



# GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

(An Autonomous Institute of Government of Maharashtra)

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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **CE404A - (Elective-I)-Advanced Structural Design**

Generated At : **18-04-2022 16:16:48**

Maximum Marks : **60**

Duration : **3 Hrs**

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**Answer Key Submission Type:** No marking scheme and solution

Instructions:

1. All questions are compulsory.
2. Illustrate your answers with suitable figures/sketches wherever necessary.
3. Assume suitable additional data and assumptions wherever required.
4. Use of IS:456, IS:1343, IS: 13920, drawing instruments and non programmable calculators is allowed.
5. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with same pen being used for writing paper or black HB pencil.
6. Figures to the right indicate full marks.

- 1) Design a combined footing with necessary reinforcement for two columns of each 600 by 600 mm size and spaced 4.2 m apart. The loads from the columns are 600 kN and 700 kN. The soil is in moderate exposure condition and with a net bearing capacity of 90 kPa, 1.2m below the ground level. Use the net reaction pressure on the footing slab as 85 kPa. Assume width of foundation 2m and length of foundation as 6.5m. [12]
- 2) A retaining wall to retain a sandy soil of 3.5 m height above the ground level is to be built in soil of safe bearing capacity of 100 kPa. The unit weight of the soil is 18 kN/m<sup>3</sup> and the angle of internal friction is 30°. Design the section for the footing ( Toe and Heel) assuming the thickness of the stem as 0.4 m, width of footing 2.3m and width of Heel as 1m. The upward pressure from the soil is calculated at the tip of the toe as 95 kN/m<sup>2</sup>, and at the end of the heel as 12 kN/m<sup>2</sup>. Use M25 grade concrete and Fe-415 steel for the retaining wall. Show reinforcement details with appropriate sketches. [12]
- 3) A floor slab is supported on columns spaced 5.5 meters in both the directions. The column is 500 mm square and the live load on the floor is 4 kN/m<sup>2</sup>. The floor finish load on the slab is 1 kN/m<sup>2</sup>. Height of each floor is 5m. A flat slab without drops or column heads is to be designed assuming overall thickness to be provided as 250 mm with M25 grade concrete and Fe-415 steel. Design the reinforcement at different sections considering bending action only and show it with details. [12]
- 4) Design a circular water tank 10m diameter and 3m meter high. The tanks rests on firm ground. The wall and the base are not monolithic. Use M30 Grade Concrete and Fe-415 steel. Show reinforcement details with appropriate sketches. [12]
- 5) a) In a pre-stressed concrete beam of cross-section of 450mm x 600 mm and span 9m, an initial pre-stressing force of 600 kN is applied at an eccentricity of 80 mm by tendons of area 600 mm<sup>2</sup>. Assume Young's modulus of Elasticity for steel as 200 GPa and that for concrete as 33 GPa, anchorage slip 1.5 mm. Calculate the loss of stress in tendons due to elastic shortening of concrete and due to anchorage slip. Show reinforcement details with appropriate sketch. [6]
- b) A pre-stressed concrete beam 600 mm x 900 mm in section has a span of 9 m and is subjected to uniformly distributed load of 20 kN/m including the self-weight of the beam. The pre-stressing tendons are located along the longitudinal centroidal axis and provide an effective pre-stressing force of 1200 kN. Calculate the extreme fiber stresses in concrete at the mid-span section [6]

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