Code :R7320103 1

III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
DESIGN OF STEEL STRUCTURES
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks

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1. (a) Explain the defects in welding.
   (b) A tie bar 120 x 10mm is to be connected to the other of size of 120mm x 14mm. The tie bars are to be loaded by a pull of 120kN. Find out the size of end fillets such that the stress in the end fillets are the same. Take the permissible stresses in the weld = 110N/mm^2.

2. (a) Discuss about effective span and deflection limitations as per IS code.
   (b) A freely supported beam spanning 10m is made up of I section ISMB 500 x 86.9 kg/m with two plates of 300 x 12mm in each flange. Calculate the maximum U.D.L the beam can carry if the compression flange is fully restrained. Also design the curtailment of outer most plate in each flange.

3. (a) Write about gusset plate.
   (b) A bridge truss diagonal carries a pull of 200kN. The length of the diagonal is 3.0m. Design a suitable section. The member is connected to a gusset plate 14mm thick. Fy = 250 N/mm^2.

4. A steel column 12m long and carries an axial load of 1500kN. The column is hinged at both the ends. Design an economical built up section, with double lacing. Design the lacing also.

5. Design a slab base for a column section ISHB 350 carries an axial load of 1500kN. The permissible bearing pressure on concrete is 5 N/mm^2. SBC of soil is 200kN/m^2.

6. The principal rafter in a tubular truss carries a load of 180kN. A tie member meeting at 45^0 to it carries a load of 1000kN. The panel length of the rafter is 2.4m and that of the tie member is 2.5m. Design the members using Y_{st} 240 Gr steel tubes.

7. Design a welded plate girder to carry a super imposed load of 50kN/m. The span of the girder = 25m. Design cross section, connection and curtailment. Sketch the longitudinal section and cross section of the girder. Show typical arrangement of stiffness.

8. Design a simply supported gantry girder to carry in electric overhand traveling crane for the following data:

Crane capacity	= 320kN
Weight of crane and crab	= 300kN
Weight of crane	= 200kN
Maximum approach of crane hook	= 1.20m
Distance between c/c of wheels	= 3.20m
Distance between c/c of gantries	= 16.0m
Span of gantry girder	= 4.0m
Weight of rails	= 300N/m
Height of rails	= 75mm.

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Code :R7320103 **2**

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1. (a) Explain I.S. code requirements for the size and length of welds.
   (b) Design a lap joint for connecting two plates of sizes 150mm x 10mm and 200 x 10mm allowing a safe shear stress of 110 N/mm^2 in the weld. The permissible tensile stress in the plate is 150N/mm^2. Draw neat sketch of the welded joint with all details.

2. (a) With neat sketches explain different types of beam connections.
   (b) A laterally supported beam having an effective span of 6m consists of ISMB 550 @ 103.7 kg/m with cover plate of 250 x 16mm connected to each flange. Determine the safe U.D.L the beam can carry in addition to its over weight.

3. A tension member 10m long is subjected to an axial tensile load of 1200kN. Design the section with channels facing each other. The rolled section available is I.S.M.C. 300 @ 358 N/m only. The channel sections are weakened by on rivet hole on each flange. Check the adequacy of the section and provided the plate if required.

4. (a) Write about eccentrically loaded columns.
   (b) Design a column to support an axial load of 700kN. The column has an effective length of 7m with respect to the x axis and 5.0m with respect to the y axis.

5. Design the slab base for a column consisting of ISHB 300 @ 58.8 kg/m and carrying an axial load of 1000kN. Take allowable bearing pressure on concrete as 4N/mm^2.

6. An industrial roof shed of size 20m x 30m is proposed to be constructed at Mangalore near a hillock of 160m and the slope is 1 in 2.8. The roof shed is to be built at a height of 120m from the base of hill. Determine the design wind pressure on the slope. The height of roof shed shall be 12m.

7. Design a simply supported welded plate girder for the following data:
   Effective span = 16m, superimposed load = 80kN/m.
   Design cross section and stiffners.

