Hall Ticket Number:

HOD

CE322 (R20)

B.TECH. DEGREE EXAMINATION, SEPTEMBER-2024

Semester VI [Third Year] (Supplementary)

DESIGN OF STEEL STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What do you mean by bolt Grade 8.8 in accordance to IS 800:2007? CO1
   (b) Define fatigue damage. CO1
   (c) List the various types of welded joints. CO1
   (d) What is shear lag? CO2
   (e) List the modes of failures in compression members. CO2
   (f) Define lacing and battening. CO2
   (g) Outline the advantages of built-up compression members. CO2
   (h) What is lateral torsional buckling of beams? CO3
   (i) Compare laterally supported beam and laterally unsupported beam. CO3
   (j) What is web buckling? CO3
   (k) Outline the modes of failure in a beam column. CO4
   (l) What are beam-columns? CO4
   (m) Where should the splice plate be located in the column? CO4
   (n) Compare gusset base and slab base. CO4

UNIT – I

2. (a) Explain in detail about the classification of structural steel sections. (7M) CO1
   (b) Explain the following: (7M) CO1
      (i) Limit state of strength/collapse
      (ii) Limit state of serviceability.

(OR)

3. An angle section 8 mm thick carrying 120 kN factored load is to be connected to a gusset plate (lap joint) using M20 bolts of grade 4.6. Find the number of bolts required and sketch the connection details. CO1

UNIT – II

4. Design a single angle to carry a tension of 100 kN. The end connection is to be done using M20 bolts of product Grade C and property class 4.6. The yield and ultimate strengths of the steel are 250 MPa and 410 MPa, respectively. CO2

(OR)

5. Design a single equal angle to carry a compression of 50 kN. The centre-to-centre distance between the end connection is 2 m. Assume that at least two bolts are used for the end connection. CO2

UNIT – III

6. A roof of a hall measuring 8 m x 12 m consists of 100 mm thick R.C. slab supported on steel I-beams spaced 3 m apart. The finishing load may be taken as 1.5 kN/m^2 and live load of 1.5 kN/m^2. Design the steel beam. CO3

(OR)

7. Find the design bending strength of MB 400 @ 61.6 kg/m has an effective span of 5 m, if the compression flange is laterally unsupported. Assume that full torsional and warping restraints are provided at the supports. Also assume that the load acts on the upper flange which will have a destabilizing effect. CO3

UNIT – IV

8. Design a beam-column for the following data:
P_u = 500 kN; M_{uz1} = -67 kNm; M_{uz2} = 100 kNm;
M_{uy1} = 30 kNm; M_{uy2} = 50 kNm;
Un supported length = 5 m.
The grade of the steel is E250. Assume side sway is prevented and the effective length factor, K = 0.7. CO4

(OR)

9. A column section ISHB 300 @ 577 N/m is carrying a factored axial load of 600 kN, a factored moment of 30 kN-m and a factored shear force of 60 kN. Design a suitable column splice. Assume ends are milled. CO4

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CE322 (R20)

Hall Ticket Number:

CE322 (R20)

B.TECH. DEGREE EXAMINATION, MAY-2024

Semester VI [Third Year] (Regular & Supplementary)

DESIGN OF STEEL STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Differentiate nominal diameter and gross diameter of bolt. CO1
   (b) What are the failure modes of bolts in a bolted connection? CO1
   (c) What are the assumptions in designing a bolted connection? CO1
   (d) What are the factors affecting the strength of the tension members? CO2
   (e) Define slenderness ratio. CO2
   (f) What do you mean by eccentrically loaded column? CO2
   (g) Classify section ISMC 300 for flexure. CO3
   (h) What is web buckling? CO3
   (i) What is laterally unsupported beam? Give an example. CO3
   (j) Differentiate build-up beam and plate girder. CO3
   (k) What are beam columns? CO4
   (l) State the uses for providing column base. CO4
   (m) What is a permissible average shear stress in a steel beam? CO4
   (n) What is the minimum thickness of a gusset plate for a column base? CO4

UNIT – I

2. (a) Explain the detail about the classification of structural steel sections. (7M) CO1

(b) Explain the following: (7M) CO1
(i) Limit state of strength/collapse
(ii) Limit state of serviceability.

