Code No: R32013 **R10** **Set No: 1**

III B.Tech. II Semester Regular Examinations, April/May -2013

DESIGN & DRAWING OF STEEL STRUCTURES

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any ONE Question from Part – A
and any THREE Questions from Part – B
Use of IS 800 (2007) code and Structural tables are permitted

Part – A (Marks = 30)

1. Design a Gantry girder to be used in an industrial building to carrying an electric overhead travelling crane, for the following data.
   Crane capacity is 200 kN. Weight of crane excluding crab is 180 kN. Self-weight of crab is 40 kN. Span of crane between rails is 16 m. Minimum approach of the crane hook is 1.2 m. Wheel base is 3.5 m. Span of gantry girder is 8 m. Weight of rail section is 300 N/m. Height of rail section is 90 mm.
   Check the suggested section for bending stresses.
   Draw to a scale the cross-section showing all details.

2. 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 the ends. Provide single **lacing** system with **bolted** connection. Design the column with two channels placed toe-to-toe. Assume steel grade Fe 410 and bolts of grade 4.6.
   Design the cross-section and also the lacing system.
   Draw to a scale the cross-section and sectional elevation of the column with lacing details.

Part – B (Marks = 3 x 15 = 45)

3. a). List common types of bolts used in structural steel.
   b). Design a seat angle connection between a beam MB 250 and a column HB 200 for a reaction of beam 90 kN, using M16 bolts of property class 4.6. Take Fe 410 grade steel with fy=250 MPa.

4. Design a rolled steel I–section for a simply supported beam with a clear span of 5 m. It carries a UDL of 60 kN/m exclusive of self-weight of the girder. The beam is laterally supported.

5. A single unequal angle 100x75x6 mm is connected to a 10 mm thick gusset plate at the ends with six-16 mm diameter bolts to transfer tension. Assume edge distance 50 mm and pitch 60 mm, Determine the design tensile strength of the angle, if the gusset is connected to the 100 mm leg. Take Fe 410 grade steel with fy=250 MPa. Assume grade 4.6 bolts.

6. Design a channel section purlin on a sloping roof truss with the dead load of 0.20 kN/m^2 and a live load of 2 kN/m^2 and also a wind load of 1.5 kN/m^2. The purlins are spaced 1.8 m apart and of span 3.6 m c/c, simply supported on a rafter at a slope 20 degrees.

7. A plate girder has the following data:
   Web 1800 x 12 mm, Flange 600 x 50 mm. The span of the girder is 18 m. Stiffeners were provided at 2 m intervals. Determine the shear strength of the panel.

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Code No: R32013 **R10** **Set No: 2**

III B.Tech. II Semester Regular Examinations, April/May -2013

DESIGN & DRAWING OF STEEL STRUCTURES

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any ONE Question from Part – A
and any THREE Questions from Part – B
Use of IS 800 (2007) code and Structural tables are permitted

Part – A (Marks = 30)

1. A riveted Plate Girder with a superimposed load of 100 kN/m for an effective span of 24 m. Assume girder is to be laterally supported through. Steel is of grade fy=250 MPa. Assume 4-unequal angle sections and thickness of plates are 14 mm and 16 mm.
   Design the cross-section of the girder and the bearing stiffener.
   Draw the cross-section, sectional elevation including bearing stiffener details to a suitable scale.

2. Design a built-up column to carry a factored axial load of 2000 kN with an effective height of 6 m. Use 4-angle sections laced together to form a column. Design also a suitable **lacing** system with **bolted** connection. Assume steel grade Fe 410 and bolts of grade 4.6
   Draw to scale the cross-section and sectional elevation of the column with lacing details.

Part – B (Marks = 3 x 15 = 45)

3. a). Explain failure of bolted joins with sketches (at least five).
   b). The plates of a tank 8 mm thick are connected by a single bolted lap joint with 20 mm diameter bolts at a 50 mm pitch. Calculate the efficiency of the joint. Take Fe 410 grade steel and assume grade 4.6 bolts. What pitch length maximum efficiency occurs?

4. Design a suitable rolled steel joist for a roof of a hall 7.5 m x 12 m consists of 100 mm thick RC slab supported on steel beams spaced at 3 m apart. The finishing may be taken as 1 kN/m^2 and live load is taken as 4 kN/m^2. Self weight of beam is taken as 1 kN/m^2. Take limiting deflection = span/250

5. Design the main tie of a roof truss. Maximum force in tension in 75 kN. Maximum compressive force due to wind is 85 kN.

6. Design an I–section purlin to support A.C sheet roof. The purlins are 1.8 m apart over roof trusses spaced 5 m c/c. The roof surface has an inclination of 30 degrees to the horizontal. The weight of A.C. sheet is 0.15 kN/m^2. The wind load on the roof surface normal to the roof is 1.5 kN/m^2

7. A simply supported gantry girder to carry one electric over head travelling crane.
   Crane capacity: 350 kN, Weight of crane excluding trolley: 180 kN,
   Weight of trolley: 100 kN, Wheel base: 3.5 m
   Minimum approach of crane hook: 1.2 m
   Span of crane girders: 18 m, Span of gantry girder: 6 m
   Design the cross-section of the gantry girder.

