Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2020

SUBJECT: DESIGN OF FOUNDATIONS AND EARTH RETAINING STRUCTURES [CIE 4009]

Date of Exam: 30-12-2020 **Time of Exam: 3 Hours** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions and missing data may be suitably assumed.

Q. No	Question statement	Marks
1A.	Discuss in detail the methods to correct tilts and shifts of wells during sinking.	3
1B.	A square footing of size 1.5m x 1.5m is to constructed at a depth of 1.5m having the following soil properties: γ=18.5 kN/m^3, γ_{sat}=19.5 kN/m^3, c=12 kN/m^2 and ϕ=30°. Using Meyerhof's equation, determine the gross safe bearing capacity, if the load is inclined at 10° to the vertical. The water table is at the base of the footing. Assume general shear failure. (Take N_c=30.1, N_q =18.4, N_γ =16.7). Assume FOS=3.	4
1C.	Using Teng's equation, proportion a square footing to carry a net safe load of 1000 kN. The depth of footing is to be kept at 1.5m below GL. Maximum permissible settlement of the footing is 40 mm and factor of safety is 2.5. The sub soil is sand with an average corrected N value 25. The water table is at the base of the footing.	3
2A.	What are the preventative measures taken for construction of buildings in expansive soils?	2
2B.	Proportion a trapezoidal footing for the two columns shown in Fig. 2B. Take the allowable soil pressure as 200 kN/m^2. Assume the column size as 0.3mx0.3m. Calculate the actual pressure per m run.	3
2C.	A plan of a mat foundation with 9 columns is shown in Fig. 2C. Assuming that the mat as rigid, using conventional method, determine the soil pressure distribution. Take the size of the column as 0.3m x 0.3m. The load taken by columns is given below: Q_1=200kN, Q_2=450kN, Q_3=350kN, Q_4=250kN, Q_5=500kN, Q_6=400kN, Q_7=400kN, Q_8=500kN, Q_9=250kN	5
3A.	A steel pile of 500mm outside diameter with a wall thickness of 25mm is driven in loose sand to a depth of 12m. The saturated unit weight of sand is 18.5 kN/m^3 and the angle of internal friction is 30°. The EI of the pile material is 450 MN-m^2. Using Brom's method, compute the deflection of pile, if the lateral load of 250 kN is acting at 2.4 m above GL. Take η_h=4.5 MN/m^3. (Refer Fig. 3A)	3

<table>
<tr><td>3B.</td><td>What is soil nailing? List the applications of soil nailing.</td><td>3</td></tr>
<tr><td>3C.</td><td>Determine the depth of embedment and force in the anchor rod for the anchored sheet pile as (Free earth support) shown in Fig. 3B.</td><td>4</td></tr>
<tr><td>4A.</td><td>Explain briefly with a neat sketch the various components of soil reinforced retaining wall.</td><td>3</td></tr>
<tr><td>4B.</td><td>Explain factor of safety for sliding, overturning and bearing capacity failure in case of external stability of cantilever retaining wall.</td><td>3</td></tr>
<tr><td>4C.</td><td>Design a circular, cellular cofferdam of total height 10m resting on rock as shown in Fig. 4C. Check the safety against sliding, overturning and slipping. Take $\phi=30^{o}$ and $\delta=20^{o}$.</td><td>4</td></tr>
<tr><td>5A.</td><td>(a) Define (i) Amplitude (ii) Damping (iii) Natural frequency (iv) Frequency ratio
(b) Write a short note on vibration isolation</td><td>4</td></tr>
<tr><td>5B.</td><td>The following data was obtained when a cyclic plate load test was carried out on a 30 cm x 30cm plate at a depth of 1.5m deposit of sand.
<table>
<tr><td>Load intensity in kN/m²</td><td>0</td><td>25</td><td>50</td><td>75</td><td>100</td><td>150</td><td>200</td><td>250</td></tr>
<tr><td>Elastic settlement (mm)</td><td>0</td><td>0.20</td><td>0.45</td><td>0.6</td><td>0.85</td><td>1.2</td><td>1.5</td><td>1.9</td></tr>
</table>
Plot the load intensity versus elastic settlement and obtain the spring constants (Coefficient of elastic uniform compression, coefficient of elastic uniform shear and coefficient of elastic non uniform shear) for a 15 sq.m base area.</td><td>3</td></tr>
<tr><td>5C.</td><td>In a test block of size 1.5m x 1.0 m x 0.75m, resonance occurs at a frequency of 18cps in the vertical direction. Determine the coefficient of uniform elastic compression and coefficient of elastic uniform shear. If the mass of the oscillator is 40kg and the force produced by it at 10 cps is 750 N, compute the maximum amplitude. Assume the density of concrete as 2500kg/m³.</td><td>3</td></tr>
</table>

