

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

**[4062]-105**

**S.E. (Civil) (I Sem.) EXAMINATION, 2011**

**GEOTECHNICAL ENGINEERING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Define consistency of soils and show the four states of consistency graphically with appropriate consistency limits. [6]
- (b) Represent soil as a three phase system and use it to derive relation between porosity and void ratio. [6]
- (c) State the different methods to determine field density of soil. Explain any *one* of them. [6]

P.T.O.

*Or*

2. (a) Write a short note on types of transported soils with examples. [6]
- (b) Define and explain coefficient of curvature, effective size and uniformity coefficient and state the values of  $C_u$  and  $C_c$  used to classify the soils. [6]
- (c) The void ratio and specific gravity of a sample of clay are 0.73 and 2.7 respectively. If the voids are 92% saturated, find the bulk density, dry density and the water content. [6]
3. (a) What is Laplace equation ? Derive it from the first principles for two-dimensional flow. [6]
- (b) State and explain the various factors which affect the permeability of soil. [4]
- (c) In a falling head permeability test on a silty clay sample, the following results were obtained : sample length 120 mm; sample diameter 80 mm; initial head 1200 mm; final head 400 mm, time for fall in head 6 minutes; stand pipe diameter is 4 mm. Find the coefficient of permeability of soil in mm/sec. [6]

*Or*

4. (a) What do you understand by critical hydraulic gradient ? Derive expression for the same. [6]
- (b) What is the flow net ? State and explain the important applications of a flow net. [6]
- (c) Calculate the coefficient of permeability of a soil sample, 6 cm in height and 50 cm<sup>2</sup> in a cross-sectional area, if a quantity of water equal to 450 ml passed down in 10 minutes under an effective constant head of 40 cm. [4]
5. (a) Compare light compaction test and heavy compaction test in a tabular form. [5]
- (b) State and explain the factors affecting the compaction of soil. [5]
- (c) The optimum moisture content of soil is 14.50% and its maximum dry density is 17.50 kN/m<sup>3</sup>. The specific gravity of soil grain is 2.60.
- Determine :
- (i) The degree of saturation and
- (ii) Percentage of air voids of the soil at OMC. [6]

*Or*

6. (a) Write a short note on Newmark's chart. [4]
- (b) Draw a typical curve showing the relation between MDD-OMC and explain the terms MDD, OMC and Air voids line. [6]
- (c) A concentrated load of 30 kN acts on the surface of a homogenous soil mass of large extent. Find the stress intensity at a depth of 8 m and :
- (i) directly under the load
- (ii) at a horizontal distance of 6 m. [6]

## SECTION II

7. (a) Explain step by step, how unconfined compression strength of soil sample is determined in laboratory with sketch. [6]
- (b) What are advantages and disadvantages of direct shear test ? [6]
- (c) In a consolidated drained triaxial test, a specimen of clay fails at a cell pressure of 60 kN/m<sup>2</sup>. The shear strength parameters are  $c = 15$  kN/m<sup>2</sup> and  $\phi = 20^\circ$ . Determine the additional axial stress (deviator stress) required for failure. [6]

*Or*

8. (a) Explain the various drainage conditions under which the shear tests can be carried out. [6]

- (b) What is liquefaction of sands ? How can it be prevented ? [6]
- (c) An unconfined compression test yielded a strength of  $0.1 \text{ N/mm}^2$ . If the failure plane is inclined at  $50^\circ$  to the horizontal, what are the values of the shear strength parameters ? [6]
- 9.** (a) Define the terms : Active earth pressure, Passive earth pressure and Earth pressure at rest. [6]
- (b) Explain the phenomenon of landslides. Also discuss causes and remedial measures. [6]
- (c) What are the different modes of slope failure ? Give examples. [4]
- Or*
- 10.** (a) Explain Culmann's graphical method of finding critical active pressure. [6]
- (b) State the assumptions made in the Rankine earth pressure theory. [6]
- (c) What is stability number ? What is its utility in the analysis of stability of slopes ? [4]
- 11.** (a) What are different index properties of rocks ? What is their importance ? [8]
- (b) State and explain geological classification of rocks in detail. [8]

*Or*

**12.** Write short notes on any *four* : (4 marks each) [16]

- (i) Shear strength of rocks
- (ii) Hardness of rocks
- (iii) Rock permeability
- (iv) *In situ* stresses in rocks
- (v) Ring shear test
- (vi) Slake durability index.