Enrolment No.

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

### M.E –II<sup>st</sup> SEMESTER–EXAMINATION – JULY- 2012 Subject code: 1724302 Date

Subject code: 1/24302

### Subject Name: Analysis & Design of Foundation Systems Time: 10:30 am – 13:00 pm

# Total Marks: 70

Date: 09/07/2012

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:

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- (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? What is the load transfer mechanism for raft foundation? How it differs
- (v) What is the load transfer mechanism for fait foundation? How it differs from slab-beam type foundation.
  What is the advantage of hered piles and for which type of soil conditions
- (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 12 680kN. The safe bearing capacity of soil is 170kN/m<sup>2</sup>. Design an isolated sloped footing. The materials are M20 grade concrete and HYSD reinforcement of grade Fe415 for both column and footing.
  - (b) Draw soil pressure distribution diagrams for footings resting on clayey 02 soils, sandy soils.
- **Q.3** Design a slab beam type combined footing for the following data:

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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  $180 \text{ kN/m}^2$ . Footing materials are M20 and HYSD-Fe415.

Q.4 Design a raft foundation supporting the columns of a building. Figure 1 07 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/m<sup>2</sup>.



- Q.5 (a) Explain Mat foundation. Explain in detail 'rigid method' for design of mat 07 foundations. Also discuss concept of Winkler foundation.
  - (b) Explain with equations the finite difference method for design of mat 07 foundations. Show necessary calculations.
- **Q.6** Design a bored pile group in clayey soil. A column under seismic load 14 condition is to transmit 1100kN axial load, 110kNm bending moment and 50kN shear force. Design pile foundation for the following data: Size of column = 400mm dia Clayey soil with N=7, Cohesion C = 75 kN/m<sup>2</sup>, Unconfined compressive strength = 0.2 N/mm<sup>2</sup>,  $\gamma = 17$ kN/m<sup>3</sup>, surcharge = q<sub>0</sub>= 20kN/m<sup>2</sup>. Assume k<sub>s</sub>(dry) = 0.078, k<sub>c</sub> = 10, L/D = 3.5, k<sub>s</sub>(submerged) = 0.053
- Q.7 Design a counterfort retaining wall with counterforts spaced 3m apart 14 using M20 concrete and HYSD-Fe415 bars. Retaining wall is to hold an embankment of 5m height. The unit weight of the soil is 17kN/m<sup>3</sup> and angle of internal friction is 25°. The allowable bearing capacity of the soil on which retaining wall rests is 80 kN/m<sup>2</sup>. Show necessary stability checks and complete reinforcement details.

#### Q.8 Attempt <u>any one</u>:

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- i. 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.
- ii. Elaborate the complete design of 'under ream' pile foundation with necessary calculations and sketches as per IS code.
- iii. State the various forces acting on well foundation. Explain in detail the analysis of various components of well foundation.

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