KUMARAGURU
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M.E/M.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Second Semester

STRUCTURAL ENGINEERING

P18SET2003**:** Advanced Design of Steel Structures

(Use of IS: 800, IS: 801, IS: 802 IS 808 & IS: 875 (Part-3) are permitted)

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. Sequence the procedure for designing Z-purlins with lips: CO2   [K$_2$]

    A. Calculate effective section modulus

    B. Determine lateral stability requirements

    C. Evaluate load-carrying capacity

    D. Identify section geometry and material properties

    a)   D-A-B-C   b)   A-B-C-D

    c)   D-C-B-A   d)   A-C-B-D

2. An example of a light moment connection is   CO1   [K$_1$]

    a)   framed connection   b)   unstiffened seat connection

    c)   clip angle connection   d)   split beam connection

3. Which factor is NOT considered in calculating the effective width of a cold-formed   CO2   [K$_2$]

    steel section?

    a)   Slenderness ratio   b)   Stress distribution

    c)   Thickness of the plate   d)   Cross-sectional shape

4. Match List I (Types of connection) with List II (Type of beams) and select the correct answer using the codes given below the lists: CO1 [K2]

List I	List II
A. Semi-rigid connection	i. To permit large angles of rotation and to transmit negligible moment.
B. Framed connection	ii. To allow small end rotation and transmit appreciable moment
C. Flexible connection	iii. When a beam is connected to a beam or stanchion by means of an angle at the botoom of the beam which is shop-bolted to the beam and an angle at the top of which is field-bolted
D. Seated connection	iv. When a beam is connected to a beam or stanchion by means of two angles bolted to them

a) 2-4-3-1   b) 4-2-1-3

c) 2-4-1-3   d) 4-2-3-1

5. The IS Code provision used for Design of Towers   CO3 [K1]

a) IS875- Part I   b) IS801- Part I

c) IS800-2007   d) IS802- Part I

6. K-bracing is used for tower height up to   CO3 [K1]

a) 50m   b) 40m

c) 100m   d) 200m

7. Assertion (A): Guyed steel chimneys are more cost-effective than self-supporting chimneys.   CO4 [K2]

Reason (R): Guy wires in steel chimneys reduce bending moments and structural weight.

a) (A) and (R) are true, and (R) is the correct explanation of (A).   b) (A) and (R) are true, and (R) is not correct explanation of (A).

c) (A) is true and (R) is false   d) (A) is false and (R) is true

8. In guyed chimneys, the guy wires are primarily used to: CO4 [K2]

a) Increase the load on the foundation.   b) Provide lateral stability.

c) Resist dead loads.

d) Reduce chimney height.

9. Which factors affect the design of composite columns?   CO5   [K$_1$]

     1. Material properties of steel and concrete

     2. Column slenderness ratio

     3. Loading eccentricity

     4. Connection type

a) 1, 2, 3 & 4   b) 1, 2 & 3

c) 2, 3 & 4   d) 1, 3 & 4

10. Composites can be classified based on _____.   CO5   [K$_1$]

a) matrix type   b) reinforcement constituent

c) matrix type & reinforcement constituent   d) neither on matrix type nor on reinforcement constituent type

PART B (10 x 2 = 20 Marks)

11. Differentiate between flexible connection and rigid connection.	CO1	[K$_1$]
12. Under which circumferences bolted framed connections are used.	CO1	[K$_2$]
13. Explain the concept of local buckling in cold-formed steel sections.	CO2	[K$_2$]
14. Define effective width in the context of cold-formed steel structures.	CO2	[K$_1$]
15. Classify the three major groups of Tower based on the Structural action.	CO3	[K$_1$]
16. What are the key loads considered in the design of transmission line towers?	CO3	[K$_1$]
17. Differentiate between a Bunker And Silo?	CO4	[K$_2$]
18. Define the Gust Factor Method.	CO4	[K$_1$]
19. What is the role of shear connectors in composite structures?	CO5	[K$_1$]
20. Define composite beams and mention their typical application.	CO5	[K$_1$]

PART C (6 x 5 = 30 Marks)

21. How are the building connections classified based on their moment-rotation characteristics?   05   CO1   [K$_2$]

22. Draw stiffened and unstiffened seated connection and indicate the salient points.   05   CO1   [K$_3$]

23. Explain the design methodology for beams in cold-formed steel structures, emphasizing deflections and beam web design.   05   CO2   [K$_2$]

24. Explain the end plate connection with neat sketch. Under which circumference this type of connections is used. 05 CO1 [K₃]

25. Outline the steps in analyzing and designing a member of a transmission tower. 05 CO3 [K₂]

26. Discuss the considerations for designing a self-supporting steel chimney under earthquake forces. 05 CO4 [K₂]

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

27. Design a seat connection for a factored beam end reaction of 110 kN. The beam section is ISMB 250 @ 365.9 N/m connected to the flange of column section ISHB 200 @ 365.9 N/m using bolted connections. Steel is of grade Fe 410 and bolts of grade 4.6. 10 CO1 [K₄]

28. Elaborate on the design of compression members in cold-formed steel structures, including failure modes and effective width calculation. 10 CO2 [K₂]

29. Describe the following: (i) Stiffened element (ii) Un-stiffened element (iii)Multiple-stiffened element (iv) local buckling 10 CO3 [K₂]

30. Design a self-supporting chimney for the following parameters: 10 CO4 [K₄]

    Height = 50 m
    Diameter = 3 m
    Wind Speed = 50 m/s
    Material = Steel (yield stress = 250 MPa)

31. Discuss the design considerations for uniaxial eccentrical composite columns. 10 CO5 [K₂]

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