Scheme - G

Sample Question Paper

Course Name : Diploma in Civil Engineering

Course Code : CE/ CR/ CS/ CV

Semester : Fifth **17505**

Subject Title : Design of Steel Structures

Marks : 100 **Time: 4 Hrs.**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Q1 A) Attempt any THREE **3 x 4 = 12**

a) State any four advantages of steel as a construction material.

b) State any four types of loads to be considered for design of steel structures.

c) Define Limit State and state different types of limit states.

d) Describe single shear failure in case of a Lap Jointed tension member.

Q1 B) Attempt any ONE **1 x 6 = 6**

a) An ISA 80 x 80 x 8 @ 75.5 N/m is welded to 10 mm thick gusset plate. Design the joint for factored tensile force of 200 kN. Assume permissible shear stress in weld material as 108 MPa. For ISA 80 x 80 x 8 Czz = 22.7 mm.

b) 2 ISA 60 x 60 x 6 is connected back to back on either sides of 10 mm thick gusset plate using fillet weld. Draw plan & section of this connection.

Q2. Attempt any TWO **2 x 8 = 16**

a) A lap joint consists of two plates (150 x 12mm) connected by means of 20 mm dia bolts of grade 4.6. All bolts are in one line. Calculate strength of single bolt and number of bolts to be provided in the joint.

b) In a truss 2 ISA 100 x100x8mm, 3 m long is used as a strut. It is welded to gusset on either sides. Calculate design strength of strut. Take r_{zz} = 18.97 mm.

Values of *f*cd (N/mm^2) are….

KL/r	120	130	140	150
$f$cd (N/mm^2)	83.7	74.4	66.2	59.2

c) An ISMB 400 @ 604.3 N/m is used as a simply supported beam for 3 m span. The compression flange of beam is laterally supported through out the span. Determine design flexural strength of member. Also calculate working u.d.load the beam can carry per m span. Check the member for deflection.

Take Zp = 1176.18 x 10^3 mm^3, γ_{mo} = 1.1, β_b = 1 and fy = 250 MPa

Q3. Attempt any FOUR **4 x 4 = 16**

a) State four types of bolts and sketch any one.

b) State any two advantages and any two disadvantages of welding.

c) Draw neat sketch of PRATT and FINK type trusses. Mark panel, panel point, rafter and tie in any one truss.

d) Draw neat sketch of connection of an angle purlin with principal rafter at panel point.

e) What are the IS code provisions for design of angle purlin.

Q4. A) Attempt any THREE **3 x 4 = 12**

a) Sketch different sections used as built up strut and built up column.

b) State effective length for a compression member having end conditions as –

i) Translation restrained at both ends and rotation restrained at one end

ii) Translation and rotation both restrained at both ends.

c) Draw neat sketch showing single and double lacing system..

d) Limiting width to thickness ratio for single angle strut of semi-compact class is 15.7ε. State whether ISA 90 x 90 x 6 is of semi-compact class or not. Take fy as 260 MPa.

B) Attempt any ONE **1 x 6 = 6**

a) Draw sketch of three different modes of failure of member in axial tension.

b) Design a tie member in a truss to carry factored load of 300 kN. Use double equal angle section connected back to back on either sides of 10 mm thick gusset plate (by means of 16 mm dia 4 bolts in one line). Assume fy = 250 MPa, fu = 410 MPa and α = 0.8.

Section available	Area (mm^2)
ISA 60 x 60 x 6	684
ISA 65 x 65 x 6	744
ISA 75 x 75 x 6	866

Q5. Attempt any TWO **8 x 2 = 16**

a) A hall of size 14 x 20 m is provided with Fink type steel roof trusses at 4 m c/c. Calculate panel point load in case of Dead Load and Live Load for following data.

i) Unit weight of roof covering = 165 N/m^2

ii) Self weight of purlins = 100 N/m^2

iii) Weight of bracing = 60 N/m^2

iv) Rise to span ratio = 1/5

b) A industrial building has trusses for 16 m span. Trusses are spaced at 4 m c/c and rise of truss is 3.5 m. Calculate panel point load in case of Live Load and Wind Load using following data.

i) Coefficient of external wind action = - 0.7

ii) Coefficient of internal wind action = ± 0.2

iii) Design wind pressure = 1.2 kPa

iv) No. of panels = 12

c) Design a slab base for column HB 350 @ 710.2 N/m to carry factored axial compressive load of 1500 kN. The base rests on concrete pedestal of grade M 20.
For HB 350, bf = 250 mm, Take fy = 250 MPa, fu = 410 MPa. γ_{mo} = 1.1

Q6. Attempt any FOUR **4 x 4 = 16**

a) Differentiate between Laterally supported and laterally unsupported beams.

b) State classification of cross sections of beams based on moment – rotation behavior.

c) AN ISMB 250 is used a simply supported beam for 3m span with carry 20 kn/m load. Take fy=250mpa, check the section for shear only tw=6.4 mm

d) State the situation wherein Gusseted base is used. Draw neat labelled sectional elevation.

e) State the theoretical consideration for finding thickness of base plate. Also state the purpose of using anchor bolts in slab base.

