Course Code: 18CE0154 **R18**

SIDDHARTH GROUP OF INSTITUTIONS: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Soil Mechanics(18CE0154) **Course & Branch**: B.Tech - AGE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R18

UNIT –I

INTRODUCTION TO SOIL MECHANICS AND INDEX PROPERTIES OF SOILS

1	**a**	Define the following: Flow index.	[L1] [CO1]	**[2M]**
	b	Toughness index.	[L1] [CO1]	**[2M]**
	c	Liquidity index.	[L1] [CO1]	**[2M]**
	d	Plasticity index.	[L1] [CO1]	**[2M]**
	e	Shrinkage index.	[L1] [CO1]	**[2M]**
2	a)	Explain the phenomenon of formation and transportation of soils.	[L2] [CO1]	**[5M]**
	b)	Explain with sketches of various types of soil structures.	[L2] [CO1]	**[5M]**
3	a)	Explain the formation of soil by weathering in detail.	[L2] [CO1]	**[5M]**
	b)	Discuss the characteristics and construction of kaolinite and Illite minerals groups.	[L2] [CO1]	**[5M]**
4	a)	Using three phase diagrams of soil, derive an expression for water content in terms of Void ratio, Specific gravity and degree of saturation.	[L2] [CO1]	**[6M]**
	b)	A saturated soil sample has a water content of 25% and unit weight of 20 kN/m^3. Determine the Specific gravity of the solid particles, dry unit weight and void ratio.	[L3] [CO1]	**[4M]**
5	Using three phase diagrams of soil, derive an expression for saturated unit weight of soil in terms of void ratio, unit weight of water, specific gravity and degree of saturation.		[L2] [CO1]	**[10M]**
6	A sample of clay soil of volume 1×10^{-3} m^3 and weight 17.62 N, after being dried out in an oven had a weight of 13.68 N. If the specific gravity of the particle was 2.69 find void ratio, saturated unit weight, dry unit weight and water content.		[L3] [CO1]	**[10M]**
7	a)	A soil has a liquid limit of 25% and flow index of 12%. If the plastic limit is 15% determine the plasticity index and toughness index. If the water content of the soil is in natural condition in the	[L3] [CO1]	**[6M]**

	field is 20%, find the liquidity index and relative consistency. b) What was the relative density. Write the importance of this term?	 [L1] [CO1]	**[4M]**
8	a) Explain Relative density. b) How to determine field density by using sand replacement method.	[L2] [CO1] [L2] [CO1]	**[4M]** **[6M]**
9	a) Briefly explain the Procedure of core cutter method. b) Explain Determination of specific gravity in the laboratory.	[L2] [CO1] [L2] [CO1]	**[5M]** **[5M]**
10	a) Describe in detail about wet and dry sieve analysis of soils. b) What are the consistency limits?	[L2] [CO1] [L1] [CO1]	**[6M]** **[4M]**

