

TE CIVIL, VI SEMESTER  
 (3 Hours) II

QP Code : 4971

[Total Marks : 80]

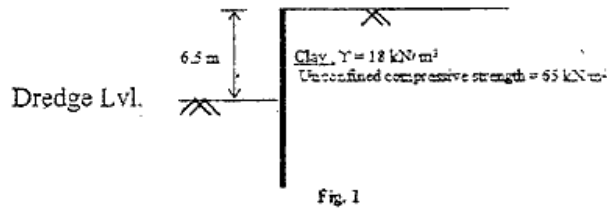
Note:

- (1) Question No. 1 is compulsory.
- (2) Answer any three out of remaining five questions.
- (3) Assume suitable data wherever necessary.

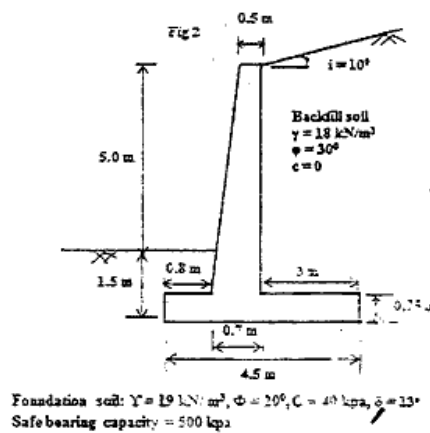
Answer any four

- (a) Draw the free body diagram of forces for an embankment in  $c-\phi$  soil with circular failure surface and define the notations used. Also determine the factor of safety with respect to cohesion for a submerged embankment 25 m high and having a slope of  $40^\circ$ . The properties of soil are  $\phi = 10^\circ$ ,  $c = 40 \text{ kN/m}^2$ ,  $\gamma_{\text{sat}} = 19 \text{ kN/m}^3$ , Taylor's stability number,  $S_n = 0.097$ . 5
- (b) An unsupported excavation is to be made in soil having  $\phi = 12^\circ$ ,  $c = 19 \text{ kN/m}^2$ ,  $\gamma = 19 \text{ kN/m}^3$ . What is the maximum depth of unsupported excavation in a soil? and draw the active pressure distribution diagram. 5
- (c) Considering Coulomb's theory of lateral earth pressure, draw and define the forces acting on the cohesionless backfill at failure under active state behind a retaining wall. Also, why are retaining walls usually designed for active earth pressure? 5
- (d) Explain the basic difference in the theoretical bearing capacity computation of shallow and deep foundations. 5
- (e) Define allowable bearing capacity of soil and what is the effect of increase in width and depth of a footing on the bearing capacity and settlement behaviour of footing resting on (i) sand and (ii) clay? 5
- (f) In what respect does the design of braced cuts differ from that of a retaining wall and What are apparent earth pressure diagrams used in the design of braced cuts? 5
- (a) Derive an expression for factor of safety of an infinite slope in a  $c-\phi$  soil when there is a steady seepage parallel to the slope. 7
- (b) A deep cut of 12 m depth is made in natural soil for the construction of a road. The properties of soil are: cohesion =  $30 \text{ kN/m}^2$ , angle of internal friction =  $15^\circ$  and a unit weight =  $20 \text{ kN/m}^3$ . The slope angle of the cut is  $35^\circ$ . Consider a trial slip circle of radius 20 m passing through the toe and cutting the top ground surface at a distance 5 m from top edge. Determine the factor of safety with respect to cohesion for the given trial slip circle by friction circle method. Assume factor of safety w.r.t. friction as 1.5. 8
- (c) Critically compare Rankine's theory with the Coulomb's lateral earth pressure theory. 5
- (a) Explain Culmann's method for the determination of active earth pressure on retaining wall considering the effect of line load on backfill. 8
- (b) A 7 m retaining wall with a smooth vertical back face has a stratified back fill and a surcharge load of 10 kpa. The properties of soil are as follows: up to 3.5 m height from top:- unit weight =  $15 \text{ kN/m}^3$ , angle of shearing resistance =  $30^\circ$  and cohesion = 0. Below 3.5 m level:- unit weight =  $20 \text{ kN/m}^3$ , angle of shearing resistance =  $10^\circ$  and cohesion = 10 kpa. Draw the lateral active earth pressure diagram and estimate the resultant thrust on the wall and its position. 8
- (c) What are the different types of conduits and the factors that affect the load on a conduit? 4

4. (a) For the cantilever sheet pile wall shown in Figure 1, compute the embedment depth below the dredge line. 10



- (b) Differentiate between general, local and punching shear failure of shallow foundations. 5
- (c) Describe how the bearing capacity of soil for shallow foundation can be determined from standard penetration test. 5
5. (a) Check the stability of the wall shown in Figure 2. Unit weight of concrete =  $24 \text{ kN/m}^3$ . 10



- (b) A circular foundation of 2.5 m diameter carries a load of 2500 kN. The soil has following properties:  $\gamma = 19 \text{ kN/m}^3$ ,  $\phi = 30^\circ$ ,  $c = 4 \text{ kN/m}^2$ ,  $N_c = 37.2$ ,  $N_q = 22.5$ ,  $N_\gamma = 19.7$ . Using Terzaghi's theory,  
(a) Find the depth at which the foundation should be located to provide a factor of safety of 3.  
(b) What is the depth of location of foundation if there exists a water table close to the ground surface? 10
6. (a) Explain the internal stability of mechanically stabilized retaining wall. 5
- (b) Explain the method of computation of settlement of pile groups in clayey soil. 5
- (c) A precast concrete pile of diameter 450 mm is driven into stiff clay. The unconfined compressive strength of the clay is  $200 \text{ kN/m}^2$ . Determine the length of pile required to carry a safe load of 400 kN with factor of safety = 2.5. Assume adhesion factor = 0.55. 5
- (d) Following data was obtained in a vertical pile load test on a 300 mm diameter pile. Plot the load-settlement curve and determine the allowable load as per IS code.

Load (kN)	50	100	200	300	400	500	600
Settlement (mm)	2.5	4	9.5	16.5	27	40.5	61