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ET-501(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00597

December, 2017

ET-501(A) : SOIL MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of calculator is allowed. Assume specific gravity of soil as 2·65.*

1. (a) Derive the relation amongst saturated density, specific gravity and void ratio. Define each of these terms. 7

(b) Explain how the liquid limit of clayey soil is determined in the laboratory. 7

2. A soil in a borrow pit has a moist density of 18 kN/m^3 and water content of 15%. The soil is brought to a construction site, placed in the form of an embankment and compacted. The dry density of compacted soil is 16 kN/m^3 and water content is 18%. Find :

(a) Void ratios of soil in the borrow pit and in the embankment,

(b) Volume of the soil to be excavated to make 100 m^3 of compacted soil, and

(c) Volume of water to be added during compaction. 14

3. (a) Discuss the factors affecting capillary rise in soil. Explain the significant consequences of capillarity on the behaviour of soil. 7

(b) Discuss the validity of Darcy's law.
A sample of fine grained soil has cross-sectional area 80 cm^2 and length 50 mm. It is subjected to variable head permeability test. The area of standpipe is 0·55 cm^2 and during the test, the head dropped from 78 cm to 38 cm in 85 minutes. Determine the hydraulic permeability of the soil. 7

4. (a) Define the zero air-voids line. The result of a Proctor test on sandy clay soil is given as follows :

Water content (X)	Wet density (kN/m^3)
14·5	17·65
16·5	18·85
18·5	19·90
20·0	20·5
22·0	20·25
24·0	20·17

Draw zero air-voids line and determine optimum moisture content and maximum dry density. 7

(b) What is Compaction Energy ? Explain with neat sketches any two types of compaction equipment. 7

5. (a) Derive the Laplace equation for the two-dimensional condition of flow in soil. Establish the relation between equipotential function and flow function. 7

(b) For a concentrated point load P = 1000 kN, draw the variation of vertical stress with depth at points below ground surface with x = 4 m and y = 3 m. 7

6. Establish the following consolidation relation :

$$\frac{\partial u}{\partial t} = C_r \frac{\partial^2 u}{\partial z^2}$$, the symbols carrying the usual meaning. 14

7. (a) Discuss Mohr-Coulomb theory of failure w.r.t. shear strength of the soil. 7

(b) An unconfined compressive strength test was conducted on a saturated clay sample of diameter 38 mm and length 76 mm. The sample failed at a load of 200 N and the deformation at failure was 9·8 mm. Determine the increased diameter of the soil and cohesion of the clayey soil. 7

8. (a) Discuss the Fellenius method for the location of critical centre of the slip circle. 7

(b) Explain why the berm is provided in the slope. How do the layers of geotextile improve the stability of the slope ? 7