

B.E. Civil Engineering (Model Curriculum) Sem-III
PCCCE304 - 004 : Geotechnical Engineering-I

P. Pages : 2

Time : Three Hours



GUG/W/22/13710

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) Void Ratio ii) Degree of saturation.
- iii) Percentage air voids iv) Specific gravity.
- b) A soil has a liquid limit of 25% and flow index of 12.5%. If plastic limit is 15%. Determine the plasticity index and toughness index. If the water content of soil in its natural state is 20%. Find the liquidity index. 6
- c) What are consistency limits of soil? Define each limit. 6

OR

2. a) Derive from the first principles the relationship 8
- $$r = \left(\frac{G + es_r}{1 + e} \right) r_w$$
- b) With neat sketch explain “Constant head test” for determination of permeability in laboratory. 8
3. a) Differentiate between consolidation and compaction with suitable examples. 6
- b) Standard compaction test was performed on a soil sample and following data was obtained. 10
- | | | | | | |
|----------------------|------|------|------|------|------|
| Water content (%) | 12 | 14 | 16 | 18 | 20 |
| Wt. of wet soil (gm) | 1680 | 1850 | 1910 | 1870 | 1850 |

Volume of mould used in 1000cm^3 . Assuming specific gravity of soil solid is 2.7.
Obtain maximum dry density and optimum moisture content. Also plot zero air void line.

OR

4. a) Write down procedure of determination of preconsolidation pressure. 8
- b) Differentiate between standard proctor test and modified proctor test. 8
5. a) With neat sketch explain the “unconfined compression test” of soil. 8
- b) A vane 10cm long and 8cm in diameter was pressed into soft clay at the bottom of bore hole. The torque was applied gradually increased to 50N-m. When failure take place subsequently the vane rotated rapidly so as to completely remoulded soil. The remoulded soil was sheared at torque 20 N-m. Calculate the cohesion of the clay in natural and remoulded state and also value of sensitivity. 8

OR

6. a) Differentiate between Terzaghi's theory and Meyerhot's theory. 6
- b) A square footing located at a depth of 1.5m below the ground has to carry a safe load of 800kN. Find the size of footing if desired factor of safety is 3. The soil has following properties: 10
- Void ratio 0.4, Degree of saturation 50% specific gravity 2.7, cohesion 10kN/m^2 Angle of internal friction ϕ is 30° .
- Take $N_c = 37.2$, $N_q = 22.5$, $N_r = 9.7$.

7. a) Explain Poncalet's construction stepwise when i is equal to ϕ (i = slope angle, ϕ = angle of internal friction) 6
- b) A retaining wall 6m high retains sand with $\phi = 30^\circ$ & unit weight 24kN/m^3 upto a depth of 3m from top. From 3m to 6m the material is cohesive soil with $c = 20\text{kN/m}^2$ and $\phi = 20^\circ$. Unit weight of cohesive soil is 18kN/m^3 . A uniform surcharge of 100kN/m^2 acts on the top of soil. Determine the total lateral pressure acting on the wall and its point of applications. Use Rankinels theory. 10

OR

8. a) How would you consider the effect of tension crack in earth pressure analysis and depict critical height of unsupported vertical cut? Illustrate with neat diagram. 4
- b) For retaining wall 8m height supporting backfill having following properties: 12
- i) Unit weight of soil = 18kN/m^3
- ii) Angle of internal friction = 30°
- iii) Angle of wall friction = 20°
- What will be the change in lateral thrust if a uniform surcharge of 36kN/m^2 acts on the surface.

OR

9. a) Discuss types of failure. 4
- b) An embankment is made of soil having cohesion of 18kN/m^2 , angle of internal friction 30° , unit weight of soil is 20kN/m^3 . Slope of embankment is 45° and 10m height. Locate the centre of rotation. 12
- Assume toe failure. Direction angle $\alpha_A = 26^\circ$ and $\alpha_B = 37^\circ$. Solve it by Swedish circle method.

OR

10. a) Explain friction circle method stepwise with diagram. 8
- b) Derive the expression for critical height for an infinite slope of $c - \phi$ soil. 8
