Code No: M0121 **R07** **Set No. 1**

IV B.Tech. I Semester Regular Examinations, November, 2012
GEOTECHNICAL ENGINEERING – II
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
****

1. a) Describe open excavation methods of exploration. What are their advantages and Disadvantages?
   b) Explain and discuss the various factors that help to decide the number and depth of bore holes required for subsoil exploration.

2. a) Derive the expression for the factor of safety of an infinite slope in cohesive soils.
   b) Determine the factor of safety of an embankment by the method of slices if the slope is 1.5: 1, (H:V) and the height is 12 m. The value of c and ϕ are 40 kN/m^2 and 25^0, respectively and γ = 19 kN/m^2. Use Fellenius's method of slices.
   Note: The soil mass above the slip circle is divided into 7 strips of 1m width and 8th strip of 0.4m width. The calculations are collected in the following table.

Strip	Width (m)	Area (m^2)	Weight (w) (kN)	Inclination angle of the normal force to the normal axis to the base of the slice 'α'
1	1.0	0.55	10.45	-24
2	1.0	3.0	57.0	-12
3	1.0	4.65	88.4	-1
4	1.0	5.60	110.2	11
5	1.0	6.15	116.8	23
6	1.0	5.35	101.6	36
7	1.0	3.30	62.7	52
8	0.4	0.20	3.8	68

3. a) What do you understand by "State of plastic equilibrium"? Explain the concept of active and passive earth pressures with the help of Mohr circle and shear strength envelopes.
   b) Calculate the horizontal and vertical components of the total active earth pressure on a retaining wall 3.3 m high. Also calculate the line of action of the lateral force from the base of the wall. Take the unit weight of the soil as 18 kN/m^3, the angle of inclination as 20^0, and the surcharge angle as 15^0.

Code No: M0121 **R07** **Set No. 1**

4. Check the stability of the following retaining wall against overturning and sliding. The wall is a regular trapezoid in section, has top width of 0.5 m, a bottom width of 4 m, and is 6 m high. The soil's unit weight is 17.8 kN/m^3 and angle of internal friction is 35^0. Take the coefficient of internal friction between the soil and the wall material as 0.45, and the unit weight of the wall material as 24 kN/m^3.

5. A foundation 2.0 m square is installed 1.2 m below the surface of a uniform sandy gravel having a density of 19.2 kN/m^2 above the water table and a submerged density of 10.1 kN/m^3. The effective strength parameters are $c^1 = 0$ kN/m^2 and $\phi^1 = 30^0$. Find the gross ultimate bearing capacity for the conditions of water table well below the base (with rupture zone above the water table) Water table rising to the level of the base of the foundation and the water table raises to the ground level. Use Meyerhof theory. The bearing capacity factors are, $\phi = 30^0$, $Nq = 18.4$ and $N_r = 15.7$. Shape factors:
$S_q = S_r = 1 + 0.1\, k_p \frac{B}{L}$ and $d_q = d_r = 1 + 0.1 \sqrt{k_p}\frac{D}{B}$, where $k_p = \tan^2(45+\phi/2)$.

6. a) What are the different types of settlements which can occur in a foundation? How are these estimated?
   b) A footing of size 3 x 3 m is to be constructed at a site at a depth of 1 .5 m below the ground surface. The water table is at the base of the foundation. The average standard penetration value at the site is 15. The soil is cohesion-less soil. Determine the safe bearing pressure for a settlement of 25 mm. Use Teng's Empirical Equations.

7. Design a friction pile group to carry a load of 3000 kN including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20 m, underlain by rock. Average unconfined compressive strength of the clay is 70 kN/m^2 and unit weight of clay is 17.5 kN/m^3. The clay may be assumed to be of normal sensitivity normally loaded with liquid limit of 60%. A factor of safety of 3 is required against shear failure. Also compute the settlement of the group assuming the load to be transferred at 2/3 length of the pile.

8. a) Sketch a completed well foundation for a Bridge pier. Indicate the various components and their functions.
   b) How do you analyze the well for its lateral stability?

