

Total No. of printed pages = 4

**CE 1318E031**

BINA CHOWDHURY CENTRAL LIBRARY  
(GIMT & GIPS)

Roll No. of candidate

Azara, Hatkhowapara, Guwahati - 781017									
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**2019**

**B.Tech. 8th Semester End-Term Examination**

**DESIGN OF SUB-STRUCTURES**

**Elective – III (Departmental)**

Full Marks – 100

Time – Three hours

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

(Use of design aid to IS : 456–1978, IS : 456–2000 is allowed)

Answer Question No. 1 and any *six* from the rest.

1. Fill up the blanks. (10)
  - (i) The horizontal distance from the lower edge of the footing to the sloping surface shall be at least \_\_\_\_\_ cm for rock and \_\_\_\_\_ cm for soil.
  - (ii) \_\_\_\_\_ footing is used in load bearing masonry construction.
  - (iii) As per IS: 1904 - 1986 the minimum factor of safety for stability of structure against sliding and overturning is \_\_\_\_\_
  - (iv) When the soil is having poor safe bearing capacity and building loads are heavy, the footing type used is \_\_\_\_\_
  - (v) In case of isolated slopped footing the minimum edge thickness of the footing slab is \_\_\_\_\_

[Turn over

- (vi) A circular pile is designed as a long column if the ratio of effective length to diameter is greater than \_\_\_\_\_
- (vii) The critical section for checking of punching shear for a shallow footing having effective depth "d" is at a distance \_\_\_\_\_ from the face of the column.
- (viii) In the design of a raft foundation the main beams connecting the columns are called as \_\_\_\_\_ beams.
- (ix) To check sliding of a retaining wall \_\_\_\_\_ is provided to develop passive resistance.
- (x) Minimum depth of foundation required can be estimated using \_\_\_\_\_ Theory.

2. An isolated footing for a column 400 mm × 400 mm in size, is carrying an axial load of 500 kN and an uniaxial moment of 50 kNm. The Allowable bearing pressure of subsoil is 140 kN/m<sup>2</sup>. Using M20 grade of concrete and Fe415 HYSD bars,

- (a) Proportionate the footing and determine the reinforcement to be provided. (10)
- (b) Check for 1-way shear and punching shear. (5)

3. A combined footing (trapezoidal beam-slab type) for two columns 400 mm × 400 mm in section each carrying 600kN and 400kN respectively spaced at 4.0m centre to centre. The allowable bearing pressure for subsoil is 130kN/m<sup>2</sup>. The projection of the footing beyond the heavier column face is to be restricted at 150 mm.

- (a) Proportionate the footing. (7)
- (b) Design the footing slab and check for shear. (8)

4. Two columns having cross section of  $300 \text{ mm} \times 300 \text{ mm}$  are loaded with  $300 \text{ kN}$  and  $500 \text{ kN}$  respectively. The centre to centre distance between the columns is  $4 \text{ m}$  and bearing capacity of soil is  $100 \text{ kN/m}^2$ . Design a rectangular combined footing without beam. (15)
5. A structure consists of 12 columns of  $400 \text{ mm} \times 400 \text{ mm}$  size arranged in three rows of four each. The distance between columns is  $5.0 \text{ m}$  each. The load carried by corner and exterior columns is  $550 \text{ kN}$  each and that carried by interior columns is  $800 \text{ kN}$  each. The SBC of soil is  $50 \text{ kN/m}^2$ .
- (a) Proportionate a raft foundation and design the raft slab.
- (b) Design one of the secondary beams. (9 + 6)
6. Design a pile group consisting of RCC piles for a column of size  $650 \text{ mm} \times 650 \text{ mm}$  carrying load of  $5000 \text{ kN}$ . Consider  $600 \text{ mm}$  diameter piles with overall length of  $18 \text{ m}$ . Allowable load of a single pile may be taken as  $142 \text{ kN}$ . (15)
7. A RCC column of size  $400 \text{ mm} \times 400 \text{ mm}$  carrying a load of  $600 \text{ kN}$  is supported on three piles of  $400 \text{ mm} \times 400 \text{ mm}$  in section. The centre to centre distance between piles is  $1.5 \text{ m}$ . Design a suitable pile cap. (15)
8. (a) Draw typical cross sections of different types of retaining walls showing its tentative dimensions. (5)
- (b) A cantilever retaining wall is used to retain earth embankment  $4 \text{ m}$  above ground level. The unit weight of soil is  $18 \text{ kN/m}^3$  and angle of repose is  $30^\circ$ . The backfill is horizontal on top. The coefficient of friction between soil and concrete is  $0.5$ . Proportionate the retaining wall and check its stability against sliding and overturning. (10)

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CE 1318E031

[Turn over

9. (a) List different forces acting on a well foundation. (4)
- (b) What are the different reasons leading to tilt and shift of well foundation? Mention any two methods to rectify tilt. (4 + 2)
- (c) Briefly explain how finite difference technique is used for analysis of footings? (5)
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