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<b>Seat No.</b>	
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**[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  $C_u$  and  $C_c$ . 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  $2 \times 10^{-4}$  cm/sec,  $3.5 \times 10^{-3}$  cm/sec and  $2 \times 10^{-3}$  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 <sup>3</sup> )	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<sup>2</sup>. 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  $\phi = 20^\circ$ ,  $C = 40 \text{ kN/m}^2$ , what will be the major principle stress at failure, if cell pressure is  $120 \text{ kN/m}^2$ . [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  $153 \text{ N-m}$  was required to shear the soil. What was the undrained strength of clay ? The vane was  $100 \text{ mm}$  in diameter and  $150 \text{ mm}$  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- $\phi$  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  $\gamma = 19 \text{ kN/m}^3$ ,  $\phi = 30^\circ$ . 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.