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Scheme – G

Sample Test Paper-I

Course Name : Diploma in Civil Engineering

Course Code : CE/ CR/ CS/ CV

Semester : Fifth **17505**

Subject Title : Design of Steel Structures

Marks : 25 **Time: 1 Hour**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Q1. Attempt any three **(3 x 3 = 9)**

1. State any six applications of steel structures.
2. Compare welded joints with bolted joints with respect to strength, efficiency and workmanship.
3. Define gauge distance, pitch and edge distance in bolted joint with sketch.
4. State purpose of using tacking bolts. Also state maximum pitch of tacking bolts.

Q2. Attempt any two **(2 x 4 = 8)**

1. Define characteristic strength of material and characteristic load.
2. A tie member 250 x 14 is connected to gusset with an overlap of 300 mm. 6 mm fillet weld is provided on all four sides. Determine design strength of joint. Take fu = 410 Mpa, fy = 250 MPa and $\gamma_{mw} = 1.25$
3. State purpose of providing Lug angle.

Q3. Attempt any one **(1 x 8 = 8)**

1. Determine strength of single bolt of dia 20 mm of grade 8.8. Take fu = 410 Mpa, fub = 800 MPa and $\gamma_{mb} = 1.25$. Also calculate no. of bolts required to resist a factored force of 300 kN.
2. A tie 0.95 m long carries factored load of 120 kN. State whether ISA 50 x 50 x 6 (Ag = 568 mm^2) is suitable as tie or not. 16 mm dia bolts are provided in one line. Take fu = 410 Mpa, fy=250 MPa and $\gamma_{mo} = 1.1$ and $\gamma_{m1} = 1.25$

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Sample Test Paper-II

Course Name : Diploma in Civil Engineering

Course Code : CE/ CR/ CS/ CV

Semester : Fifth **17505**

Subject Title : Design of Steel Structures

Marks : 25 **Time: 1 Hour**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
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4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Q1. Attempt any three **(3 x 3 = 9)**

1. Define Slenderness Ratio of compression member. State its limiting value in case of member carrying axial compression due to DL and LL.
2. Define lateral restraint to beam and state ways to provide it.
3. State types of column bases generally adopted in steel structures.
4. Determine intensity of Live Load for a truss having angle 12° with access provided.

Q2. Attempt any two **(2 x 4 = 8)**

2. ISLB 200 as a beam carries service udload 40 kN/m over 4 m span and is laterally supported. Check the section for shear capacity if fy=250 MPa , γ_{mo} = 1.1 and tw = 5.4 mm.
3. Calculate value of least radius of gyration of a compound column consisting of ISHB 250 with one cover plate 300 x 20 mm on each flange.
   For ISHB 250, A = 6971 mm2, Izz = 7983.9 x 10^4 mm^4, Iyy = 2011.7 x 10^4 mm^4
4. Determine thickness of base plate for a column having equal projections of 0.3 m, with fy 250 steel, γ_{mo} 1.1 and effective pressure of 8.5 kN/m^2

Q3. Attempt any one **(1 x 8 = 8)**

1. A built up section of a 6 m high column has flanges 300 x 30 and web 500 x 20. Determine safe service load that the section can carry . Both ends are restained in rotation and translation.

   Take fu = 410 Mpa, fy=250 MPa and γ_{mf} = 1.5

KL/r	40	50	60	70
*f*cd (N/mm^2)	198	183	168	152

2. A hall has trusses spaced at 3 m c/c having span 12 m. Rise of truss is 4 m and no. of panels in truss are 10. Determine panel point load due to Dead Load and Wind Load for following data
    a) Intensity of load due to purlin, bracing and sheeting together excluding self-weight = 555 MPa
    b) Coefficient of external and internal wind actions are (- 0.6) and (± 0.2) respectively
    c) Design wind pressure is 1.3 kPa.

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