DEPARTMENT OF CIVIL ENGINEERING

CE 8491 - SOIL MECHANICS

Course Objectives

The Student should be able

S. No.	Course Objective
1	To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

Course Outcomes:

On Completion of the course the students will be able to

CO No.	Course Outcome
1	classify the soil and assess the engineering properties, based on index properties.
2	Understand the stress concepts in soils
3	Understand and identify the settlement in soils.
4	Determine the shear strength of soil
5	Analyze both finite and infinite slopes.

BLOOMS TAXONOMY(BT Level)

K1-Remembering , K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating ,K6-Creating

UNIT - 1

		Part B	CO	BT level	Univ.QP Reference	Marks Alloted
1.		Explain with a neat procedure for determining water content and specific gravity of a given soil in the laboratory by using a pycnometer	CO 1	KI	**(AUC Nov/Dec 2012)**	13
2.		The mass of wet soil when compacted in a mould was 19.55kN. The water content of the soil was 16%. If the volume of the mould was 0.95m^3. Determine (i) dry unit weight, (ii) Void ratio, (iii) degree of saturation and (iv) percent air voids. Take G = 2.68.	CO 1	K5	**(AUC May/June 2012)**	13
3.		In a hydrometer analysis, the corrected hydrometer reading in a 1000 ml uniform soil suspension at the start of sedimentation was 28. After a lapse of 30 minutes, the corrected hydrometer reading was 12 and the corresponding effective depth 10.5cm. the specific gravity of the solids was 2.68. Assuming the	CO 1	K5	**(AUC Apr/May 2012)**	13

		viscosity and unit weight of water at the temperature of the test as 0.001Ns/m2 and 9.81kN/m^3 respectively. Determine the weight of solids mixed in the suspension, the effective diameter corresponding to the 30 minutes reading and the percentage of particle finer than this size.				
4.		A soil sample has a porosity of 40 percent. The specific gravity of solids is 2.70. Determine **(i)** Voids ratio **(ii)** Dry density and **(iii)** Unit weight if the soil is completely saturated.	CO 1	K5	**(AUC Apr / May 2011)**	13
5.		A laboratory compaction test on soil having specific gravity equal to 2.67 gave a maximum dry unit weight of 17.8kN/m3 and a water content of 15%.Determine the degree of saturation, air content and percentage air voids at the maximum dry unit weight. What would be theoretical maximum dry unit weight corresponding to zero air voids at the optimum water content?	CO 1	K1	**(AUC Nov/Dec 2011)**	13
6.		Explain Standard Proctor Compaction test with neat sketches.	CO 1	K2	**(AUC Nov/Dec 2010)**	13
7.		Explain in detail the procedure for determination of grain size distribution of soil by sieve analysis.	CO 1	K2	**(AUC Apr / May 2009)**	13
8.		An earth embankment is compacted at a water content of 18% to a bulk density of 1.92g/cm3. If the specific gravity of the sand is 2.7, find the void ratio and degree of saturation of the compacted embankment.	CO 1	K1	**(AUC Apr / May 2009)**	13
UNIT-II						
Part B			**CO**	**BT level**	**Univ.QP Reference**	**Marks Alloted**
1.		Explain the procedure for determination of permeability by constant head test in the laboratory.	CO 2	K2	**(AUC Nov/Dec 2012)**	13
2.		Determine the total, effective and pore pressure at a depth of 20m below the bottom of a lake 6m deep. The bottom of lake consists of soft clay with a thickness of more than 20m. the average water content of the clay is 35% and specific gravity of the soil may be assumed to be 2.65.	CO 2	K5	**(AUC Apr / May 2010)**	13
3.		In a constant head permeameter test, the following observations were taken. Distance between piezometer tappings = 15cm, difference of water levels in piezometers = 40cm, diameter of the test sample = 5cm, quantity of water collected = 500ml, duration of the test = 900sec. Determine the coefficient of permeability of the soil. If the dry mass of the15cm long sample is 486g and specific gravity of the solids is 2.65. Calculate seepage velocity of water during the test.	CO 2	K5	**AUC May/June 2012)**	13

