[5560]-503

T.E. (Civil)

STRUCTURAL DESIGN- I

(2015 Course) (Semester-I) (301003)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10

2) Neat sketches must be drawn wherever necessary.

3) Figures to the right indicate full marks.

4) Take Fe 410 grade of steel

5) Take ultimate stress in bolt, f_{ub} = 400N/mm²

6) Assume suitabel data, if necessary.

7) Use of electronic pocket calculator IS: 800-2007 and steel table allowed.

8) Use of cell phone is prohibited in the examination hall.

Q1) a) Explain the terms gauge line, gauge distance, pitch, edge/end distance with sketch. **[5]**

b) A strut consist of 2 ISA 80×80×8 mm @ 9.6 kg/m placed back to back on opposite side of gusset plate is to carry factored load of 275 kN. Design welded connection. **[5]**

OR

Q2) a) State the serviceability condition for tension member, compression member, beam, gantry girder and purlin as per limit state method. **[5]**

b) Check the adequacy of an ISA 90×60×6 @ 6.8 kg/m to carry factored axial tensile load of 150 kN for yielding and block shear only. Assume longer leg is connected to 8 mm thick gusset plate by 4 numbers of M20 bolts. **[5]**

Q3) a) State and explain lacing for built-up column section and bracing in industrial steel structures. **[4]**

b) A column of effective 8 m consist of 2 ISMC 350 @ 42.1 kg/m spaced 220 mm back to back. If the column is restrained in translation but not in rotation at both ends, determine design compressive strength. **[6]**

OR

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Q4) a) Differentiate slab base and gusseted base. **[4]**

b) Design the slab base for a column ISHB 350 @ 66.1 kg/m supporting a factored axial compression of 1500kN. Consider grade of concrete as M20. Take width of base plate as 410 mm. **[6]**

Q5) a) State and explain laterally restrained and unrestrained beam with suitable sketch. **[4]**

b) Calculate safe uniformly distributed load over a laterally unsupported beam ISMB 400@ 61.6 kg/m for an effective length of 6 m. Also check for serviceability. **[12]**

OR

Q6) a) Explain different modes of failure of flexural members with sketches. **[4]**

b) A simply supported beam of span 6 m loaded with uniformly distribute load 25 kN/m including self weight. It also subject to two point load of 50 kN each at quarter span from supports. If the compression flange is laterally restrained, design the section using I section. **[12]**

Q7) a) State and explain types of beam to column connections with suitable sketches. **[4]**

b) A simply supported welded plate girder of span of 24 m subjected to uniformly distributed load 30 kN/m throughout the span including the self weight. Assume compression flange laterally supported throughout the span, design cross section and curtailment of flange plate. **[12]**

OR

Q8) a) State and explain design steps to check of web buckling and web crippling. **[6]**

b) Design a bolted beam column bracket connection to support an end factored reaction of 400 kN from the beam. The column section is ISHB 150 @ 30.6 kg/m. Assume thickness of bracket plate is 10 mm and the eccentricity of end reaction is 250 mm. **[10]**

Q9) a) Differentiate welded plate girder and gantry girder. **[4]**

b) Determine the maximum wheel load, shear force and bending moment for the gantry girder as per the following data. **[14]**

Self weight of crane girder: 200 kN

Capacity of crane :200 kN

Weight of crab and motor: 50 kN

Span of crane girder: 16 m

Minimum hook approach: 1.2 m

Center to centre between gantry column: 8 m

Self weight of rail: 0.3 kN/m

Wheel base = 3.5 m

OR

Q10) a) Differentiate purlin and gantry girder. **[4]**

b) A truss shown in Fig.10 b is used for an industrial building situated at Allahabad covered with AC sheets. Determine panel point dead, live and wind load with following data. **[14]**

Spacing of truss = 8 m

Self weight of AC sheet = 171 N/m²

Self weight of purlin = 318 N/m

Height of column = 11m

k_1=1.0, k_2=0.89, k_3= 1.0, C_{pe} = -0.8 and C_{pi} = -0.2
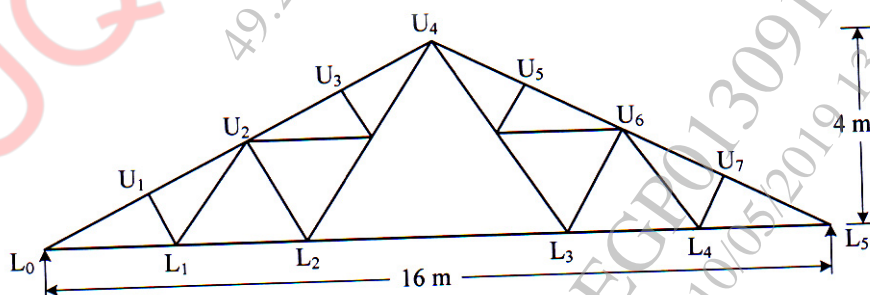

Fig. 10