



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

III B.Tech I Sem Supply End Examination, July 2022

Geotechnical Engineering (CIVIL)

Time: 3 Hours.

Max. Marks: 70

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part - A, answer all questions which carries 20 marks.

3. In Part - B, answer any one question from each unit.

Each question carries 10 marks and may have a, b as sub questions.

PART- A

(10 x 2 Marks = 20 Marks)

- | | | | | |
|-------|--|----|-----|---|
| 1. a) | Define degree of saturation and air content and write the relation between them. | 2M | CO1 | 1 |
| b) | Define liquidity index and consistency index. Write their usefulness. | 2M | CO1 | 2 |
| c) | Write the relation between coefficient (k) of permeability and void ratio (e) of soil. Also discuss how k varies with e. | 2M | CO2 | 1 |
| d) | Express the equation for capillary rise and write its influence on effective stress. | 2M | CO2 | 2 |
| e) | Discuss why zero air void line is important in compaction of soil. | 2M | CO3 | 2 |
| f) | Write the assumptions of Boussinesq's theory. | 2M | CO3 | 1 |
| g) | What is over consolidation ratio? What is its use? | 2M | CO4 | 2 |
| h) | Define compression index and write its use. | 2M | CO4 | 1 |
| i) | What is sensitivity of soil? Write range of sensitivity of soil. | 2M | CO5 | 1 |
| j) | Draw the Mohr's Circle for a soil sample tested using Unconfined Compression Stress Test. | 2M | CO5 | 2 |

PART- B

(10 x 5 Marks = 50 Marks)

- 2 a) With neat sketches explain the following soil structures:
- | | | | | |
|---|--|----|-----|---|
| i. Flocculated structure and | | 5M | CO1 | 2 |
| ii. Dispersive structure | | | | |
| b) A soil has bulk density of 20.1 kN/m ³ and water content of 15%. Calculate the water content if the soil partially dries to a density of 19.4 kN/m ³ and the void ratio remains unchanged. | | 5M | CO1 | 3 |

OR

- 3 The following observations were recorded in a Field density determination by sand-replacement method:
- | | | | | |
|---|--|-----|-----|---|
| Volume of Calibrating can = 1000 cm ³ | | | | |
| Weight of empty can = 10 N | | | | |
| Weight of can + sand = 26.6 N | | 10M | CO1 | 3 |
| Weight of sand required to fill the excavated hole = 8.28 N | | | | |
| Weight of excavated soil = 9.90 N | | | | |

In-situ water content = 10%. Determine the *in-situ* dry unit weight and the *in-situ* dry unit weight. Also comment the level of compaction *in-situ*, if the Maximum Dry Density of soil obtained from the Proctor's compaction test is 19.5 kN/m^3 .

- 4 a) Drawing neat sketches, define the following: Pore water pressure, Effective stress and Total stress in soil. 5M C02 2
 A saturated sand layer over a clay stratum is 5 m in depth. The water is 1.5 m below ground level. If the bulk density of saturated sand is 17.66 kN/m^3 , calculate the effective and neutral pressure on the top of the clay layer. Assume $G = 2.68$. b) 5M C02 3

OR

- 5 A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeabilities of these layers are $8 \times 10^{-4} \text{ cm/s}$, $52 \times 10^{-4} \text{ cm/s}$, and $6 \times 10^{-4} \text{ cm/s}$, and their thicknesses are 7, 3 and 10 m respectively. Find the effective average permeability of the deposit in the horizontal and vertical directions. Explain why effective coefficient of permeability is more in the horizontal direction of stratified deposits. 10M C02 4

- 6 a) How compaction is different than consolidation? Explain clearly. 5M C03 2
 b) How you ensure compaction quality in the field? Discuss. 5M C03 3

OR

- 7 Describing the drawbacks of Boussinesq's theory, solve the following problem:
 A ring foundation is of 3.60 m external diameter and 2.40 m internal diameter. It transmits a uniform pressure of 135 kN/m^2 . Calculate the vertical stress at a depth of 1.80 m directly beneath the centre of the loaded area. 10M C03 4

- 8 a) How you analyze a soil is Over consolidated, Normally Consolidated and Under consolidated? Discuss the procedure of estimation of preconsolidation pressure. 5M C04 2
 There is a bed of compressible clay of 4 m thickness with pervious sand on top and impervious rock at the bottom. In a consolidation test on an undisturbed specimen of clay from this deposit 90% settlement was reached in 4 hours. The specimen was 20 mm thick. Estimate the time in years for the building founded over this deposit to reach 90% of its final Settlement. b) 5M C04 4

OR

- 9 How you analyse time rate of settlement in a clay soil? Discuss the estimation of coefficient of consolidation by square root time method. 10M C04 3

- 10 a) Write the merits of triaxial compression test over direct shear test in the estimation of shear parameters of soil. 5M C05 2
 A sample of dry sand is subjected to a triaxial test. The angle of internal friction is 36° . If the cell pressure is 180 kN/m^2 , at what value of deviator stress will the soil fail? b) 5M C05 3

OR

The following results were obtained from an undrained triaxial test on a soil. Determine the cohesion and angle of internal friction of the soil with respect to total stresses.

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Cell pressure kN/m^2

Additional axial stress at failure (kN/m^2)

10M C05 4

200
400
600

690
840
990

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