

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April 2018

B. Tech in Civil Engineering, Semester VI

Roll No.....

CE608: Geotechnical Engineering - II

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. In order to solve complex mathematical forms, Casio fx-991 MS or fx-991 ES or fx-991 ES Plus shall be permitted, however programmable calculators are strictly not entertained.

Q.1 Objective type questions (10 questions @ 1.5 marks each)
Comment, validate and support your answer

15

- i. A strip footing is resting on the surface of a purely clayey soil deposit. If the width of the footing is doubled, the ultimate bearing capacity of the soil (a) becomes double (b) becomes half (c) becomes four-times (d) remains the same
- ii. Negative skin friction occurs when (a) an upward drag exists in the pile (b) the surrounding soil settles more than the pile (c) the pile passes continuously through a firm soil (d) the driving operation begins
- iii. The group efficiency of pile group (a) will be always less than 100% (b) will be always greater than 100% (c) may be less than 100% or more than 100% (d) will be more than 100% for pile group in cohesionless soils and less than 100% for those in cohesive soils
- iv. The action of negative skin friction on the pile is to (a) Increase the ultimate load on the pile (b) reduce the allowable load on the pile (c) maintain the working load on the pile (d) reduce the settlement of the pile
- v. Frictional piles are also called 'floating piles' (True/False)
- vi. The earth pressure for the design of bridge abutments is taken as (a) Active thrust (b) passive thrust (c) thrust in at rest condition (d) none of the above
- vii. When a RW moves away from the backfill, the pressure exerted on the wall is termed as (a) Passive earth pressure (b) Swelling pressure (c) pore pressure (d) active earth pressure (e) 'At Rest' pressure
- viii. Coulomb's theory of earth pressure is based on (a) Theory of elasticity (b) Theory of plasticity (c) Empirical rules (d) Wedge theory
- ix. When a smooth RW moves towards the backfill, the force exerted on the wall is (a) Parallel to the wall face and acting downwards (b) Normal to the wall face

- (c) Oblique to the wall face acting downwards
- (d) Oblique to the wall face acting upwards
- x. For a sample of dry cohesionless soil with friction angle ϕ , the failure plane will be inclined to the major principal plane by an angle equal to _____

Q.2 Short answer type questions (10 questions @ 3 marks each)

30

Comment, validate and support your answer

- i. A direct shear test was conducted on a cohesionless soil specimen under a normal stress of 200 kPa. The specimen failed at a shear stress of 100 kPa. The angle of internal friction of the soil is _____ (in degrees)
- ii. What is the effective shear strength of a saturated soil mass whose total normal stress is 295 kPa and pore pressure is 120 kPa. The effective shear strength parameters are 12 kPa and 30° .
- iii. A 3 m high retaining wall is supporting a sand of bulk density 18 kN/m^3 and the angle of shearing resistance is 30° . The change in magnitude of active earth pressure at the base due to rise in ground water table to the ground surface shall (a) increase by 20 kN/m^2 (b) decrease by 20 kN/m^2 (c) increase by 30 kN/m^2 (d) decrease by 30 kN/m^2
[Take saturated density to be same as that of bulk density]
- iv. A vertical wall 6 m high retains a 20° soil slope, the retained soil has a unit weight of 18 kN/m^3 , the appropriate shear strength parameters are $c=0$ and $\phi=40^\circ$. The coefficient of active earth pressure to be used in estimating the active pressure on the wall is _____
- v. Two footings, one circular and the other square, are founded on the surface of a purely cohesionless soil. The diameter of the circular footing is same as that of the side of the square footing. The ratio of their ultimate bearing capacities is (a) $3/4$ (b) $4/3$ (c) 1.0 (d) 1.3
- vi. In a plate load test conducted on cohesionless soil, a 600 mm square test plate settles by 15 mm under a load intensity of 0.2 N/mm^2 . All conditions remaining the same, settlement of a 1 m square footing will be (a) 15.60 mm (b) 20.50 mm (c) 19.97 mm (d) 25.00 mm
- vii. A strip footing is resting on the ground surface of a pure clay bed having an undrained cohesion c_u . The ultimate bearing capacity of the footing is equal to (a) $2\pi c_u$ (b) πc_u (c) $(\pi+1)c_u$ (d) $(\pi+2)c_u$
- viii. If the cross section of the pile is $250 \text{ mm} \times 250 \text{ mm}$ and the length of the pile is 20 m driven into a homogeneous clay layer having undrained cohesion value of 40 kPa and adhesion factor of 0.7625, the ultimate load capacity will be (a) 350 kN (b) 632.5 kN (c) 722.5 kN (d) 1400 kN
- ix. Write down the assumptions made in Westergaard's Theory.
- x. Mention the assumptions of Terzaghi's theory of bearing capacity.

- Q.3 Explain in detail about boring and types of boring. (07) 15
What do you mean by sampling? What are the types of samples extracted during soil exploration? Explain about the sources of disturbance and precaution to be taken during this process. (08)

OR

- Q.3 Why in-situ testing is important in civil engineering construction projects? How are they classified? Explain in detail about SPT, CPT and field Vane shear? 15

- Q.4 What do you mean by pile foundation? When are they generally used? What are its types? How are they classified? Explain in detail. 10

OR

- Q.4 Describe in detail about plate load test. 10

- Q.5A A group of 16 piles was installed in a layered clay having cohesion 25 kPa for top 8 m and 40 kPa beneath it. The friction angle is zero for both the layers. The adhesion factor is 1.0 and 0.7 for top and bottom layers. The diameter of each pile is 50 cm at a c/c spacing of 1 m. The total length of the pile is 18 m. Determine the safe load carrying capacity in kN with a FoS of 2.5. 10

- Q.5B Determine the design load for a FoS of 2 on a pile which is driven thro' dense sand having $\gamma=19.7 \text{ kN/m}^3$, $\gamma'=10.5 \text{ kN/m}^3$, $\phi=39^\circ$, earth pressure coefficient 3, wall friction angle is 0.62 times the friction angle. The water table is 3 m below the ground level. The total length of the pile is 8 m. Take N_q as 108. 10

- Q.6 A square footing of width 2 m embedded at 1.5 m below the ground level on the bed of sand. The water table is at 1 m below the ground level. The unit weight above and below the water table is 20 kN/m^3 . The density index of the soil is 85%. FoS=3, $N_c=65$, $N_q=53$, $N_\gamma=49$. Determine the ultimate bearing capacity (UBC), net ultimate bearing capacity, safe bearing capacity (SBC). During the summer season, if the water table goes down to 2 m below the base of the footing, then what will be the change in UBC & SBC? 10

OR

- Q.6 What do you understand by the term soil slopes? Explain its types. What are the causes and types of failures? Write in detail. 10