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UNIT –II
PERMEABILITY OF SOILS AND EFFECTIVE STRESS PRINCIPLES

1	**a**	what is meant by Darcy's law?	[L1] [CO2]	**[2M]**
	b	What is meant by effective stress and write expression?	[L1] [CO2]	**[2M]**
	c	What is flow net?	[L1] [CO2]	**[2M]**
	d	What is meant by capillary rise?	[L1] [CO2]	**[2M]**
	e	Write the formula for falling head permeability test. Explain the terms?	[L1] [CO2]	**[2M]**
2	a) Explain the phenomenon of capillary rise in soil and write an expression for the Capillary rise. b) What is Darcy's law? What are its limitations?		[L2] [CO2] [L1] [CO2]	**[6M]** **[4M]**
3	a) A constant head permeability test was run on a sand sample 30cm in length and 20 cm^2 in area. When a loss of head was 60 cm, the quantity of water to be collected in 2 minutes was 250ml. Determine the coefficient of permeability of soil. b) How would you determine the average permeability of a soil deposit consisting of number of layers? What is its use in soil engineering?		[L3] [CO2] [L2] [CO2]	**[5M]** **[5M]**
4	What are the different methods for determination of coefficient of permeability in a laboratory. Explain any one method?		[L2] [CO2]	**[10M]**
5	Explain the constant head permeability test with the help of neat sketch?		[L2] [CO2]	**[10M]**
6	A falling head permeability test was performed on a sample of clean, uniform sand. One minute was required for the initial head of 100cm to fall to 50cm in the stand pipe of cross-sectional area 1.50cm^2. If the sample was 4cm in diameter and 30cm long, calculate the coefficient of permeability of sand.		[L3] [CO2]	**[10M]**
7	a) Explain factors affecting the permeability of soils? b) Estimate the quantity of flow of water through a soil mass in a 300 sec period when a constant head of 1m is maintained. The length of the sample is 150 mm and the cross-Sectional area is100×100 mm. The coefficient of permeability of the soil sample is1×10^{-1}mm/s.		[L2] [CO2] [L3] [CO2]	**[5M]** **[5M]**
8	What is flow net? Explain the characteristics and uses of flow net?		[L2] [CO2]	**[10M]**
9	Explain in details about Quick sand condition.		[L2] [CO2]	**[10M]**
10	a) Prove that the effective stress (σ') for a standard soil can be expressed as $\sigma'=\sigma-u$ Where σ= total stress, u= pore water pressure b) An 8m thick layer of stiff saturated clay (γ = 19 kN/m^3) is underlain by a layer of sand. The sand is under an artesian pressure of 5m. Calculate the maximum depth of cut that can be made without causing a heave.		[L2] [CO2] [L3] [CO2]	**[5M]** **[5M]**

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UNIT –III

STRESS DISTRUBUTION IN SOILS AND COMPACTION OF SOILS

1	**a**	what is meant by compaction of soil?	[L1] [CO4]	**[2M]**
	b	Write the formula for Boussinesq's equation for point load.	[L1] [CO3]	**[2M]**
	c	What is meant by zero air void line?	[L1] [CO4]	**[2M]**
	d	Discuss about optimum moisture content.	[L1] [CO4]	**[2M]**
	e	What is relative compaction?	[L1] [CO4]	**[2M]**
2		Derive an expression for vertical stress at a point due to a point load, using Boussinesq's theory.	[L2] [CO3]	**[10M]**
3		Explain Westergaard's theory for the determination of the vertical stress at a point.	[L2] [CO3]	**[10M]**
4		A concentrated load of 2000kN is applied at the ground surface. Determine the vertical stress at a point p which is 6m directly below the load. Also calculated the vertical stress at a point which is at a depth of 6m but at a horizontal a depth of 5m from the axis of the load.	[L3] [CO3]	**[10M]**
5		A rectangular foundation 4m by 5m carries a u.d.l of 200 kN/m^2. Determine the vertical stress at a point p located and at a depth of 2.5 m.	[L3] [CO3]	**[10M]**
6		a) Explain the concept of 'Pressure Bulb' in soils. b) What do you understand by 'Pressure bulb'? Illustrate with sketches plane method.	[L2] [CO3] [L1] [CO3]	**[4M]** **[6M]**
7		Explain the standard proctor test with help of neat sketch.	[L2] [CO4]	**[10M]**
8		Describe in detail about modified proctor test with neat sketch.	[L2] [CO4]	**[10M]**
9		What are the factors affecting compaction soils explain them?	[L2] [CO4]	**[10M]**
10		The following data are obtained in a compaction test. Specific gravity= 2.65	[L3] [CO4]	**[10M]**

Moisture content (%)	2	4	5.8	6.7	7.8	10
Wet density (Kn/m^3)	20.4	20.9	21.4	22.2	22.4	22.0

Determine the OMC and maximum dry density. Draw 'Zero-air-void line.

