

USN

Course Code 2 2 C V 6 3 1

Sixth Semester B.E. Degree Examinations, May/June 2026

APPLIED GEOTECHNICAL ENGINEERING

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions choosing ONE full Question from each Module
 2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<u>Module-1</u>			
1.	a. What is subsurface exploration? What are the objectives of soil exploration?	07	(2 :1: 2.2.1)
	b. With a neat sketch explain seismic refraction method.	07	(2 :1: 1.2.1)
	c. With neat sketch of sampler define the following terms (i) Area ratio (ii) inside clearance (iii) outside clearance (iv) recovery ratio	06	(2 :1: 1.3.1)
(OR)			
2.	a. List the different methods used for controlling ground water during excavation. Explain Vacuum method with neat sketch.	07	(2 :1: 2.2.1)
	b. List and explain different types of soil samples.	06	(2 :1: 1.2.1)
	c. Estimate ground water table, with the following data : Depth upto which water bailed out=10.5 m; Water rise in 1 st day =0.63 m ; water rise in 2 nd day =0.57m ; water rise in 3 rd day =0.51m by Hvorselve's method	07	(2 :1: 1.3.1)
<u>Module-2</u>			
3.	a. Compare Boussinesq's theory with Westergaard's theory of stress distribution.	06	(3 :2: 1.2.1)
	b. Explain the construction of Newmark's influence chart.	08	(2 :2: 2.2.1)
	c. Find intensity of vertical pressure at a point 3 m directly below 25 kN point load acting on a horizontal ground surface. What will be the vertical pressure at a point 2 m horizontally away from the axis of loading and at same depth of 3 m? Use Boussinesq's equation.	06	(2 :2: 2.2.1)
(OR)			
4.	a. Explain the concept of elastic settlement.	06	(3 :2: 1.2.1)
	b. What is consolidation settlement? How is it determined?	06	(2 :2: 2.2.1)
	c. A normally consolidated clay layer is 18 m thick. Natural water content is 45 %, saturated unit weight is 18 kN/m ³ , grain specific gravity is 2.7 and liquid limit is 63 %. The vertical stress increment at the center of clay layer due to foundation load is 9 kPa. Ground water table is at the surface. Determine the settlement.	08	(2 :2: 2.2.1)
<u>Module-3</u>			
5.	a. Compare coulomb's earth pressure theory over Rankine's theory.	05	(3 :3: 1.3.1)
	b. Explain the Cullman's graphical method of finding out active earth pressure.	07	(2 :3: 2.2.1)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

- c. A retaining wall with a smooth vertical back is 5 m high and retains a sand backfill. There is uniformly distributed surcharge load of 30 kN/m^2 intensity over the backfill. Water table is at 2 m from the surface of backfill. The unit weight of the dry backfill is 19 kN/m^3 and submerged unit weight is 10 kN/m^3 ; the angle of internal resistance is 32° for both layers. Determine the magnitude and point of application of active pressure per meter length of wall. **08 (3 :3: 3.1.1)**

(OR)

6. a. With neat sketches explain different types of slope failures. **06 (2 :3: 1.3.1)**
 b. Explain Swedish circle method of stability analysis of slopes for c- ϕ soils. **06 (2 :3: 2.2.1)**
 c. An embankment is to be constructed with $c = 20 \text{ kN/m}^2$, $\phi = 20^\circ$, $\gamma = 18 \text{ kN/m}^3$, FS =1.25 and height is 10 m. Estimate side slope required. Taylor's Stability Numbers are as follows for various slope angles **08 (3 :3: 3.1.1)**

Slope angle	90	75	60	45	30	20	10
S_n	0.182	0.134	0.097	0.062	0.025	0.005	0

Module-4

7. a. Explain the types of shear failures with neat sketches. **06 (2 :4: 1.2.1)**
 b. With the help of neat sketches explain the effect of water table on bearing capacity of soil. **06 (2 :4: 1.2.1)**
 c. A square footing is to be constructed on a deep deposit of sand at a depth of 0.9 m to carry a design load of 300 kN with a factor of safety of 2.5. The ground water table may rise to the ground level during rainy season. Design the plan dimension of footing given $\gamma_{\text{sat}} = 20.8 \text{ kN/m}^3$, $N_c = 25$, $N_q = 34$ and $N_\gamma = 32$. **08 (3 : 4: 2.2.1)**

(OR)

8. a. List the assumptions and limitations made in Terzaghi's analysis. **06 (2 :4: 2.1.1)**
 b. Explain the effect of eccentric loading on bearing capacity of soil. **06 (2 :4: 1.2.1)**
 c. A square footing located at a depth of 1.3 m below ground has to carry a safe load of 800 kN. Find the size of footing if the desired factor of safety is 3. Use Terzaghi's analysis for general shear failure. **08 (3 : 4: 2.2.1)**
 Take $c = 8 \text{ kPa}$, $N_c = 37.2$, $N_q = 22.5$, $N_\gamma = 19.7$, assume $\gamma_d = 18 \text{ kN/m}^3$

Module-5

9. a. Explain the various types of Piles based on the material and function. **06 (2 :5: 1.3.1)**
 b. Explain negative skin friction in pile foundation. **06 (2 :5: 2.2.1)**
 c. In a group of 16 piles. Pile diameter is 45 cm and centre to centre spacing of square group is 1.5 m. If $c=50 \text{ kN/m}^2$, determine whether the failure would occur with the pile acting individually or as a group. Neglect bearing at the tip of pile. All the piles are 10m long. Take $\alpha=2$ and factor of safety 2.5. Also find safe allowable load. **08 (3 : 5: 2.2.1)**

(OR)

10. a. Mention the situations where pile foundation is necessary and list the classification of Piles based on the material and function. **06 (2 :5: 1.3.1)**
 b. Write a short note on pile load test. **06 (2 :5: 2.2.1)**
 c. A square group of 9 piles was driven into the soft clay extending to large depth. The diameter and length of piles are 35 cm & 10 m respectively. If the unconfined compressive strength of clay is 90 kN/m^2 and pile spacing is 110 cm centre to centre, what is the capacity of group? Assume factor of safety of 2.5 and adhesion factor 0.75. **08 (3 : 5: 2.2.1)**

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