Code No: M0121 **R07** **Set No. 2**

IV B.Tech. I Semester Regular Examinations, November, 2012
GEOTECHNICAL ENGINEERING – II
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
****

1. a) Describe with the help of a neat sketch the wash boring method of subsoil exploration. In what type of soils this method is recommended? What are the limitations of this method?
   b) Explain how the standard penetration test is conducted?

2. a) Compute the factor of safety of an infinite slope in steady seepage condition. Take unit weight of the saturated soil as γ_s and submerged unit weight as γ_b.
   b) Derive the equation for factor of safety of a finite slope by Bishop's simplified method of analysis.

3. a) Derive the equation for maximum passive earth pressure using the Mohr envelop.
   b) Calculate the total active earth pressure on a retaining wall of 9 m height. The retaining soil has a 12^0 surcharge angle, a unit weight of 19 kN/m^3, an angle of internal friction of 24^0, and a cohesion of 10 kN/m^2. Also calculate the height of the line of action of the total pressure from the bottom of the wall. Neglect negative pressure when calculating the total pressure.

4. Check the stability of a cantilever concrete retaining wall having a stem thickness of 0.3 m uniform throughout, 3.5 m height bed block thickness 0.4 m, and a projection of 1.7 m on the heel side and 1 m on the toe side. The unit weight of the wall material is 25 kN/m^3. The soil has a unit weight of 18 kN/m^3 and an angle of internal friction of 30^0. Take in to account a uniform surcharge on the ground of 30 kN/m^2. The ground level on the toe side is 1.2 m high above the base of the wall.

Code No: M0121 **R07** **Set No. 2**

5. a) What are the major criteria to be satisfied in the design of foundation?
   b) A square footing carries a load of 800 kN. The depth of the footing is 1.5 m. The properties of the soil are C = 0, $\phi = 38^0$, $\gamma = 18.5$ kN/m^3. Determine the size of the footing for a factor of safety of 3 against shear failure. What will be the changes in the size of the footing, if the water table rises to ground level? For $\phi = 38^0$, $N_q = 49$, $N_\gamma = 64$.

6. A plate load test was conducted on a uniform deposit of sand and the fallowing results were obtained.

Pressure (kN/m^2)	50	100	200	300	400	500	600
Settlement (mm)	1.5	2.0	4.0	7.5	12.5	20.0	40.0

   The size of the plate was 750 mm x 750 mm and that of the pit is 3.75 m x 3.75 m x 1.5 m. Plot the pressure – settlement curve and determine the failure stress. Determine the settlement of square plate of size 3 x 3 m under the load intensity of 500 kN/m^2.

7. a) Describe the procedure for the estimation of settlement of a pile group by considering only the frictional resistance of the pile group.
   b) A group of 16 piles 25 m long and 450 mm in diameter is to be arranged in a square form in a clay soil with an average unconfined strength of 36 kN/m^2. Workout the center to center spacing of the piles for a group efficiency factor of 1. Neglect bearing at the tip of the piles.

8. a) What considerations govern the fixing of the depth of a well foundation?
   b) How is the allowable bearing pressure of a well foundation in sand determined?
   c) Discuss the various remedial measures that can be adopted to rectify the tilts in well foundation.

Code No: M0121 **R07** **Set No. 3**

IV B.Tech. I Semester Regular Examinations, November, 2012

GEOTECHNICAL ENGINEERING – II

(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

****

1. a) What are the objectives of the exploration program.
   b) Write briefly about the Standard penetration test conducted in the field. What are the correction to be made to the standard penetration value?

2. a) Derive the expression for the factor of safety of an infinite slope in cohesion less soils.
   b) How is the slope analyzed using Swedish circle method? Derive an expression for the factor of safety.

3. a) Differentiate critically between Rankine's and Coulomb's theories of earth pressures.
   b) Calculate the uniform surcharge per sq.m, which will neautralise the negative pressure on top of a retaining wall due to the effect of cohesion. The cohesion is 30 kN/m^3 and the angle of internal friction is 30^0.

