B.E. CIVIL ENGINEERING (PART TIME) THIRD YEAR FIRST SEMESTER SUPPLEMENTARY 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. Semi-log and MM graph papers will be provided, if required.*	
1.	a) What is Mohr's circle? Describe its important characteristics.	5
	b) Define slow, quick and consolidated quick triaxial shear tests, illustrating their use by at least one field example.	5
	c) The following results were obtained from a CU test on a normally consolidated soil: Cell Pressure (kN/m^2) 250 500 750 Deviator stress at failure (kN/m^2) 152 300 455 Pore water pressure at failure (kN/m^2) 120 250 350 Determine the total stress strength parameters by plotting modified failure envelope.	15
2.	a) A partially saturated soil sample has a density of 1950 kg/m^3 and a water content of 21%. If the specific gravity of solids is 2.65, determine the degree of saturation and voids ratio of the soil. If the sample subsequently gets saturated, determine its saturated density.	5
	b) Derive an expression for bulk density in terms of its water content, void ratio, specific gravity of solids and density of water.	5
	c) One kg of soil was sieved through a set of 8 sieves of size 4.75 mm, 2 mm, 600 μ, 425 μ, 300 μ, 212 μ, 150 μ and 75 μ. The mass of soil retained on these sieves were found to be 50, 78, 90, 150, 160, 132, 148, and 179 gm, respectively. Draw the particle size distribution curve and find out the values of uniformity coefficient and coefficient of curvature.	10
	d) Write short notes on (i) Toughness index and (ii) Liquidity index.	5
3.	a) Estimate the capillary rise in a soil with a void ratio of 0.6 and an effective size of 0.01 mm. Take C = 15 mm^2.	5
	b) A soil has liquid limit and plastic limit of 47% and 33% respectively. If the volumetric shrinkages at the liquid limit and the plastic limit are 44% and 29%, determine the shrinkage limit.	5
	c) A clay layer 3 m thick is overlain by a deposit of silty sand 6 m thick. The water table is located 3 m below the ground surface. The unit weight of the silty sand above and below the water table is 18.5 kN/m^3 and 20.5 kN/m^3 respectively. Also the unit weight of clay is 19.2 kN/m^3. Draw (i) the total stress, (ii) the pore water pressure, and (iii) the effective stress profile.	10
	d) A sandy layer 10 m thick overlies an impervious stratum. The water table is in the sandy layer at a depth of 1.5 m below the ground surface. Water is pumped out from a well at the rate of 100 litres/sec. The drawdown of the water table at radial distances of 3 m and 25 m is 3m and 0.5 m respectively. Determine the coefficient of permeability.	5

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No. of questions	PART II	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) What are the factors affecting compaction. Discuss them briefly. 7

(b) The following are the observations of a Standard Proctor's Compaction Tests. 12

Weight of wet Soil (kg)	1.7	1.89	2.03	1.99	1.96	1.92
Water Content (%)	7.7	11.5	14.6	17.5	19.5	21.2

If the volume of compaction mould is 950 cc assuming specific gravity of solid=2.65, make necessary calculation and

i) Draw Proctor Compaction curve and hence find out maximum dry density $(\gamma_d)_{max}$ and optimum moisture content.
ii) Plot Zero air voids line and 80% saturation line.
iii) What is the degree of saturation at optimum moisture content?

(c) Compute compaction energy for Standard Proctor Test and Modified Proctor Test. 6

2 (a) Explain with neat diagrams a method of locating the phreatic line in a homogeneous earthen dam. Assume that there is no toe drain. 10

(b) Explain the practical application of a flow net. 3

(c) A 16 m high homogeneous earthen dam, is constructed on impermeable

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	foundation. The relevant data are given below. Co-efficient of permeability of the embankment material = 4.0×10^{-8} m/s. Downstream Head= 3.0 m. Free board = 2.0 m Upstream slope = 2.50(H):1(V) ; Downstream slope = 2.50(H):1(V) Crest width = 6.0 m horizontal drain = 10 m Sketch the phreatic line and calculate the seepage through an earthen dam resting on an impervious foundation.	12
3. (a)	Write a short note on Casagrande method for determination of pre-consolidation pressure.	5
(b)	A normally consolidated clay stratum of thickness 3 m is under double drainage condition. It has a Co-efficient of permeability k= 125×10^{-2} cm^2/kN. a)Determine the ultimate value of compression of the strata by assuming a uniformly distributed load of 200 kN/m^2 and also b) Determine the time required for 20% and 80% consolidation.	12
(c)	Soil investigation at the site gave the following information. Top soil up to a depth of 10.60m is fine sand, and below this lies soft clay layer of 7.60 m thick. The water table is at 4.60 m below ground surface. The submerged unit weight of sand = 10.4 kN/m^3. The water content of normally consolidated clay = 40% and its liquid limit = 45% and specific gravity of solid particle (G) = 2.78. The proposed construction will transmit a net stress of 120 kN/m^2. Find the settlement of at the middle of the clay layer.	8