Code : 011620

B.Tech 6th Semester Examination, 2017

Design of Steel Structures

Time : 3 hours *Full Marks : 70*

Instructions :

*(i) There are **Nine Questions** in this Paper*

*(ii) Attempt **Five** questions in all.*

*(iii) **Question No. 1 is Compulsory.***

(iv) The marks are indicated in the right-hand margin

1. Write short answer (any seven) of the following: 2×7=14

(a) A propped cantilever of span L is subjected to a concentrated load of mid span. If MP is plastic moment capacity of beam then find the value of collapse load.

(b) Give disadvantages of welded joints.

(c) What is slenderness ratio? How does it affect the load carrying capacity of column

(d) Give the factor by which effective length of battened column is altered

(e) A groove weld is to connect two plates 180 mm × 18 mm each. Determine the design bending strength of the joint, if it is subjected to a moment of 13 KNm. Also, determine the adequacy of the joint, if the shear force at the joint is

P.T.O.

200 kN. Assume the welds to be of double-U shop welded

(f) Give, in detail, various load considered for the design of roof Trusses.

(g) Calculate the value of the least radius of gyration for a compound column consisting of ISHB 250 @ 536.6 N/m with one cover plate 300 mm × 20 mm an each flange.

(h) What is the difference in behaviour of long and intermediate column?

(i) Differentiate between the bending and buckling of beam.

(j) Why is a reduction of live loads done for the columns of multi-storey structures?

2. (a) A 120 mm diameter and 6 mm thick pipe is fillet welded to a 14 mm plate. It is subjected to a vertical factored load of 4.5 kN at 1.0 m from the welded end and a factored twisting moment of 1.8 KNm. Design the joint assuming shop welding and steel of grade Fe 410. 12

(b) In what situation are concave fillet welds recommended ? 2

3. Explain the term 'plastic hinge". Explain the theorems of plastic collapse. Find out he collapse load for a fixed beam subjected to a point load 'W' at its mid span. 14

4. (a) Explain various modes of failure (behaviour) of bolted connections, with neat sketches. 3

(b) Two flats (Fe 410 Grade steel), each 210 mm × 8 mm, are to be jointed using 20 mm diameter, 4.6 grade bolts, to form a lap joint. The joint is supposed to transfer a factored load of 250 KN. Design the joint and determine suitable pitch for the bolts. 11

5. Design a bridge truss diagonal subjected to a factored tensile load of 300 KN. The length of the diagonal is 3.0 m. The tension member is connected to a gusset plate 16 mm thick with one line of 20 mm diameter bolts of grade. 8.8. 14

6. Design a double angle discontinuous strut to carry a factored load of 135 KN, resulting from combination with wind load. The length of the strut is 3.0 m between intersections. The two angles are placed back-to-back (with long legs connected) and are tack bolted. Use steel of grade Fe 410.

(i) Angles are placed on opposite sides of 12 mm gusset plate.

(ii) Angles are placed on same side of 12 mm gusset plate.

 14

7. Design a welded plate girder 24 m in span and laterally restrained throughout. It has to support a uniform load of 100 KN/m throught the span exclusive of self-weight. Design the girder without intermediate transverse stiffeners. The steel for the flange and web plates is of grade Fe 410. Design the

cross section, the end load bearing stiffener and connections 14

8. (a) An I-section beam is fabricated with plates of following dimensions

Flanges : 600 × 20 mm

Web : 1600 × 12 mm

Classify flanges, web and the section. Also determine the plastic moment capacity of the beam about its strong axis, if the grade of steel is Fe 410. 7

(b) Determine the design bending strength of ISLB 350 @ 486 N m considering the beam to be laterally unsupported. The design shear force V is less than the design shear strength. The unsupported length of the beam is 3.0 m. Assume steel of grad Fe 410. 7

9. Design a strut in a roof truss for the following data. 14

Length of strut : 2.235 m

Factored compressive force : 50 KN (due to D.L. and L.L.)

Factored tensile force : 17.80 KN (due to D.L. and W.L.)

Grade of steal : Fe 410

Grade of bolts : 4.6

Bolt diameter : 20 mm

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