4.		Explain the falling head permeability test.	CO 2	K2	**(AUC Apr / May 2011)**	13
5.		What are the applications of flow net and explain briefly?	CO 2	K1	**(AUC Apr / May 2011)**	13
6.		Determine the effective stress at 2m, 4m, 6m, 8m and 10m is a soil mass having γs =21 KN/m3. Water table is 2m below ground surface. Above water table there is capillary rise upto ground surface. Also draw total stress diagram up to 10m.	CO 2	K5	**(AUC Apr / May 2011)**	13
7.		Explain in detail the laboratory determination of permeability using constant head method and falling head method.	CO 2	K2	**(AUC Apr / May 2011)**	13
8.		The discharge of water collected from a constant head permeameter in a period of 15 minutes is 500 ml. the internal diameter of the permeameter is 5cm and the measured difference in head between two gauging points 15cm vertically apart is 40cm. Determine the coefficient of permeability. If the dry weight of the 15 cm long sample is 486 gm and the specific gravity of the solids is 2.65, calculate the seepage velocity.	CO 2	K5	**(AUC Apr / May 2009)**	13
UNIT -III						
Part B			**CO**	**BT level**	**Univ.QP Reference**	**Marks Alloted**
1.		A water tank is supported by a ring foundation having outer diameter of 10m and inner diameter of 7.5m. the ring foundation transmits uniform load intensity of 160 kN/m2.Determine the vertical stress induced at depth of4 m, below the centre of ring foundation, using (i) Boussinesque analysis and (ii)Westergaard's analysis, taking μ= 0.	CO 3	K5	**(AUC Apr / May 2010)**	13
2.		Explain with a neat sketch the Terzhaghi's one dimensional consolidation theory	CO 3	K2	**(AUC Nov/Dec 2012)**	13
3.		The load from a continuous footing of width 2m,which may be considered to be strip load of considerable length, is 200 kN/m2. Determine the maximum principal stress at 1.5m depth below the footing, if the point lies (i)directly below the centre of the footing, (ii)directly below the edge of the footing and (iii)0.8m away from the edge of the footing.	CO 3	K5	**(AUC May/June 2012)**	13
4.		What are different components of settlement? Explain in detail.	CO 3	K1	**(AUC May/June 2012)**	13

5.		Explain the Newmark's influence chart in detail	CO 3	K2	**(AUC Apr / May 2011)**	13
6.	a)	Explain how will you determine pre-consolidation pressure?	CO 3	K2	**(AUC Apr / May 2011)**	6
	b)	Explain how will you determine coefficient of compression index (CC)from an oedomoter test**?**	CO 3	K2		7
7.		Develop Boussinesque equations to find intensity of vertical pressure and tangential stress when a concentrated load is acting on the soil.	CO 3	K6	**(AUC Nov/Dec 2010)**	13
8.		Explain in detail the laboratory determination of co-efficient of consolidation.	CO 3	K2	**(AUC Apr / May 2009)**	13
UNIT-IV						
Part B			**CO**	**BT level**	**Univ.QP Reference**	**Marks Alloted**
1.		Show the relationship between the principal stresses in triaxial compression test using Mohr-Coulomb failure theory.	CO 4	K1	**(AUC Apr / May 2010)**	13
2.		Explain the step by step procedure for determination of cohesion of a given clayey soil by Conducting unconfined compression test.	CO 4	K2	**(AUC Apr / May 2012)**	13
3.		Explain with neat sketches the procedure of conducting direct shear test. Give its advantages over other methods of finding shear strength of soil.	CO 4	K2	**(AUC May/June 2012)**	13
4.		Explain in detail the unconfined compression test.	CO 4	K2	**(AUC May/June 2012)**	13
5.		A vane, 10 cm long and 8cm in diameter, was pressed into soft clay at the bottom of a borehole. Torque was applied and gradually increasedto45 N-m when failure took place. Subsequently, the vane rotated rapidly so as to completely remould the soil. There moulded soil was sheared at a torque of 18N-m. Determine the cohesion of the clay in the natural and remoulded states and also the value of the sensitivity.	CO 4	K5	**(AUC Nov/Dec 2011)**	13
6.		Explain the triaxial shear test. What are the advantages of triaxial shear test over the direct shear test?	CO 4	K2	**(AUC Nov/Dec 2011)**	13
7.		Explain drained behavior of clay with reference to shear strength.	CO 4	K2	**(AUC Apr / May**	13

					2011)	
8.		A saturated specimen of cohesionless sand was tested in triaxial compression and the sample Failed at a deviator stress of 482kN/m2 when the cell pressure was 100kN/m2 under the drained conditions. Find the effective angle of shearing resistance of sand. What would be the deviator stress and the major principal stress at failure for another identical specimen of sand, if it is tested under cell pressure of 200kN/m2. Use either Mohr's circle method or analytical method.	CO 4	K1	**(AUC Apr / May 2012)**	13
UNIT - V						
Part B			**CO**	**BT level**	**Univ.QP Reference**	**Marks Alloted**
1.		Explain the procedure to calculate the factor of safety of a finite slope possessing both cohesion and friction(c - Φ) by method of slices	CO 5	K2	**(AUC Apr / May 2010)**	13
2.		Explain the procedure for determining the factor of safety of a given slope by friction circle method.	CO 5	K2	**(AUC Nov / Dec 2012)**	13
3.		Explain with neat sketches the Bishop's method of stability analysis	CO 5	K2	**(AUC May/June 2012)**	13
4.		A canal is to be excavated to a depth of 6m below ground level through a soil having the following characteristics c=15kN/m2,Φ=20°,e=0.9andG=2.67.The slope of the banks is 1in1. 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 completely?	CO 5	K5	**(AUC May/June 2012)**	13
5.		What are different types of slope failures? Discuss the various methods for improving the stability of slopes.	CO 5	K1	**(AUC Nov / Dec 2011)**	13
6.		Explain the Swedish slip circle method in detail	CO 5	K2	**(AUC April/May 2011)**	13
7.		Explain Taylor's stability number and its applicability.	CO 5	K2	**(AUC April/May 2011)**	13
8.		Explain any four methods of slope protection	CO 5	K2	**(AUC April/May 2011)**	13

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