

B.E. Civil Engineering (Model Curriculum) Semester - III
004 / PCCCE304 - Geotechnical Engineering-I

P. Pages : 3

Time : Three Hours



GUG/S/23/13710

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Retain the construction lines.
 5. Illustrate your answers wherever necessary with the help of neat sketches.
 6. Use graph paper whenever necessary.

1. a) Define the following terms: 4
- i) Porosity ii) Void Ratio
- iii) Degree of saturation iv) Air content
- b) Saturated specimen of undisturbed inorganic clay has a volume of 20cm^3 and mass 35 gm. 8
After oven drying at 105°C for 24 hrs, the mass reduced to 25 gm. For the soil in natural state find water content, specific gravity, void ratio and dry density of soil.
- c) Define the term “Density Index” of soil. 4

OR

2. a) Explain with the help of sketches gap graded and well graded soils. 4
- b) For a liquid limit, following were the observation. 8
- | | | | | |
|-------------------|-----|-----|-----|-----|
| No. of blows | 9 | 21 | 34 | 44 |
| Water content (%) | 68% | 57% | 47% | 40% |
- Determine liquid limit and flow index of soil. If plastic limit of the same soil is found to 28%. What will be its plasticity index.
- c) Explain “quick sand condition” of soil. 4
3. a) Differentiate between consolidation and compaction with suitable examples. 8
- b) Standard compaction test was performed on a soil sample and following data was obtained. 8

Water content (%)	10	12	14.3	16.1	18.2
Weight of wet soil (gm)	1925	2095	2150	2125	2070

Volume of mould use is 1000 ml, specific gravity of soil is 2.7. For above data draw compaction curve showing OMC and MDD on it. Also plot the zero air void line.

OR

4. a) Discuss the factors affecting compaction. 8
- b) Explain the term: 8
- a) Time factor
- b) Degree of consolidation
- c) Co-efficient of consolidation
5. a) Prove that most dangerous plane on which failure of soil take place is having direction $\alpha = 45^\circ + \frac{\phi}{2}$ to the horizontal. 8
- b) A sample of cohesionless sand in a direct shear test fails under a shear stress of 160 kN/m^2 when normal stress is 140 kN/m^2 . Find angle of shearing resistance and principal stresses at failure. 8

OR

6. a) Explain plate load test with its limitation. 8
- b) Design a strip footing to carry a load of 750 kN/m at a depth of 1.6 m in a $C-\phi$ soil having a unit weight of 18 kN/m^3 and shear strength parameters as $C = 20 \text{ kN/m}^2$ and $\phi = 25^\circ$. Determine the width of footing, using a factor of safety of 3 against shear failure. Use Terzaghi equation consider $N_c = 25.1, N_q = 12.7, N_r = 9.7$. 8
7. a) Explain Poncelet's construction stepwise when i is less than ϕ (i = slope angle, ϕ = angle of internal friction). 6
- b) Determine active earth pressure and the point of application of the resultant pressure before formation of tensile crack and after formation of tensile crack by Rankine's Theory. Details are as following: 10
- Height of retaining wall is 6 m . The ground surface is horizontal in level with the top of the wall. Effective cohesion of backfill is 20 kN/m^2 , angle of internal friction of 20° and unit weight of soil is 18 kN/m^3 . There is uniform surcharge of intensity 8 kN/m^2 over the surface of backfill. Water table is at middle of height of embankment. Consider saturated unit weight of soil below W.T. is 20 kN/m^3 .

OR

8. a) For the vertical retaining wall 8 m high find the safe distance of the footing from the back of wall. The details are given below. 12
- i) Unit weight of soil is 18 kN/m^3
- ii) Line load of footing is 100 kN/m
- iii) Angle of internal friction $\phi = 30^\circ$ and angle of wall friction δ is 20° .
- b) State the assumption made by Rankine's Earth Pressure theory. 4

9. a) Derive the relation for F.O.S. of an infinite slope made of cohesionless soil subjected to seepage parallel to slope for cohesionless soil. **6**
- b) Find the FOS of the slope with following properties **10**
- i) Slope angle = 45°
 - ii) Height of slope = 10 m
 - iii) Angle of internal friction = 20°
 - iv) Unit weight of soil = 18 kN/m^3
 - v) Cohesion = 20 kN/m^2
- The tension cracks are likely to be developed. Consider the effect of tensile crack on F.O.S. Take direction angle $\alpha_A = 28^\circ$, $\alpha_B = 37^\circ$. Retain all construction line.

OR

10. a) Explain the factors improving stability of slopes. **8**
- b) Explain friction circle method stepwise with diagram. **8**
