

- (e) A concentrated load of 40 kN acts on the surface of a soil. Determine the vertical stress increment at points directly beneath the load upto a depth of 5 m.
- (f) A water tower is supported only on three pillars forming an equilateral triangle with 10 m side. The total weight of the tower is 120 tonnes. Calculate vertical stress 10 m below the ground level under any one of the legs.
2. Attempt any **two** parts of the following : **(6×2=12)**
- (a) A foundation in sand will be 5 metres wide and 1.5 metres deep. Adopting a factor of safety of 2.5, what will be safe bearing capacity if the unit weight of the sand is 1.9 gm/c.c. and angle of internal friction is 35°. How does it compare with safe bearing capacity for surface loading.
 $N_c = 57, N_q = 44, N_y = 42.$
- (b) Determine the ultimate bearing capacity of the footing, 1.5 m wide and its base at a depth of 1 m, if the ground water table is located :
- (i) at a depth of 0.5 m below the ground surface.
- (ii) at a depth of 0.5 m below the base of the footing.
 $Y_{sat} = 20 \text{ kN/ m}^3.$
 $Y_d = 17 \text{ kN/ m}^3, \phi = 38^\circ \text{ \& } c = 0$ use Terzaghi's theory. $N_q = 60 \text{ \& } N_y = 75.$
- (c) Explain in detail, the effects of size of footing on both the ultimate bearing capacity & the settlement.

3. Attempt any **two** parts of the following : (6×2=12)

- (a) What are the factors governing load carrying capacity of pile ? What is the objective of pile load test ? Write steps to determine safe load from pile load test.
- (b) What is negative skin friction ? What is its effect on the pile ? A 30 cm. diameter concrete pile is driven in a normally consolidated clay deposit 15 m thick. Estimate the safe load. Take $C_u = 70 \text{ kN/m}^2$, $\alpha = 0.9$ and F.S. = 2.5
- (c) Discuss the components of well foundation and draw the neat sketch of a well foundation. Explain all the terms in brief.

4. Attempt any **two** parts of the following : (6×2=12)

- (a) Derive an expression for the factor of safety of an infinite slope in a cohesionless soil. What is the effect of steady seepage parallel to the slope on the stability ?
- (b) A 10 m high cutting has a slope of 40° to horizontal, the soil was tested and its cohesion, void ratio & angle ϕ were found to be 2.5 t/m^2 , 0.81 and 14° respectively. Determine the FOS with respect to cohesion against failure of the slope. When water level rises upto the full height :
Given : $G = 2.7$ & for 40° slope values of stability number for different values of ϕ

| ϕ | N |
|------------|-------|
| 6° | 0.122 |
| 7° | 0.116 |
| 14° | 0.074 |

- (c) What are the design criteria for foundations of reciprocating machines based on IS : 2874 (I) - 1982 ? Discuss criteria for the design of foundation in case of free vibration without damping.