

Time: 01 Hour

(Answer all the questions)

Total marks: 20

1. A 3×3 m square footing $ABCD$ with its CG at E , carrying a UDL of 250 kN/m^2 is located at ground level (Figure 1). Assuming it as an equivalent circular footing, calculate the vertical stress at a depth of 4 m directly below the following points; (a) Center E of the square $ABCD$ and (b) At corner A . [1.5 + 2.5]
2. Compute the corrected SPT- N value at different depth for bore hole data in Table 1 as per IS 2131 (1981). The water table is located at a depth of 10.5 m below ground level. [4]
3. A square footing and a circular footing are to be designed to carry a allowable load of 120 kN at a depth of 2 m below GL in a soil with the following data. $\gamma_{\text{soil}} = 18 \text{ kN/m}^3$, $c = 10 \text{ kN/m}^2$, $\phi = 20^\circ$ (consider general shear failure and $N_c = 17.69$, $N_q = 7.44$ and $N_\gamma = 3.64$). Calculate the dimensions of square and circular footing. Use Terzaghi's Bearing Capacity Theory. Given: Factor of safety, $F_s = (\text{Ultimate load} / \text{Allowable load}) = 3$. [1.5 + 1.5]
4. A continuous footing of width 2 m is located at a depth of 1.2 m in a stronger sand. A softer clay layer is located at a depth 1.5 m, measured from the bottom of the foundation. For the top sand layer: Friction angle = 40° , Cohesion = 0, Unit weight = 17.5 kN/m^3 . For the bottom clay layer: Friction angle = 0° , Cohesion = 30 kN/m^2 , Unit weight = 16.5 kN/m^3 . Determine the gross ultimate load per unit length of foundation. [3]
5. Load tests were carried out on a 0.3 m square plate and a 0.3 m diameter circular plate on a dense cohesionless sand having a unit weight of 17 kN/m^3 . The plates were tested at a depth of 0.6 m below GL. Failure occurred at 10 kN and 7 kN for square and circular plates respectively. Determine the values of bearing capacity factors N_q and N_γ . What would be the failure load per unit area of 0.3×0.3 m square footing. [2 + 1]
6. Describe with suitable diagram the sequence of operation of the penetrometer used in static cone penetration test. [3]

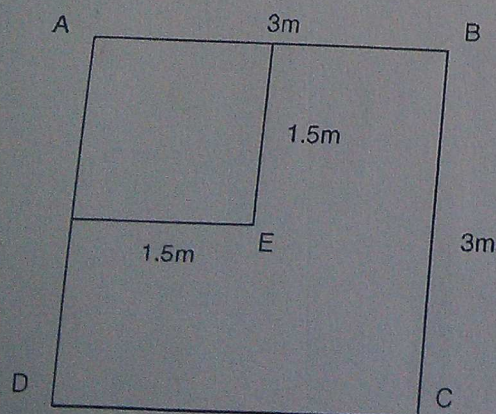
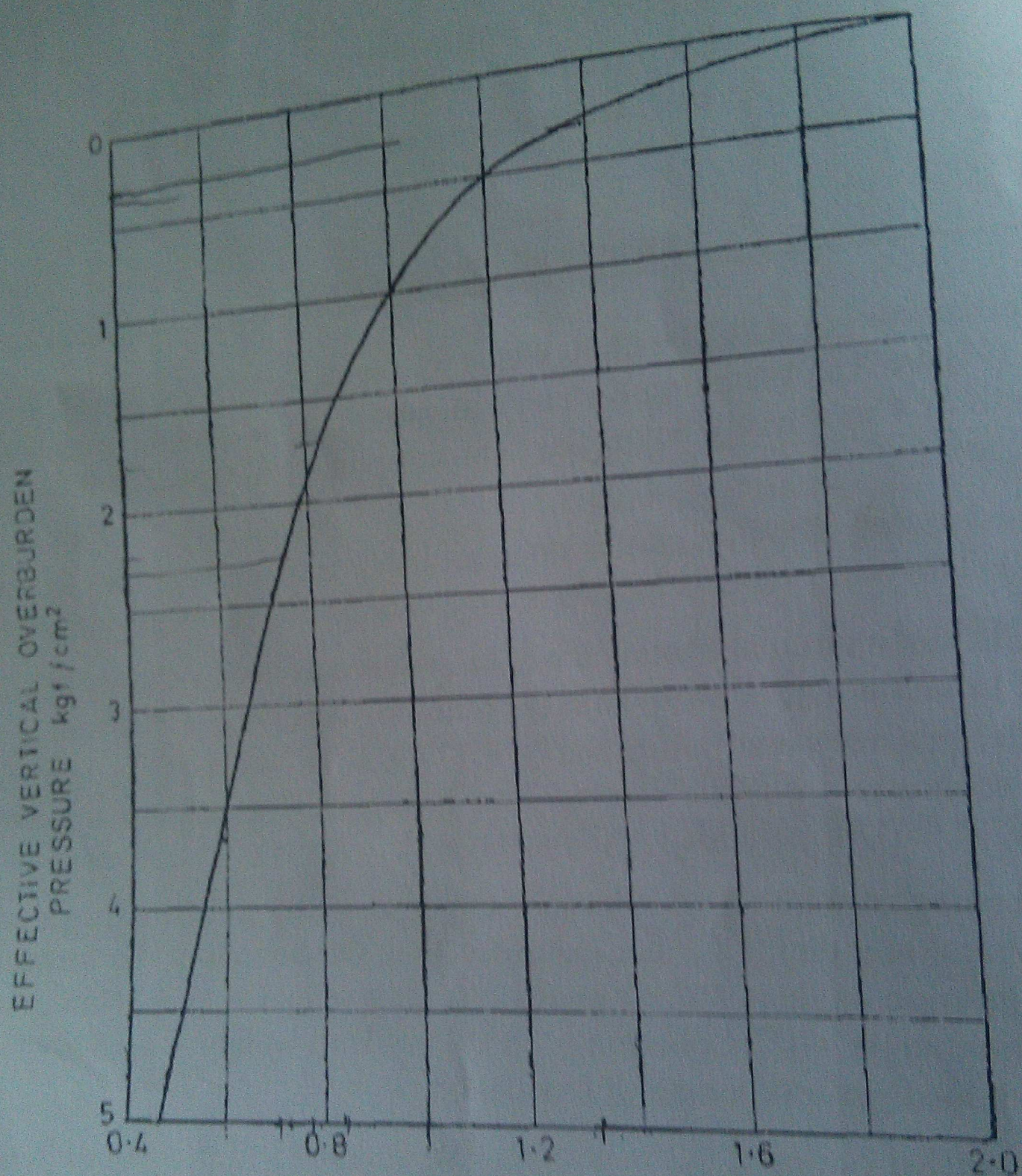


Figure 1

Table 1

Depth (m)	Field SPT- N	% Gravel	% Sand	% Silt	% Clay	Unit weight (kN/m^3)
1.75	9	8	20	67	5	17.5
5.75	27	2	22	71	5	18.0
9.75	28	0	22	73	5	18.0
11.75	41	10	49	41	0	18.8
15.00	30	0	18	71	11	18.8



CORRECTION OF N-VALUE IN
COHESIONLESS SOIL FOR OVERBURDEN