Total No. of Questions : 10]

SEAT No. :

P3955

[Total No. of Pages : 3

[5253] - 503

T.E. (Civil) (End Semester)

STRUCTURAL DESIGN - I

(2015 Pattern) (Semester - I)

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} = 400 N/mm^2.*
6) *Assume suitable 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) State and Explain modes of failure in tension member with sketch. **[6]**

b) A single angle section 90 × 60 × 10 @ 11.0 kg/m is connected with gusset plate with 7 bolts of 20 mm diameter in one line at pitch of 50 mm and edge distance of 30 mm. Determine design tensile strength of the section for rupture of net section. (Assume the section is connected with longer leg and gauge distance = 50 mm) **[4]**

OR

Q2) a) A discontinuous strut of effective length 2.975 m consists of two unequal angles ISA 100 × 75 × 10 @ 13 kg/m and is connected to a 12 mm thick gusset plate by its longer leg on the opposite side of the gusset plate. Determine the strength of the member. **[5]**

b) Check the adequacy of an ISA 90 × 60 × 6 @ 8.9 kg/m to carry factored axial tensile load of 150 kN for yielding and rupture only. Assume angle is connected to 8 mm thick gusset plate by 4 numbers of M20 bolts. **[5]**

Q3) a) A 6 m long column is effectively held in position at both ends and restrained against rotation at one end. If an ISHB350 @ 67.4 kg/m is used, calculate design compressive strength. **[5]**

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b) An ISA 130 × 130 × 10 @ 19.7 kg/m used as a strut has the length between the intersections at each end as 3 m. If it is connected with gusset plate by one bolt at each end (assume fixed condition), then determine the equivalent slenderness ratio. **[5]**

OR

Q4) Design the gusseted base for a column ISHB 350 @ 66.1 kg/m supporting a factored axial compression of 1700 kN. Use M20 grade of concrete and gusset angle ISA 150 × 115 × 15 mm. **[10]**

Q5) Determine the design bending strength of ISLB350 @ 49.5 kg/m considering the beam to be **[16]**

a) laterally supported

b) laterally unsupported. The unsupported length of beam is 6 m.

OR

Q6) A conference hall 8 m × 18 m is provided with a 120 mm RC slab over rolled steel beams spaced 3 m c/c. A wearing coat of 100 mm thickness is provided over the roof. Design the beam section if. the compression flange of the beam is laterally supported throughout the span. Assuming unit weight of reinforced concrete and wearing coat are 25 kN/m^3 and 20 kN /m^3 respectively. Take Live load 3 kN/m^2. Assume self weight of beam 0.75 kN/m. **[16]**

Q7) a) Explain types of beam to beam and beam to column connections with suitable sketches. **[6]**

b) A beam ISMB 450 @ 72.4 kg/m transmit an end reaction of 120 kN to the column ISHB 300 @ 58.8 kg/m. Design seated bolted connection using M20 bolts of 4.6 grade. **[10]**

OR

Q8) Design suitable cross section for welded plate girder for an effective span of 30 m and carrying uniformly distributed load 30 kN/m including self weight. It is also loaded with two concentrated load of 150 kN acting at 10 m from either supports. The compression flange of the girder is laterally supported throughout the span. Also design connection between flange and web. Draw the design sketches. **[16]**

Q9) Determine the maximum wheel load, shear force and bending moment for the manually operated gantry girder as per the following data. Also check for fatigue strength. **[18]**

Weight of crane girder : 150 kN

Crane capacity : 180 kN

Weight of crab and motor : 50 kN

Span of crane girder : 15m

Minimum hook approach : 1.2 m

Span of gantry girder : 5m

Weight of rail : 0.25 kN/m

Crane operates : 225 days

Working hours : 9 am to 5 pm

Maximum no of trip per hour : 03

Design life : 50 years

Section modulus of cross section : 3765×10^3 mm^3

Shear area of cross section : 4560 mm^2

OR

Q10) Determine the design forces in the members $L_0 U_1$, $U_1 L_1$ and $L_0 L_1$ of an Accessible truss as shown in Fig. 10. Assume design wind pressure is 1200 N/mm^2 and the c/c spacing of truss is 4m. Assume self weight of purlin is 100 N/m^2, self weight of bracing 80 N/m^2, Self weight of AC sheet 130 N/m^2 and rise of truss = 3 m. **[18]**

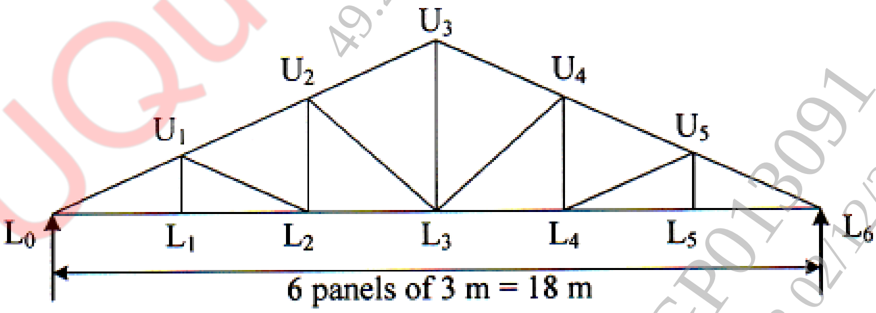

Fig. 10

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