

**BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR**  
**SECOND SEMESTER EXAM 2019**  
**ADVANCED FOUNDATION ENGINEERING**

Time: Three hours,

Full Marks:100

Use a separate Answer-Script for each part

Page : 1 of 1

1. Answer all questions
2. Assume reasonable values of data if it is not supplied.
3. No code is allowed

No. of Question	Part I (50 Marks)	Marks
Q.1	<p>A 5m x8m deep trench is excavated in medium clay for the foundation of a multistoried building with basement.</p> <p>The sides of the trench are supported with sheet pile walls fixed in place by struts and wales. The first row of strut is located at 3.0m below GL and bottom of cut is located at 2m below bottommost (2nd) row of strut, which is placed at 6m below GL. In each row horizontal spacing of strut is 2.8m centre to centre The soil parameters are as follows:</p> <p><math>\gamma = 19.5 \text{ kN/m}^3</math>, <math>c = 30 \text{ kN/m}^2</math> and <math>\phi = 0^\circ</math></p> <p>Determine: (i) The pressure distribution on the walls with respect to depth and (ii) the strut loads.(iii) Factor of safety against bottom heaving if <math>N_c = 6.7</math> and <math>7.2</math> for <math>H/B = 1</math> and <math>2</math> respectively and for <math>L/B = 3</math>. Take length of cut = 15m</p>	15
Q.2	<p>A 24m diameter x 15.5m high steel oil storage tank is proposed to be built at a site with a 1m thick sand pad with projection of 1m on each side at base of the tank. The side slope of sand pad is 1:1. The subsoil profile at the site consists of soft grey silty clay (<math>\gamma = 18 \text{ kN/m}^3</math>, <math>C_u = 25 \text{ kN/m}^2</math>, <math>C_v / (1 + e_0) = 0.15</math>) down to 12m below GL followed by stiff layer of bluish grey silty clay (<math>\gamma = 19 \text{ kN/m}^3</math>, <math>C_u = 80 \text{ kN/m}^2</math>, <math>C_v / (1 + e_0) = 0.08</math>) down to 15m below GL. The ground water table is near the ground surface. The formation level of the ground is to be raised by 1.5m thick sand fill prior to construction. The ground is to be treated by stone column of 500mm diameter with centre to centre spacing of 1m installed in triangular grid. Find the load bearing capacity of individual stone column, bearing capacity and settlement of treated ground. Take stress concentration ratio, <math>n = 5</math></p>	15
Q.3 a)	What is damping factor and how it can be obtained from Block Vibration Test?	8
b)	<p>Design a block foundation with the following data :</p> <p>Speed of machine = 420 rpm, Unbalanced vertical force = 45 kN, <math>C_u = 3 \times 10^4 \text{ kN/m}^3</math>, Permissible amplitude = 200 micron and damping factor = 0.25</p>	12

**B. E. (CIVIL ENGINEERING) PART TIME FIFTH YEAR SECOND SEMESTER – 2019****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.	Part II (50 Marks)	Marks
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*Answer ANY TWO questions from this Part. Assume reasonable values of data, if not supplied.*

1. a) Derive the expression for obtaining equivalent resisting force due to earth pressure for a light well using Terzaghi's analysis. 10
- b) A bridge 120 m long is to be constructed over a river having  $Q_{\max} = 2418 \text{ m}^3/\text{s}$ . Given H.F.L = 81.17 m and existing bed level = 72 m. The subsoil consists of loose silty sand layer ( $N_{\text{corr}} = 10$ ) 3.5 m thick, underlain by a thick stratum of medium to coarse sand ( $N_{\text{corr}} = 24$ ). Determine the maximum scour depth near the bridge abutment, the founding level and allowable bearing capacity of the abutment well of 4.5 m diameter. The weighted mean diameter of the bed material is 0.275 mm and the permissible settlement is 45 mm. 15
2. a) Explain the working of a multi-stage well point system with the help of a neat sketch. What are its limitations? 5+2
- b) A slot is made in an unconfined aquifer to drain water. The flow to the slot occurs from one side only. If the water table is at a height of 12 m above the base and the drawdown is 4 m, find the discharge per metre length, assuming that the distance of the slot from both sides is 120 m. Take  $k = 6 \times 10^{-4} \text{ m/s}$ . 10
- c) Write short notes on (a) Vacuum well points, (b) Deep well system. 4+4
3. a) Define swelling potential. How would you classify expansive soils based on swelling potential? 2+3
- b) Write short notes on (a) Free swell, (b) Differential swell. 5
- c) A single under-reamed pile is installed in a soft clay deposit. The centre of the under-ream is located at a depth of 15 m from the ground surface. 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,  $\alpha = 1.0$ . The undrained shear strength of the soil is given by the relation,  $c_u = 56 + 7D$ , where  $c_u$  is in  $\text{kN/m}^2$  and  $D$  is the depth of soil in metres. 15