(3 Hours) **Marks : 80**

N. B.: (1) Question No. 1 is compulsory.
(2) Attempt any three from remaining five questions.
(3) Figures to the right indicate the full marks.
(4) Assume suitable data if not given and justify the same.

Q. 1. A. An infinite slope of 28^0 of cohesionless soil is in submerged condition. The angle of shearing resistance of soil is 33^o. Check the stability of slope. 5

B. Differentiate between Rankine's and Coulomb theory for earth pressure theory. 5

C. Write the factors affecting the bearing capacity of soil. 5

D. Explain the type of piles based on mechanism of load transfer. 5

Q.2. A. A 5 m deep canal has side slope of 1 : 1. The properties of soil are c = 20 kN/m^2, ϕ_u = 10^o, e = 0.8 and G = 2.8. If the Taylor's stability number is 0.108, determine the factor of safety with respect to cohesion when the canal runs full. Also find the same in case of sudden drawdown, if Taylor's stability number for this condition is 0.137. 10

B. A retaining wall 5 m high, retains a soil with c = 24 kN/m^2, $\phi = 28^0$, γ = 19 kN/m^3 with horizontal surface level with the top of wall. Compute the total active and passive earth resistance on the wall and their point of application. 7

C. Write the assumptions made by Coulomb in developing earth pressure theory. 3

Q.3. A. A strip footing is to be designed for a given total load of 250 kN per m. Determine the width of strip footing by taking a factor of safety of 3 and use Terzaghi' bearing capacity equation. Take γ = 19 kN/m^3, $\phi' = 35^0$, $c' = 5$ kN/m^2. The depth of foundation is 1 meter. Bearing capacity factors are given as: N_c = 46, N_q = 33, N_γ = 48. 12

B. Write the use and limitations of the plate load test. 8

Q.4. A. The details of a cantilever retaining wall are given as below: 10

Stem: 0.35 m width and 5.4 m height from top to bottom of base slab.

Heel slab: 2.5 m length and 0.35 m depth

Toe slab: 1.25 m length and 0.35 m depth.

Earth fill is retained above heel slab and ground surface on top is horizontal. Calculate the maximum and minimum pressures under the base if the water table rises behind the wall to the level 3.1 m from the top of wall. The shear strength parameters of soil are C= 0, $\phi = 32^0$ γ_{sat} = 18 kN/m^3. Unit weight of concrete is 23 kN/m^3 if wall friction is taken as two third of ϕ value on the base of wall, check the stability of all for all conditions

B. Write the formulae for water table correction for computation of bearing capacity. 5

C. Write procedure how to compute the struts load in an open cut. 5

Q. 5 A. A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of the piles were 300 mm and 9 m respectively. If undrained cohesion is 45 kN/m^2 and the pile spacing is 1 m centre to centre. What is the capacity of group? Take factor of safety of 2 and adhesion factor as 0.7. 10

B. Write the formula for negative projecting conduit and explain its use in design of conduits with meaning of all parameters. 5

C. Explain the advantages of reinforced soil. 5

Q. 6 A. A retaining wall, 3 m high supports a dry cohesionless backfill with a plane ground surface sloping upwards at a surcharge angle of 10^o from top of the wall. The back of the wall is inclined to the vertical at a positive batter angle of 8^o. The unit weight of soil is 19.6 kN/m^3 and ϕ = 29^o. Assuming an angle of wall friction of 11^o, determine the total active force by Rebhann's Method. 10

B. In a failed soil slope of soft clay, the failure surface is circular and the centre of rotation is known. The driving moment is computed to be 2800 kN-m and the resisting moment is computed to be 2450 kN-m. It is proposed to reconstruct the slope using several layers of geogrids having allowable tensile force of 20 kN/m. The average centroid of the reinforcement is anticipated to be 8 m away (vertically) from the centre of rotation. Compute the required number of layers of the reinforcement, if the desire factor of safety is 1.5. 5

C. Explain the types of conduits. 5