4. Check the stability of a cantilever concrete retaining wall having a stem thickness of 0.4 m uniform throughout, 6.0 m height bed block thickness 0.5 m, and a projection of 2.4 m on the heel side and 1 m on the toe side. The unit weight of the wall material is 25 kN/m^3. The soil has a unit weight of 19.5 kN/m^3 and an angle of internal friction of 36^0. Take in to account a uniform surcharge on the ground of 30 kN/m^2. The ground level on the toe side is 1.5 m high above the base of the wall.

5. a) What are the assumption made Terzaghi's analysis of bearing capacity?
   b) A strip footing 1 m wide rests on the surface of dry Cohesionless soil having $\phi = 25^0$ and $\gamma = 1.8$ t/m^3, what is the ultimate bearing capacity? What is its value if there as complete flooding Assume $N_\gamma = 10$; $N_q = 12$.

Code No: M0121 **R07** **Set No. 3**

6. a) Describe the plate load test. What are its limitations?
   b) A plate load test using a plate of size 30 x 30 cm was carried out at the level of a prototype foundation. The soil at the site was cohesionless with the water table at great depth. The plate settled by 10 mm at a load intensity of 160 kN/m2. Determine the settlement of a square footing of size 2 x 2 m under the same load intensity.

7. a) Describe the procedure for the estimation of settlement of a pile group by considering the only bearing resistance of the pile group.
   b) A group of 9 piles with 3 piles in a row were driven into a soft clay extending from ground level to a great depth. The diameter and the length of the piles were 30 cm and 10 m respectively. The unconfined compressive strength of the clay is 70 kPa. If the piles were placed at 90 cm center to center, compute the allowable load on the pile group on the basis of shear failure criteria for a factor of safety of 2.5.

8. a) What are 'Tilts and Shifts'? What are the remedial measures to control these?
   b) Sketch a completed well foundation for a Bridge pier. Indicate the various components and their functions.

Code No: M0121 **R07** **Set No. 4**

IV B.Tech. I Semester Regular Examinations, November, 2012
GEOTECHNICAL ENGINEERING – II
(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
****

1. a) What is the object of Exploration Program and list out the phases of the Exploration program and explain in brief?
   b) Write short note on depth of Exploration and how can you fix the depth of boring in different case of Foundations? i.e Shallow and Deep Foundations.

2. a) Explain the method of slices for stability analysis of slopes. How can steady seepage be accounted form in this method
   b) A vertical cut was made in a plastic clay having unit weight of the soil is 19.3 kN/m^3. The cut was failed at a depth of excavation 4.5 m. Determine the cohesive strength of clay.

3. a) What is Coulomb's Wedge theory of earth pressure ? Derive the condition for obtaining the maximum active earth pressure.
   b) Calculate the total active earth pressure on a vertical wall, when the soil has a unit weight of 17 kN/m^3 and an angle of internal friction 35^0. The wall is 4 m high and has a uniform surcharge of 36 kN/m^2.

Code No: M0121 **R07** **Set No. 4**

4. Compute the stability of a retaining wall shown in Fig. 1. The allowable pressure is 200 kN/m^2. $\phi = 34^0$ and $\delta = 25^0$. $\gamma = 18$ kN/m^2 and I = 15^0.

