Ref. No. Ex/CE/5/T/302/2018

B.E. CIVIL ENGINEERING (PART TIME) THIRD YEAR FIRST SEMESTER EXAM – 2018

SOIL MECHANICS – I

Time: Three Hours

Full Marks 100
Part I: 50 Marks
Part II: 50 Marks

Use Separate Answer-Scripts for each Part

Question No.	Part I (50 Marks)	Marks
	*Answer **ANY TWO** questions from this Part. Assume reasonable values of data, if not supplied. MM graph papers will be provided, if required.*	
1.	a) Derive a relationship between the principal stresses at failure using Mohr-Coulomb failure criterion.	7
	b) A direct shear test was carried out on a soil sample and the following results were obtained: Normal Stress (kN/m^2) 150 250 Shear Stress at failure(kN/m^2) 110 120 What would be the deviator stress at failure if a triaxial test is carried out on the same soil with cell pressure equal to 150 kN/m^2?	8
	c) The following results were obtained from a CU test on a normally consolidated soil: Cell Pressure (kN/m^2) 100 200 300 Deviator stress at failure (kN/m^2) 135 210 285 Pore water pressure at failure (kN/m^2) 25 85 145 Determine the effective stress strength parameters and total stress strength parameters by plotting conventional failure envelope from Mohr circles.	10
2.	a) An undisturbed sample of soil has a volume of 100 cm^3 and mass of 185 g. On oven drying for 24 hours, the mass is reduced to 155 g. If the specific gravity of grains is 2.7, determine the water content, voids ratio and degree of saturation of the soil?	5
	b) Develop a relationship between the void ratio, water content, specific gravity of soil solids and degree of saturation.	5
	c) The sieve analysis of a given sample of soil gave information that 57% of the particles passed through IS 75 sieve. The liquid and plastic limits of the soil were 62% and 28% respectively. Classify the soil.	5
	d) Explain briefly with neat sketches the structure of Kaolinite, Illite and Montmorillonite clay mineral.	5
	e) The dry unit weights of sand in the loosest and densest state are found to be 13.5 kN/m^3 and 21.4 kN/m^3 respectively. Assuming the specific gravity of the solids as 2.67, determine the relative density of sand with porosity 30%.	5

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B.E. CIVIL ENGINEERING (PART TIME) THIRD YEAR FIRST SEMESTER EXAM – 2018

SOIL MECHANICS – I

Time: Three Hours

Full Marks 100
Part I: 50 Marks
Part II: 50 Marks

Use Separate Answer-Scripts for each Part

Question No.	Part I (50 Marks)	Marks
3.	a) A clay layer 3.66 m thick rests beneath a deposit of submerged sand 7.92 m thick. The top of the sand is located 3.05 m below the surface of a lake. The saturated unit weight of the sand is 19.62 kN/m^3 and of the clay is 18.36 kN/m^3. Compute (i) the total stress, (ii) the pore water pressure, and (iii) the effective stress at mid height of the clay layer.	5
	b) State Darcy's law? What do you mean by discharge velocity and seepage velocity? Prove that the seepage velocity is always greater than discharge velocity.	5
	c) If during head permeability test on a soil sample, equal time interval times are noted for head to drop from h_1 to h_2 and h_2 to h_3, find the relation between h_1, h_2 and h_3.	5
	d) On a certain site there are three horizontal layers down to an impermeable rock bed, the details of which are as follows: Layer A: Thickness = 3 m, k = 5×10^{-5} m/sec Layer B: Thickness = 5 m, k = 2×10^{-5} m/sec Layer C: Thickness = 2 m, k = 3×10^{-5} m/sec Determine the ratio of k_H to k_V. Assume the average hydraulic gradient of 0.3 in both horizontal and vertical seepage, find (a) discharge value and discharge velocity in each layer for horizontal flow and (b) hydraulic gradient and head loss in each layer for vertical flow.	10

Ref. No. Ex/CE/5/T/302/2018

BACHELOR OF CIVIL ENGINEERING (PART TIME) EXAMINATION 2018
(Third Year, First Semester)

SOIL MECHANICS - I

Time: Three Hours

Full Marks 100
(50 Marks for each part)

PART II

No. of questions

Marks

(Answer any two questions and illustrate your answer with neat sketch and figures wherever necessary. Assume suitable values for the parameters if not supplied)

1 (a) The following are the observation of a standard proctor's compaction tests.

Weight of wet Soil (kg)	1.80	1.94	2.0	2.05	2.03	1.98
Moisture Content (%)	8.5	12.2	13.75	15.50	18.2	20.2

If the volume of compaction mould is 950 cc assuming specific gravity of solid=2.65

i) Draw proctor compaction curve and hence find out maximum dry density $(\gamma_d)_{max}$ and optimum moisture content.
ii) Plot Zero air void line and 90% saturation line.
iii) What is the degree of saturation at optimum moisture content? 11

(b) Sketch a typical compaction curve for a cohesion-less soil & explain the characteristics feature of it. In what way this is different from that of cohesive soil. 3+3

(c) i) Compute compaction energy for standard proctor test. 3+3
ii) Discuss the influence of compaction Energy on Engineering properties of soil.

(d) Write a short note on relative compaction. 2

2 (a) Calculate the seepage through an earthen dam resting on an impervious foundation. The relevant data are given below.
Height of a dam = 60.0 m
Upstream slope = 2.75(H):1(V) ; Downstream slope = 2.50(H):1(V)
Free board = 2.5 m