M.Tech. Structural Engineering & Construction (CBCS Pattern) Semester-II

PSES23 - Design of Substructures

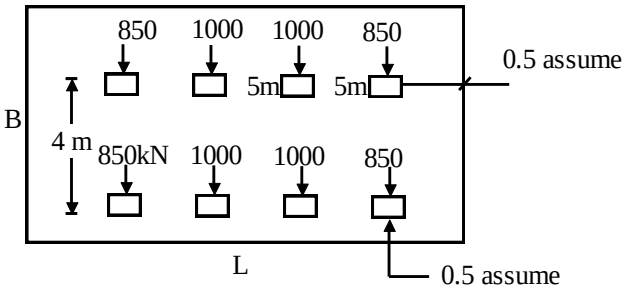
P. Pages : 1 **GUG/W/24/11015**

Time : Three Hours * 4 1 6 5 * Max. Marks : 70

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Illustrate your answers wherever necessary with the help of neat sketches.
4. Solve **any five** questions.

1. Design a combined column footing with a strap beam for two reinforced concrete columns 300 mm × 300 mm size spaced 4 m apart and each supporting a factored axial load of 750 kN. Assume the ultimate safe bearing capacity of the soil at site as 225 kN/m2. Adopt M20 grade concrete and Fe 415 HYSD Bars. **14**

2. Design a mat foundation for system of columns shown in figure. All the columns are 500 mm × 500 mm. They carry loads as indicated in figure. **14**



3. Design a friction square pile group to carry a load of 3000kN including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20m, underdrain by rock. Average cohesion of the clay is 35kN/m2 . The clay may be assumed to be of normally loaded with liquid limit 60%. A factor of safety of 3 is required against shear failure. **14**

4. Design the outside well diameter of a cassion to be sunk through 40m of sand and water bed rock if the allowable bearing capacity is 2000kN/m2. The cassion receives a load of 50000kN from the super structure. The mantle friction is 30kN/m2. Test the feasibility of sinking. Also calculate the thickness of the seal. **14**

5. Explain in detail the general criterion for the design of machine foundation. **14**

6. a) Theory of sub grade reaction, beam on elastic foundation. **7**

b) Explain the critical load conditions for a beam on elastic foundation. **7**

7. Design a cantilever retaining wall to retain earth embankment 4m height above ground level the density of earth is 18kN/m^3 and its angle of repose is 30 degrees. The embankment is horizontal at its top. The safe bearing capacity of the soil may be taken as 20018kN/m^2 and the coefficient of friction between soil and concrete is 0.5. adopt M20 grade concrete and Fe415 HYSO bars. **14**

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