

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

Term-End Examination

June, 2008

ET-501(A) : SOIL MECHANICS

Time : 3 hours

Maximum Marks : 70

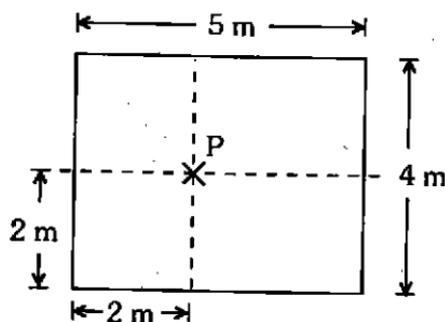
Note : Answer any **seven** questions. Assume any missing data suitably.

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1. (a) What is sedimentation analysis ? Discuss its limitations. 5
- (b) For a given sandy soil, $e_{\max} = 0.82$ and $e_{\min} = 0.42$. Let $G_s = 2.66$. In the field, the soil is compacted to a moist density of 1720 kg/m^3 at a moisture content of 9%. Determine the relative density of soil after compaction. 5
2. (a) What do you understand by consistency of soil ? How is it determined ? 5
- (b) In a shrinkage limit test, a dish with volume 10.5 ml was filled with saturated clay. The mass of saturated clay was 18.75 gm. The clay was dried gradually first in atmosphere and then in an oven. The mass of the dry clay was 12.15 gm and its volume 5.85 ml. Determine the shrinkage limit. 5

3. (a) Describe the unified classification system of soils. 5
- (b) Classify the soil with following properties : 5
- Liquid limit = 39%
- Plastic limit = 29%
- % passing 4.75 mm sieve = 60
- % passing 75 μ sieve = 45
4. (a) Discuss the influence of pore water pressure on soil behaviour. 5
- (b) In a falling head permeameter if the time intervals for drop in levels from h_1 to h_2 and h_2 to h_3 are equal, prove that $h_2 = \sqrt{h_1 \times h_3}$. 5
5. (a) What are the types of piping failure in the soil ? Discuss with neat sketches. 5
- (b) If excavation is carried out in a soil with a porosity 0.36 and specific gravity of solids of 2.66, determine the critical gradient. A 15 m layer of soil is subjected to an upward seepage head of 1.95 m. What depth of coarse sand would be required above the soil to provide a factor of safety of 2.5 ? 5
6. (a) Discuss the factors affecting compaction of soils. 5
- (b) The maximum dry density of a sample by light compaction test is 1.78 g/cc at an optimum moisture content of 15%. Find the air voids and the degree of saturation. Take $G = 2.67$.
- What would be the corresponding value of dry density on the zero air void line at OMC ? 5

7. A rectangular foundation $4\text{ m} \times 5\text{ m}$ carries a uniformly distributed load of 200 kN/m^2 . Determine vertical stress at a point P located as shown in figure and at a depth of 2.5 m .

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8. (a) Define coefficient of compressibility, coefficient of volume change, compression index, expansion index and coefficient of consolidation. 5
- (b) A homogeneous clay layer, 9 m thick is expected to have an ultimate settlement of 308 mm . After a time span of 2 years , the average settlement was measured to be 108 mm . How much longer will it take for the average settlement to attain 220 mm ? 5
9. (a) How are the drainage conditions adopted in a triaxial shear test realised in the field? 5
- (b) A specimen of fine dry sand when subjected to a triaxial compression test, failed at a deviator stress of 400 kN/m^2 . It failed with a pronounced failure plane with an angle of 66° with the horizontal. Compute the lateral pressure at which the specimen would have been subjected. 5

10. (a) Explain the various causes of failure of earth slopes, with sketches.

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(b) A long natural slope in an over consolidated clay is inclined at 10° to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip had developed at a depth of 5 m below the surface, determine the factor of safety. Take $c' = 10 \text{ kN/m}^2$, $\phi^c = 25^\circ$, $\gamma_{\text{sat}} = 20 \text{ kN/m}^3$ and $\gamma_w = 10 \text{ kN/m}^3$.

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