Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4162]-105

S.E. (Civil) (First Semester) EXAMINATION, 2012

GEOTECHNICAL ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What are the various index properties of soil ? Explain the significance of each. [6]

P.T.O.

(*b*) What is Stokes' Law ? What are the limitations of Stokes' law ? [6]

(*c*) Sketch the plasticity chart and show thereon a soil with W_L = 55%, W_P = 20%. Assign its IS classification. [6]

Or

2. (*a*) Explain the terms with the help of three-phase diagram, void ratio, degree of saturation, water content and bulk unit weight. [6]

(*b*) Draw a typical particle size distribution curve and for a well graded, uniformly graded and gap graded soil. [6]

(*c*) The grading curve of a soil gives the effective size as 0.16 mm, D_{30} = 0.4 mm and D_{60} = 0.3 mm. Find Cu and Cc. Classify the soil. [6]

3. (*a*) What is Laplace equation ? Derive it from the first principles for two-dimensional flow. [6]

(*b*) Explain the variable head method to determine the permeability of soil. Derive the equation used. [6]

(*c*) A soil profile consists of layers of thickness equal to 2 m, 3 m and 4 m with coefficient of permeability equal to 2×10^{-4} cm/sec, 3.5×10^{-3} cm/sec and 2×10^{-3} cm/sec. Find the equivalent coefficient of permeability, when the flow is perpendicular to the layers. [4]

Or

4. (*a*) What is flow net ? What are the properties of flow net ? [6]

(*b*) What are the various factors affecting permeability ? [6]

(*c*) In order to compute the seepage loss through the foundation of a cofferdam flow nets were constructed. The results of the flow net study gave $N_f = 5$ and $N_d = 15$. The head of water lost during seepage was 6 m. If the coefficient of permeability of soil $K = 5 \times 10^{-4}$ m/min. Compute the seepage loss per meter length of dam per day. [4]

5. (*a*) How will you ensure compaction control at the time of construction of an earthen dam ? [5]

(*b*) Explain Boussinesq's equation for estimation of vertical stress below the soil mass. [4]

(*c*) In a standard proctor test the following observations were recorded :

Sample No.	Bulk density (kg/m^3)	Water content (%)
01	1978	11.3
02	2083	12.2
03	2147	13.0
04	2208	14.2
05	2188	15.1
06	2147	16.4

Plot the moisture density curve and find MDD and OMC. [7]

Or

6. (*a*) What is compaction curve ? Give its salient features. What is zero air void line ? [5]

(*b*) What is pressure bulb ? Explain its use. [5]

(*c*) A water tank is constructed by a ring foundation having outer diameter of 8 m and inner diameter of 6 m. The uniform load intensity on foundation is 200 kN/m^2. Determine the vertical stress caused by the water tank at a depth of 4 m below the centre of the foundation. [6]

SECTION II

7. (*a*) How would you find the shear strength of soil with the help of unconfined compression test ? What are its limitations ? [6]

(*b*) State the advantages and disadvantages of triaxial test. [6]

(*c*) For a soil with $\phi = 20°$, C = 40 kN/m^2, what will be the major principle stress at failure, if cell pressure is 120 kN/m^2. [6]

Or

8. (*a*) What is sensitivity ? How are soils classified based on sensitivity ? [6]

(*b*) State and explain Coulomb's law of shear strength. How is it affected by the pore pressure ? [6]

(*c*) An in-situ vane shear was conducted in a clay at the bottom of a bore hole. A torque of 153 N-m was required to shear the soil. What was the undrained strength of clay ? The vane was 100 mm in diameter and 150 mm long. [6]

9. (*a*) Explain the terms : Active earth pressure, Passive earth pressure and Earth pressure at rest. [6]

(*b*) What is stability number ? What is its use ? [4]

(*c*) Derive the expression for the critical height of a vertical cut that can stand unsupported in a C-ϕ soil. [6]

Or

10. (*a*) Draw a neat sketch to show :

(*i*) Toe failure

(*ii*) Face failure and

(*iii*) Base failure. [5]

(*b*) Explain finite and infinite slopes with suitable examples. [5]

(*c*) A retaining wall with a vertical smooth back is 8 m high. It supports a cohesionless soil with γ = 19 kN/m^3, ϕ = 30°. The surface of soil is horizontal. Determine the thrust in the wall. [6]

11. (*a*) What are different modes of failure of rocks ? Give examples of each. [8]

(*b*) What are different index properties of rocks ? How are they determined ? Explain any *two*. [8]

Or

12. Write short notes on : [16]

(*a*) Beam bending test

(*b*) Unconfined compression test

(*c*) Ring shear test

(*d*) Hardness of rock.