Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

CE3CO13 Geotechnical Engineering-I

Programme: B.Tech. Branch/Specialisation: 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.

Q.1 i. The curve situated at the right side of the particle size distribution curve is _____. **1**

(a) Coarse-grained soil (b) Fine-grained soil
(c) Silty clay soil (d) None of these

ii. A clay is said to be inactive, if the activity is_____ **1**

(a) <0.75 (b) 0.75-1.40 (c) >1.40 (d) None of these

iii. The neutral pressure is transmitted through _____ **1**

(a) Soil particle (b) Pore fluid
(c) Air particle (d) Atmosphere

iv. In the zone of soil through which water seeps, there will be _____ change in the degree of saturation. **1**

(a) More (b) Less (c) All of these (d) None of these

v. What is the maximum dry density for a soil sample having sp. gr. of 2.7 and OMC=16 %? **1**

(a) 3.0 g/cm^3 (b) 1.88 g/cm^3
(c) 0.562 g/cm^3 (d) 1.00 g/cm^3

vi. The ultimate consolidation settlement is **1**

(a) Directly proportional to void ratio
(b) Directly proportional to compression index
(c) Inversely proportional to compression index
(d) Inversely proportional to thickness

vii. Which of the following is a disadvantage of the shear box test? **1**

(a) Stress condition of soil is complex
(b) The test cannot be used for coarse grained soil
(c) No control on the drainage of soil
(d) The shear box test is more complex test

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viii. Which of the following is an advantage of using tri axial test? **1**
(a) Accurate result is not possible
(b) The plane of shear failure is predetermined
(c) Stress conditions are complex
(d) Precise measurement

ix. Which of the following quantity is called as Taylor's stability number? **1**
(a) c/Fc γ H (b) c/γ H (c) cm/ Fc γ (d) None of these

x. In Coulomb's wedge theory, the angle λ is referred as _____ **1**
(a) Angle of wall friction (b) Surcharge angle
(c) Critical slip angle (d) None of these

Q.2 i. What is 2 phases of soil? Draw neat sketches of 2 phase diagram of soil. **2**

ii. A clay sample has a liquid limit and plastic limit of 96% and 24% respectively. Sedimentation analysis reveals that the clay soil has 50% of the particles smaller than 0.002 mm. Indicate the activity classification of the clay soil. **3**

iii. Explain various gradations of soil in sieve analysis. Also draw particle size distribution curve. **5**

OR iv. What is density index? Derive all relationships between void ratio and porosity of soil with diagrams. **5**

Q.3 i. What is critical hydraulic gradient? Explain any two applications of flow net. **4**

ii. Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 square cm in cross sectional area, if a quantity of water equal to 450 ml passes down in 10 minutes under an effective constant head of 40 cm. On oven drying, the test specimen weighs 495 gm. Taking the specific gravity of soil 2.65, calculate the seepage velocity of water during the test. **6**

OR iii. What will be the ratio of average permeability in horizontal direction to that of vertical direction for a soil deposit consisting of three horizontal layers, if the thickness and permeability of the second layer are twice of those of the first and those of the third layer twice those of second? **6**

Q.4 i. What is zero air void line? **2**

ii. Explain Terzaghi's theory of one-dimensional consolidation with diagram and derive equation of consolidation. **8**

OR iii. Explain determination of coefficient of consolidation by square root of time fitting method and logarithm of time fitting method with graphs. **8**

Q.5 i. Find the intensity of vertical pressure and horizontal shear stress at a point of 4 m directly below a 20 kN point load acting at a horizontal ground surface. What will be vertical pressure and shear stress at a point 2 m horizontally away from the axis of loading but at a depth of 4 m. **4**

ii. What is critical void ratio? What are the advantages and disadvantages of Direct Shear Test? **6**

