Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18CE3028** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ADVANCED DESIGN OF FOUNDATION STRUCTURES** | **Max. Marks :** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Marks** |
|  |  | **ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)** |  |  |
| 1. | a. | List the precautions to be taken while locating a footing;  (i) on a slope and  (ii) adjacent to an existing structures. | CO1 | 4 |
| b. | Analyze the requirements of a good foundation to ensure structural integrity and economy. | CO1 | 4 |
| c. | Discuss with a neat sketch Dynamic Cone Penetration test. | CO1 | 8 |
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| 2. | a. | List the classification of piles with reference to (i) material of the pile (ii) mode of load transfer. | CO2 | 3 |
| b. | An RC pile weighing 35kN (inclusive of self weight and dolly) is driven by a drop hammer weighing 45 kN and having an effective fall of 1 m. Average set per blow is 16mm. The total elastic compression observed is 18mm. Calculate the ultimate load and allowable load of the pile. Take the coefficient of restitution as 0.25 and factor of safety as 2. | CO2 | 5 |
| c. | A concrete pile of 45cm diameter is driven through a system of layered cohesive soils. The length of the pile is 16m. The following data are available. The water table is close to the ground surface.  Top layer 1: Soft clay, thickness = 8m, Cu = 30kN/ m2 α = 0.9  Layer 2: Medium stiff clay thickness = 6m, Cu = 50kN/ m2 α =0.75  Layer3: Stiff clay stratum extends to great depth, Cu.105kN/ m2 α =0.5 Compute Qu and Qa with F.S. = 2.5. | CO2 | 8 |
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| 3. | a. | Explain with a neat sketch the various components of a well foundation. | CO3 | 6 |
| b. | A cylindrical well of external diameter 6m and internal diameter 4m is sunk to a depth of 16m below the maximum scour level in a sandy deposit. The well is subjected to a horizontal force of 1000kN acting at a height of 8m above the scour level. Determine the total allowable equivalent resisting force due to earth pressure assuming that (i) the well rotates about a point above the base and (ii) the well rotates about the base. Assume submerged unit weight of sand deposit as 10kN/m3and factor of safety against passive resistance as 2. Use Terzaghi’s approach. | CO3 | 10 |
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| 4. | a. | List the design steps for the foundation of RC Chimney. | CO4 | 4 |
| b. | Discuss the special techniques that are employed for the design of foundation in expansive soil. | CO4 | 4 |
| c. | Sketch an underreamed pile foundation, in an expansive clay, for a continuous load bearing wall, naming the various parts and showing the relative dimensions of the stem, and the bulb and the minimum spacing. Explain the functions of the ‘under-ream’ and the ‘air gap’. Determine the pile spacing in the above foundation, given: pile stem dia = 300 mm, Load = 80 kN/m (including the grade beam), Permissible load in compression per pile = 160 kN. Check the spacing obtained with the codal provision. | CO4 | 8 |
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| 5. | a. | List the various types of machine foundations used for different kinds of machinery. | CO5 | 4 |
| b. | Bring out the design criteria for the design of foundation for impact machines. | CO5 | 4 |
| c. | The resonant frequency of a block foundation excited by an oscillator is observed as 20 Hz. The amplitude of vibration at resonance is 1mm. The magnitude of dynamic force at 20 Hz is 5kN. If the total weight of block and oscillator is 20 kN, Calculate the damping factor associated with it. | CO5 | 8 |
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| 6. | a. | Discuss the concept of Floating foundation. | CO6 | 2 |
| b. | A rectangular footing of size of 1.8mx3m has to transmit the load of a column at a depth of 1.5m. Calculate the safe load which the footing can carry at a factor of safety of 3 against shear failure. Use IS code method. The soil has following properties: Porosity, n =40%; Specific Gravity, G=2.67; water content, w=15%; Cohesion, c =8kN/m2 ; Angle of shearing resistance ɸ =32.5°. | CO6 | 6 |
| c. | A trapezoidal footing is to support two square columns of sides 300 mm and 500 mm respectively. The centre to centre distance between two columns is 5 m and the safe bearing capacity of the soil is 400 kN/ m2.The bigger column will transmit a load of 5000kN and the smaller column transmit a load of 3000kN. Design the suitable size of the trapezoidal footing so that it does not extend beyond the column faces. | CO6 | 8 |
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| 7. | a. | List out the various factors that are to be considered for the selection of pile foundation. | CO4 | 4 |
| b. | Explain how lateral capacity of a pile is evaluated. | CO4 | 4 |
| c. | Design a pile group to carry a load of 5000 kN. The soil exploration data reveal that the sub soil consists of deposit of soft clay extending to a great depth. The other properties of clay are compression index = 0.10, initial void ratio= 0.90, Saturated unit weight = 19kN/ m3, unconfined compression strength = 40kPa. Proportion the pile group for a maximum permissible settlement of 50 mm. | CO4 | 8 |
|  | | **COMPULSORY QUESTION (1 x 20 = 20 Marks)** |  |  |
| 8. | a. | Develop the equations for stress distribution in the soil after the excavation of tunnel using elastic theory. | CO2 | 6 |
| b. | Discuss the phenomenon of arching in soils. | CO2 | 4 |
| c. | Determine the loads in the three struts shown in figure. The center to center spacing of the struts along the length of the cut is 2.50 m. The soil is stiff, fissured clay (γ=19 kN/m3, c=40 kN/m2). Also determine the maximum bending moments in Wales and sheet piles.  A  B  C  (1)  (2)  (3)  6m  1m  2m  2m  1m  E | CO2 | 10 |