(OR)

3. An ISLC 300@331 N/m is used to transmit a force of 500 kN. The channel section is connected to a gusset plate of 8 mm thick. Design a fillet weld if the overlap is limited to 350 mm. CO1

UNIT – II

4. A double angle ISA 75 mm x 75 mm x 8 mm back welded to one side of a 12 mm gusset have allowable stress 150 MPa. Determine the allowable tensile load on the member and weld length and overlap length of gusset plate. CO2

(OR)

5. Design a column with single lacing system to carry a factored axial load of 1500 kN. The effective height of the column is 4.2 m. Use two channels placed toe to toe. CO2

UNIT – III

6. Design a laterally unsupported I-beam with simply supported ends of effective span 6 m subjected to a working load of 35 kN/m. Assume that full torsional and warping restraints are provided at the supports and the load acts on the upper flange which will have destabilizing effect. CO3

(OR)

7. Design rolled steel I-sections for a simply supported beam with a clear span of 6 m. It carries a UDL of 50 kN per metre exclusive of self-weight of the girder. The beam is laterally unsupported. CO3

UNIT – IV

8. 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 Mz
At top of column = 27 kNm
At bottom of column = 45 kNm
Design a suitable beam column assuming fy = 250 N/mm^2. Take the effective length of the column as 0.8L along both axes. CO4

(OR)

9. Design a slab base for a beam-column SC 250 to transfer a factored axial compression of 750 kN and a factored bending moment of 75 kN-m. The grade of the steel is Fe 250 and the grade of the concrete pedestal is M30. CO4

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CE322 (R20)

F-2

Hall Ticket Number:

CE322 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2023

Semester VI [Third Year] (Supplementary)

DESIGN OF STEEL STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List the basic classification of structural steel sections. CO1
   (b) Outline any two factors that cause failure in bolted connections. CO1
   (c) List the various types of welded joints. CO1
   (d) Outline the factors affecting the strength of the tension members. CO2
   (e) Define Euler's buckling theory. CO2
   (f) Define slenderness ratio. CO2
   (g) What do you mean by the effective length in accordance with IS 800: 2007? CO2
   (h) Outline the formula for the elastic critical moment. CO3
   (i) Distinguish between laterally supported beam and laterally unsupported beam. CO3
   (j) Distinguish between web buckling and web crippling. CO3
   (k) What are the parameters that affect the behavior of beam-column? CO4
   (l) What is the need for column splicing? CO4
   (m) Outline the formula for design for yielding and buckling of beam-column. CO4
   (n) Outline the uses for providing a column base. CO4

UNIT – I

2. (a) Explain briefly various types of loads to be considered in the design of steel structures. (7M) CO1

(b) Explain the following terms: (i) Partial safety factor for loads (ii) Partial safety factor for material strength. (7M) CO1

(OR)

3. Design a lap joint between the two plates each of width 120 mm, if the thickness of one plate is 16 mm and the other is 12 mm. The joint has to transfer a design load of 160 kN. The plates are of Fe 410 grade. Use M16 bolts of grade 4.6. CO1

UNIT – II

4. Design a double-angle section to carry a tension of 300 kN. The end connection is to be made using M20 bolts of product Grade C and property class 5.6. Assume that the angles are provided on both sides of the gusset. The yield and ultimate strengths of the steel are 250 MPa and 410 MPa, respectively. CO2

(OR)

5. Design a single-angle section to carry a compression of 100 kN. The centre-to-centre distance between the end connections is 2 m. Assume that the end connection is done by at least two bolts. Design the end connection also. The grade of the steel is E250. CO2

UNIT – III

6. Design a simply supported I-section to support the slab of a hall 9 m x 24 m with beams spaced at 3 m centre to centre. The thickness of the slab is 120 mm. Consider a floor finish load of 0.5 kN/m^2 and a live load of 3.5 kN/m^2. The grade of the steel is E250. Assume that adequate lateral support is provided to the compression flange. CO3

(OR)

