Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2724302 **Date: 24/05/2016**

Subject Name: Analysis & Design of Foundation Systems

Time:10:30 am to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
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(a) What do you understand mean by Winkler hypothesis for beams resting on elastic foundations? Compute the various equations for slope, contact pressures, deflection, moments and shear forces with their standard diagrams. **07**

(b) Explain the following with reasons: **07**

(i) Explain the suitability of various types of footings with reference to soil type. Also state limitations of each.

(ii) What difference limit state methods makes in design of foundations and why limit state method is considered to me more preferable compared to other design methods. What role soil pressure plays in any foundation design?

Q.2(a) Narrate in detail the design steps for strip footing. Support your answer with detail sketch and sample calculations. **07**

(b) A RCC column of size 450mm x 450mm carries a characteristic load of 900kN. The safe bearing capacity of soil is 175kN/m^2. Design an isolated square pad footing. The materials are M20 grade concrete and HYSD reinforcement of grade Fe415 for both column and footing. Apply all necessary checks and show complete reinforcement detailing sketch. **07**

OR

(b) A 230mm x 600mm RCC column carries a service load of 900kN and service moment of 160kNm about its major axis. The column is reinforced with 10no. 25mm diameter HYSD Fe415 grade bars and M20 grade concrete. Design an isolated slab-beam type foundation. The safe bearing capacity of soil is 180kN/m^2 at 1.8m depth. The footing materials are M20 grade concrete and HYSD reinforcement of grade Fe 415. **07**

Q.3 Attempt **<u>any two</u>** of the following: **14**

i. Define mat foundation and its various types. What is the basic difference between 'rigid method' and 'elastic plate' method for design of mat foundation?

ii. Write only design steps for design of well foundation. Assume suitable data of your own and support your answer with reinforcement detail sketch as per current practices.

iii. Explain Mat foundation. Discuss with steps finite difference method for beams resting on an elastic foundation given by Malter.

OR

Q.3 Design a suitable raft foundation supporting the columns of a building of size **14**

16m x 16m with column spaced at 4m interval. Service load transmitted by each column = 800 kN, size of column = 400mm x 400mm, take SBC of soil as 95 kN/m^2. Use M20 grade concrete and HYSD Fe415 steel.

Q.4(a) A column 300mm x 300mm 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 1.2m c/c. Design pile cap. Use M20 grade concrete and Fe 415 steel. **07**

(b) Design the driven pile if the section adopted is 300 mm diameter and length of the pile obtained from the soil design is 6 meter to support a load of 300kN. Use Fe 415 steel and M20 grade of concrete. **07**

OR

Q.4 Design a counterfort retaining wall with counterforts spaced 1.5m apart using M20 concrete and HYSD-Fe415 bars. Retaining wall is to hold an embankment of 6.0m height. The unit weight of the soil is 18.5kN/m^3 and angle of internal friction is 27°. The allowable bearing capacity of the soil on which retaining wall rests is 110kN/m^2. Show necessary stability checks and complete reinforcement details. **14**

Q.5(a) A column carrying a load of 2500kN of size 600mm x 600mm has to be supported by four piles each of size 300mm x 300mm. Assuming your own geometrical configuration such that piles are spaced at 1m centers, design pile cap using M20 grade concrete and Fe 415 grade steel. **07**

(b) Explain under reamed pile with its load transfer mechanism and stepwise structural design supported by I.S. Code for the same. **07**

OR

Q.5 Design a gravity retaining wall to retain the earth 6.0m high. The top surface is horizontal behind the wall but subjected to a surcharge of 40 kN/m^2. The soil behind the wall is a well drained medium dense sand with γ = 18.5kN/m^3 angle of internal friction Ø = 30°. The material under the wall is the same as above with SBC of 160 kN/m^2. The coefficient of friction between base and soil is 0.55. Design the wall using M20 grade concrete and HYSD Fe415 steel. Show necessary stability checks and complete reinforcement details. **14**