53 (CE 601) DGST–II

2017

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)* In class 4·6 bolts, what do the numbers 4 and 6 indicate? What are the advantages of bolted connections over riveted or welded connections? 1+4=5

   (b) Define efficiency of a joint. A single bolted double cover bolt joint is used to connect two plates 8*mm* thick and thickness of cover plate is 4*mm*. Assuming the bolts of 20*mm* diameter at 50*mm* pitch, calculate the efficiency of the joint. Use 410*MPa* plates and grade 4·6 bolts. 1+7=8

(c) Design a lap joint between two plates of size $100 \times 16mm$ thick and $100 \times 10mm$ thick so as to transmit a factored load of $100kN$ using a single row of M20 bolts of grade 4·6 and grade 410 plates. 7

2. (a) Write short notes on rigid, simple and semi-rigid joints. 3

(b) Write the expression for calculating the force R in a bolt subjected to a moment M and located at a distance 'd' from the centre of rotation and also write the expression used to find the number of bolts when a bolt group is subjected to applied moment or torque. Design a bolted connection for a bracket carrying an eccentric load of $300kN$ at a distance of $200mm$ from the centre line of an ISHB 350 @ $67{\cdot}4kg/m$. Thickness of plate is $10mm$, end distance = $40mm$, pitch = $65mm$ and gauge distance = $60mm$. 2+8=10

(c) Design a butt joint to connect two plates $200 \times 8mm$ (Fe 410 grade) using M20 bolts. Arrange the bolts to give maximum efficiency. 7

3. *(a)* Define slot weld and plug weld with figures. 3

(b) A 10*mm* thick plate has been connected with the flanges of an I-section by applying 8*mm* fillet weld as shown in *Figure* I. A load of 150*kN* is placed eccentrically at a distance 120*mm* from the flange. Check the safety of the joint. 12

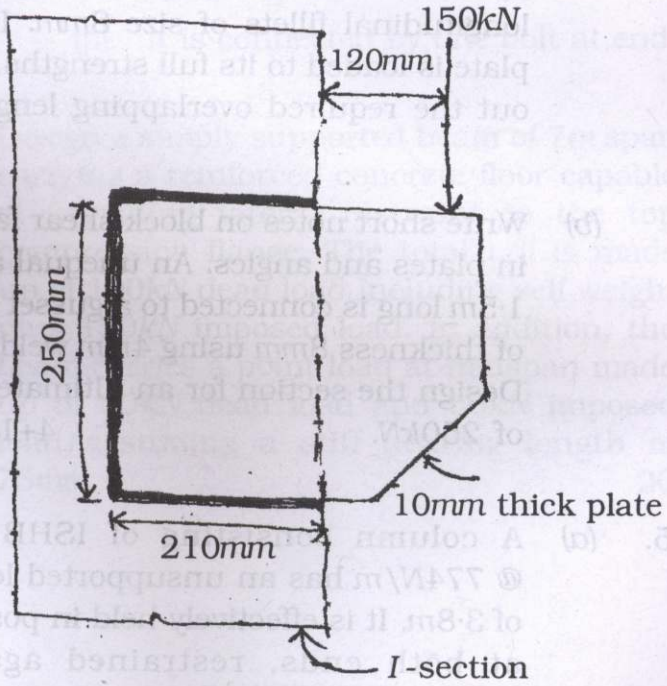

Figure I

(c) Write notes on : 5

(i) Single U

(ii) Double U

(iii) Single V

(iv) Double V

4. (a) 120*mm* × 10*mm* plate is welded to other by means of end fillet and two longitudinal fillets of size 8*mm*. If the plate is loaded to its full strengths, find out the required overlapping length. 6

(b) Write short notes on block shear failure in plates and angles. An unequal angle 1·5*m* long is connected to a gusset plate of thickness 8*mm* using 4*mm* weld size. Design the section for an ultimate load of 250*kN*. 4+10=14

5. (a) A column consisting of ISHB 400 @ 774*N*/*m* has an unsupported length of 3·8*m*. It is effectively held in position at both ends, restrained against rotation at one end. Calculate the axial load this column can carry. 8

(b) What is the basic difference in behaviour between tension and compression members, while resisting the loads? 2

(c) Calculate the compressive resistance of a $200 \times 200 \times 20$ angle assuming that the angle is loaded through only one *kg* when 10

(a) it is connected by two bolts at the ends

(b) it is connected by one bolt at end.

6. Design a simply supported beam of 7*m* span carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The total *udl* is made up of 100*kN* dead load including self weight plus 150*kN* imposed load. In addition, the beam carries a point load at midspan made up of 50*kN* dead load and 50*kN* imposed load/assuming a stiff bearing length of 75*mm*. 20