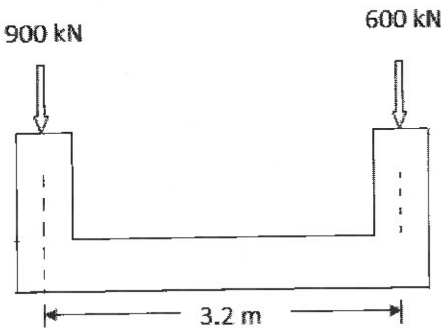

Fig. 2B

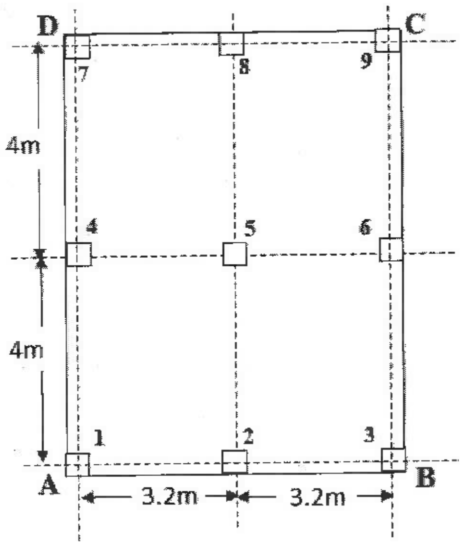

Fig. 2C

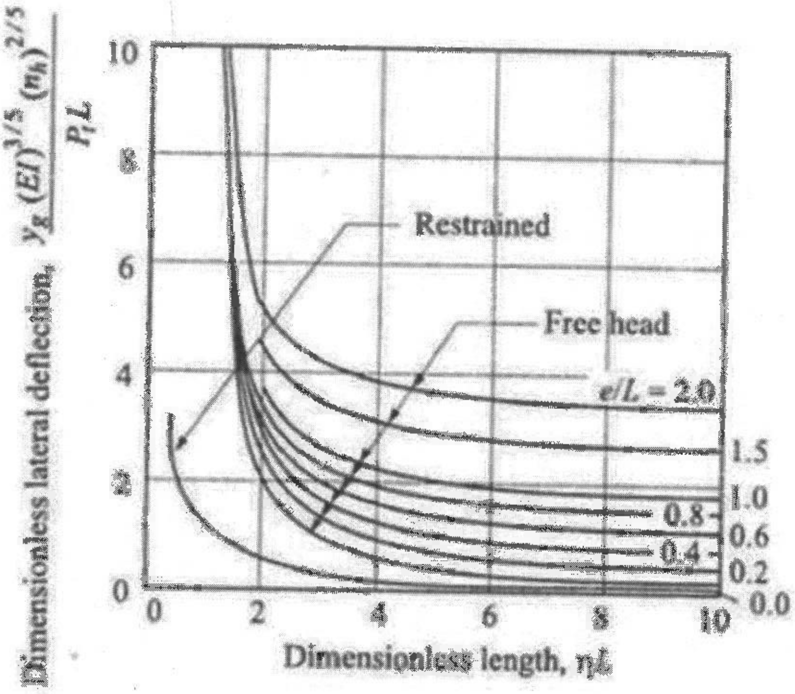

Fig. 3A

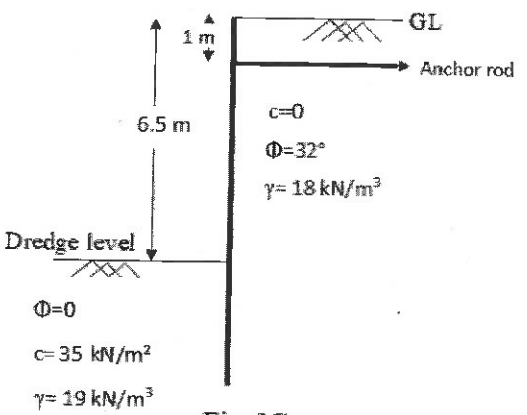

Fig. 3C

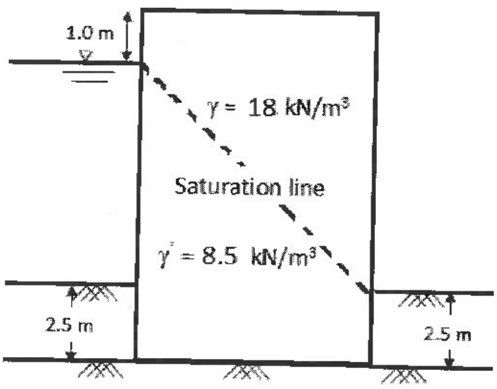

Fig. 4C