



- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Explain in brief the following. 6
 i) Area ratio, ii) Inside clearance iii) Outside clearance.

- b) What are geophysical methods? Explain any one method with its limitations. 7

OR

2. a) Explain the factors governing the depth of sub-surface exploration for construction projects. 7

- b) Explain in detail standard penetration test. 6

3. An embankment is to be made of sandy clay has $\gamma = 18 \text{ kN/m}^3$, $c = 30 \text{ kN/m}^2$ & $\phi = 20^\circ$. 14
 The slope and height of the embankment are 1.6:1 and 10m respectively. Find factor of safety using method of slices. Assume $\alpha_a = 20^\circ$ and $\alpha_b = 35^\circ$.

OR

4. a) Explain friction circle method with a neat sketch. 6

- b) Explain types & causes of slope failure. 8

5. a) Explain the following:- 6

- i) Earth pressure at rest. ii) Active earth pressure & iii) Passive earth pressure

- b) The backfill of a 5m high retaining wall is having following properties : Angle of internal friction = 30° , Cohesion = 10 kN/m^2 , unit weight = 17.5 kN/m^3 . Determine the unsupported length & calculate active earth pressure on the wall. 7

OR

6. a) A two layer cohesive horizontal backfill is supported by a 10 m high vertical smooth wall. Determine the Rankine's active force per unit length of the wall before & after tension crack develop in the top layer. The details of the soil properties are given below: 8

Properties	Top layer	Bottom layer
Depth	0 – 5m	5 – 10 m
Cohesion	12 kN/m^2	35 kN/m^2
Angle of internal friction	0°	10°
Unit weight	17 kN/m^3	18 kN/m^3

- b) Derive equation for unsupported length from Rankine's theory of earth pressures. **5**
7. a) Explain ground improvement using sand drains. **6**
- b) Write short notes on functions and applications of Geosynthetics. **7**

OR

8. a) Write short note on 'Preloading'. **7**
- b) Write a short note on geosynthetics. **6**
9. a) Explain various modes of shear failures with suitable sketch. **6**
- b) A square footing of size 1.3m x 1.3m is located at depth of 1m below ground level. The soil properties are : $c = 22 \text{ kN/m}^2$, $\phi = 22^\circ$ & $\gamma = 18 \text{ kN/m}^3$. Determine ultimate bearing capacity without water table effect. Also determine the change in ultimate bearing capacity if water table rises 0.5m above the foundation level. $N_c = 22.5$, $N_q = 10.2$ and $N_\gamma = 8.1$. Consider General shear failure condition. **8**

OR

10. a) Explain the procedure of plate load test with assumption and limitations. **7**
- b) Plate load test was conducted with 300mm square plate at a depth of 3m from ground level on dry sand. Find **7**
- i) Ultimate bearing capacity of soil.
- ii) Safe bearing capacity of soil.
- iii) Width of square footing to carry a safe load of 2000 kN. Assume factor of safety is 3.

The plate load test data is given in Table below:

Applied pressure (kN/m ²)	50	100	150	200	250	275	300	325	350
Settlement (mm)	3	5	9.8	13	19	22	28	39	65

11. a) A concrete pile of diameter 200mm is to be constructed in a cohesive soil of stiff consistency with unconfined compressive strength of 180 kN/m^2 . Determine the length of pile to carry a safe load of 100 kN with a factor of safety of 2. Assume adhesion factor is 0.5 and $N_c = 9$. **7**
- b) Write short notes on efficiency of pile groups. **6**

OR

12. a) Write short notes on negative skin friction in piles. **6**
- b) Explain under-reamed pile foundation. **7**
