



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. - Civil Engineering

Semester End Examination; February - 2022

Design of Steel Structures

Time: 3 hrs

Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge on steel as a structural material to understand its area of application and the design principle involved as per IS code.

CO2: Apply limit state design method for the connection of steel members by bolting and welding.

CO3: Apply limit state design method for the design of tension and compression members and understand the behavior of steel members under axial tension and compression

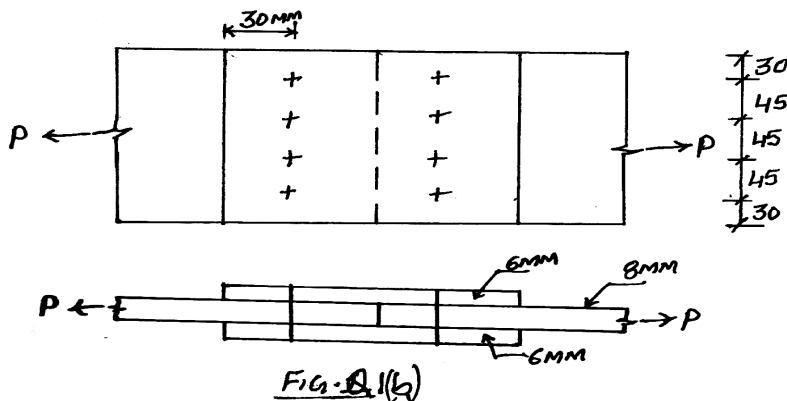
CO4: Ability to apply the concepts of plastic behavior of steel members for the plastic analysis of structural system and to apply the limit state design method for the design of beams.

Note: I) PART - A is compulsory. Two marks for each question.

II) PART - B: Answer any Two sub questions (from a, b, c) for Maximum of 18 marks from each unit.

III) Use of IS:800-2007 and steel tables are permitted.

Q. No.	Questions	Marks	BLs	COs	POs
I : PART - A		10			
I a.	Define efficiency of joints.	2	L1	CO1	PO1,3
b.	List any four types of welds used for connections.	2	L1	CO2	PO3
c.	Define Gusset plate.	2	L1	CO3	PO3
d.	Define column base.	2	L1	CO4	PO3
e.	List any four types of beams based on the cross section used.	2	L1	CO5	PO3,4
II : PART - B		90			
UNIT - I		18			
1 a.	Explain the failure criterion for steel.	9	L2	CO1	PO1,3
b.	A single bolted double cover butt joint is used to connect two plates which are 8 mm thick. Assuming 16 mm ϕ bolts of grade 4.6 and cover plates to be of 6 mm thick. Calculate the strength of the joint for the Fig. Q 1(b).	9	L3	CO1,2	PO1,3



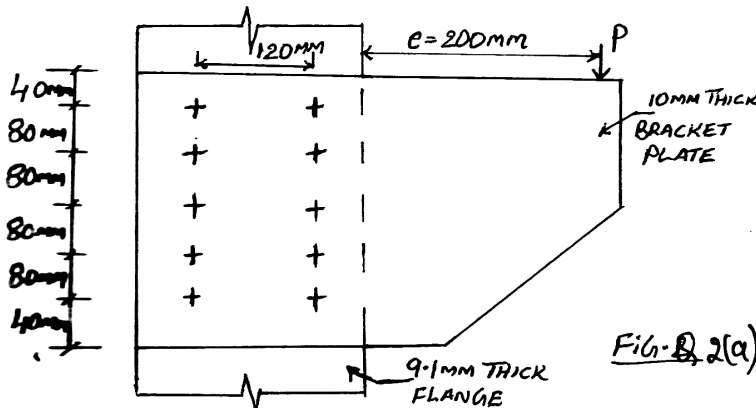
- c. An ISA 100 mm × 100 mm × 10 mm carries a factored tensile force of 100 kN. It is to be jointed with a 12 mm thick gusset plate using HSFG bolts of 16 mm of 8.8 grades. Design a high strength bolted joint. When,
 - i) No slip is permitted
 - ii) Slip is permitted

9 L4 CO1,2 PO1.3

UNIT - II

18

- 2 a. Determine the safe load 'P' that can be carried by the joint shown in Fig. Q2(a). The bolts used are 20 mm diameter of grade 4.6. The thickness of the flange of I-section is 9.1 mm and that of bracket plate is 10 mm.



