*Total number of printed pages: 2*

**UG/5th Semester/UCE505**

**2023**

# GEOTECHNICAL ENGINEERING

*Full Mark: 100*

Time: Three hours

***The figures in the margin indicate full marks for the questions.***

*Answer **any five** questions.*

1. a) What are the building blocks of clay minerals? Explain the three common groups of clay minerals with suitable figures. 4+6=10

   b) What do you understand by weathering of rocks? Explain briefly the process of physical and chemical weathering of rocks. 4+6=10

2. a) What is Atterbergs' limit of soil? Explain the soil classification based on plasticity chart. 4+6=10

   b) A cohesive soil yields a maximum dry density of 1.8 g/cc at an OMC of 16% during a standard proctor compaction test. If the value of G is 2.65, what is the degree of saturation? What is the maximum dry density it can further compacted to? 10

3. a) What is Darcy's law? Explain two laboratory method for determining Co-efficient of permeability and show the expression for coefficient of permeability. 4+6=10

   b) A horizontal stratified soil deposit consists of three uniform layers of thickness 6m, 4m, and 12m respectively. The permeability of these layers are $8x10^{-4}$ cm/s, $52x10^{-4}$ cm/s and $6x10^{-4}$ cm/s. Find the effective average permeability of the deposit in the horizontal and vertical direction. 10

4. a) What are the assumptions made in deriving Terzaghi's one dimensional consolidation theory? Explain a graphical method of determining pre-consolidation pressure. 4+6=10

   b) A clay stratum has a 3m thickness and has an initial overburden pressure of 40 $kN/m^2$. The clay is over-consolidated, with a pre-consolidation pressure of 60 $kN/m^2$. Determine the final settlements due to an increase in pressure of 50 $kN/m^2$ at the middle of the clay layer. Take the following values: 10

(i) Recompression index= 0.05

(ii) Compression index= 0.28

(iii) Initial voids ratio= 1.3

5. a) What is Quick sand condition of soil? Derive the Laplace equation for two-dimensional flow. 4+6=10

b) Briefly explain the Mohr-Coulomb theory for determining the shear strength of soil. Draw the strength envelope for (i) Cohesive soil; (ii) cohesionless soil; (iii) purely cohesive soil. 6+4=10

6. a) What is shear strength parameters of soil? How will you determine the shear strength parameters in laboratory for different types of soil? Explain. 4+6=10

b) Explain finite and infinite slope with suitable figures. What are the different types of failure of finite slope? Explain with figures 4+6=10