



## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, M. Tech. - Civil Engineering (MCAD)

Semester End Examination; Dec - 2016/Jan - 2017

**Computer Aided Design of Substructures**

Time: 3 hrs

Max. Marks: 100

*Note: i) Answer FIVE full questions, selecting ONE full question from each unit.*

*ii) Assume missing data, if any.*

### UNIT - I

- 1 a. Distinguish between general and punching shear failures. 8
- b. A square footing is proposed to carry a load of 1000 kN on a ground with unit cohesion of 15 kN/m<sup>2</sup>, friction angle of 20° and unit weight of 16 kN/m<sup>3</sup> at a depth of 1.2 m below ground level. If the safety factor is 2.5, find the size of the footing. Take,

$$N_q = \tan^2 \left( 45 + \frac{\phi}{2} \right) e^{\pi \tan \phi} \quad 12$$

$$N_c = (N_q - 1) \cot \phi$$

$$N_\gamma = 2(N_q + 1) \tan \phi$$

- 2 a. Distinguish between consolidation and secondary settlements. 6

- b. A ground level water tank of radius 3 m, height 5 m and free board of 0.5 m is proposed at a site consisting of 6 m thick saturated normally consolidated clay resting on rocky stratum. The properties of clay are as follows:

Soil modulus = 20 MPa, Poisson's ratio = 0.4, Influence factor = 0.9, Natural water content = 30%, Liquid limit = 50%, Specific gravity of soil solids = 2.7, Angle of load dispersion = 45°. If the degree of consolidation is 50%, estimate the total settlement. 14

### UNIT - II

- 3 a. Discuss the methods of treatment for foundation of a light structure on B.C. Soil. 10
- b. What is liquefaction? List the ill effects of liquefaction. Discuss any two measures to mitigate against liquefaction. 10
- 4 a. Discuss the steps involved in the analysis of strip footing by soil line method. 8
- b. A 4 m long, 1 m wide and 0.6 m deep combined footing carries loads of 1000 kN each at 0.5 m from each end. Footing is made of M30 grade concrete and tests on ground with modulus of subgrade reaction of 50 MN/m<sup>3</sup>. Using finite difference approach, find the displacement at the centre. 12

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**UNIT - III**

- 5 a. Discuss a method of analysis of piles for lateral load carrying capacity. 10
- b. Explain the method of separating skin frictional component from end bearing component using cyclic pile load test. 10
- 6 a. Explain the method of evaluating the capacity of pile group. Find the group efficiency of 9 piles arranged in a square pattern equally spaced. 8
- b. A pile foundation system is proposed in a 12 m thick clayey soil having unconfined compressive strength of  $180 \text{ kN/m}^2$ . If adhesion factor is 0.8, design a pile group neglecting end bearing. Total load on foundation is 1000 kN. 12

**UNIT - IV**

- 7 a. What are the main requirements in the design of foundation for transmission line tower? 10
- b. Discuss the critical forces acting on the foundation of transmission line tower. 10
- 8 a. Discuss the basic information to be collected in the design of foundation for transmission line tower. 10
- b. Define soil-structure-interaction. What is its significance? Discuss how soil structure interaction can be considered in the design of foundations? 10

**UNIT - V**

- 9 a. Which are the dynamic properties of soil? How are they determined? 10
- b. Define 'Natural frequency' of a vibrating system. Explain Barkan's method of determining the natural frequency of foundation-soil system. 10
- 10 a. Discuss the method of analysis and design of block foundation carrying a vibrating machine. 10
- b. Resonance occurs at a frequency of 20 cycles/sec in a vertical vibration test on a block 1 m x 1 m x 1 m. Determine the coefficient of elastic uniform compression of soil given the weight of oscillator is 800 N and that the force produced by it at 10 cycles/sec is 10000 N. Find the amplitude in vertical direction at 10 cycles/ sec. 10

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