m and coefficient of permeability is $4 \times 10^{-3} \text{ cm/sec}$. Determine the seepage through the foundation soil.
- Q4 What are the factors affecting compaction of a clayey soil? Discuss how the result of a proctor compaction test is used in actual field application emphasizing the methodology adopted if the required degree of compaction is not achieved. 5+5=10

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Q5 (a) Draw a typical $e - \log p$ curve. Explain how preconsolidation pressure and compression index are determined from this curve.

10+15

= 25

(b) For a normally consolidated clay, the following data are given:

$$p_0 = 50 \text{ kN/m}^2 \quad e = e_0 = 0.92$$

$$\Delta p + p_0 = 120 \text{ kN/m}^2 \quad e = 0.78$$

The hydraulic conductivity (k) of the clay for the preceding loading range is 3.1×10^{-5} cm/sec.

- (i) How long (in days) will it take for a 4 m clay layer (drained on both faces) in the field to reach 50% degree of consolidation?
- (ii) What is the magnitude of settlement at that time?