



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

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; October - 2023

Advanced Design of Steel Structures

Time: 3 hrs

Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1: Illustrate the behaviour of laterally unsupported beams and the factors affecting its behaviour so as to be able to relate them to the design concepts involved with laterally unsupported beams.

CO2: Apply the knowledge of structural members subjected to combined forces (axial and Bending moments) in analysing and designing such members.

CO3: Outline the influence of web openings on the structural behaviour of beams and to extend this concept for the design of castellated beams and vierendeel girders.

CO4: Demonstrate the behavior and design concepts involved with light gauge steel structures and tubular structures. And apply the knowledge of structural members subjected to fire and able to know the methods of fire protection.

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

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

III) Use of IS 800, IS 801, IS 811 and Steel table are permitted.

Q. No.	Questions	Marks	BLs	COs	POs
I : PART - A		10			
1 a.	Define elastic critical moment as applied to laterally unsupported beam.	2	L1	CO1	PO1,3,4
b.	What are the possible modes of failure in case of a short beam-column and long beam-column?	2	L1	CO2	PO1,3,4
c.	What are the ideal locations for a web opening along the span of the beam?	2	L1	CO3	PO1,2,3,4,5
d.	How do you find the form factor (Q) for compression member of light gauge steel section consisting of both stiffened and unstiffened element?	2	L1	CO4	PO1,3,4,5
e.	Define period of structural adequacy.	2	L1	CO4	PO1,3,4,5
II : PART - B		90			
UNIT - I		18			
2 a.	Explain the behaviour of laterally unsupported beam with the help of neat sketches. List and explain the factors affecting the lateral stability of beam with neat sketches.	18	L2	CO1	PO1,3,4
b.	A simply supported beam of clear span 6 m supported on 250 mm wall is subjected to an all-inclusive load of 25 kN/m. The beam is laterally unsupported. Design the beam using suitable ISMB as per IS:800. Apply necessary checks.	18	L5	CO1	PO1,3,4

UNIT - II		18
3 a.	A non-sway column in a building frame with flexible joints is 4 m high and subjected to the following loads and moments. Factored axial load = 500 kN Factored moment M_z , at top of column = 27 kN-m at bottom of column = 45 kN-m Design a suitable beam column assuming $f_y = 250 \text{ N/mm}^2$ Take the effective length of the column as 0.8 L along both the axes.	18 L5 CO2 PO1,3,4
b.	A simply supported beam of effective length 6 m subjected to UDL of 30 kN/m. In addition to this the beam is also subjected to an axial force of 75 kN due to lateral load. Design the member.	18 L5 CO2 PO1,3,4
UNIT - III		18
4 a.	Describe the general guidelines to be followed while placing a web opening in order to minimize its adverse effects. Also explain force distribution and failure pattern at web openings with neat sketches.	18 L2 CO3 PO1,2,3,4,5
b.	An ISLB 600 is to be used as a castellated beam for a span of 16 m subjected to a design load of 23.6 kN/m. The expansion ratio of 1.5 is to be used. Design the castellated beam by determining the size and spacing of the castellation. The beam shall be checked for shear, bending and deflection.	18 L5 CO3 PO1,2,3,4,5
UNIT - IV		18
5 a.	Explain cold rolling and press forming operations of cold forming of light gauge steel structures.	9 L2 CO4 PO1,3,4,5
b.	A column of effective length 2.3 m carrying a load of 125 kN is to be made of light gauge steel section. Design the column using a lipped channel section. Take $E = 205 \text{ kN/mm}^2$, $f_y = 240 \text{ MPa}$.	9 L5 CO4 PO1,3,4,5
c.	Explain briefly; i) Effective width concept ii) Treatment of elements with stiffeners iii) Stiffened and Un-stiffened elements	9 L2 CO4 PO1,3,4,5
UNIT - V		18
6 a.	Explain any three methods of fire protection with the help of neat sketches.	9 L2 CO4 PO1,3,4,5
b.	Explain fire load and fire rating as applied to structural steel design.	9 L2 CO4 PO1,3,4,5
c.	Explain the behavior of steel as a structural material subjected to elevated temperature with the help of stress-strain diagram.	9 L2 CO4 PO1,3,4,5