

**B.E/B.TECH. DEGREE EXAMINATIONS: NOV/DEC 2010**

Sixth Semester

**CIVIL ENGINEERING**

U07CE603: Design of Steel Structures

(Is 800 -2007 and Steel Tables are Permitted)

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The maximum slenderness ratio permissible in steel ties is  
A) 250                      B) 350                      C) 450                      D) 400
2. The tensile strength adjacent to a hole during the elastic stage behavior will be approximately  
A) Three times the average stress in the member  
B) 1.5 times the average stress in the member  
C) Less than two times the average stress in the member  
D) Five times the average stress in the member
3. What is the vertical member primarily subjected to compression called?  
A) Principle rafter                      B) Strut                      C) Beam                      D) Column or posts
4. The lacing bars in the built-up columns should be designed to resist a total transverse shear equal to  
A) 2.5% of the column load  
B) 1.5% of the column load  
C) 3.5% of the column load  
D) 2.5% of the column load + additional shear due to B.M or lateral load
5. Why/Where are intermediate transverse stiffeners provided?  
A) Where the concentrated loads are acting  
B) In order to reduce panel aspect ratio  
C) For aesthetic purposes  
D) On one face of the web only for aesthetic reasons

6. Slender beam-column may fail by
- A) lateral torsional buckling      B) buckling similar to columns
  - C) local buckling                      D) lateral torsional buckling and buckling similar to columns
7. The impact allowance for drag forces along the rail for an EOT crane is
- A) 10% of static load wheel
  - B) 5% of static load wheel
  - C) 10% of weight of crab and the weight lifted on the crane.
  - D) 5% of weight of crab and the weight lifted on the crane.
8. The surge load on gantry girder is assumed to be resisted by the
- A) Whole cross section                      B) Compression flange alone
  - C) Compression and tension flanges      D) Cross section above the neutral axis
9. For computation of wind load the effective area of columns and braces may be taken as
- A) 20% of the overall projected area facing the wind
  - B) 10% of the overall projected area facing the wind
  - C) 25% of the overall projected area facing the wind
  - D) 30% of the overall projected area facing the wind
10. The area of breach or flue opening is kept about
- A) 10% of the internal cross-sectional area of the chimney
  - B) 15% of the internal cross-sectional area of the chimney
  - C) 20% of the internal cross-sectional area of the chimney
  - D) 25% of the internal cross-sectional area of the chimney

**PART B (10x2=20 Marks)**

11. What is the use of a lug angle?
12. What is the concept of shear Lag?
13. List the four ideal cases of end conditions of a column.
14. Define slenderness ratio.
- 15 Write any four components of a plate girder.

16. State any four advantages of plate girders over trusses.
17. List the items that are to be considered while planning and designing an industrial building.
18. What is main purpose of the gantry girder?
19. What are the loads acting on steel stack of a chimney?
20. What are the types of pressed steel tank?

**PART C (5x14=70 Marks)**

21. a) Determine the design tensile strength of plate (160 x 8 mm) connected to 10-mm thick gusset using 16-mm bolts, as shown in the fig.1, if the yield and the ultimate stress of the steel used are 250 MPa and 410 MPa, respectively.

**(OR)**

- b) Determine the tensile strength of a roof truss diagonal 100 x 75 x 6 mm ( $f_y=250\text{MPa}$ ) connected to the gusset plate by 4-mm welds as shown in the fig.2.
22. a) Calculate the compressive resistance of a compound column consisting of ISHB 300 with one cover plate of 350 x 20 mm on each flange(fig.3) and having a length of 5 m. Assume that the bottom of the column is fixed and top is pinned and  $f_y = 250\text{MPa}$ .

**(OR)**

- b) Design a laced column 10-m long to carry a factored axial load of 1100 kN. The column is restrained in position but not in direction at both ends. Provide single lacing system with bolted connection. Design the column with two channels back-to-back.
23. a) Design a simply supported beam of 7 m span carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The total udl is made up of 100 kN dead load including self weight plus 159 kN imposed load. In addition, the beam carries a point load at mid span made up of 50 kN imposed load (assuming a stiff bearing length of 75 mm).

**(OR)**

- b) A non-sway column in a building frame with flexible joints is 4-m high and subjected to the following load and moment:

Factored axial load = 500 kN

Factored moment  $M_z$ :

At top of column = 27.0 kNm

At bottom of the column = 45.0 kNm.

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.

24. a) The trusses for a factory building are spaced at 5 m centre to centre and the purlins are spaced at 1.275m centre to centre. The roof angle is  $11.3^\circ$ . The live load is equal to  $0.724 \text{ kN/m}^2$  and dead load is  $0.21 \text{ kN/m}^2$  while the wind pressure is equal to  $2.586 \text{ kN/m}^2$ . Design a channel section purlin.

**(OR)**

- b) Determine the moments and forces due to the vertical and horizontal loads acting on a simply-supported gantry girder given the following data.

1. simply-supported span = 6 m.
2. Crane's wheel centres = 3.6 m.
3. Self-weight of the girder =  $1.5 \text{ kN/m}$ .
4. Maximum crane wheel load (static) =  $220 \text{ kN}$ .
5. Weight of crab /trolley =  $60 \text{ kN}$ .
6. Maximum hook load =  $200 \text{ kN}$ .

Calculate also the serviceability deflection (working load).

25. a) Describe the step by step procedure of designing an elevated cylindrical tank with spherical bottom.

**(OR)**

- b) Explain the steps involved in the design of self supporting steel chimney.

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