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Code No: R32013 **R10** **Set No: 3**

III B.Tech. II Semester Regular Examinations, April/May -2013

DESIGN & DRAWING OF STEEL STRUCTURES

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any ONE Question from Part – A
and any THREE Questions from Part – B
Use of IS 800 (2007) code and Structural tables are permitted

Part – A (Marks = 30)

1. Design a built-up column 7 m long to carry a factored axial load of 1000 kN. The column is restrained in position but not in direction at both the ends. Design the column with two channels placed toe-to-toe. Provide single **lacing** system with **welded** connection. Steel is of grade Fe 410.
   Draw to scale the cross-section and sectional elevation of the column with lacing details.

2. Design a Gantry girder for an industrial building to carry a hand operated travelling crane with the following data.
   Crane capacity is 300 kN. Weight of crane excluding crab is 250 kN. Weight of crab is 6 kN. Span of crane between rails is 18 m. Minimum hook approach is 1.0 m. Wheel base is 3 m. Span of gantry girder is 9 m. Weight of rail section is 300 N/m. Height of rail section is 75 mm.
   Check the suggested section for bending stresses.
   Draw to a scale the cross-section showing all details.

(Part – B) (Marks = 3 x 15 = 45)

3. a). How do you classify the bolted connections?
   b). Two plates 10 mm and 18 mm thick are to be joined by double cover butt joint. Design the joint for the following data.
   Factored design load= 650 kN, Bolt diameter = 20 mm, Grade of bolt= 4.6,
   2 cover plates (one on each side) = 8 mm thick, Grade of steel = Fe 410.

4. Design a built-up beam using rolled I-section ISMB 350. The effective span of the beam is 6 m, it carries a UDL of 35 kN/m for the whole span. The ends of the beam are framed to the column. Use fy= 250 MPa. Available thickness of plates: 14 mm and 16 mm.

5. A tension member in a bridge structure having a length of 8 m is subjected to an axial tensile (factored) load of 2000 kN. Design the section with channels facing each other. Take Fe 410 grade steel with fy=250 MPa. Assume grade 4.6 bolts, plate of thickness 6 mm and 8 mm are available.

6. Design a 20 m long simply supported welded plate girder carry a UDL of 60 kN/m excluding its self weight and three concentrated loads of 350 kN each at quarter span. Assume the girder is laterally supported through out.

7. Design a roof truss channel section for purlin of the following data:
   D. L of roof = 0.3 kN/m^2, L.L = 0.9 kN/m^2, Wind Load = 2.8 kN/m^2, Roof inclination = 12.5^0, Span of roof trusses = 18 m, Spacing of trusses = 5 m, c/c of purlin = 1.4 m. Check for adequacy of section both (DL+LL) and (DL+WL) with respect to moment capacity and deflection.

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Code No: R32013 **R10** **Set No: 4**

III B.Tech. II Semester Regular Examinations, April/May -2013

DESIGN & DRAWING OF STEEL STRUCTURES

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any ONE Question from Part – A
and any THREE Questions from Part – B
Use of IS 800 (2007) code and Structural tables are permitted

(Part – A) (Marks = 30)

1. A simply supported bridge deck beam with a clear span of 18 m, subjected to a service shear force of 450 kN and a B.M of 3000 kN-m. Use 10 mm thick plates for web with fy=250 MPa. Design the Plate Girder beam for the following: a) Design plate girder cross-section, b) Check for bending moment, and c) Design of end bearing stiffener (Available Thickness of flats :10 mm and 12 mm).
   Draw the cross-section, the longitudinal section including bearing stiffener details to a suitable scale.

2. Design a laced column with two channel sections placed back-to- back so as to carry an axial load of 1400 kN over an effective span of 5.5 m. Also design the **lacing** system with **bolted** connection. Assume steel grade Fe 410 and 20 mm diameter bolts of grade 4.6
   Draw to scale the cross-section and sectional elevation of the column with lacing details.

Part – B (Marks = 3 x 15 = 45)

3. a). Why fillet welds is preferred compared to butt welds?
   b). Two ISF sections 200 mm x 10 mm each and 1.5 m long are to be joined to make a member of length 3 m. Design the butt weld with the bolts arranged in the diagonal pattern. The flats have to carry a factored tensile load of 350 kN. Steel is of grade Fe 410. 20 mm diameter bolts of grade 4.6 are used to make the connections. Also, determine the net tensile strength of the main plate and cover plates.

4. Calculate the moment carrying capacity of a built-up beam of section ISMB 450 plus flange plates and with an effective span of 8000 mm. The ends are framed to the columns and the grade of steel fy = 250 MPa. Two flange plates each of size 250 x12 mm are provided on the compression side and one plate is curtailed at 1600 mm from both edges.

5. Design the principal tie member to carry a tensile force of 35 kN. The panel length is 3 m. Design the connection. Apply the slenderness check.

6. Design an I–section purlin to support A.C sheet roof. The purlins are 1.4 m apart over roof truss spaced 5 m c/c. The roof surface has an inclination of 15 degrees to the horizontal. The dead load of 0.25 kN/m^2 and a live load of 1 kN/m^2. The wind load on the roof surface is 2.6 kN/m^2.

7. Design a Crane girder to be used in a work shop, when columns are placed at 9 m centers. Given
   a) Crane capacity: 100 kN, b) weight of crab: 35 kN
   c) weight of crane excluding crab: 160 kN, d) wheel base: 3.5 m
   e) minimum clearance between centre of crane girder and travel is 1.2 m
   f) center to center of crane girders: 25 m

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