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Paper ID and Roll No. to be filled in your Answer Book

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B. Tech.

(SEM.VI) (EVEN SEM.) EXAMINATION, 2013

DESIGN OF STEEL ELEMENTS

Time : **3** Hours] [Total Marks : **100**

Note : Attempt all questions, the marks assigned to each question is indicated at question itself.

1 Attempt any four : 5×4

(a) Compare the properties of cast iron, wrought iron and steel. Why is steel considered superior for structural applications compared to the other two materials?

(b) Sketch the residual stresses in typical rolled I- beam, welded I-beam and welded box section. How are the stresses induced in steel sections?

(c) Distinguish between working stress method, ultimate load method and limit state method.

(d) Determine the wind pressure for a bridge (assume a life of 100 years), of span 30m located at about 30 km from Chennai. Also find the design wind force in terms of the width of the bridge.

(e) A roof truss has a span of 20 m and a rise of 4 m, and is placed at 4 m c/c. Calculate the live load on the roof truss.

(f) A roof having a span of 24 m and rise of 4m is spaced 4m apart. Assuming ACC sheeting, estimate the dead and live loads on the purlins, assuming a purlin spacing of 1.4 m.

2 Attempt any four : 5×4

(a) A member of a truss consists of two angles ISA 65 x 65 x 6 placed back to back. It carries an ultimate tensile load of 125 kN and is connected to a gusset plate 8 mm thick placed in between the two connected legs. Determine the number of 16 mm diameter grade 4.6 ordinary bolts required for the joint. Assume fu of plate as 410 MPa.

(b) Design a bolted web angle connection for a ISMB 300 beam, to carry a reaction of 90 kN due to factored loads. The connection is to the flange of a ISHC 200 column. Use Fe 410 grade steel (fy= 250 MPa) and M16 bolts of grade 4.6.

(c) A beam-column of length 5 m is subjected to a compression of 8000 kN and a major axis moment of 4.5 kNm. The weaker plane of the column is strengthened by bracing. If the effective length factor is 0.8, design the beam- column, assuming Fe 410 grade steel.

(c) Design an I-section purlin for an industrial building to support a 18 guage galvanised corrugated iron sheet roof (with dead weight 131 N/m^2) with the following data:

Spacing of truss c/c = 5 m

Span of truss = 15 m

Spacing of purlin c/c = 1.5 m

Intensity of wind pressure = 2.3 kN/m^2

Yield stress of steel = 250 MPa

5 Attempt any two : 10×2

(a) Determine the buckling resistance moment for a welded plate girder consisting of 500 × 25 mm flange plates and a 1250 × 12 mm web plate in grade 410 steel. Assume a laterally unbraced span 5.5 m.

(b) A welded plate girder is fabricated from two 600 × 25 mm flange plates and 1500 × 12 mm web plate of grade 410 steel. What is the moment capacity of the girder? If the section is required to carry full plastic moment, what would be the changes required in the plate thickness.

(c) Design a bolted splice for an ISMB 300 section to transfer a factored bending moment of 100 kNm and a factored shear of 60 kN. Assume that the flange splice carries all the moment and that the web splice carries only the shear. Use M16 bolts.

(d) Design a connection to joint two plates of size 200 × 10 mm of grade Fe 410 to mobilize full plate tensile strength using shop fillet welds, if (i) a lap joint is used (ii) double cover butt joint is used.

(e) Design a welded splice for an ISMB 300 section to transfer a factored bending moment of 80 kNm and a factored shear of 60 kN. Assume that the flange splice carries all the moment and that the web splice carries only the shear.

(f) Two plates of thickness 12 mm and 10 mm are to be joined by a groove weld. The joint is subjected to a factored tensile force of 275 kN. Assuming an effective length of 150 mm , check the safety of the joint for (Fe 410 grade steel and welds are shop welded)

(i) Single V grove weld joint.

(ii) Double V grove weld joint.

3 Attempt any two : 10×2

(a) Determine the design tensile strength of a plate (160 × 6 mm) connected to an 8 mm thick gusset using 16 mm diameter bolts as shown in figure -1, if the yield and the ultimate stress of the steel used are 250 MPa and 410 MPa, respectively.

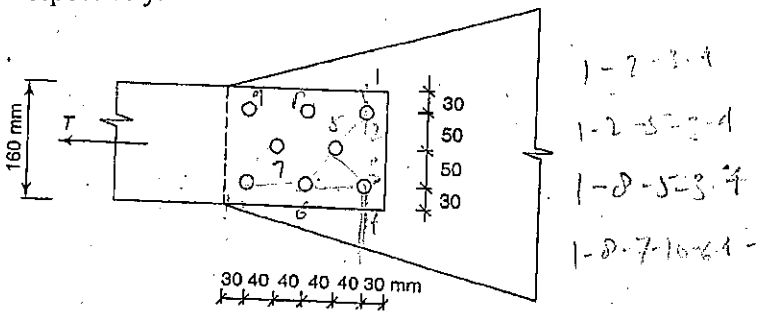

Figure - 1

(b) A single unequal angle 75 x 75 x 6 is connected to a 8 mm thick gusset plate at the ends with four 20 mm diameter bolts to transfer tension as shown in figure -2. Determine the design tensile strength of the angle. Assume that the yield and the ultimate stress of steel used 250 MPa and 410 MPa respectively.

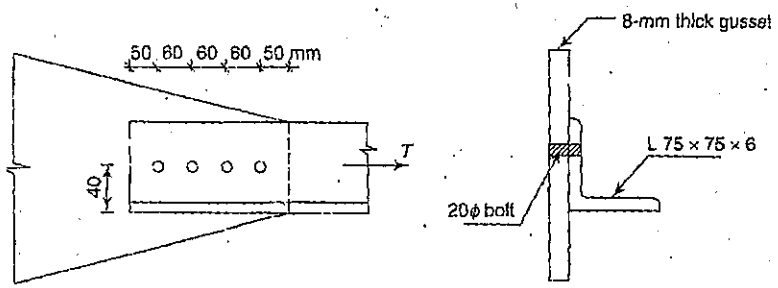

Figure – 2

(c) Determine the axial load capacity of a short length of a square box column in Fe 540 steel fabricated by welding together four 600 x 14 mm plates.

4 Attempt any two : 10×2

(a) Determine the design axial load of a column section ISHB 300. The column is having a height of 9 m and is effectively restrained by two bracings in the y-y direction at 3m and 6m and one bracing member in the z-z direction at mid height. Assume pinned condition at both ends of the column.

(b) A proposed cantilever beam is built into a concrete wall. It supports a dead load of 20 kN/m and a live load of 10 kN/m. The length of beam is 5 m. Select a suitable section with necessary checks. Assume stiff bearing length of 100 mm.