

Enrollment No.....



Faculty of Engineering
End Sem Examination Dec-2023
CE3CO27 Geotechnical Engineering -I

Programme: B.Tech.

Branch: CE

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. A soil mass in a three-phase system consists of _____. 1
 (a) Solids, water and air (b) Sand, gravel and air
 (c) Solids and water only (d) Solids and air only
- ii. According to IS classification, the range of sand size particles is- 1
 (a) 4.75 mm to 0.075 mm (b) 2.00 mm to 0.425 mm
 (c) 0.425 mm to 0.075 mm (d) 0.075 mm to 0.002 mm
- iii. The velocity of flow is proportional to _____ according to Darcy's law: 1
 (a) Effective stress (b) Hydraulic gradient
 (c) Cohesion (d) Adhesion
- iv. What is the relationship between permeability and viscosity of water? 1
 (a) Directly proportional (b) Inversely proportional
 (c) Both are equal (d) None of these
- v. In consolidation test of soil, for determination of time required for consolidation of same soil with same drainage condition in field and laboratory, the following statement is true: 1
 (a) Coefficient of consolidation is same in both condition
 (b) Coefficient of consolidation is different in both condition
 (c) The time factor is different in both condition
 (d) The time required for the consolidation is same in both condition
- vi. For same soil, the effect of heavier compaction is in _____. 1
 (a) Increase in the maximum dry density
 (b) Decrease in the maximum dry density
 (c) Decrease in stability
 (d) Decrease in strength

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- vii. In Unconfined compressive strength test, the mohr circle will be started from- **1**
 (a) Origin
 (b) A horizontal distance equals to minor principle stress from origin
 (c) A distance equals to major principle stress from origin
 (d) A vertical distance equals to minor principle stress from origin
- viii. In tri-axial compression test, the deviator stress is given by- **1**
 (a) $\sigma_1 + \sigma_3$ (b) $\sigma_1 - \sigma_3$ (c) $0.5(\sigma_1 - \sigma_3)$ (d) $0.5(\sigma_1 + \sigma_3)$
- ix. Earth embankments or slopes are commonly required for which of the following purpose? **1**
 (a) Railways (b) Earth dams
 (c) Roadways (d) All of these
- x. If the soil properties for all identical depths below the surface are constant, it is a _____. **1**
 (a) Finite slope (b) Infinite slope
 (c) Planar failure surface (d) All of these
- Q.2 i. Draw the particle size distribution chart for uniformly distributed soil. **2**
 ii. What are the various laboratory methods of determination of water content? **2**
 iii. A partially saturated sample from borrow pit has a natural moisture content of 15% and bulk unit weight of 1.9 g/cc. The specific gravity of solids is 2.70. Determine the degree of saturation and void ratio. **6**
- OR iv. What is the use of soil classification system? Describe Indian standard soil classification system. **6**
- Q.3 i. Explain total, neutral and effective stress in brief. Give the relationship between total, neutral and effective stress. **3**
 ii. What do you mean by quicksand phenomena? Drive the relation for critical hydraulic gradient. **7**
- OR iii. A horizontal stratified soil deposit consists of three uniform layers of thickness 4, 6 & 12 m respectively. The permeabilities of these layers are 52×10^{-4} cm/s, 8×10^{-4} cm/s, & 6×10^{-4} cm/s, find the effective average permeability of the deposit in the horizontal & vertical direction. **7**
- Q.4 i. Explain the graphical method for determination of pre consolidation. **4**

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- ii. Explain the various methods for determination of coefficient of consolidation in detail. **6**
- OR iii. An undisturbed sample of clay, 24 mm thick, consolidated 50% in 20 minutes, when tested in the laboratory with drainage allowed at top & bottom. The clay layer, from which the sample was obtained, is 4m thick in the field. How much time will it take to consolidate 50%, with double drainage? **6**
- Q.5 Attempt any two:
 i. What is the basic difference between Unconsolidated Undrained (UU) test, Consolidated Undrained Test (CU), and Consolidated Drained test (CD) tri-axial test for determination of shear strength of soil. **5**
 ii. A concentrated load of 1000 kN is applied at the ground surface. Compute the vertical pressure (a) at a depth of 4 m below the load, (b) at a distance of 3 m at the same depth. Use Boussinesq's equation. **5**
 iii. Draw the contact pressure distribution graph for cohesive and cohesionless for rigid & flexible foundation. **5**
- Q.6 Attempt any two:
 i. Discuss the different types of the earth pressure with neat sketches. **5**
 ii. Drive an expression for factor of safety of infinite slope for cohesionless soil. **5**
 iii. Compute the intensities of active & passive earth pressure at depth of 8 meters in dry cohesionless sand with an angle of internal friction of 30° and unit weight of 18 kN/m^3 . What will be the intensities of active and passive earth pressure if the water level rises to the ground level? Take saturated unit weight of sand as 22 kN/m^3 . **5**

