



M.E DEGREE EXAMINATIONS: JUNE 2018

(Regulation 2015)

Second Semester

STRUCTURAL ENGINEERING

P15SET203: Advanced Steel Structures

(Relevant IS Codes are Permitted)

COURSE OUTCOMES

CO1: Analyze and design various types of steel structural components for industrial buildings.

CO2: Design connections for steel structural elements.

CO3: Analyze and design cold-formed steel structural components

CO4: Analyze and design steel towers.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Assertion (A): The direction of the wind depends on the topography of the region. CO1 [K₂]
Reason (R): In planes, the wind is parallel to the ground whereas at the hills, the direction of the wind changes with slopes.
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
2. Roof purlins are CO1 [K₁]
- a) Tension members b) Compression members
c) Flexural members d) Designed for torsion
3. Angle provided at the upper flange of the beam is called_____ CO2 [K₁]
- a) Stiffening plate b) cleat or clip angle
c) Stiffening angle d) Stiffening angle

4. Match List I and List II

CO1 [K₂]

List I	List II
A. Category 1	i. Surrounding object 1.5m to 10m ht
B. Category 2	ii. Surrounding object less than 1.5m ht
C. Category 3	iii. Surrounding object above 25m ht
D. Category 4	iv. Surrounding object 10m to 25m ht

- | | A | B | C | D |
|----|-----|----|-----|-----|
| a) | ii | i | iv | iii |
| b) | iii | iv | ii | i |
| c) | ii | iv | iii | i |
| d) | iii | i | ii | Iv |

5. Assertion (A): Width of the industrial building units with gabled roofs may vary from 8m to 30m.

CO1 [K₂]

Reason (R): The gable end walls or cladding require intermediate support, So the DL and WL acting on the gable end cladding transmitted to ground through column.

- | | |
|---|---|
| a) Both A and R are Individually true and R is the correct explanation of A | b) Both A and R are Individually true but R is not the correct explanation of A |
| c) A is true but R is false | d) A is false but R is true |

6. The self-supporting towers, subjected predominantly to wind loads are called

CO4 [K₁]

- | | |
|-------------------|------------------|
| a) Guyed towers | b) Slender tower |
| c) Lattice towers | d) Angle towers |

7. All permanent buildings are to be designed for Gust wind because,

CO4 [K₂]

- 1) Gust wind comes for short duration
- 2) Duration is not more than 5 minutes
- 3) Tend to damage the structure
- 4) Duration is not more than 10 minutes

- | | |
|------------|----------|
| a) 1 only | b) 1,2,4 |
| c) 1,2,3,4 | d) 2,3,4 |

8. The width of steel plates required for steel chimney varies from

CO4 [K₂]

- | | |
|-------------------|--------------------|
| a) 0.9 m to 2.5 m | b) 1.5 m to 2.0 m |
| c) 1.0 m to 2.0 m | d) 1.75 m to 2.5 m |

9. The maximum allowable overall flat width thickness ratio w/t for stiffened compression element with simple bent lip is CO3 [K₁]
- a) 60 b) 90
c) 500 d) 120

10. Sequence the following based on the design of column. CO2 [K₁]
1. Calculation of load carrying capacity and check the factored load
 2. Selection of trial section based on factored load
 3. Assume the slenderness ratio and design compressive stress based on type of member.
 4. Calculation of slenderness ratio and design compressive stress of the trial section.
- a) 2-3-4-1 b) 1-3-2-4
c) 3-4-2-1 d) 4-1-3-2

PART B (10 x 2 = 20 Marks)

11. What are the design components in industrial building? CO1 [K₁]
12. What are the advantages of cold formed steel sections? CO3 [K₂]
13. What is meant by semi-rigid connection? CO2 [K₂]
14. What are the advantages of plastic design? CO1 [K₂]
15. What are the different types of beam column connections? CO2 [K₂]
16. Define web crippling CO2 [K₁]
17. Draw the different types of cross sections of cold formed steel sections CO3 [K₂]
18. State the merits and demerits of bolted connections. CO2 [K₂]
19. Distinguish between self supporting and guyed steel chimneys CO4 [K₂]
20. Compare Bunkers and Silos. CO4 [K₂]

