MASTER OF CIVIL ENGINEERING EXAMINATION, 2017
(1ST SEMESTER)
(1st / 2nd-Semester/ Repeat/ Supplementary/Spl. Supplementary/Old/ Annual/ Biannual)
SUBJECT: ADVANCED THEORY OF SOIL MECHANICS
(Name in full)

Full Marks 30/100

Time: Two hours/Three hours/Four hours/ Six hours   (15/30 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	Part I (Marks:60)	Marks
Q1. a)	What is Cauchy's stress formula? How these are used to obtain principal stresses in Cartesian coordinate system. In this connection write the expressions of stress invariants.	4+8 = 12
b)	The state of stress at a point is characterized by the components $\sigma_x = 12$, $\sigma_y = 4$, $\sigma_z = 10$, $\tau_{xy} = 3$, $\tau_{yz} = 0$, $\tau_{zx} = 0$. Find the values of principal stresses and their directions. Also calculate the magnitude of octahedral stresses.	15
Q2	The displacement field for a body is given by, $$U = [(x^2 +2z) i + (4x+2y^2 +z) j + z^2 k] \, 10^{-3}$$	
(a)	For the above displacement field, write down the strain matrix.	8
(b)	What is the strain at (2,2,3) in the direction $n_x = 0$, $n_y == 1/\sqrt{2}$, $n_z = 1/\sqrt{2}$?	8
(c)	Determine the stress vector at (1,2,3) for $E = 200 \times 10^6$ kPa and $G = 80 \times 10^6$ kPa	7
Q3	Draw a Newmark's chart. Discuss how it is used to obtain vertical stresses in soil below a loaded area.	6+4=10

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No. of Questions	Part II (Marks :40)	Marks
1.(a)	What are free vertical strain and equal vertical strain occuring due to radial flow towards a sand drain in a clay layer?	5
	A uniform surcharge of 150 kN/m^2 is applied at the ground surface where the subsoil consists of a sand layer 4m thick just below ground surface followed by a clay layer 4m thick and permeability of 2.8×10^{-7} mm/s and coefficient of consolidation 0.26 m^2/d. Another clay layer 4m thick, permeability 2×10^{-7} mm /s and coefficient of consolidation 0.38 m^2 /d lies following the clay layer underlain by a sand deposit. GWT is at 2m below ground surface. Determine the distribution of excess pore pressures for the clay layers after 10 days of load application by using numerical method .	15
2. (a)	What are pore pressure parameters? Mention the factors influencing these parameters. How these parameters are determined experimentally?	2+2+3 =7
(b)	Describe the different steps followed in a CU and CD test and draw the Mohr circles for different types of fine grained soils.	6
(c)	Two samples of a soil were tested in a triaxial machine. The all-round pressure maintained for the first sample was 200kN/m^2 and failure occurred at an additional pressure of 770kN/m^2 . For the second sample the values were 500kN/m^2 and 1370KN/m^2 respectively. Find c and ω for the soil.	7