Course Code: 20CE0114 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: Geotechnical Engineering(20CE0114) **Course & Branch**: B.Tech & CE

Year & Sem: II & II **Regulation:** R20

UNIT –I
INTRODUCTION, PERMEABILITY & EFFECTIVE STRESS ANALYSIS

1		Define weathering and explain the process of soil formation by weathering in details.	**[L2][CO1]**	**[12M]**
2	**a)**	Classify various types of soil structures occur in nature with neat sketch.	**[L2][CO1]**	**[6M]**
	b)	Explain clay mineralogy with neat sketch.	**[L2][CO1]**	**[6M]**
3	**a)**	Using three phase diagram of soil, develop an expression for Void ratio, water content, specific gravity and degree of saturation.	**[L3][CO1]**	**[6M]**
	b)	The moist unit weight of soil sample is 19.2 kN/m^3 and has water content of 9.8%. The specific gravity of soil particles is 2.69. Determine dry unit weight, void ratio, porosity and degree of saturation.	**[L3][CO1]**	**[6M]**
4	**a)**	Write short notes on Index Properties of soils.	**[L1][CO1]**	**[4M]**
	b)	Explain in detail the laboratory method for particle size distribution of coarse grained soils by dry sieve analysis.	**[L2][CO1]**	**[8M]**
5		Explain in detail the Indian Standard classification System and list out group symbols in detail.	**[L2][CO1]**	**[12M]**
6	**a)**	Define Liquid limit, Plastic limit, Shrinkage limit and Plasticity index.	**[L1][CO1]**	**[6M]**
	b)	A soil has a liquid limit of 45%, plastic limit of 20% and flow index of 50%. Determine its toughness index. If the natural water content is 25%, determine its consistency index.	**[L3][CO1]**	**[6M]**
7		Define permeability. Explain various factors affecting permeability.	**[L2][CO1]**	**[12M]**
8		Determine the average coefficient of permeability in the horizontal and vertical direction for a deposit consisting of three layers of thickness 5 m, 1m, and 2.5 m and having the coefficient of permeability of 3 x10^{-2} mm/sec, 3x10^{-5} mm/sec and 4 x10^{-2} mm/sec respectively.	**[L3][CO1]**	**[12M]**
9		Explain the coefficient of permeability in laboratory by constant head method with neat sketch.	**[L2][CO1]**	**[12M]**
10	**a)**	Explain Quick sand condition.	**[L2][CO1]**	**[6M]**
	b)	Define flow net and various applications of flow net.	**[L1][CO1]**	**[6M]**

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UNIT –II
COMPACTION AND CONSOLIDATION

<table>
<tr><td>1</td><td>a)</td><td>Differentiate between compaction and consolidation.</td><td>[L2][CO2]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>Differentiate between Standard proctor test and Modified proctor test.</td><td>[L2][CO2]</td><td>[6M]</td></tr>
<tr><td>2</td><td></td><td>What is the Compaction phenomenon of soils? Explain various factors effecting of compaction on properties of soils.</td><td>[L2][CO2]</td><td>[12M]</td></tr>
<tr><td>3</td><td></td><td>For constructing an embankment, the soil is transported from a Borrow area using a truck which can carry 6 m ^{3} of soil at a time. With the following details, determine the number of truckloads of soil required to obtain 100 m^3 of compacted earth fill and the volume of borrow pit.
<table>
<tr><th>Property</th><th>Borrow area (In-situ)</th><th>Truck (Loose)</th><th>Field (Compacted)</th></tr>
<tr><td>Bulk Unit Weight (kN/m^3)</td><td>16.6</td><td>11.5</td><td>18.2</td></tr>
<tr><td>Water Content (%)</td><td>14</td><td>8</td><td>6</td></tr>
</table></td><td>[L3][CO2]</td><td>[12M]</td></tr>
<tr><td>4</td><td></td><td>Explain the procedure of standard proctor’s test conducted in the laboratory.</td><td>[L2][CO2]</td><td>[12M]</td></tr>
<tr><td>5</td><td>a)</td><td>The Maximum dry density of a sample by the light compaction test is 1.78g/ml atan optimum water content of 15%. Find the air voids and degree of saturation G=2.67. What would be the corresponding value of dry density on the zero air voidsat optimum moisture content.</td><td>[L3][CO2]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>An earth embankment is compacted at a water content 18%.to a bulk density of 19.2 kN/m^3. If the specific gravity of the sand is 2.7 find the void ratio and the degreeof saturation of compacted embankment.</td><td>[L3][CO2]</td><td>[6M]</td></tr>
<tr><td>6</td><td></td><td>What is consolidation? Describe briefly various types of consolidation of soils.</td><td>[L1][CO2]</td><td>[12M]</td></tr>
<tr><td>7</td><td>a)</td><td>State the assumptions made in Terzaghi’s theory of one-dimensional consolidation.</td><td>[L2][CO2]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clay layer produces a pressure of 2.6 kg/cm^2 and the new construction increases the pressure by 1.0 kg/cm^2. If the compression index is 0.5. Compute the settlement. Water content is 40% and specific gravity of grains is 2.65.</td><td>[L3][CO2]</td><td>[6M]</td></tr>
<tr><td>8</td><td>a)</td><td>Define Coefficient of compressibility, Coefficient of Volume Change and Compression index.</td><td>[L2][CO2]</td><td>[6M]</td></tr>
<tr><td></td><td>b)</td><td>A 15 m thick hydraulically isotropic clay stratum overlies an impervious stratum. If the coefficient of consolidation is 5 x 10^{-4} cm^2/s, find the time required for 50% and 90% consolidation (Tv = 0.20 and 0.85 respectively).</td><td>[L3][CO2]</td><td>[6M]</td></tr>
<tr><td>9</td><td></td><td>Explain the procedure of consolidation test with neat sketch.</td><td>[L2][CO2]</td><td>[12M]</td></tr>
<tr><td>10</td><td></td><td>In a consolidation test the following results have been obtained. When the load was changed from 50 kN/m^2 to 100 kN/m^2, the void ratio changed from 0.70 to 0.65. Determine compression index, coefficient of volume change and coefficient of consolidation in mm^2/sec.</td><td>[L3][CO2]</td><td>[12M]</td></tr>
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UNIT –III
STRESS DISTRIBUTION IN SOILS AND SHEAR STRENGTH OF SOILS