8. Design a simply supported gantry girder to be used in an industrial building for the following data:

Crane capacity	= 100kN
Weight of crab	= 35kN
Weight of crane (excluding crab)	= 160kN
Minimum clearance between crane hook and gantry girder	= 1.0m
Wheel base	= 3.0m
Distance between c/c of gantries	= 20.0m
Distance between c/c of gantry columns	= 6.0m
Crane type	= M.O.T.

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Code :R7320103 **3**

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1. A rafter of a truss consists of two 75 x 75 x 8mm angles and it is subjected to a compression of 300kN. Design a suitable joint between the rafter and 10mm thick gusset plate. The angles are back to back and on either faces of the gusset and draw details.

2. (a) Explain the term 'Limiting deflecting' including IS codal provisions.
   (b) Design a simply supported beam of 10m span carrying a U.D.L of 40kN/m if the beam is laterally unsupported. Each and the beam is restrained against torsion and ends of compression flanges are fully restrained against lateral bending.

3. (a) Explain the I.S codal specifications for permissible tensile stresses.
   (b) Design a horizontal tension member carrying a load of 600kN. The length of the member is 3m. The member is connected to a 45mm thick gusset plate.

4. (a) Explain about difference between single lacing and double lacing.
   (b) Design a column section to be used in public building. Column is 4.80m long with its ends restrained in direction and position. The column is to support a 1800kN load.

5. A column section ISHB 350 @ 674 N/m carries an axial load of 1100kN. The column is to the supported on a concrete pedestal. The permissible bearing pressure on concrete is $4N/mm^2$. Design suitable slab base.

6. The principal RAFTER in a tubular truss carries a load of 200kN. A tie member meeting at 45^0 to it carries a load of 60kN. The panel length of the rafter is 2.4m and that of tie member is 2.5m. Design the members.

7. Design a welded plate girder of span 30.0m. It is subjected to a U.D.L of 32kN/m. Design also the stiffners and their connections. Use the steel with yield stress 250MPa.

8. Design a gantry girder to carry an electric overhead traveling crane to suit the following data:

Crane capacity	= 200kN
Weight of crab alone	= 70kN
Weight of Crane	= 150kN
Min approach of crane hook	= 1.2m
Distance between centre of crane wheels	= 3.5m
Distance between centre gantry girders	= 15.0m
Span of gantry girder	= 7m
Weight of rail section	= 0.3kN/m.
Height of rail section	= 80mm

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Code :R7320103 4

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1. (a) What are the advantages of welded connections?
   (b) Two plate 180mm x 10mm are to be connected in a lap joint, the connection being made by transverse filleted weld and necessary plug welds. Design the connection. Use 6mm welds.
2. (a) With neat sketches explain laterally unsupported beams.
   (b) Design a rolled steel I section for a simply supported beam with a clear span of 8m. If carries a U.D.L. of 45 kN.m exclusive of self weight. The beam is laterally unsupported.
3. (a) Write about different types of tension members.
   (b) Design a tension member to carry a load of 280kN. The two angles placed back-to-back with long legs outstanding are desirable. The length of the members is 2.9m.
4. (a) What are the assumptions made while designing a column.
   (b) Design a column to carry an axial load of 1100kN. The column is 5m long and restrained in position and direction at both ends. Use M20 grade concrete.
5. Design a gusset base for a column ISHB 350 @ 724 N/m subjected to an axial load of 3000kN. The base rests on a M-15 concrete pedestal. Safe bearing pressure of concrete is 4000kN/m^2.
6. A tension member carrying a force of 47kN meets the principal tie of a truss at an angle of 45^0. The force in the principal tie is 81kN. Design the members and also the welded joints. Use Y_{st} steel.
7. Design a welded plate girder 20m span and simply supported at the two ends. It carries a U.D.L of 120kN/m. Design cross section and stiffne.
8. Design a gantry girder of span 5m to the following particulars

capacity of crane	= 300kN
Dead load of crane	= 200kN
Weight to crab and accessories	= 40kN
Minimum clearance between centre of gantry girder and crane hook	= 1.25m
Distance between gantry rails	= 18m
Spacing of columns	= 6m
Wheel base	= 3.

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