M.E. DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

STRUCTURAL ENGINEERING

P18SET2003: Advanced Design of Steel Structures

COURSE OUTCOMES

CO1: Design various types of connections for steel structural elements.

CO2: Analyze and design cold-formed steel structural components.

CO3: Analyze and design steel towers.

CO4: Design special structures like steel chimney and bunkers and silos and analyse the structures for Wind and earthquake forces for design loads.

CO5: Design composite beams, slabs and columns.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. What is the yield strength of bolt of class 4.6?   CO1 [K₁]
   a) $400 \ N/mm^2$ b) $410 \ N/mm^2$
   c) $300 \ N/mm^2$ d) $240 \ N/mm^2$

2. A T stub contains _____ loaded web and _____ loaded flange   CO1 [K₁]
   a) Tension, Bending   b) Tension, Twisting
   c) Compression, Twisting   d) Compression, Bending

3. Which cross section has equal flange widths and a symmetrical shape? CO2 [K₁]
   a) I   b) C
   c) H   d) Angle

4. Limit state of lateral torsion buckling is not applicable to   CO2 [K₂]
   a) square shapes   b) doubly symmetric I shaped beams
   c) I section loaded in plane of their webs   d) I section singly symmetric with compression flanges

5. What is the typical height of a transmission line tower?   CO3 [K₁]
   a) 10-20 meters   b) 30-40 meters
   c) 20-30 meters   d) 40-50 meters

6. The purpose of dampers in power systems   CO3 [K₂]
   a) To reduce the tension in the conductors.   b) To reduce the sag in the conductors.
   c) To reduce the vibrations in the conductors. d) To reduce the length of the tower line

7. The minimum thickness of the wall of a silo should be   CO4 [K₂]
   a) 10 cm   b) 15 cm
   c) 20 cm   d) 25 cm

8. The minimum slope of the hopper bottom of a bunker   CO4   [K$_1$]
   - a) 30°
   - b) 60°
   - c) 45°
   - d) 50°
9. Purpose of using composite beam is   CO5   [K$_2$]
   - a) To increase the weight of the structure
   - b) To decrease the strength of the structure
   - c) To increase the stiffness of the structure
   - d) To decrease the load-carrying capacity of the structure
10. the minimum compressive strength of the infill material in an encased column is   CO5   [K$_1$]
    - a) 15 MPa
    - b) 25 MPa
    - c) 20 MPa
    - d) 30 MPa

PART B (10 x 2 = 20 Marks)

11.	List the types of stiffeners using in the steel structure.	CO1	[K$_1$]
12.	Compare framed connection with seated connection.	CO1	[K$_2$]
13.	As per IS 800:2007, how the steel cross sections are classified.	CO1	[K$_1$]
14.	What do you understand from combined stress in steel sections	CO1	[K$_2$]
15.	Pen down the advantages and disadvantages of transmission tower	CO3	[K$_2$]
16.	How does wind speed affect the sag in transmission line?	CO3	[K$_1$]
17.	What is the impact of using the Gust factor method on the design of chimneys?	CO4	[K$_2$]
18.	Mention the design and construction considerations that can be implemented to mitigate the stress on a chimney during an earthquake.	CO4	[K$_2$]
19.	In terms of the materials used, how are composite beams classified?	CO5	[K$_1$]
20.	In what ways does the behavior of a uniaxial eccentric composite column differ from that of a biaxial eccentric composite column?	CO5	[K$_2$]

PART C (6 x 5 = 30 Marks)

21.	Write a short note on key principles of semi-rigid connections	CO1	[K$_2$]
22.	Outline effective width concept of a steel element.	CO2	[K$_2$]
23.	Explain the safety factors that need to be considered while calculating the load capacity of Z-purlins with lips and wall studs, emphasizing their significance.	CO2	[K$_2$]
24.	What are the considerations to be done in design of transmission towers?	CO3	[K$_3$]
25.	Compare self-supporting chimney with guyed steel chimney.	CO4	[K$_2$]
26.	Explain in detail about the composite slab.	CO5	[K$_2$]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27. Calculate the strength and efficiency of a lap joint used to connect two plates of 12 mm thickness using 22mm dia – 6no's power driven shop rivets. Take pitch distance =80 mm, edge distance = 45 mm and fy = 250 N/mm^2 CO1   [K$_3$]

28. Design a bridge truss diagonal subjected to a factored tensile load of 300kN. The length of the diagonal is 3m. The tension member is connected to a guest plate of 16 mm thick with one line of 20 mm dia bolts of grade 8.8   CO2   [K$_3$]

29. A simple supported steel beam of 4m effective span is laterally supported throughout. It carries a lateral UDL of 10kN/m. Design an appropriate section using Fe410 grade steel.   CO2   [K$_3$]

30. Explain the step by step procedures for the self-supported steel chimney of height 70 m and diameter 2.5 m located in the outskirts Coimbatore. Assume II terrain category and flat topography at site.   CO4   [K$_2$]

31. Design a simply supported composite beam with 8m span spaced at 2.5 m c/c. The thickness of slab is 125 mm. The floor is to carry an imposed load of 2.0 kN/m^2, partition load of 1.5 kN/m^2 and a floor finish load of 0.5 kN/m^2. Check the adequacy of section against bending moment if ISMB 450 is used.   CO5   [K$_3$]

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