OR iii. Explain Triaxial compression test in detail with diagram. **6**

Q.6 Attempt any two:

i. A long natural slope in a c-ϕ soil is inclined at 12^0 to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip has developed at a depth of 4 m, determine the factor of safety. **2**
Take c = 8 kN/m^2, $\phi = 22^0$ and γ_{sat} = 19 kN/m^3

ii. Calculate the factor of safety with respect to cohesion of a clay slope laid at 1 in 2 to a height of 10 m, if the angle of internal friction $\phi = 10^0$; c = 25 kN/m^2, S_n = 0.064 and γ = 19 kN/m^3. What will be critical height of the slope in this soil? **3**

iii. Write assumptions of Rankine's Theory of active earth pressure? Derive active earth pressure for dry or moist backfill with no surcharge. **5**

OR iv. Explain Friction Circle method for finding factor of safety in detail with diagrams. **5**

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Marking Scheme
CE3CO13 Geotechnical Engineering-I

Q.1	i.	The curve situated at the right side of the particle size distribution curve is _____. (a) Coarse-grained soil		**1**
	ii.	A clay is said to be inactive, if the activity is_____ (a) <0.75		**1**
	iii.	The neutral pressure is transmitted through _____ (b) Pore fluid		**1**
	iv.	In the zone of soil through which water seeps, there will be _____ change in the degree of saturation. (d) None of these		**1**
	v.	What is the maximum dry density for a soil sample having sp. gr. of 2.7 and OMC=16 %? (b) 1.88 g/cm^3		**1**
	vi.	The ultimate consolidation settlement is (b) Directly proportional to compression index		**1**
	vii.	Which of the following is a disadvantage of the shear box test? (c) No control on the drainage of soil		**1**
	viii.	Which of the following is an advantage of using tri axial test? (d) Precise measurement		**1**
	ix.	Which of the following quantity is called as Taylor's stability number? (a) c/Fc γ H		**1**
	x.	In Coulomb's wedge theory, the angle λ is referred as _____ (c) Critical slip angle		**1**
Q.2	i.	Explanation	1 mark	**2**
		Diagram	1 mark	
	ii.	Plasticity index= 72%	1 mark	**3**
		Activity=1.44	1 mark	
		Classify= Active	1 mark	
	iii.	Explanation (4 Types)	4 marks	**5**
		Diagram	1 mark	
OR	iv.	Density index	1 mark	**5**
		Derivation	3 marks	
		Diagrams.	1 mark	
Q.3	i.	Definition	2 marks	**4**
		Application (Any Two)	2 marks	
	ii.	K=2.25*10^{-3}cm/sec	2 marks	**6**
		Dry density=1.65 gm/cc	1 mark	
		e = 0.606	1 mark	
		n=0.377	1 mark	
		v_s=3.975*10^{-2}cm/sec	1 mark	
OR	iii.	$k_h=\left(\frac{21}{7}\right)$k	2 marks	**6**
		$k_v=\left(\frac{7}{3}\right)k$	2 marks	
		$\frac{k_h}{k_v}=\frac{9}{7}$	2 marks	
Q.4	i.	Explanation	1 mark	**2**
		Diagram	1 mark	
	ii.	Diagram	2 marks	**8**
		Derivation	6 marks	
OR	iii.	Diagrams	(2 marks*2)	**8**
		Explanations	(2 marks*2)	
Q.5	i.	Vertical pressure and horizontal shear stress Ans: 0.597,Zero,0.342,0.171 kN/m^2	(1 mark*4)	**4**
	ii.	Critical void ratio	2 marks	**6**
		Advantages (Any two)	2 marks	
		Disadvantages (Any two)	2 marks	
OR	iii.	Diagram.	2 marks	**6**
		Explanation	4 marks	
Q.6		Attempt any two:		
	i.	Formula	1 mark	**2**
		FOS=1.44	1 mark	
	ii.	Formula	1 mark	**3**
		FOS=2.06	1 mark	
		Critical height=20.6 m	1 mark	
	iii.	Assumption (Any two)	(1 mark*2)	**5**
		Derivation	2 marks	
		Diagram	1 mark	
OR	iv.	Diagram	2 marks	**5**
		Explaination	3 marks	

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