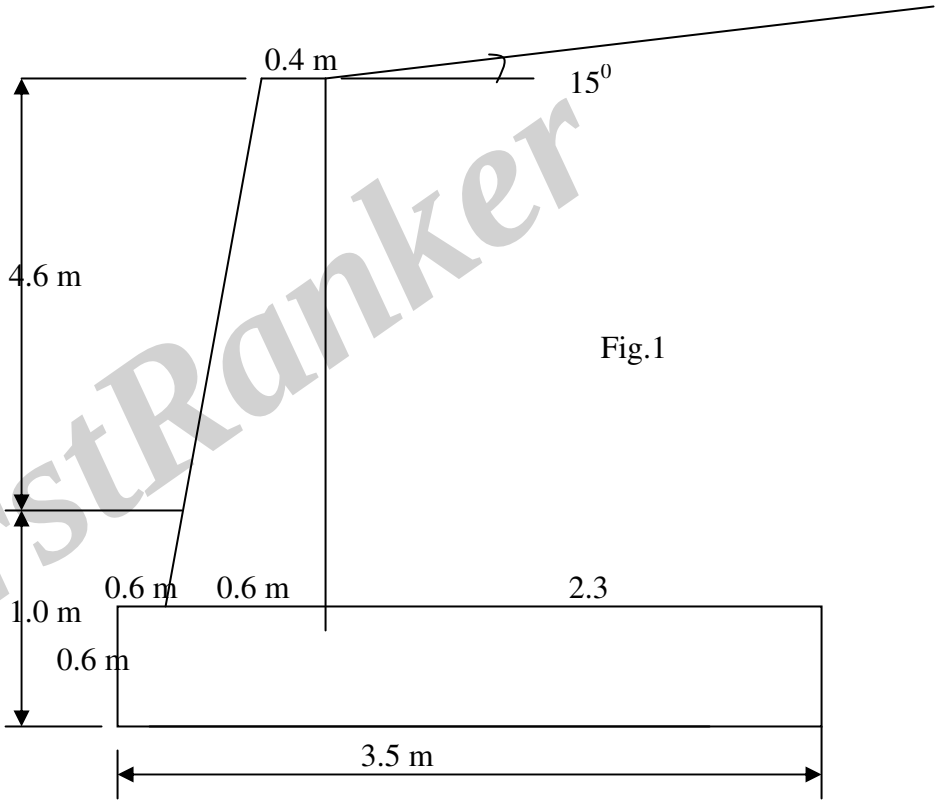

Fig.1

Code No: M0121 **R07** **Set No. 4**

5. A foundation 2.0 m square is installed 1.5 m below the surface of a uniform sandy gravel having a density of 19.2 kN/m^2 above the water table and a submerged density of 10.1 kN/m^3. The effective strength parameters are c^1 = 0 kN/m^2 and ϕ^1 = 36^0. find the gross ultimate bearing capacity for the conditions of water table well below the base (with rupture zone above the water table) Water table rising to the level of the base of the foundation and the water table raises to the ground level. Use Meyerhof theory. The bearing capacity factors are, $\phi = 36^0$, Nq = 37.7 and N_r = 44.4. Shape factors: $S_q = S_r = 1 + 0.1\ k_p \frac{B}{L}$ and $d_q = d_r = 1 + 0.1\ \sqrt{k_p}\frac{D}{B}$, where k_p = $\tan^2(45+\phi/2)$.

6. a) Differentiate between total settlement and differential settlement. What are the harmful effects of differential settlements on structures? What are the possible remedial measures?
   b) A foundation 4 m X 2 m, carrying a uniform pressure of 150 kN/m^2, is located at a depth of 1 m in layer of clay 5 m thick for which the value of E_u is 40 MN/m^2. The layer is underlain by a second clay layer 8 m thick for which the value of E_u is 75 MN/m^2. A hard stratum lies below the second layer. Determine the average immediate settlement under the foundation
   For H/B = 2 and L/B ➔ μ_1 = 0.60
   H/B = 6 and L/B ➔ μ_2 = 0.85
   For D/B = 0.5 and L/B = 2 ➔ μ_0 = 0.94.

7. a) Differentiate critically in principles in deriving the Engineering News formula and Hiley's formula for Pile load capacity.
   b) What are the basis on which the dynamic pile formulae are derived?. Discuss critically the limitations of dynamic pile formulas.
   c) What will be the penetration per blow of a pile, which must be obtained in driving with a 3t steam hammer falling through 1 m allowable load, is 25 tones?

8. a) What is the grip length of the well? What are the considerations in the determination of the grip length?
   b) Write a brief note on tilts and shifts. Discuss the remedial measures to control tilts and shifts.