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CE 1818 PE 41

Roll No. of candidate

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BINA CHOWDHURY CENTRAL LIBRARY  
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Azara, Haikhowapara,  
Guwahati - 781017

2022

B.Tech. 8<sup>th</sup> Semester End-Term Examination

DESIGN OF SUBSTRUCTURES

CE

(New Regulation 2017 - 18 & New Syllabus 2018 - 19)

Full Marks - 70

Time - Three hours

Use of Design Aid to IS 456-978, IS: 456-2000, IS:1893-2016, IS:1893-pt 3-2014, IS:13920-2016, IS 2314-1986 and IRC 78-2014 is allowed

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)
- (i) For a column of size 300mm × 450mm, the probable size of the footing is
- (a) 1.2m × 1.2m (b) 1.2m × 1.5m  
(c) 1.2m × 1.8m (d) None of the above
- (ii) If the cantilever projection of an isolated footing, from the face of the column is less than the effective depth of the footing, then the footing will not fail by
- (a) Bending (b) One way shear  
(c) Two-way shear (d) All of the above
- (iii) Trapezoidal combined footing is provided when \_\_\_\_\_
- (a) The soil pressure below the footing is trapezoidal  
(b) Difference in load in the two adjacent columns is very high  
(c) There is a set-back restriction  
(d) All of the above
- (iv) In a rectangular combined footing, if the line of action of the resultant action force does not coincide with that of the resultant reaction force from the soil, the pressure distribution of soil will be
- (a) Rectangular (b) Triangular  
(c) Trapezoidal (d) None of the above

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- (v) The minimum thickness of the pile cap should be \_\_\_\_\_
- (a) 150mm (b) 300mm  
(c) 450mm (d) None of the above
- (vi) A bridge pier may be subjected to \_\_\_\_\_
- (a) Vertical load  
(b) Horizontal load along the length of the bridge  
(c) Horizontal load perpendicular to the length of the bridge  
(d) All of the above
- (vii) A pile group shall be considered to have fixed head condition if \_\_\_\_\_
- (a) The top soil is very stiff  
(b) The piles are connected by grade beams at top  
(c) The rigid pile cap of the pile groups are connected by grade beams  
(d) Any one of the above
- (viii) When a pile in a group is found to fall just short of the load required to be carried by it, an over load of \_\_\_\_\_ percent of the pile capacity may be allowed in each pile.
- (ix) The minimum percentage of reinforcement in a bored and cast-in-situ pile is \_\_\_\_\_
- (x) Minimum amount of vertical reinforcement in the steining of an R.C.C. well is \_\_\_\_\_
- (a) 0.2% (b) 0.3%  
(c) 0.4% (d) 0.8%

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2. A column  $400\text{mm} \times 400\text{mm}$  in size carries an axial load of  $400\text{kN}$  and a uni-axial moment of  $50\text{ kNm}$ . The safe bearing capacity of the supporting soil at a depth of  $1.5\text{m}$  from existing ground level is given as  $120\text{ kN/m}^2$ . Proportion the footing and design the footing for one way shear consideration only. (15)
3. Two columns  $500\text{mm} \times 500\text{mm}$  in size carry axial loads of  $600\text{kN}$  and  $400\text{kN}$  respectively. The columns are spaced at centre-to-centre distance of  $3.0\text{m}$ . The safe bearing capacity of the supporting soil is given as  $125\text{ kN/m}^2$ . Proportion a beam and slab type of combined footing and design the central beam connecting the two columns against bending moment consideration only. (15)
4. Two columns  $500\text{mm} \times 500\text{mm}$  and  $300\text{mm} \times 300\text{mm}$  in size carry axial loads of  $700\text{kN}$  and  $450\text{kN}$  respectively. There is a set back restriction of  $1.5\text{m}$  from the outer face of the larger column. The S.B.C. of the supporting soil is  $100\text{kN/m}^2$ . Proportion a beam and slab type trapezoidal combined footing to support the two columns. Design the slab of the combined footing. (15)



5. 12 columns  $400\text{mm} \times 400\text{mm}$  in size are arranged in a  $3 \times 4$  pattern, with a centre-to-centre distance between the columns as  $6.0\text{m}$ . The corner columns carry axial loads of  $450\text{kN}$  each, other exterior columns carry axial loads of  $600\text{ kN}$  each and the interior columns carry axial load of  $750\text{kN}$  each. The columns are to be supported by a raft. To reduce the thickness of the raft slab, intermediate secondary beams are introduced. Proportion the raft slab. Design a primary beam in the short direction. Given, the safe bearing capacity of the supporting soil as  $45\text{ kN/m}^2$ . (15)
6. A column of size  $500\text{mm} \times 700\text{mm}$  carries an axial load of  $700\text{kN}$  and biaxial moments of  $65\text{kNm}$  about the shorter side of the column and  $50\text{ kNm}$  about the longer side of the column respectively. The column is to be supported by a  $3 \times 5$  pile group of  $450\text{mm}$  diameter piles. Calculate the maximum and minimum load in the piles of the pile group. (15)
7. A twin D well, to be placed in a boulderous strata, has a depth, below the top of the well cap, of  $30.0\text{m}$ . The smaller dimension of the twin D well, in plan, is  $6.0\text{m}$  and the longer dimension is  $10.0\text{m}$ . Calculate the minimum thickness of the well steining. (15)

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