

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025 Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C
Q.1	a.	With the help of 3-phase diagram, Explain voids ratio, specific gravity, water content and degree of saturation.	8	L2	CO1
	b.	With usual notations, derive the relationship. $Y_d = \frac{(1 - n_a) G \cdot Y_w}{1 + WG}$	6	L2	CO1
	c.	With the help of particle size distribution curve, explain well graded soil, uniformly graded soil and gap grade soil.	6	L3	CO1
OR					
Q.2	a.	Explain determination of In-Situ density of soil by sand replacement method.	8	L2	CO1
	b.	Define Stoke's law. What are its assumptions and limitations?	6	L2	CO1
	c.	Define liquid limit, plastic limit and shrinkage limit.	6	L2	CO1
Module – 2					
Q.3	a.	Explain with neat sketches the various soil structures.	6	L2	CO1
	b.	Explain any two clay minerals with the help of neat sketches.	8	L2	CO2
	c.	List and explain factors affecting compaction.	6	L2	CO1
OR					
Q.4	a.	What are the differences between standard and modified Proctor's compaction test methods?	6	L2	CO2
	b.	Explain electrical diffused double layer and adsorbed water.	6	L2	CO2
	c.	A soil in the borrow pit is at a dry density of 16.67 kN/m^3 with water content of 12%. If the soil of 2000 m^3 is excavated from it and compacted in an embankment with porosity of 0.32. Calculate the volume of embankment which can be constructed out of this material, Take $G = 2.70$.	8	L3	CO2
Module – 3					
Q.5	a.	Derive the equation for average co-efficient of permeability's in vertical and horizontal directions.	8	L2	CO3
1 of 3					

	b.	Explain with a neat sketch the method of locating the phreatic line in a homogeneous earth dam with horizontal filter.	6	L2	CO3
	c.	If during a variable head permeability test on a soil sample, equal time intervals are noted for drops of head from h_1 to h_2 and again from h_2 to h_3 . Find the relationship between h_1 , h_2 and h_3 .	6	L2	CO3
OR					
Q.6	a.	State the characteristics and uses of flownets.	6	L2	CO1
	b.	Explain the terms: i) Total stress ii) Effective stress iii) Neutral stress.	6	L2	CO1
	c.	Compute the quantity of water seeping under a weir per day for which the flow net has been satisfactorily constructed, the coefficient of permeability is 2×10^{-2} mm/s, $n_f = 5$ and $n_d = 18$. The difference in water level between upstream and downstream is 3.0 m. The length of the weir is 60 m.	8	L3	CO1
Module – 4					
Q.7	a.	Explain Mohr-Coulomb theory of shear strength.	6	L2	CO1
	b.	What are the advantages and disadvantages of direct shear test and over triaxial test?	6	L2	CO1
	c.	A direct stress test was carried out on a cohesive soil sample and following results were obtained: Normal stress (kN/m ²) 150 250 Shear stress (kN/m ²) 110 160 A triaxial test is carried out on the same soil with cell pressure of 150 kN/m ² . What would be the deviator stress @ failure?	8	L3	CO2
OR					
Q.8	a.	What are the factors affecting the shear strength of soil?	6	L2	CO1
	b.	A cylindrical specimen of saturated clay 40 mm in diameter and 80 mm in length is tested in an unconfined compression test. Find shear strength of clay, if the specimen fails under an axial load of 360 N. The change in length of the specimen @ failure is 8 mm. Also find the shear parameters if the angle made by the failure plane with horizontal is 50°.	8	L3	CO1
	c.	What are the advantages of triaxial shear test over direct shear test?	6	L2	CO1
Module – 5					
Q.9	a.	Enamurate the assumptions and limitations of Terzaghi's consolidation theory.	6	L2	CO1

	b.	Briefly explain: i) Normally consolidated ii) Under consolidated iii) Over consolidated soils.	6	L2	CO1
	c.	A soil sample 20 mm thick takes 20 minutes to reach 20% consolidation. Find the time taken for a clay layer 6 mm thick to reach 40% consolidation. Assume double drainage in both cases.	8	L3	CO1
OR					
Q.10	a.	Explain square root of time fitting method.	6	L2	CO1
	b.	Explain mass spring analogy.	6	L2	CO1
	c.	A 20 mm thick isotropic clay layer overlies on impervious rock. The coefficient of consolidation of soil is $50 \times 10^{-2} \text{ mm}^2/\text{sec}$. Find the time required for 50% and 90% consolidation. Time factor are 0.2 and 0.85 for 50% and 90% consolidation, respectively.	8	L3	CO2
