BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

Advanced Concrete Structures (CE G613)– Mid Sem Examination (Second Semester 2022-2023)

Duration: 90 Mins. (Open book) **Date: 14-03-2023** **Max. Marks: 30**

Consider **M 25** grade of concrete and **Fe 415** grade of steel. Assume any other suitable data necessary as per standard. All the dimensions given in Fig. 1 and Fig. 2 are in **mm**.

1. A simply supported isolated T-beam with a span of 5 m carries a uniformly distributed service load of 50 kN/m in the entire span and a concentrated service load of 100 kN at the mid-span, 60 % are the permanent loads in the above-mentioned loads. The T-beam section has been designed for maximum bending moment and is shown in **Fig. 1**. Give answers to the following questions:

(i) Find the maximum curvature and deflection due to shrinkage. **[3 marks]**

(ii) Compute the maximum deflection due to creep. Assume the creep coefficient is equal to 1.6. **[6 marks]**

(iii) Calculate the design surface crack width at a left corner point in an extreme tension face (i.e., P_1 location). **[4 marks]**

2. An inverted isolated T-beam with cross-sectional dimensions is shown in **Fig. 2.** Give answers to the following questions:

(i) Find the approximate and actual cracking moments. **[4 marks]**

(ii) Estimate the stresses at both the top and bottom ends as well as at the junction of the web and flange due to the applied moment of 25 kNm. **[3 marks]**

3. A flat slab is supported on the 300 mm x 300 mm column, spaced apart at 5 m c/c in both directions. The size of the rectangular column head is 500 mm x 500 mm. The superimposed dead load (excluding self-weight) and live loads are 2 kN/m^2 and 4 kN/m^{2,} respectively. Assume the thickness of the drop is 100 mm and the height of the floor is 3.5 m. Consider reinforced concrete density is 25 kN/m^3. The finish load has already been considered in the superimposed dead load. Give answers to the following questions:

(i) Determine the moment in the column and middle strips of the flat slab. **[6 marks]**

(ii) Check the flat slab in shear for the corner column. **[4 marks]**

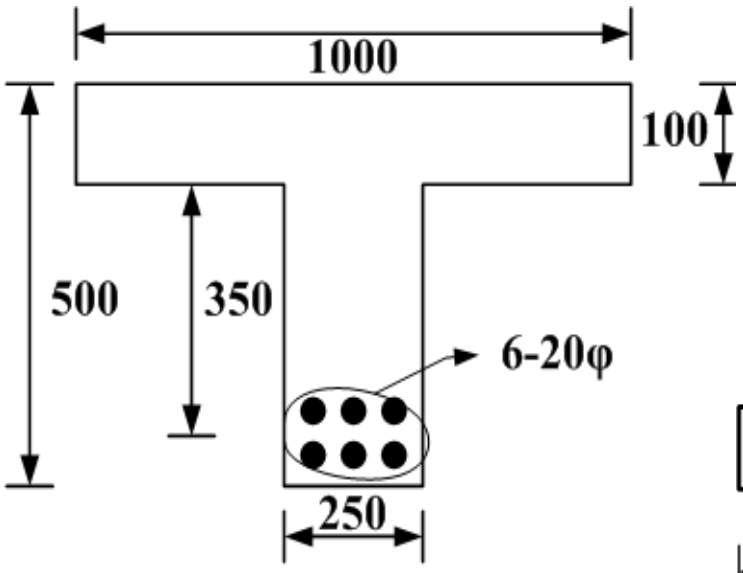

Fig. 1

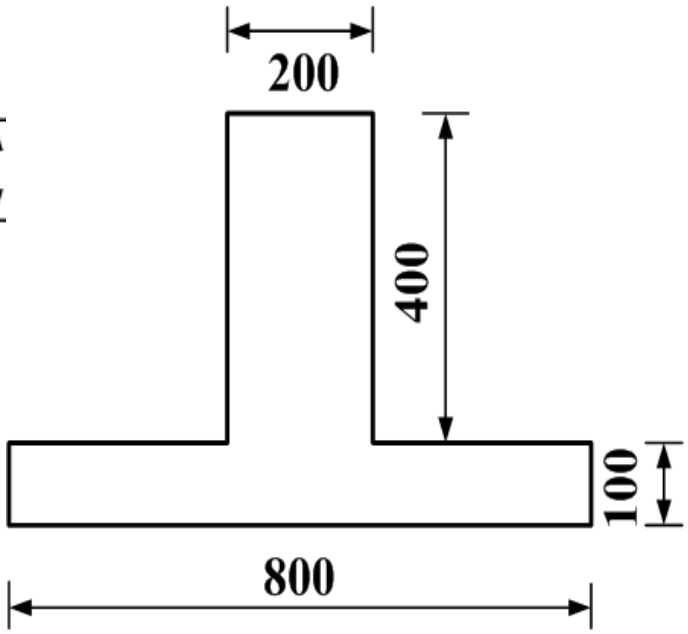

Fig. 2