

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014****Subject code: 1724302****Date: 18-06-2014****Subject Name: Analysis and Design of Foundation Systems****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Use of IS: 456 and SP:16 is allowed.
3. Draw neat sketches with detailing.
4. Draw soil pressure distribution diagram where necessary.
5. Make suitable assumptions wherever necessary.
6. Figures to the right indicate full marks.

- Q.1** (a) What is under ream pile? State IS design procedure briefly with necessary equations for under-ream pile foundation. **07**
 (b) Which foundation would you prefer for oil tanks? Explain its design criteria in detail. **07**
- Q.2** (a) Explain Winkler foundation. Give solution for beams resting on elastic foundation. Support your answer showing necessary equation for slope, deflection, moment and shear force. **07**
 (b) Explain the IS criteria for reinforcement curtailment in retaining wall. **07**
- Or
- (b) A rectangular footing 2.4 m X 3.5 m size is to be constructed at 1.5 m below ground level in $c-\phi$ soil having the following properties: $\gamma = 17.5 \text{ kN/m}^3$, $\phi = 20^\circ$, $C = 10 \text{ kN/m}^2$. The footing has to carry a gross vertical load of 700 kN inclusive of its self weight. In addition, the column is subjected to a horizontal load of 110 kN. Applied at a height of 3.3 m above the base of footing. Determine the factor of safety of footing against shear failure as per I.S.-6403-1981. (For $\phi = 20^\circ$ $N_c = 14.83$, $N_q = 6.40$, $N_\gamma = 5.39$). **07**
- Q.3** Design an isolated slab-beam footing for column of size 230 X 600 mm carrying service load of 600 kN and service moment of 100 kN.m about its major axis. The column is reinforced with 8 nos. 25 mm dia. HYSD FE 415 grade bars in M25 Grade concrete. The footing materials are M 20 and Fe 415. $SBC = 180 \text{ kN/m}^2$.
 Or
- Q.3** Two columns C1 and C2 are the boundary columns of a building of size 8m x 18m in city area. Size of the columns is 230mm x 500mm spaced at 6m out to out. Column C1 and C2 carry 600 kN and 700 kN characteristics loads respectively. Design a strap footing for columns C1 and C2. SBC of soil is 250 kN/m^2 . Use M20 grade concrete and HYSD Fe415.
- Q.4** (a) Discuss the various structural features of limit state method. Define pile. State classification of pile foundation. List the merits and demerits of pile foundation. Also state the various methods of analysis of pile foundation design. **10**
 (b) Draw a detailed sketch of well foundation and show its components. Enumerate the forces for which it is designed. **04**
- Or
- Q.4** (a) Give uses of Mat foundation. Which are common types of mat foundations? List the various factors influencing settlement of mat foundation. What is the basic difference between rigid method and elastic plate method for design of mat foundation? **07**

- (b) Find length of pile (300mm dia.) in sandy clay required to support a load of 200kN. **07**
 Properties of soil are: F.S = 4, $\mu=0.35$, $\phi = 30^\circ$, $\gamma = 18 \text{ kN/m}^3$. Bearing capacity factors- $N_c = 30.1$, $N_q = 18.4$, $N_{\gamma} = 15.7$.
- Q.5** Design only stem of a counterfort retaining wall with necessary stability checks to retain a soil of height 6.5 m above ground level. Take $\gamma_s = 18 \text{ kN/m}^3$, SBC = 200 kN/m^2 , $\phi = 32^\circ$, $\mu = 0.55$, $f_{ck} = 20 \text{ MPa}$ and $f_y = 415 \text{ MPa}$. **14**
- Or
- Q.5** (a) A group of 9 piles with 3 piles in a row was driven into a soft clay extending from ground level to a great depth. The diameter and length of piles were 30 cm and 10m respectively. The unconfined compressive strength of the clay is 70 kPa. If the piles were placed 90 cm center to center, compute the allowable load on the pile group on the basis of a shear failure criteria for a factor of safety = 2.5. **10**
- (b) Describe Under-reamed pile foundation. **04**