B.Tech. / B.E. Civil Engineering (Model Curriculum) Semester-III

004 / PCCCE304 - Geotechnical Engineering-I

P. Pages : 2 **GUG/W/23/13710**

Time : Three Hours 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.

1. a) Differentiate between residual and transported soil. **6**

b) A soil has a liquid limit of 25% and flow index of 13%. If plastic limit is 12%. Determine the plasticity index and toughness index. If the water content of soil in its natural state is 22% Find the liquidity index. **6**

c) Define the term "Density index of soil". **4**

OR

2. a) Derive from first principle that **6**

$$r = \left[\frac{G + eSr}{1+e}\right] r_w$$

b) Explain co-efficient of uniformity and co-efficient of curvature. **4**

c) Due to rise of temp, the viscosity and unit weight of the percolating fluid are reduced to 70% and 90% respectively other things being constant, calculate the percentage change in co-efficient of permeability. **6**

3. a) Compare standard proctor test and modified proctor test. **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%
Mass of mould + wet soil (g)	2925	3095	3150	3125	3070

Volume of mould is 1000ml, mass of mould is 1000gm, specific gravity 2.7 obtain maximum dry density and optimum moisture content.

OR

4. a) Explain with suitable graphical representation **8**
i) Zero air void line ii) MDD and OMC
iii) Compaction curve

b) Explain the term **8**
i) Time factor ii) Degree of compaction.
iii) Co-efficient of consolidation.

5. a) Explain in brief Mohr Coulomb theory with neat sketch. **8**

b) A soil has angle of internal friction 22º and cohesion $50kN/m^2$. Draw Mohr circle of failure if soil is tested in shear box at normal stress of $50kN/m^2$ calculate magnitude and direction of principle stress **8**

OR

6. a) Explain different factors affecting bearing capacity of soil. **6**

b) A square footing located at a depth of 1.5m below the ground has to carry a safe load of 800 kN. Find the size of footing if the desired FOS is 3. The soil has the properties void ratio of 0.50, Degree of saturation 50% specific gravity 2.62, cohesion 'C' is 8 kPa, Angle of internal friction 28º. Use Terzaghi analysis Consider Nc = 37.2, Na = 22.5, Nr = 19.7. **10**

7. a) State assumptions made in Rankine's Earth pressure theory. **4**

b) Determine active earth pressure and point of application of the resultant pressure before formation of tensile crack and after formation of tensile crack by Rankine's theory. **12**
Details are as follows:
Height of retaining wall = 8m.
Ground surface is horizontal in level with top of the wall.
Effective cohesion of backfill is $20\,kN/m^2$
Angle of internal friction = 20º
Unit weight of soil = $18\,kN/m^3$.
Uniform surcharge over the surface of backfill = $10\,kN/m^2$
Water table is at a middle height of embankment. Consider saturated unit weight of soil below W. T. is $20kN/m^3$.

OR

8. a) Explain stepwise Rebhann's graphical method for i nearly equal to ϕ. **6**

b) For retaining wall supporting backfill having unit weight of soil is $19\,kN/m^3$, angle of interval friction is 30º, Angle of wall friction is 20º. What will be the change in lateral thrust and line of action if line load of 100 kN/m at a distance of 2.5m from face of wall. **10**

9. a) Discuss various causes and types of slope failure.

b) An embankment is made of soil having cohesion of $18\,kN/m^2$, angle of internal friction 30º, unit weight of soil is $20\,kN/m^3$, slope of embankment is 45º and 10 m height. Locate centre of rotation. Assume toe failure. $\alpha_A = 26^o$ and $\alpha_B = 37^o$. Solve by Swidish circle method.

OR

10. a) Derive the relation for F. O. S. of an infinite slope made up of cohesion less soil subjected to seepage parallel to the slope.

b) An embankment is made of soil having following properties.
i) Height of slope = 10m
ii) The angle of internal friction 26º
iii) Angle of slope = 45º.
iv) Unit weight of soil = $20\,kN/m^3$
v) Cohesion = $17\,kN/m^2$
vi) $\alpha_A = 27^o, \alpha_B = 36^o$ Solve it by Swedish circle method or Friction circle method. Adopt Fellenius construction. Retain all construction lines.

****