1		Develop an expression for the vertical stress at a point due to a point load, using Boussinesq's theory.	**[L2][CO3]**	**[12M]**
2	**a)**	Explain Newmaark's influence chart with neat sketch.	**[L2][CO3]**	**[6M]**
	b)	A water tank is supported by a ring foundation having outer diameter of 10 m and inner diameter of 7.5 m. The ring foundation transmits uniform load intensity of 160 kN/m^2. Compute the vertical stress induced at depth of 4 m, below the centre of ring foundation.	**[L3][CO3]**	**[6M]**
3	**a)**	What do you understand by 'Pressure bulb'? Illustrate with sketches.	**[L1][CO3]**	**[6M]**
	b)	A concentrated load of 2000 kN acts vertically at the ground surface. Determine the vertical stress at a point P which is 6m directly below the load. Also calculate the vertical stress at a point R which is at a depth of 6m but at a horizontal distance of 5m from the axis of the load.	**[L3][CO3]**	**[6M]**
4	**a)**	Explain vertical stress under line load, strip load, circular load and rectangular area with neat sketch.	**[L2][CO3]**	**[6M]**
	b)	A circular ring footing for an overhead water tank carries a load of 1000 kN whose outer diameter is 3 m and inner diameter is 1.5 m. Determine the induced stress at a depth of 3 m from surface below the centre of the loaded area.	**[L3][CO3]**	**[6M]**
5	**a)**	Explain the concept of 'Westergaards theory' in soils.	**[L2][CO3]**	**[6M]**
	b)	Determine the vertical stress at a point P which is 3m below and at a radial distance of 3m from the vertical load 100kN. Use westergaard's solution.	**[L3][CO3]**	**[6M]**
6	**a)**	Write short notes on Mohr's Circle of stress.	**[L1][CO4]**	**[6M]**
	b)	Explain the Mohr-Coulomb strength theory.	**[L2][CO4]**	**[6M]**
7	**a)**	What are the various methods of determination of shear strength in the laboratory?	**[L1][CO4]**	**[6M]**
	b)	Explain types of shear strength based on drainage conditions.	**[L2][CO4]**	**[6M]**
8		The results for triaxial tests conducted on three samples of a soil are given below.Obtain the shear strength parameters of the soil.	**[L3][CO4]**	**[12M]**

Cell pressure (kN/m^2)	100	200	450
Deviator stress (kN/m^2)	375	575	973

9		Describe the vane shear test with a neat sketch.	**[L2][CO4]**	**[12M]**
10	**a)**	Explain types of soils based on total strength.	**[L2][CO4]**	**[6M]**
	b)	A cylindrical specimen of saturated soil fails under an axial stress 175 kN/m^2 in an unconfined compression test. The failure plane makes an angle of 55° with thehorizontal. Calculate the cohesion and angle of internal friction of the soil.	**[L3][CO4]**	**[6M]**