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UNIT- IV
CONSOLIDATION OF SOILS

1	a	Coefficient of compressibility.	[L1] [CO5]	**[2M]**
	b	Coefficient of volume change.	[L1] [CO5]	**[2M]**
	c	Compression index.	[L1] [CO5]	**[2M]**
	d	Expansion index.	[L1] [CO5]	**[2M]**
	e	Recompression index.	[L1] [CO5]	**[2M]**
2	Describe in detail about initial consolidation, primary consolidation, secondary consolidation.		[L2] [CO5]	**[10M]**
3	Describe the consolidometer test. Show how the results of this test are used to predict the rate of settlement and the magnitude of settlement.		[L2] [CO5]	**[10M]**
4	Discuss the Terzaghi's theory of consolidation, state the various assumptions and their validity.		[L2] [CO5]	**[10M]**
5	Discuss the spring analogy for primary consolidation. What are its uses.		[L2] [CO5]	**[10M]**
6	Obtain the differential equation defining the one-dimensional consolidation as given by Terzaghi listing the various assumptions		[L2] [CO5]	**[10M]**
7	A clay stratum, 5m thick has an initial void ratio of 1.50 and the effective overburden pressure of 120kN/m^2 when the sample is subjected to an increases pressure of 120kN/m^2 the void ratio reduces to1.90. Determine the volume of compressibility and final settlement of stratum.		[L3] [CO5]	**[10M]**
8	Calculate the final settlement of the clay layer with an increase of pressure of 30kN/m^2 at mid height of layer takeγ = 10kN/m^3.		[L3] [CO5]	**[10M]**
9	A clay stratum, 7m thick has an initial void ratio of 2.05 and the effective overburden pressure of 140 kN/m^2 when the sample is subjected to an increases pressure of 140 kN/m^2 the void ratio reduces to 1.44. Determine the volume of compressibility and final settlement of stratum.		[L3] [CO5]	**[10M]**
10	The laboratory consolidation data for undisturbed clay sample are as follows $e_{1=1.00}$, σ_1 = 85kN/m^2, $e_{2=0.80}$, σ_2 = 465kN/m^2 determine the void ratio for a pressure of σ_3 = 600KN/m^2		[L3] [CO5]	**[10M]**

UNIT –V
SHEAR STRENGTH OF SOILS

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1	**a**	What is meant by liquification of soil?	[L1] [CO6]	**[2M]**
	b	Explain the merits and demerits of triaxial test.	[L1] [CO6]	**[2M]**
	c	Write the formula for major and minor principle stress.	[L1] [CO6]	**[2M]**
	d	What do you understand by shear strength of soils?	[L1] [CO6]	**[2M]**
	e	Write the merits and demerits of vane shear test.	[L1] [CO6]	**[2M]**
2		Describe the direct shear test. What are merits and demerits?	[L2] [CO6]	**[10M]**
3		Explain the triaxial shear test? What are the advantages of triaxial shear test over the direct Shear test?	[L2] [CO6]	**[10M]**
4		What is unconfined compression test? Sketch the apparatus used what are its advantages over triaxial test?	[L2] [CO6]	**[10M]**
5		Write short notes on a) Mohr's circle b) Explain the Mohr's coulomb strength envelope.	[L1] [CO6]	**[10M]**
6		Describe the vane shear test with a neat sketch.	[L2] [CO6]	**[10M]**
7		The stresses at failure on the failure plane in a cohesion less soil mass was Shear stress = 5 kN/m^2; Normal stress = 18 kN/m^2. Determine the resultant stress on the failure plane, the angle of internal friction of the soil and the angle of inclination of the failure plane to the major principal plane.	[L3] [CO6]	**[10M]**
8		A vane, 10.8 cm long, 7.2 cm in diameter, was pressed into a soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45 N-m. Find the shear strength of the clay on a horizontal plane.	[L3] [CO6]	**[10M]**
9		A triaxial compression test on a cohesive sample cylindrical in shape yields the following effective Stresses: Major Principal stress ...8 mN/m^2 Minor principal stress ...2 mN/m^2 Angle of inclination of rupture plane is 60° to the horizontal. Present the above data, by means of a Mohr's circle of stress diagram. Find the cohesion and angle of internal friction.	[L3] [CO6]	**[10M]**
10		The stresses at failure on the failure plane in a cohesion less soil mass was Shear stress = 4 kN/m^2; Normal stress = 10 kN/m^2. Determine the resultant stress on the failure plane, the angle of internal friction of the soil and the angle of inclination of the failure plane to the major principal plane.	[L3] [CO6]	**[10M]**

Prepared by:

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