53 (CE 601) DGST-II

2018

DESIGN OF STRUCTURE–II

Paper : CE 601

Full Marks : 100

Time : Four hours

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

Answer ***any five*** *questions.*

1. *(a)* What is Ductility ? Why is it important ? What do you mean by bolted connection ? Write in brief advantages and disadvantages of such type of connection. In grade 6·8 bolt, what are the ultimate tensile stress and yield stress ? 10

(b) Write short notes on different modes of failure of a bolted joint. A member of a truss consists of two angles ISA $65 \times 65 \times 6$ 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 ordinary bolts required for the joint. Assume f_u of plate as $410MPa$.

4+6=10

2. (a) Design a butt joint to connect two plates $200 \times 8mm$ of *Fe* 410 grade using *M* 16 bolts. Arrange the bolts to give maximum efficiency. Define efficiency of a joint. 10

(b) Design a bolted connection for a bracket carrying an eccentric load of $250kN$ at a distance of $200mm$ from the centre of the extreme bolts of an ISHB 350 @ $0{\cdot}674kN/m$. The thickness of the plate is $10mm$. Assume grade 4·6 bolt and *Fe* 410 steel. 10

3. *(a)* Describe some of the important advantages of welding over bolting. Are there any disadvantages of using welding? What are they? 6

(b) What are the various types of groove welds? What do you mean by partial penetration and full penetration groove weld? Which one is preferred and why? 6

(c) Two plates of thickness 12*mm* and 10*mm* are to be jointed by a groove weld. The joint is subjected to a factored tensile force of 275*kN*. Assuming an effective length of 150*mm*, check the safety of the joint for

(i) single-V groove weld joint and

(ii) double-V groove weld joint.

Assume *Fe* 410 grade steel plates and that the welds are shop welded. What is the minimum thickness of the groove weld to be provided in U, V and J types? What is the effective throat thickness taken in the calculation? 8

4. *(a)* In a roof truss a tie member consists of two numbers of ISA 100 75 10. The member is subjected to a pull of 350*kN*. The angles are connected to either side of a gusset plate of 10*mm* thick. Design the welded connection using both side and end fillet welds. 8

(b) A 10*mm* thick plate has been connected with the flanges of an I-section by applying 8*mm* fillet weld. A load of 150*kN* is placed eccentrically at a distance of 150*mm* from the flange. Length of longitudinal fillet is 200*mm* and that of end fillet as 250*mm*. Check the safety of the joint. 12

5. Write short notes on block shear failure in plates and angles. The single angle ISA 100 75 8 is used as a tension member. It is connected to a 8*mm* gusset plate and arrange with 6 nos. of 20*mm* diameter bolts at a pitch of 50*mm* and end distance of 30*mm*. Calculate the strength of the angle when it is connected by

(i) the long leg ($g = 60mm$)

(ii) the short leg ($g = 40mm$)

20

6. *(a)* Calculate the compressive resistance of a $200 \times 200 \times 25$ angle assuming that the angle is loaded through one by leg, when

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

(ii) it is connected by one bolt at each and

(iii) it is welded at each end.

Assume that the member has a length of $3m$ and $f_y = 250MPa$. 10

(b) Design a simply supported beam of span $5m$ carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The uniformly distributed load is made up of $20kN/m$ imposed load and $20kN/m$ dead load. Assume $Fe\,410$ grade steel. 10