Ref. No. Ex/PG/CE/T/111C/2018

M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAMINATION 2018

ADVANCED FOUNDATION ENGINEERING (SMFE)

Time: Three Hours

Full Marks 100
(Part I: 60 Marks
Part II: 40 Marks)

Use a separate Answer-Script for each part

Question No.	Part I (60 Marks)	Marks
	*Answer **ALL** questions from this Part.* *Assume reasonable values of data, if not supplied* *No code etc will be required to answer the questions*	
Q.1 a)	What is CNS layer? In which case it is suitable to provide and why?	
b)	Illustrate with a neat sketch the use of isolating a footing below a building when expansive soil is encountered.	
c)	A drilled pier was constructed in an expansive soil. The water table was not encountered. The following data are given. Depth of unstable zone is 4m. Total shaft length is 15m., swelling pressure = 0.5 kg/cm^2, undrained shear strength= 0.40 kg/cm^2, SPT=7 per 30cm. Determine the length of pier required in the stable zone if factor of safety is 1.2 for no superimposed load and 2.2 for a superimposed load of 5 tons. Justify your answer.	5+5+10 =20
Q.2 a)	Describe vertical Block Vibration Test illustrating its application in the design of machine foundation.	8
b)	Design a block foundation with the following data. Speed of machine=420 rpm, Unbalanced vertical force = 4·5 cos wt, C_u = 3·2 × 104 KN/m^3. Permissible amplitude = 200 micron, Damping coefficient = 0·25.	12
Q.3 a)	A bridge 250 m long, is to be constructed over a river having Q_{max}= 10000 m^3/s, HFL=+81.17m; LWL=+73.00m and existing bed level=+ 72.00m. The subsoil consists of loose silty sand layer (N_{corr}=10), 3.5 m thick, underlain by a thick stratum of medium to coarse sand (N_{corr}=28). Determine normal and maximum depths of scour along with allowable bearing capacity of a 9.0m diameter abutment well. Given that the weighted mean diameter of the bed material down to relevant depth is 0.40 mm and permissible settlement is 50 mm. It is embedded down to a depth of 15 m below scour level in the lower sand deposit. (Corrected N-value = 28, unit weight = 20kN/m^3, and $\phi = 35^\circ$) (For $\phi = 35^\circ$, Nq=33.3 and Nγ=48.03). Find the stability of the well in respect of bearing capacity by method recommended in IS 6403. If the resultant horizontal force on the well is 2000 kN and the moment at base level is 38000KN-m, check the safety of the well against bearing capacity.	20

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MASTER OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2018

(1^{ST} YEAR 1^{st} SEMESTER)

(1^{st} / ~~2^{nd}~~ Semester/ ~~Repeat/~~ ~~Supplementary/Spl. Supplementary/Old/ Annual/ Biannual)~~

SUBJECT: ADVANCED FOUNDATION ENGINEERING

(Name in full)

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

No. of Questions	PART II (40 marks)	Marks
	Answer all questions	
Q1 a)	Why factor of safety is applied on ultimate bearing capacity of soil? Give typical values of factor of safety for different types of structures / construction in practice.	5
b)	A raft foundation is to be constructed for a multistoried building with a total column load of 75000 kN. Size of the raft is 25m x 30m. Subsoil stratification and properties at the site is as given below: Stratum I : Depth 0 – 3.0m : Brownish grey silty clay / clayey silt γ = 18.6 kN/m^3 , C_u = 40 kN/m^2, $C_c/1+e_0$ = 0.11, p_c = 70kN/m^2, $C_c'/1+e_0$ = 0.04 Stratum II : Depth 4.0 – 15.0m : Dark grey silty clay / clayey silt with decomposed wood γ = 16.5 kN/m^3 , C_u = 15 kN/m^2, $Cc/1+e_0$ = 0.15 Stratum III : Depth 15.0 – 24.0m : Stiff / very stiff bluish / mottled brown silty clay / clayey silt with rusty spots γ = 19.5 kN/m^3 , C_u = 75 kN/m^2, $C_c/1+e_0$ = 0.09 Stratum IV : Depth 24.0m - 30.0m : Dense / very dense sand γ = 20 kN/m^3, $\varphi = 36^0$ Stratum III : Depth 30.0 – 50.0m : Hard/ very hard brownish grey silty clay / clayey silt γ = 20.5 kN/m^3 , C_u = 140 kN/m^2, $C_c/1+e_0$ = 0.06 Ground water table at a depth of 1.0m below G.L. Design the raft foundation considering the following aspects: a. Depth of foundation b. Bearing capacity c. Settlement	15
Q2	Determine the capacity of a single bored pile of diameter 600mm constructed in the subsoil deposit given in Q1(b) with pile tip at 25 m and cut off level at 2m below existing ground level. Using the capacity of single pile as well as group action, determine the safe capacity of a 3 x 3 pile group. Also estimate the consolidation settlement of the pile group.	20