Roll No.

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M.Tech. (Soil Mechanics & Foundation Engineering) (Sem.–2) STRUCTURAL DESIGN AND FOUNDATION ENGG. Subject Code : CESE-16 M.Code : 37206 Date of Examination : 15-12-22

Time: 3 Hrs.

Max. Marks: 100

INSTRUCTIONS TO CANDIDATES :

- 1. Attempt any FIVE questions out of EIGHT question.
- 2. Each question carry TWENTY marks.
- 1. Two reinforced concrete columns 800 mm \times 800 mm and 600mm \times 600 mm in size carry axial loads of 1500 kN and 1000 kN, respectively. These columns are placed 4m apart centre to centre. The safe bearing capacity of the soil is 200 kN/m². M20 grade of concrete and HYSD steel bars shall be used for the footing. Design beam and slab type rectangular combined footing. The cantilever projection available from the property line of column 1 is 1.72m.
- 2. a) How are the penetration tests useful in the estimation of point bearing and skin friction resistance of piles?
 - b) Compare the reduction in the average unit pressure on a horizontal plane immediately below the tips of 9m long, 450 mm dia. Friction piles embedded in clay, that will be caused by the shearing resistance C_u along the perimeter of a single pile and of a 9 pile footing as shown in figure, with that of a 36-pile footing 4 times larger with the spacing of piles *s* equal to 1.2m on centres.



3. A retaining wall with a smooth vertical back retains sand backfill for a depth of 6m. The backfill has a horizontal surface and has the following properties.

 $c' = 0, \, \phi' = 28^{\circ}; \ \gamma = 16 \text{ kN/m}^3; \ \gamma_{sat} = 20 \text{ kN/m}^3$

Calculate the magnitude of the total thrust against the wall for the conditions given below:

- a) Backfill fully drained but the top of the wall is restrained against yielding.
- b) Backfill full drained and the wall is free to yield, and
- c) Wall free to yield, water table on 3m depth and there is no drainage. Detemine the point of application of the resultant thrust for case (c).
- 4. a) For the cartilever sheet pile wall as shown in fig. Compute the depth of embedment of sheet pile. (10)



- b) What is a coffer dam. Explain the different types of coffer dam with their merits and demerits. (10)
- 5. What are the various types of foundations used for transmission line towers. Explain the method of selecting a proper type of foundation. Illustrate your answer with neat sketches. How is the safety of a tower foundation checked against uplift?
- 6. a) Sketch a typical cross-section of abundment and indicate the forces acting on the abundment. (10)
 - b) State how you would determine the depth of foundation for a pier of a bridge located near the mouth of pier. (10)
- 7. A circular well of 5m external diameter and staining thickness 1m is used as foundation for a bridge pier in a sandy stratum. The submerged unit weight of sand is $1.0 < m^3$ and the angle of shearing resistance $d = 30^\circ$. The well is subjected to a horizontal force of 50 < and a total moment of 500 < m at the scour level. The depth of well below scour level is 12 m. Assuming the well to be light, check the lateral stability of the well.
- 8. Write short notes on any **two** :
 - a) Basement Walls b) Function of sub-structure of bridge c) Floating foundation.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.