7. Design a laterally unsupported I-beam with simply supported ends of effective span 6 m subjected to a working load of 35 kN/m. Assume that full torsional and warping restraints are provided at the supports and the load acts on the upper flange which will have a destabilizing effect. CO3

UNIT – IV

8. Design a beam-column carrying compression of 500 kN at an eccentricity of 125 mm along the minor axis. Assume that the ends of the column are hinged with an unsupported length of 5 m. The grade of the steel is E250. CO4

(OR)

9. A column section ISHB 350 @ 710 N/m is carrying a factored load of 800 kN, a factored moment of 30 kN-m and a factored shear of 80 kN. Assuming ends are milled, design a suitable column splice. CO4

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CE322 (R20)

Hall Ticket Number:

CE322 (R20)

B.TECH. DEGREE EXAMINATION, JULY-2023

Semester VI [Third Year] (Regular)

DESIGN OF STEEL STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List various types of connections used for connecting the structural steel members. CO1
   (b) List the various types of welded joints. CO1
   (c) What is the minimum size of pitch in a riveted joint? CO1
   (d) What are the various modes of failure of tension members? CO2
   (e) Mention the advantages of built-up compression members. CO2
   (f) Write the formula for design strength due to yielding of gross section as per IS code. CO2
   (g) Differentiate between laterally supported beam and laterally unsupported beam. CO3
   (h) What is web crippling? CO3
   (i) List the design consideration in the design of steel beam. CO3
   (j) Define laterally restrained beam. CO3
   (k) List the modes of failure for beam-columns. CO4
   (l) Where should the splice plate be located in the column? CO4
   (m) What is meant by curtailment of flanges? CO4
   (n) For double lacing, what should be minimum thickness of the flat lacing bars? CO4

UNIT – I

2. (a) Enumerate with example of the various method of fabrication used in steel structures. (7M) CO1
   (b) A tie bar 50 mm x 80 mm is to carry a load of 80 kN. A specimen of the same quality steel of cross-sectional area 250 mm^2 was tested in the laboratory. The maximum load carried by the specimen was 125 kN. Find the ultimate strength and factor of safety. (7M) CO1

(OR)

3. Design a double cover plate butt joint using M24 bolts of product grade C and property class 5.6 to connect two flats of size 350 mm x 16 mm for maximum efficiency. Assume that one shear plane intercepts the threads of the bolts. The yield and ultimate strengths of the flats are 250 MPa and 410 MPa respectively. CO1

UNIT – II

4. Design a 10 m long tension member subjected to a factored tensile load of 2000 kN. The section should consist of 2 channels facing each other. The rolled channels ISMC 300 at 358 N/m only are available. Assuming the channels to be weakened by one bolt hole only, check the adequacy of the section. Use Fe 410 grade of steel. The bolts to be used are of grade 4.6 and of 16 mm diameter. CO2

(OR)

5. Design a single angle section to carry a compression of 100 kN. The centre to centre distance between the end connections in 2 m. Assume that the end connection is done by at least two bolts. Design the end connection also. The grade of the steel is Fe250. CO2

UNIT – III

6. Design a simply supported I-section to support the slab of a hall 9 m x 24 m with beams spaced at 3 m centre to centre. The thickness of the slab is 100 mm. Consider a floor finish load of 0.5 kN/m^2 and a live load of 3 kN/m^2. The grade of the steel is E250. Assume that an adequate lateral support is provided to the compression flange. CO3

(OR)

7. Design a simply supported beam to carry uniformly distributed load of 44 kN/m. The effective span of beam is 8 m. The effective length of compression flange of the beam is also 8 m. The ends of beam are not to free to rotate at the bearings. CO3

UNIT – IV

8. Design a beam-column carrying compression of 400 kN at an eccentricity of 125 mm along the minor axis. Assume that the ends of the column are hinged with an unsupported length of 5 m. The grade of steel is Fe250. CO4

(OR)

9. A column ISHB 300 @ 576.8 N/m is to support a factored axial load of 500 kN, shear force of 120 kN and bending moment of 40 kNm. Design the splice plate and connection using 4.6 grade bolts. Use steel of grade Fe 410. CO4

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