

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E –IIst SEMESTER–EXAMINATION – JULY- 2012****Subject code: 1724302****Date: 09/07/2012****Subject Name: Analysis & Design of Foundation Systems****Time: 10:30 am – 13:00 pm****Total Marks: 70****Instructions:**

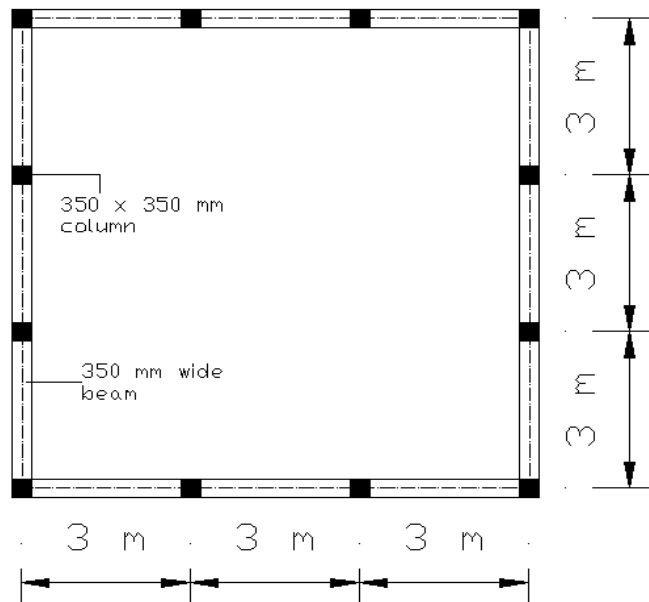
1. Question 1 is compulsory and attempt any four questions from remaining.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of Programmable calculator is strictly prohibited
5. Draw neat sketch/reinforcement detailing wherever necessary
6. Use of code IS 456 and SP 16 is permitted.

- Q.1** Explain the following with reasons in two-three lines: **14**
- (i) Why limit state method is considered better compare to working stress method.
 - (ii) Under which conditions counterfort retaining wall is preferred. What is curtailment of reinforcement?
 - (iii) What is the basic principle on which combined footings are designed?
 - (iv) In case of differential settlement problems, why raft foundation are used?
 - (v) What is the load transfer mechanism for raft foundation? How it differs from slab-beam type foundation.
 - (vi) What is the advantage of bored piles and for which type of soil conditions it is used?
 - (vii) For which soil conditions under-ream piles are preferred. What is the main function of under-ream?
- Q.2 (a)** A RCC column of size 450mm x 450mm carries a characteristic load of 680kN. The safe bearing capacity of soil is 170kN/m². Design an isolated sloped footing. The materials are M20 grade concrete and HYSD reinforcement of grade Fe415 for both column and footing. **12**
- (b)** Draw soil pressure distribution diagrams for footings resting on clayey soils, sandy soils. **02**
- Q.3** Design a slab beam type combined footing for the following data: **14**

Column	P1	P2
Size	300mm x 300mm	300mm x 300mm
Concrete	M20	M20
Main steel	4-20#	8-20#
DL & LL	450kN & 190kN	630kN & 170kN

The width of the base shall not exceed 2.0m. The safe bearing capacity of soil is 180 kN/m². Footing materials are M20 and HYSD-Fe415.

- Q.4** Design a raft foundation supporting the columns of a building. Figure 1 shows the position of the columns. The load on each column is 400kN, Use M20 concrete and F415 steel. SBC of soil is 120 kN/m². **07**



- Q.5 (a)** Explain Mat foundation. Explain in detail 'rigid method' for design of mat foundations. Also discuss concept of Winkler foundation. **07**
- (b)** Explain with equations the finite difference method for design of mat foundations. Show necessary calculations. **07**
- Q.6** Design a bored pile group in clayey soil. A column under seismic load condition is to transmit 1100kN axial load, 110kNm bending moment and 50kN shear force. Design pile foundation for the following data: **14**
 Size of column = 400mm dia
 Clayey soil with $N=7$, Cohesion $C = 75 \text{ kN/m}^2$, Unconfined compressive strength $= 0.2 \text{ N/mm}^2$, $\gamma = 17 \text{ kN/m}^3$, surcharge $= q_0 = 20 \text{ kN/m}^2$. Assume $k_s(\text{dry}) = 0.078$, $k_c = 10$, $L/D = 3.5$, $k_s(\text{submerged}) = 0.053$
- Q.7** Design a counterfort retaining wall with counterforts spaced 3m apart using M20 concrete and HYSD-Fe415 bars. Retaining wall is to hold an embankment of 5m height. The unit weight of the soil is 17 kN/m^3 and angle of internal friction is 25° . The allowable bearing capacity of the soil on which retaining wall rests is 80 kN/m^2 . Show necessary stability checks and complete reinforcement details. **14**
- Q.8** Attempt any one: **14**
- A column 400mm x 400mm in section stands on a pile cap supported on three piles. The column is situated at the centroid of the pile group. The total load transferred to the column is 800kN. The piles are 1.4m c/c. Design pile cap. Use M20 grade concrete and Fe 415 steel.
 - Elaborate the complete design of 'under ream' pile foundation with necessary calculations and sketches as per IS code.
 - State the various forces acting on well foundation. Explain in detail the analysis of various components of well foundation.

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