CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

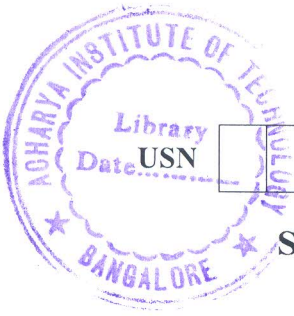**15CV62**

Sixth Semester B.E. Degree Examination, July/August 2021
Design of Steel Structural Elements

Time: 3 hrs.   Max. Marks: 80

Note: 1. Answer any FIVE full questions.
2. Use of IS-800-2007, SP(6) – I or steel table is permitted.
3. Assume missing data suitably.

1 a. List out any four advantages and four disadvantages of steel structures. **(06 Marks)**
    b. What are the different loads and load combinations in the design of steel structures? **(06 Marks)**
    c. With a neat sketch, mention the classification of steel sections as per IS 800:2007. **(04 Marks)**

2 a. Define: (i) Plastic hinge (ii) Shape factor **(06 Marks)**
    b. Determine the maximum plastic moment for the beam shown in Fig.Q2(b). Take load factor as 1.5.
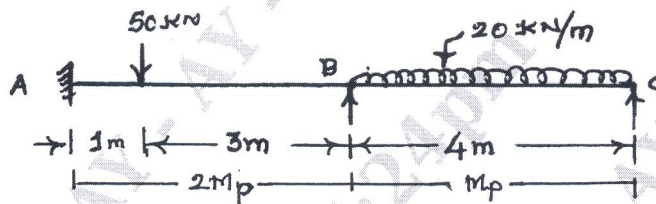

Fig.Q2(b) **(10 Marks)**

3 a. With neat sketches, explain the various modes of failures of bolted connections. **(06 Marks)**
    b. Find the efficiency of a butt joint shown in Fig.Q3(b). Black bolts of M20 and grade 4.6 and the plates are made of grade Fe410 [E250] are provided.
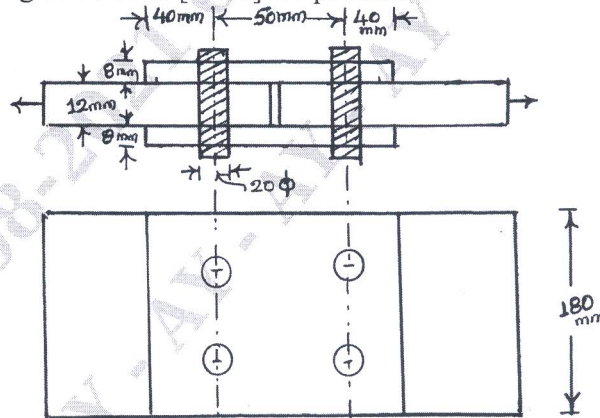

Fig.Q3(b) **(10 Marks)**

4 a. Explain the various types of defects in welded connections with neat sketches. **(06 Marks)**
    b. In a truss, a tie member consisting of an angle section ISA 100 × 100 8 mm of Fe 410 grade is subjected to factored tension of 200 kN. It has to be connected to a 12 mm thick gusset plate using fillet welds at tow and back. Determine the weld length required so that centre of gravity of weld lies in the plane of the centre of gravity of the angle. **(10 Marks)**

5   a. Explain the different modes of failure of axially loaded compression members. **(06 Marks)**
    b. Determine the design load carrying capacity of a single angle (discontinuous) ISA $50 \times 50 \times 5$ mm used as a compression member in a roof truss connected to a 10 mm gusset by two bolts. The centre to centre distance between and connections is 1.5 m. Assume $f_y = 250$ MPa. **(10 Marks)**

6   Calculate the compressive resistance of a compound column consisting of ISHB 300 with one cover plate of 350×20 mm on each flange and having a length of 5m. Assume, that the bottom of the column is fixed and top is rotation fixed, translation free and $f_y = 250$ MPa. Refer Fig.Q6.
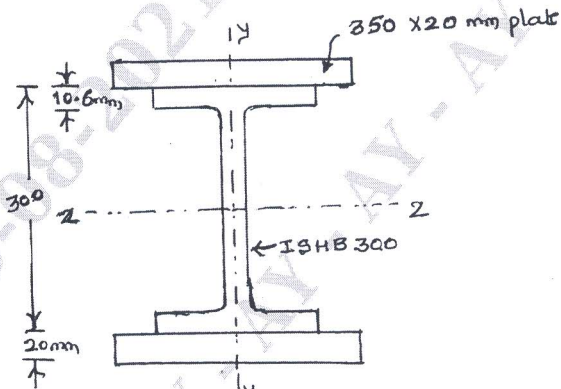

Fig.Q6 **(16 Marks)**

7   a. Explain with the aid of neat sketches, (i) Lug angle (ii) Gusset plate **(06 Marks)**
    b. Determine the block shear strength of the welded tension member shown in Fig.Q7(b). Steel grade is Fe 410.
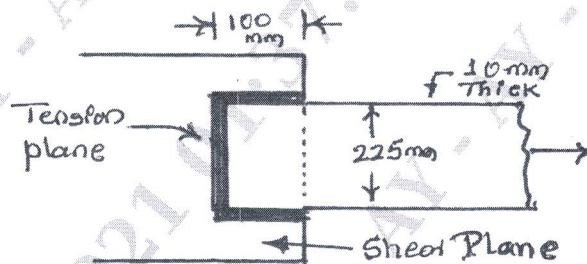

Fig.Q7(b) **(10 Marks)**

8   Design a gusseted base for a column to carry an axial factored load of 3000 kN. The column is ISHB 400 @ 77.4 kg/m, with two cover plates of 250×20 mm on either side. Use M22 property class 5.6 bolts. Sketch the base showing the detail of bolts. Take grade of concrete M20 and SBC of soil = 180 N/m^2. **(16 Marks)**

9   a. Mention the various factors affecting lateral stability of beams. **(04 Marks)**
    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 20 kN/m imposed load and 20 kN/m dead load. Section is stiff against bearing. Assume Fe 410 grade steel. **(12 Marks)**

10 a. How do you analyze the design strength of laterally unsupported beams? **(08 Marks)**
    b. Describe the behaviour of beam-column with neat graph. **(08 Marks)**

* * * * *