



Marks

**Question (1):**

**[20]**

- a) Discuss why subsurface exploration may be carried out for: (8)
- New structures.
  - Existing structures.
- b) Explain the various steps of subsurface exploration programme. (12)

**Question (2):**

**[20]**

- a) Draw neat sketches for: (6)
- Wash borings.
  - Hollow stem auger borings.
- b) What are the causes of sample disturbance? How are they taken care of in soil samples for undisturbed sampling? (8)
- c) Explain the following terms which are used in subsurface investigation: (6)
- Area ratio.
  - Undisturbed soil sample.
  - Friction ratio.

**Question (3):**

**[20]**

- a) Explain and discuss the various factors that be considered in deciding the depth of borings required for subsoil exploration. (8)
- b) Suggest the required borehole spacing and depth for the following: (6)
- Five story building on uniform soil.
  - 15 story building on erratic soil..
- c) State whether the following statements are true or false and correct the false statements: (6)
- 1) It is necessary to obtain undisturbed samples of clay for determining its Atterberg's limits.
  - 2) One can effectively drill a borehole in sand using solid stem auger.
  - 3) Van Shear Test used to obtain the drained shear strength of soft clay.

**Question (4):**

**[20]**

- a) Describe using sketches the Standard Penetration Test. What are the factors affecting the SPT blow count? (8)

- b) Draw neat sketches for the different types of Cone Penetration Test. What type of results can be obtained for each type? (6)
- c) A Standard Penetration Test was conducted in a fine sand stratum at a depth of 6.0 m. The blow counts obtained in the field were (8,11,14) blows. The ground water table is at the ground surface. The average saturated unit weight of the soil is  $2.0 \text{ t/m}^3$ . The test was conducted in a 12 cm diameter boring using a drill rod of length 6.50 m. Determine the corrected SPT blow counts. (6)

**Question (5):**

**[20]**

- a) A vane of diameter 14 mm and height 22 mm is used to determine the shear strength of clayey soil and fails at maximum torque of 0.15 N.m. Determine the undrained shear strength of clay. (6)
- b) How are the results of field plate load tests extrapolated for sand and clay? (Write the extrapolation for ultimate bearing capacity and settlement). (8)
- c) A 30 cm square plate settles by 10 mm in a plate load test on a cohesionless soil under a certain loading intensity. Find the settlement of a prototype footing of size (1.50 m  $\times$  2.0 m ) resting on the same soil and loaded to the same load intensity. (6)

**With my best wishes,  
*Dr. Ahmed Abdel-Galil***