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UNIT –IV

EARTH SLOPE STABILITY

1	**a)**	Define earth slope.	**[L1][CO5]**	**[6M]**
	b)	Explain factor of safety with respect to shear strength, cohesion and friction.	**[L2][CO5]**	**[6M]**
2	**a)**	What are the factors causing the slope failures?	**[L1][CO5]**	**[6M]**
	b)	Explain different types of slope failures with neat sketches.	**[L2][CO5]**	**[6M]**
3		Derive the expression for stability analysis of infinite slope of cohesive soils.	**[L2][CO5]**	**[12M]**
4		Derive the expression for stability analysis of infinite slope of cohesion less soils	**[L2][CO5]**	**[12M]**
5	**a)**	Explain Taylor's stability number.	**[L2][CO5]**	**[6M]**
	b)	A vertical cut is made is made in a clay deposit ($c=30$ kN/m^2, $\Phi' = 0^0$, $\gamma=16$ kN/m^2). Find the maximum height which can be temporarily supported. Take $S_n=0.261$.	**[L3][CO5]**	**[6M]**
6		With the help of a neat sketch explain in detail about friction circle method.	**[L2][CO5]**	**[12M]**
7		A canal is to be excavated through a soil with c = 15 kN/m^2, φ= 20^o, e = 0.9 and G = 2.67. The side slope is 1 in 1. The depth of the canal is 6 m. determine the factor of safety with respect to cohesion when the canal runs full. What will be the factor of safety if the canal is rapidly emptied.	**[L3][CO5]**	**[12M]**
8		Analyze the slope, if it is made of clay having $c^1 = 30$ kN/m^2, $\varphi' = 20^0$, e = 0.65 and G = 2.67 and under the following conditions: (i) When the soil is dry (ii) When water seeps parallel to the surface of the slope (iii) When the slope is submerged slope angle = 25^0	**[L3][CO5]**	**[12M]**
9		Give the step by step procedure of analyzing stability of a finite slope using Swedish circle method.	**[L3[CO5]**	**[12M]**
10		With the help of a neat sketch show various forces considered for the analysis of a finite slope using Bishop's simplified method. Mention the equation for factor ofSafety given by this method.	**[L3][CO5]**	**[12M]**

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UNIT –V
SOIL EXPLORATION

1	**a)**	What are the different stages in sub soil exploration?	**[L1][CO6]**	**[6M]**
	b)	Explain various uses of site investigations.	**[L2][CO6]**	**[6M]**
2		Describe with a neat sketch how will you carry out the wash boring method of soil exploration.	**[L2][CO6]**	**[12M]**
3	**a)**	Discuss various open excavation methods for conducting soil exploration.	**[L2][CO6]**	**[6M]**
	b)	Sketch scraper bucket sample and explain how an undisturbed soil sample is extracted using it.	**[L2][CO6]**	**[6M]**
4	**a)**	How boring operations are carried out using rotary auger boring and percussion drilling?	**[L1][CO6]**	**[6M]**
	b)	Describe the construct of a split spoon sampler. Explain how undisturbed soil sample is extracted using it.	**[L2][CO6]**	**[6M]**
5	**a)**	Explain various types of soil samples.	**[L2][CO6]**	**[6M]**
	b)	List out various design features affecting the sample disturbance.	**[L1][CO6]**	**[6M]**
6		Give a detailed account on how Standard Penetration Test is conducted. What are the relevant corrections applied to SPT number?	**[L2][CO6]**	**[12M]**
7	**a)**	A SPT was conducted in fine sand below the water table and a value of 25 isobtained for N. What is the corrected value of N.	**[L3][CO6]**	**[6M]**
	b)	A SPT was conducted in a dense sand deposit at a depth of 22m and a value of 48 was observed for N. The density of the sand was 15 kN/m^2 . What is the value of Ncorrected for over burden pressure?	**[L3][CO6]**	**[6M]**
8		Explain in detail how cone penetration test is conducted with neat sketch.	**[L2][CO6]**	**[12M]**
9	**a)**	Describe in detail execution of soil exploration program.	**[L1][CO6]**	**[6M]**
	b)	Explain various salient features of a soil exploration report	**[L2][CO6]**	**[6M]**
10		Explain in detail how plate load Test is conducted with neat sketch.	**[L2][CO6]**	**[12M]**

Prepared by:
Mrs. K.ASHALATHA
Asst Professor/CE