9 L3 CO1,2 PO 1,3

- b. What are the advantages and disadvantages of welded connections?
- c. A tie member consisting of an ISA 80 × 50 × 8 mm of Fe-410 grade steel is welded to a 12 mm thick gusset plate at site. Design the welds to transmit load equal to the design strength of the members. Provide two side welds.

9 L4 CO2 PO3

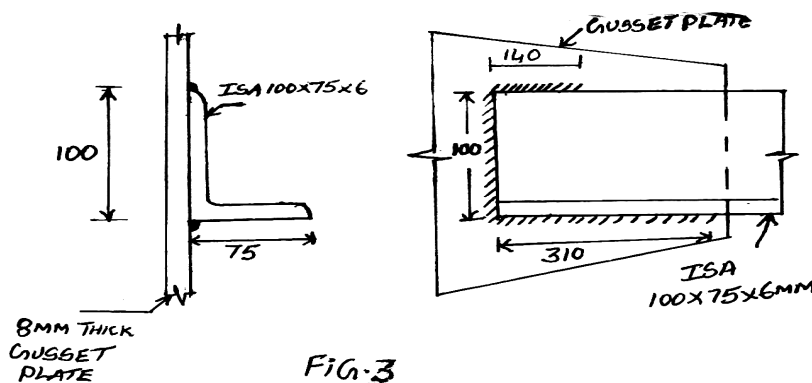
9 L4 CO2 PO3

UNIT - III

18

- 3 a. Explain the various modes of failure of tension member with neat sketch.
- b. A single unequal angle 100 × 75 × 6 mm is connected to a 8 mm thick gusset plate at the ends by 4 mm weld as shown in Fig. 3. Determine the design tensile strength of the angle, if guest plate is connected to 100 mm leg. The yield strength and ultimate strength of steel used are $f_y = 250 \text{ N/mm}^2$ and $f_u = 400 \text{ N/mm}^2$.

9 L4 CO3 PO3



9 L4 CO3 PO3

- c. An ISHB450@855.43 N/m is to be used as a short column carrying axial load. Calculate the compressive strength. Take;
- i) Fe-410 steel with $f_y = 250 \text{ N/mm}^2$
 - ii) Fe-540 steel with $f_y = 410 \text{ N/mm}^2$

9 L4 CO3 PO3

UNIT - IV

18

- 4 a. Design a suitable double channel built-up column 8 m long to carry a factored axial load of 1100 kN. Both ends of the columns are restrained in position but not in direction. Provide single lacing system. Assume Fe-410 grade steel and bolts of 4.6 grade.
- b. Design a slab base for an ISHB350@661.2 N/m to carry a factored load of 1000 kN. Adopt M25 concrete and Fe-415 grade steel for foundation. Adopt welding for the connection of column to base plate.

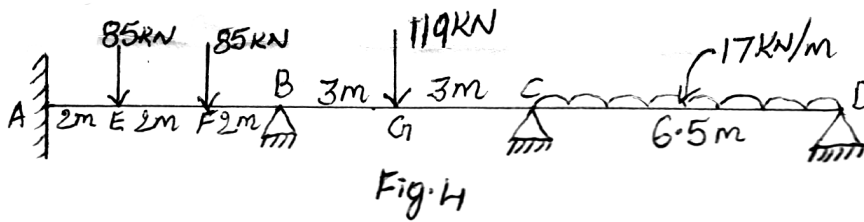
18 L4 CO3 PO3

18 L4 CO3 PO3

UNIT - V

18

- 5 a. Analyse a continuous beam ABCD with the loads as shown in Fig. 4. Also draw the plastic moment diagram.



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- b. Design a cantilever beam which is built into concrete wall and carrying a load of 25 kN/m and live load of 10 kN/m. The span of beam is 5 m. Assume the beam to be laterally supported throughout.

18 L4 CO4 PO3,4

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