

- Instructions :** (1) All Questions are Compulsory.  
(2) Answer each next main Question on a new page.  
(3) Illustrate your answers with neat sketches wherever necessary.  
(4) Figures to the right indicate full marks.  
(5) Assume suitable data, if necessary.  
(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

1. (a) Attempt any **SIX** of the following : [12]
- (i) Define soil as per IS.
  - (ii) Define geology and state the various branches.
  - (iii) What do you mean by normal and reverse fault?
  - (iv) Draw three phase diagram when soil is :
    - (i) moist
    - (ii) fully saturated
  - (v) Define water content and voids ratio of soil.
  - (vi) State any four physical properties of minerals.
  - (vii) Explain the use of soil as foundation material.
  - (viii) Define outcrop and fold of rock.
- (b) Attempt any **TWO** of the following : [8]
- (i) What is meant by geologic cycle? State the types of weathering and explain in brief.
  - (ii) Explain different types of folds occurs in rocks.
  - (iii) Explain any four field applications of geotechnical engineering knowledge.
2. Attempt any **FOUR** of the following : [16]
- (a) State the methods of construction of earthquake resisting structures.
  - (b) Define specific gravity and describe its determination by pycnometer.
  - (c) Explain the formation process of soil. State various types of soils available in India.
  - (d) State the types of earthquakes based on focus and Richter scale.
  - (e) Define the terms related to earthquake :
    - (i) Focus
    - (ii) Epicenter
    - (iii) Intensity
    - (iv) Seismograph
  - (f) State any two causes and effects of an earthquake.
3. Attempt any **FOUR** of the following : [16]
- (a) Explain the procedure to determine coefficient of permeability by falling head method.
  - (b) Explain direct shear test carried out on given soil sample.
  - (c) State field identification test on soil and explain any one.
  - (d) Calculate coefficient of uniformity and coefficient of curvature if  $D_{10} = 0.43$  mm,  $D_{30} = 1.78$  mm and  $D_{60} = 2.39$  mm.

- (e) Explain any four factors affecting permeability of soil.
- (f) Draw shear strength envelope for purely cohesive and cohesionless soil with its equations.

4. Attempt any **FOUR** of the following : [16]

- (a) Define flow net and state its characteristics.
- (b) Differentiate between compaction and consolidation with minimum four points.
- (c) Draw the experimental set up of plate load test using gravity loading.
- (d) Explain standard proctor test to obtain OMC and MDD values for given soil.
- (e) Define active and passive earth pressure using necessary sketches.
- (f) Define soil stabilization. State any three points of necessity of soil stabilization.

5. Attempt any **TWO** of the following : [16]

- (a) Explain in steps laboratory method to determine plastic limit of soil sample as per IS 2720.
- (b) A soil sample 10 cm in diameter and 15 cm long is tested in falling head permeameter. The initial head was 45 cm, which was dropped to 25 cm in 12 minutes. The diameter of burette pipe was 0.5 cm. Find coefficient of permeability in metre/day.
- (c) Define dry unit weight of soil. Explain core cutter method to determine dry unit weight of field soil using necessary sketches.

6. Attempt any **FOUR** of the following : [16]

- (a) State the four assumptions of Rankine's theory.
- (b) A permeameter ( $A = 3000 \text{ mm}^2$ ,  $L = 200 \text{ mm}$ ) gave a discharge of 25 ml in 20 minutes under a constant head of 1 m. Determine the value of coefficient of permeability.
- (c) State the criteria for deciding the location and number of test pits and bores.
- (d) Compute the intensity of active and passive earth pressure at depth 8.7 m in dry cohesionless sand with angle of internal friction of  $28^\circ$  and unit weight of  $18 \text{ kN/m}^3$ . Also calculate total earth pressure and its line of action.
- (e) State suitability of following compaction equipments :
  - (i) Smooth wheel roller
  - (ii) Sheep foot roller,
  - (iii) Rammer and
  - (iv) Vibrator

