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

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

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| **Code :** | **17CE2013** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FOUNDATION ENGINEERING** | **Max. Marks :** | **100** |

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

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| **Q.**  **No.** | **Sub**  **Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Define significant depth of exploration. | CO1 | 2 |
| b. | Name a suitable method of site investigation for a highway project to assess the suitability. | CO1 | 2 |
| c. | List the various methods of boring for soil exploration and explain any one method in detail with necessary diagram. | CO1 | 8 |
| d. | What is a bore log report? What are the essential points to be included in a bore log report? | CO1 | 8 |
| **(OR)** | | | | |
| 2. | a. | State the difference between disturbed and undisturbed soil sample. | CO1 | 2 |
| b. | Calculate the significant depth of exploration from ground level for a  cluster of three footings of 1.2 m square and depth of footing 1.5 m placed close to each other. The center to center distance between the footings is 1.0 m. | CO1 | 2 |
| c. | What are the design features of a good soil sampler? Explain in detail with suitable diagram. | CO1 | 8 |
| d. | What is geophysical methods of site investigation? Explain any one of the methods in brief. | CO1 | 8 |
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| 3. | a. | What is presumptive bearing capacity? | CO2 | 2 |
| b. | Describe the different modes of shear failure in detail with diagrams. | CO2 | 3 |
| c. | Define settlement and mention its types. | CO2 | 3 |
| d. | A square footing 2.2 m size is laid at a depth of 1.20 m in a cohesionless soil. Calculate the net ultimate bearing capacity of the soil by IS code method. Take unit weight of soil 20 kN/m3 and angle of internal friction of sand is 350. Assume position of water table at a depth of 0.6 m and 1.20 m from ground level. Consider,***Nc* = 46.12, *Nq*= 33.3, *Nγ* = 48.03** and ***Sc*= 1.3, *Sq*= 1.2 , and *Sγ* = 0.8.** Depth and inclination factors may be assumed as 1.0. | CO2 | 12 |
| **(OR)** | | | | |
| 4. | a. | Why shape factors are incorporated while calculating bearing capacity of soil? | CO2 | 2 |
| b. | What is the limitations of plate load test? | CO2 | 3 |
| c. | Suggest some remedial measures to reduce settlement of footings. | CO2 | 3 |
| d. | Explain in detail, how standard penetration test (SPT) is conducted. Using the  SPT test data how will you estimate the bearing capacity of soil? | CO2 | 12 |
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| 5. | a. | What is the minimum depth of foundation as per I S Code? | CO4 | 2 |
| b. | Differentiate between strip and strap footing. | CO4 | 3 |
| c. | It is proposed to construct a combined footing for a structure having  two columns positioned 6 m center to center spacing. The heavier column 0.5 m x 0.5 m carries a load of 2200 kN and is close to boundary line. The lighter column 0.4 m x 0.4 m carries a load of 1400 kN. Assume allowable soil pressure as 200 kN/m2. Design a suitable footing to support the columns. Supplement the design with necessary diagrams. | CO4 | 10 |
|  | d. | Suggest a suitable foundation for the following cases of soil profile.   1. Black cotton soil extending for a depth of 15 m approximately from ground level. 2. Compact sand deposit extending to a great depth. 3. Loose sand extending to a great depth. 4. Hard clay extending to a great depth. 5. Recently formed compressible fill. | CO3 | 5 |
| **(OR)** | | | | |
| 6. | a. | State the important principle based on which a footings are designed. | CO4 | 2 |
| b. | Enlist the various types of loads to be taken into account while designing a foundation. | CO4 | 2 |
| c. | What is mat foundation and what are the types of it? Explain in detail different types of mat foundations with suitable diagrams mentioning its applicability. | CO4 | 6 |
| d. | It is proposed to construct a combined footing for a structure having two columns positioned 5 m center to center spacing. The lighter column 0.3 m x 0.3 m carries a load of 500 kN and is close to boundary line. The heavier column 0.4 m x 0.4 m carries a load of 1000 kN. Assume allowable soil pressure as 120 kN/m2. Design a suitable footing to support the columns. Supplement the design with necessary diagrams. | CO4 | 10 |
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| 7. | a. | Describe Culmaan’s graphical method of estimation of active earth pressure behind a retailing wall with a neat diagram. | CO5 | 10 |
| b. | Estimate the passive earth pressure behind a retailing wall of height 6m having a smooth vertical back. The backfill soil is having a cohesion value of 20 kN/m2 and angle of internal friction is 30o. Draw the pressure distribution diagram and locate the point of application of resultant pressure from toe. | CO5 | 10 |
| **(OR)** | | | | |
| 8. | a. | Define plastic equilibrium of a soil mass. | CO5 | 2 |
| b. | Distinguish between active and passive earth pressure. | CO5 | 2 |
| c. | State the assumptions made in Rankine’s earth pressure theory. | CO5 | 4 |
| d. | Estimate the active earth pressure behind a retailing wall of height 5 m having a smooth vertical back. The top layer of the backfill soil is cohesionless with angle of internal friction is 30o. Thickness of top layer is 3.0 m. The bottom layer of the backfill soil is having ɸ =33o. Draw the pressure distribution diagram and locate the point of application of resultant pressure from toe. | CO5 | 12 |
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| **Compulsory:** | | |  |  |
| 9. | a. | Enlist various types of deep foundation. | CO6 | 2 |
| b. | How load carrying capacity of piles are estimated? Explain in detail. | CO6 | 2 |
| c. | State Feld’s rule and where is it used? Estimate the efficiency of a group of 25 piles arranged in a square pattern. Assume diameter of piles as  30 cm and spacing between piles is 1.0 m center to center. | CO6 | 4 |
| d. | It is proposed to provide pile foundation for a heavy column. The pile group consisting of sixteen piles, spacedat 0.8 m center to center forming a square pattern. The underground soil is clay, having undrained cohesion at surface as 80 kN/m2, and at a depth of 10 m, is 120 kN/m2. Compute the allowable column load on the pile cap, if the piles are circular having diameters 0.4 m each and length as 10 m. Use shear mobilization factor as 0.65 and *Nc* =9.0. | CO6 | 12 |