Ref No.– **Ex/CE/T/ /424C/2019**

BACHELOR OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2019
(4^{TH} YEAR 2^{ND} SEMESTER)
(1^{st} / 2^{nd} Semester/~~Repeat/ Supplementary/Spl. Supplementary/Old/ Annual/ Biannual~~)
SUBJECT: ADVANCED SOIL MECHANICS (ELECTIVE)
(Name in full)

Full Marks ~~30~~/100

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~

No. of Questions	PART II (60 MARKS)	Marks
	Answer all questions	
Q1	Consolidated drained test was conducted on a normally consolidated clay sample collected from a depth of 5.0m below ground level after consolidating at a cell pressure of 200 kPa and back pressure of 100kPa. After compilation of the data effective stress shear strength parameters are found to be $c' = 0$, $\varphi' = 26^0$. Draw the failure envelope and determine the magnitude of maximum $(\sigma_1 - \sigma_3)$. Further, determine the magnitude of maximum deviator stress if the test was conducted under undrained condition and the corresponding pore water pressure is 140 kPa.	5+4+6 = 15
Q2	Derive the expressions for pore water pressure parameters A and B. Discuss the various factors affecting the magnitude of these parameters.	8+7= 15
Q3	A highway embankment of height 10m, with side slope 2H:1V, is be constructed over a hard clay deposit. Calculate the factor of safety for a typical slip circle passing through the toe of the embankment using both Bishop's simplified and rigorous method. Properties of Embankment soil: Bulk density = 19.5 kN/m^3, $c' = 65$ kPa, $\varphi' = 18^0$, $r_u = 0.3$ Properties of Foundation soil: Bulk density = 20.0 kN/m^3, $c = 75$ kPa, $\varphi = 0^0$, $c' = 40$ kPa, $\varphi' = 20^0$ $r_u = 0.3$ Ground water table at Ground level.	30

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2019

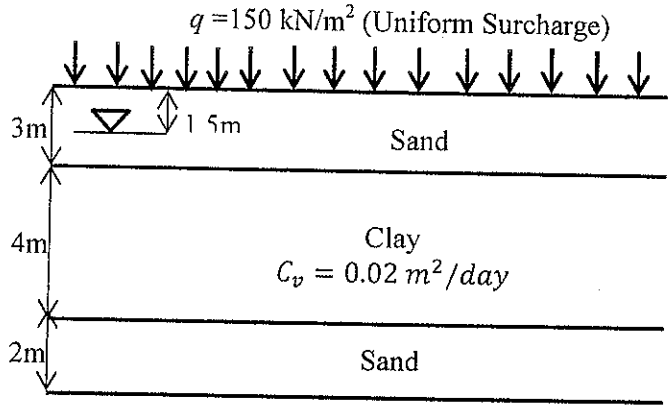
ADVANCED SOIL MECHANICS

PART-II

Time: Three Hours

Full Marks 100
(40 marks for this part)

Use a separate Answer-Script for each part
[Assume any data reasonably wherever necessary]

Q. No.	Part II (Answer all the questions.)	Marks
1 (a)	A uniform surcharge (q = 150 kN/m^2) is applied at the ground surface of the soil profile shown in Fig.1. Using numerical method, determine the distribution of excess pore water pressure for the clay layer after 10 days of load application. Also calculate the average degree of consolidation.	[10]
		
	Fig. 1	
(b)	(i) Write a short note on Free-strain and Equal-strain solution concept of Sand drains.	
	(ii) A 5-m-thick clay layer, drained at the top only, has some sand drains. A uniform surcharge is applied at the top of the clay layer. Calculate the average degree of consolidation for combined vertical and radial drainage after 100 days of load application, given $C_{vr} = C_v = 4$ mm^2/min, $d_c = 2$m, $r_w = r_s$ and $r_w = 0.2$ m. [Use the equal-strain solution].	[4+6]
	$U_r = 1 - \exp\left[\frac{-8T_r}{F(n)}\right]$ | $T_r = \frac{C_{vr}t}{d_c^2}$ | $F_n = \frac{n^2}{n^2-1}\ln(n) - \frac{3n^2-1}{4n^2}$ | [Symbols carry usual meanings]	
2 (a)	Write down the steps to draw flow net to calculate the rate of seepage through anisotropic soil	[6]
(b)	An earth dam section is shown in Figure 2 determine the rate of seepage through the earth dam using (a) Schaffernak's method and (b) L. Casagrande's method. Assume that k = 10^{-5}m/min.	[7+7]

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ADVANCED SOIL MECHANICS

PART-II

Time: Three Hours

Full Marks 100
(40 marks for this part)

Use a separate Answer-Script for each part
[Assume any data reasonably wherever necessary]

Q. No.	Part I (Answer all the questions.)	Marks

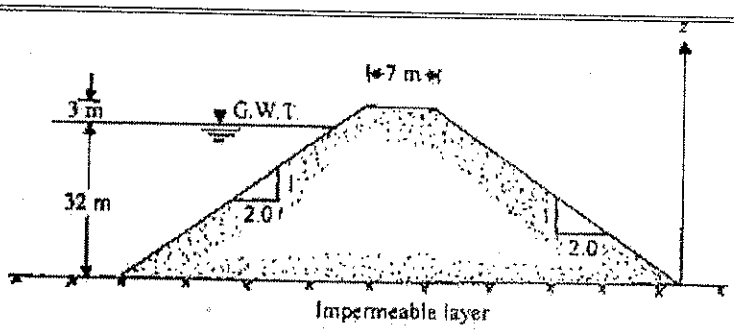

Fig. 2

Schaffernak's method	$q = k(\tan\alpha)(L\sin\alpha)$	$L = \frac{d}{\cos\alpha} - \sqrt{\frac{d^2}{\cos^2\alpha} - \frac{H^2}{\sin^2\alpha}}$	[Symbols carry usual meaning]
L. Casagrande's method	$q = kL\sin^2\alpha$	$L = \sqrt{d^2 + H^2} - \sqrt{d^2 - H^2\cot^2\alpha}$	