Marking Scheme

CE3CO27 Geotechnical Engineering-1

Q.1	i)	a) solids, water and air	1
	ii)	a) 4.75 mm to 0.075 mm	1
	iii)	b) hydraulic gradient	1
	iv)	b) Inversely proportional	1
	v)	a) coefficient of consolidation is same in both condition	1
	vi)	a) increase in the maximum dry density	1
	vii)	a) origin	1
	viii)	b) $\sigma_1 - \sigma_3$	1
	ix)	d) All of the mentioned	1
	x)	b) Infinite slope	1
Q.2	i.	Draw the particle size distribution chart for uniformly distributed soil.	2
		Particle size distribution	-2
	ii.	What are the various laboratory methods of determination of water content?	2
		Determination of water content	-2
	iii.	A partially saturated sample from borrow pit has a natural moisture content of 15% and bulk unit weight of 1.9 g/cc. The specific gravity of solids is 2.70. Determine the degree of saturation and Void Ratio.	6
OR		Degree of saturation	-3
		Void Ratio	-3
	iv.	What is the use of soil classification system? Describe Indian standard soil classification system.	6
		Soil classification system	-3
		Indian standard soil classification system	-3
Q.3	i.	Explain Total, Neutral and Effective Stress in brief. Give the relationship between total, neutral and effective stress.	3
		Total, Neutral and Effective Stress	-1.5
		Relationship between	-1.5
	ii.	What do you mean by quick sand phenomena? Derive the relation for critical hydraulic gradient.	7
		Quick sand phenomena	-2
OR		Derivation of hydraulic gradient	-5
	iii.	A horizontal stratified soil deposit consists of three uniform layers of thickness 4, 6 & 12 m respectively. The permeabilities of these layers are 52×10^{-4} cm/s, 8×10^{-4} cm/s, & 6×10^{-4} cm/s, find the	7

effective average permeability of the deposit in the horizontal & vertical direction.
 Effective average permeability in horizontal -3.5
 effective average permeability in vertical -3.5

Q.4	i.	Explain the graphical method for determination of pre consolidation.	4
		Graphical methods determination	-4
	ii.	Explain the various methods for determination of coefficient of consolidation in detail.	6
		Methods of coefficient of determination	-6
	OR	iii.	6
		An undisturbed sample of clay, 24 mm thick, consolidated 50% in 20 minutes, when tested in the laboratory with drainage allowed at top & bottom. The clay layer, from which the sample was obtained, is 4m thick in the field. How much time will it take to consolidate 50%, with double drainage?	
		Time taken for consolidation	-6
Q.5	i.	Attempt any two: What is the basic difference between Unconsolidated Undrained (UU) test, Consolidated Undrained Test (CU), and Consolidated Drained test (CD) tri-axial test for determination of shear strength of soil.	5
		Minimum five difference between the tests	-5
	ii.	A concentrated load of 1000 kN is applied at the ground surface. Compute the vertical pressure (i) at a depth of 4 m below the load, (ii) at a distance of 3 m at the same depth. Use Boussinesq's equation.	5
		Vertical pressure at 4m depth	-2.5
		Vertical pressure at 3 m	-2.5
OR	iii.	Draw the contact pressure distribution graph for cohesive and cohesionless for rigid & flexible foundation.	5
		Cohesive soil contact distribution (rigid and flexible foundation)	-2.5
		Cohesionless soil contact distribution (rigid and flexible foundation)	-2.5
Q.6	i.	Attempt any two: Discuss the different types of the earth pressure with neat sketches.	5
		Rest earth pressure	-1
		Active earth pressure	-1.5
		Passive earth pressure	-1.5
	ii.	Derive an expression for factor of safety of infinite slope for cohesionless soil.	5

- Derivation for infinite slope -5
- iii. Compute the intensities of active & passive earth pressure at depth of 8 meters in dry cohesionless sand with an angle of internal friction of 30° and unit weight of 18 kN/m^3 . What will be the intensities of active and passive earth pressure if the water level rises to the ground level? Take saturated unit weight of sand as 22 kN/m^3 . 5
- Active earth pressure -2.5
- Passive earth pressure -2.5
