Ref No. EX/PG/CE/T/128C/2018

M.E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM. 2018

RETAINING STRUCTURES AND UNDERGROUND CONSTRUCTION(SMFE)

Time: / Three hours **Full Marks 100**

Use a separate Answer-Script for each part

1. Answer ALL questions.
2. Maintain neatness. Assume reasonable values of data if it is not supplied.
3. No code etc. will be needed to answer the questions of this part
4. Notations used bear their usual meanings

No. of Question	Part –I (40 Marks)	Marks
Q.1 a)	Explain Equivalent Beam Method with mechanistic approach for design of a sheet pile in case of anchored bulkhead .	6
b)	A sheet pile is required to be provided at a site. The relevant data are as follows: Dredge line : 12m below GL Water Table : 2m below GL Location of anchor rod : 1.0m below GL Subsoil consists of sand down to dredge line. Properties of sand : γ =19 kN/m^3, c= 0 and $\Phi = 32^0$ Soil below dredge line : purely cohesive : γ =19.0 kN/m^3, c= 45 kN/m^2 and $\Phi = 0$ i) Determine the depth of embedment to be provided ii) Find the anchor force per unit length of wall.	14
Q.2	A retaining wall, 8m high, supports a backfill (γ =20 kN/m^3, c= 0 kN/m^2 and $\Phi = 32^0$, a)Compute the total active earth pressure on the wall and also find its point of application b) Calculate the factor of safety against overturning and sliding if the details of cross section of the retaining wall are as follows: Top width=0.7m, depth below ground = 2.5m, width of wall at its junction with base = 0.8m, projection towards heel= 3.0m and that towards toe=0.8m. The wall is vertical on the side of heel and tapered on the other side. Thickness of base=0.7m.	14
Q.3	State different types of cellular cofferdams mentioning the advantages of each type	6

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MASTER OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2018
(1^{ST} YEAR 2^{ND} SEMESTER)
(1^{st} /2^{nd} Semester/~~Repeat/ Supplementary/Spl. Supplementary/Old/ Annual/ Biannual~~)
SUBJECT: RETAINING STRUCTURES AND UNDERGROUND CONSTRUCTION(SMFE)
(Name in full)

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ Full Marks ~~30~~/100

No. of Questions	PART II (MARKS 60)	Marks
	Answer all questions	
Q1	For construction of an underground metro station braced excavation was done by using 800 mm thick RCC diaphragm walls. Size of excavation : 80 m x 30 m Depth of excavation : 15 m Depth of braced wall : 20 m Take suitable vertical and horizontal position of struts. Subsoil data at the proposed site are as given below: Depth 0 – 3.0m : Brownish grey silty clay / clayey silt $\gamma = 18.5$ kN/m^3 , $C_u = 35$ kN/m^2, $m_v = 0.0004$ m^2/kN Depth 3.0 – 16.0m : Dark grey silty clay / clayey silt with decomposed wood $\gamma = 17.0$ kN/m^3 , $C_u = 25$ kN/m^2, $m_v = 0.0006$ m^2/kN Depth 15.0 - 20.0m : Stiff / very stiff bluish / mottled brown silty clay / clayey silt with rusty spots $\gamma = 19.5$ kN/m^3 , $C_u = 75$ kN/m^2, $m_v = 0.0003$ m^2/kN Depth > 20.0m till 35.0m : Dense / very dense sand $\gamma = 20$ kN/m^3, $\varphi = 36^0$ Ground water table at a depth of 1.0m below G.L.\ (i) Check the stability of braced excavation (ii) Draw the earth diagram may develop on the soil side of the wall (iii) Determine moments and forces on the walls, wales and struts	10+10+10 = 30
Q2	(a) Check the stability of a typical 6.0m diameter tunnel with depth of the axis 14.0m below ground surface. Subsoil at the site is same as that given in Q1. (b)Discuss the term 'ground loss' with respect to tunneling through clayey soil highlighting how it governs the settlement trough at the ground level. (c)Draw the settlement trough of the ground surface above the tunnel mentioned in Q2(a). Take maximum settlement at the ground surface = 60 mm.	7+7+6 = 20
Q3	A tunnel of diameter 1.5 m is to be constructed at a depth of 6.0m below ground level (ground level to axis level). Expected ground loss = 4% of the face area. Calculate the bending strain which will develop during tunneling in a transverse pipeline of outside diameter 500 mm and wall thickness 18 mm lying above the tunnel at a depth of 1.5 m below ground level. Pipe secant modulus = 7×10^{10} N/mm^2 Soil secant modulus = 10×10^{10} N/mm^2 Soil poisson's ratio = 0.5	10