PART C (6 x 5 = 30 Marks)

21. Design Louver rails for the following data, Louvers are provided with 1.5m height and 300mm horizontal projections. The building is in the medium wind zone of 47m/s and the columns are spaced at 4m apart. Take width of the building as 15m. CO1 [K₄]
22. A bracket plate 10mm thick is used to transmit a reaction of 140 kN at an eccentricity of 100mm from the column flange as shown in figure (1). Design the fillet weld. CO3 [K₄]

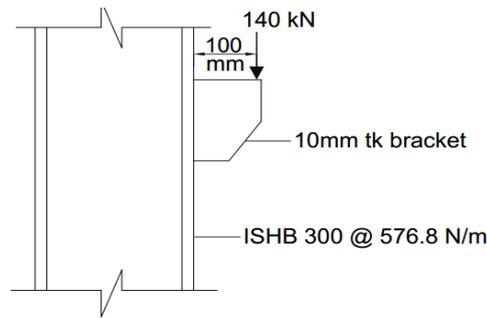


Fig (1)

23. Determine the Effective width of the column section shown in figure 2. The effective length of the column is 3m.yield strength of steel is 240 Mpa. CO2 [K₄]

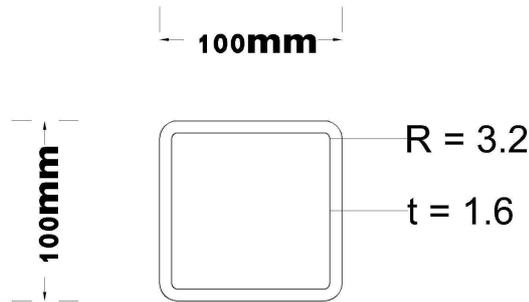


Fig 2.

24. Explain Plastic Collapse Theorem. CO1 [K₃]
25. Explain different types of beam column connections with sketches. CO2 [K₃]
26. Write a detailed note about the classification of towers. CO4 [K₃]

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

27. Design the gable rafter, side rails, gable column for the industrial building with the following data. The span of knee roof trusses used over the industrial building 30m long is 18m, the spacing of roof trusses is 5m. The pitch of the roof truss is $\frac{1}{4}$. The galvanized corrugated iron sheets are used for roof covering. The basic wind pressure is 1.25kN/m² and there is no snow fall. The height of the eaves above ground level is 8m. Propose a suitable type of roof truss. CO1 [K₄]
28. Design a bracket connection to transfer an end reaction of 225kN due to factored load. The end reaction from the girder acts at an eccentricity of 300mm from the face of the column flange. Design the bolted joint connecting the Tee flange with the column flange. Steel is of grade Fe410 and bolts of grade 4.6. CO2 [K₄]

29. Two channel sections without bent lips 90mm x 50mm X 2mm are connected with webs to act as a beam.. The effective span of simply supported beam is 3.5 m. Determine the maximum uniformly distributed load inclusive of its self weight which can be supported by the beam. The beam is laterally supported throughout its length. Take arc of the connecting beam in flange and web as 5mm. CO3 [K₄]
30. A 60 m high microwave antenna lattice tower is to be built near Coimbatore where the terrain at the site is nearly a level ground with terrain of category 2. The diameter of the hemi-spherical antenna disc, fixed at the top is 3m. The width of the tower at the top has to 3.5m. Select a suitable configuration for the tower and determine maximum compressive force and tension in the tower legs and also the maximum shear at the base, for the following data:
Weight of antenna disc and fixtures :9kN
Weight of platform at top : 0.82kN/m²
Weight of railing at top : 0.3kN/m²
Weight of ladder and cage : 0.65kN/m
Weight of miscellaneous items: 2.5kN CO4 [K₃]
31. Explain the design loads and design concepts of steel towers. CO4 [K₃]
