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53 (CE 601) DGST-II

2021

**DESIGN OF STRUCTURE-II**

Paper : CE 601

Full Marks : 100

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

Answer **any five** questions.

1. (a) What are the advantages of bolted connections over riveted or welded connections ?

A member of a truss consists of two angles ISA 65 × 65 × 6 placed back-to-back. It carries an ultimate tensile load of 125kN and is connected to a gusset plate 8mm thick placed in between the two connected legs. Determine the number of 16mm diameter grade 4.6 bolts required for the joint. Assume  $f_u$  of plate as 410MPa. 2+8=10

Contd.

- (b) What is the difference between a pitch and a staggered pitch?

Design a butt joint to connect two plates  $200 \times 8\text{mm}$ , Fe 410 grade using M 20 bolts. Arrange the bolts to give maximum efficiency.  $2+8=10$

2. (a) Design a bolted connection for a bracket carrying an eccentric load of  $250\text{kN}$  at a distance  $250\text{mm}$  from the centre line of an ISHB 300 @  $0.588\text{kN/m}$ .

Assume any missing data. Thickness of plate =  $10\text{mm}$ .  $10$

- (b) Write short notes on :  $2 \times 5 = 10$

(i) Rigid joint and semi-rigid joint

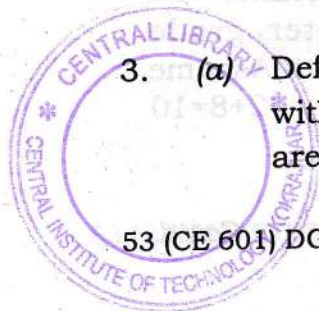
(ii) Pin connection

(iii) Efficiency of a joint

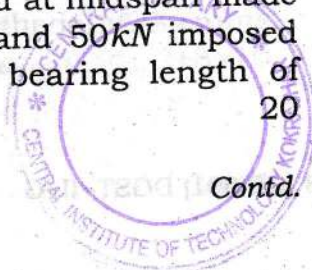
(iv) Black bolts

(v) Lap joint and Butt joint.

3. (a) Define fillet, groove, plug and slot welds with figures. Under what circumstances are slot and plug welds used?  $5$



- (b) An ISMC 250 is used to transmit a factored force of  $700\text{kN}$ . The channel section is connected to a gusset plate  $10\text{mm}$  thick. Design a fillet weld if the overlap is limited to  $300\text{mm}$ . Use plug and slot welds if required. 8
- (c) A plate of size  $120\text{mm} \times 10\text{mm}$  is welded to other by means of end fillet and two longitudinal fillets of size of  $8\text{mm}$ . If the plate is loaded to its full strengths, find out the required overlapping length. 7
4. Write notes on block shear failure in plates and angles. An unequal angle  $1.5\text{m}$  long is connected to a gusset plate of thickness  $8\text{mm}$  using  $4\text{mm}$  size weld. Design the section for an ultimate load of  $250\text{kN}$ . 20
5. Design a simply-supported beam of  $7\text{m}$  span carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The total udl is made up of  $150\text{kN}$  dead load including self-weight plus  $200\text{kN}$  imposed load. In addition, the beam carries a point load at midspan made up of  $75\text{kN}$  dead load and  $50\text{kN}$  imposed load (assuming a stiff bearing length of  $75\text{mm}$ ). 20



6. What is the basic difference in behaviour between tension and compression members, while resisting the loads ?

Calculate the compressive resistance of a  $200 \times 200 \times 18$  angle assuming that the angle is loaded through only one leg, when —

- (i) it is connected by two bolts at the ends
- (ii) it is connected by one bolt at each end
- (iii) it is welded at each end. 20

