Ref No. EX/CE/5/T/505A/2018(Old)

B.ECIVIL ENGG (Part Time) Fifth YEAR SECOND SEMESTER. (Old) 2018

(~~1st~~ /2nd-Semester/~~Repeat/Supplementary /Spl. Supplementary /Old/Annual/Bi Annual~~)

SUBJECT: **ADVANCED FOUNDATION ENGINEERING**

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

(~~15~~/50 marks for each part)

Use a separate Answer-Script for each part

1. Answer All questions.
2. Assume reasonable values of data if not supplied.
3. No code etc. will be needed to answer the questions of this part

No. of Question	Part – I	Marks
Q.1	A 3.50m wide vertical cut is to be made down to a depth of 13.0m below Ground level using struts and Diaphragm wall. The subsoil is soft clay of unit wt. 1.8t/m^3 and undrained strength of 2.5 t/m^2. The first strut is placed at a depth of 2.0m and the subsequent struts at 4.0m interval. Bottom of cut is at3m below the last strut. Horizontal spacing of strut is 3.0m. Find out the load on each strut and also check the factor of safety against bottom heave. Take Nc= 8	15
Q.2 a)	What is critical damping and damping factor? What is the use of frequency ratio in machine foundation design?	(3+2)+5=10
b)	A block of size 1.0 m × 2.0 m ×1 m high is undergoing vibration. The weight of motor oscillator= 2.1 kN, vertical unbalanced force= 50 kN, Cu= 3× 10^4 kN/ m^3, ξ= 0.25. Find the natural frequency of vibration and also the frequency for frequency ratio of 0.5. Then find the amplitude of vibration	10
Q.3	The subsoil profile at a site consists of soft grey silty clay with decomposed wood (γ=18 kN/m^3,Cu=20 kN/m^2, Cc/1+e_0=0.14) down to 10m below GL followed by stiff to very stiff layer of bluish to yellowish grey silty clay (γ=19.5 kN/m^3,Cu=8 kN/m^2, Cc/1+e_0=0.11).The ground water table is near the ground surface. A 25m diameter x 19m high steel oil storage tank is proposed to be built at the site with a 1m thick sand pad with projection of l m on each side at base of the tank. The side slope of sand pad is 1:1 Consider 1st stage preloading with sand (γ=20 kN/m^3) with a height of 3m for ground improvement by stone column of 500 mm diameter installed in triangular grid. Find the allowable load to be carried by stone column, area ratio and bearing capacity of treated ground. Check whether the ground is capable of carrying the superimposed load. Given that ground water table is 1m below GL, K=4 and ϕ =38^0.	15

B. CIVIL ENGINEERING (PART TIME) FIFTH YEAR SECOND SEMESTER (Old) – 2018

ADVANCED FOUNDATION ENGINEERING

Time: Three Hours

Full Marks 100
Part I: 50 Marks
Part II: 50 Marks

Use Separate Answer-Scripts for each Part

Question No.	PartII (50 Marks)	Marks

Answer ANY TWO questions from this Part. Assume reasonable values of data, if not supplied.

1. a) Describe the various components of a well foundation with the help of a neat sketch. What are their uses? 5+3

   b) Discuss the causes and remedies for tilts and shifts during construction of wells. 7

   c) A circular well of 6 m external diameter and 4 m internal diameter is embedded to a depth of 15 m below the maximum scour level in a sandy soil deposit. The well is subjected to a horizontal force of 800 kN acting at a height of 8 m above the scour level. Determine the allowable equivalent resisting force assuming the well foundation to be a (i) light well, (ii) heavy well. Take $\gamma_{sat} = 20$ kN/m^3, $\varphi = 30^0$, factor of safety = 2. 10

2. a) Explain the working of a single-stage well point system with the help of a neat sketch. What are its limitations? 5+2

   b) Derive the expression for discharge from a fully penetrating slot under gravity flow. 8

   c) Design an open well in coarse sand (specific yield = 1.0 m^3/hr/m^2 under unit drawdown) for a yield of 0.003 m^2/s, when operated under a depression head of 3.0 m. 5

   d) A slot is made in a confined aquifer 2 m thick to drain water. The flow to the slot occurs from both sides. If the water table is at a height of 10 m above the base and the drawdown is 3 m, find the discharge per metre length, assuming that the distance of the slot from both sides is 120 m. Assume coefficient of permeability = 4×10^{-4} m/s. 5

3. a) What is swell pressure? What is its significance? 2+3

   b) What is an under-reamed pile? What are its design criteria? 2+3

   c) What are the effects of swelling of soils on buildings? 5

   d) A double under-reamed pile is installed in a soft clay deposit. The centre of the first bulb is located at a depth of 15 m from the ground surface and the spacing between the centres of the two bulbs is 4 m. The diameters of the pile shaft and bulb are 1.0 m and 2.5 m respectively. If the depth of active zone is 3 m, determine the allowable load with a factor of safety 2.5. Assume adhesion factor for side friction = 0.9, undrained strength at the bulb = 130 kN/m^2, undrained strength at the base = 150 kN/m^2, and average undrained strength on shaft = 100 kN/m^2. 10