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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17CE3018** | **Duration :** | **3hrs** |
| **Sub. Name :** | **DESIGN OF SUBSTRUCTURES** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

*(Permitted BIS code books IS 6403:1981, IS 8009(Part 1):1976, IS 8009(Part II):1980, IS:2911(PartI/Sec.1) :1979and IS 456:2000)*

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | List the factors to be considered to decide the depth of subsoil exploration. | CO1 | 2 |
| b. | Discuss the effect of water table on the design of foundation. | CO2 | 4 |
| c. | Explain how undisturbed soil samples are taken. | CO2 | 6 |
| d. | Explain with a neat sketch Dynamic Cone Penetration test. | CO3 | 8 |
| (OR) | | | | |
| 2. | a. | List the various types of loads to be considered in the design of foundations. | CO1 | 2 |
| b. | What are the responsibilities of a foundation engineer in providing good foundation? | CO2 | 4 |
| c. | Explain the steps involved in subsoil exploration. | CO2 | 6 |
| d. | Classify the foundation systems and explain how do you select the type of foundation. | CO3 | 8 |
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| 3. | a. | Sketch the shear failure modes of foundation soil. | CO1 | 3 |
| b. | Explain the design requirements of shallow foundation. | CO2 | 5 |
| c. | Discuss the factors affecting bearing capacity. | CO2 | 6 |
| d. | A 30cm square bearing plate settles by 8mm in the plate load test on cohesionless soil, when the intensity of loading is 180kN/m2  . Estimate the settlement of a shallow foundation of 1.6m square footing under the same intensity of loading and resting on same soil stratum 3m thick. | CO4 | 6 |
| (OR) | | | | |
| 4. | a. | List the causes for foundation settlement. | CO1 | 2 |
| b. | Distinguish between settlement behavior of foundation in sand and the foundation inclay. | CO2 | 4 |
| c. | Calculate the immediate settlement of a rigid footing of size 2.4X1.2 m in clay loaded at 200 kN/m2 assuming E=5000 kN/m2 poissons ratio = 0.25. | CO3 | 6 |
| d. | A soft normally consolidated clay layer is 18m thick. The natural water content is 45%. The saturated unit weight is 18 kN/m3 . The grain specific gravity is 2.7. The liquid limit is 63%. The vertical stress increment at the centre of the layer due to foundation load is 9kN/ m2. The ground water level is at the surface of the clay layer. Determine the settlement of the foundation. | CO4 | 8 |
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| 5. | a. | Explain the situations that require different types of combined footings. | CO2 | 2 |
| b | Explain where do you provide floating type raft foundation . | CO3 | 2 |
| c. | Discuss the methods of analysis of raft foundation. | CO5 | 8 |
| d. | A 1.5 m wide strip footing is resting on a sandy soil stratum having unit weight of soil Yd = 18 kN/m3  , Ysat = 21 kN/m3 , ɸ = 35°, and c =0 and its base at a depth of 1.5 m from ground level. Determine the safe bearing capacity of the footing if the ground water table is located (a) at a depth of 1m below the ground surface and (b) at a depth of 1.0 m below the base of the footing. Use a factor of safety of 2 and bearing capacity factors. | CO5 | 8 |
| (OR) | | | | |
| 6. | a. | Distinguish between the bearing capacity of raft on sand and raft on clay. | CO5 | 3 |
| b. | Explain the situations that require raft foundation. | CO5 | 3 |
| c. | Explain the method of proportioning strap footing. | CO3 | 4 |
| d. | A building has to be supported on a R.C. raft foundation of dimensions 14 m X 25 m. The subsoil is clay having an average unconfined compressive strength of 30 kN/m2  . The pressure on the soil due to weight of the building and the loads that it carry will be 150kN/m2 at the base of the raft. If the unit weight of the excavated soil is 19 kN/m3 , at what depth should the bottom of the raft be placed to provide a factor of safety of 3 against shear failure?. | CO5 | 10 |
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| 7. | a. | List the types of piles based on their function. | CO1 | 2 |
| b | Distinguish between driven and bored precast concrete pile. | CO2 | 2 |
| c. | A 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. Determine the ultimate load allowable load of the pile. Take the coefficient of restitution as 0.25 and factor of safety as 2. | CO6 | 8 |
| d. | In a two layered cohesive soil, bored piles of 400mm are installed. The top layer has a thickness of 5m and bottom one is of considerable depth. The shear strength of the top clay layer is 45kN/m2 and that of the bottom is l00 kN/m2. Determine the length of the bored pile required to carry a safe load of 380kN allowing a factor of safety of 2.0. | CO6 | 8 |
| (OR) | | | | |
| 8. | a. | Explain where does negative skin friction occur. | CO2 | 2 |
| b. | Distinguish between displacement pile and non-displacement pile. | CO2 | 2 |
| c. | A group of nine piles 300 mm diameter arranged in three rows are spaced at 1 m c/c. Determine the group capacity of the pile unit and the efficiency of pile group, if the single pile capacity is 300Kn. | CO6 | 6 |
| d. | Design a friction pile group and find out the settlement of the same for the following data:  i.Load including the weight of pile cap = 2500 KN.  ii.The depthof uniform clay underlain by rock = 18 m.  iii. Average unconfined compressive strength of clay = 60 KN/m2  iv. Liquid limit of the clay = 55 %  v. Factor of safety against shear = 2.5  Assume that the load is to be transferred for two-third of the length of pile. | CO6 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Discuss Terzaghi’s method of analysis and design of well foundation. | CO5 | 10 |
| b. | Explain the general concept of design of tower foundation with neat sketches. | CO5 | 10 |