19402

11920

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. a) **Attempt any THREE of the following:** **12**

(i) State the meaning of following:

1) ISLB

2) ISMB

3) ISJC

4) ISNT

(ii) Explain rivet value? How to calculate it?

(iii) Enlist with sketch four types of steel sections used as tension member.

(iv) State any four advantages and four disadvantages of welded connections.

P.T.O.

Marks

b) **Attempt any ONE of the following:** **06**

(i) A double angle discontinuous strut of length 1.4 m consists of 2 ISA $80 \times 50 \times 10$ mm connected on either side of gusset plate 12 mm thick with longer legs. Rivets of 16 mm diameter are used for the connection. For single angle $80 \times 50 \times 10$ mm $\Rightarrow$ Area $= 1202\ mm^2$, $C_x = 28.1$ mm, $C_y = 13.2$ mm, $I_{xx} = 74.7 \times 10^4\ mm^4$, $I_{yy} = 22.1 \times 10^4\ mm^4$. Assume $f_y = 250$ MPa.

λ	50	60	70
σ_{ac} (MPa)	132	122	112

(ii) A single riveted lap joint is provide to connect 10 mm plates with 20 mm rivets at a pitch of 80 mm. State how the joint will fail. Calculate also the efficiency of the joint. Take permissible tensile stress in plate 150 MPa, permissible shear stress in rivet 100 MPa and permissible bearing stress in rivet 300 MPa.

2. Attempt any TWO of the following: **16**

a) Design a tension member consisting of single unequal angle section to carry a tensile load of 100 kN. Assume 16 mm diameter rivet to 10 mm thick gusset plate. Assume $\sigma_{at} = 150$ MPa.

Sr. No	Sections	Sectional area
i)	ISA $65 \times 45 \times 8$	$817\ mm^2$
ii)	ISA $75 \times 50 \times 8$	$938\ mm^2$
iii)	ISA $75 \times 50 \times 10$	$1152\ mm^2$

b) An angle $50 \times 50 \times 6$ mm is to be connected to a gusset plate 8 mm thick. The angle carries a tensile load of 32 kN. Design the riveted connection. Assume permissible bearing stress in rivet = 300 MPa, permissible shear stress in rivet = 100 MPa.

Marks

c) A compound column is made up of 2 ISMC 250 placed face to face. The length of column is 10 m with both ends fixed. Find permissible axial compressive load. For single ISMC 250, $A = 3867\ mm^2$, $C_{yy} = 23\ mm$, $I_{xx} = 3816.8 \times 10^4\ mm^4$, $I_{yy} = 219.1 \times 10^4\ mm^4$

λ	50	60	70
σ_{ac}	132 MPa	122 MPa	112 MPa

3. Attempt any FOUR of the following: **16**

a) Enlist types of loads to be considered while designing the steel structures.

b) Write the steps for design of welded connection.

c) Determine the rivet value of 20 mm diameter rivets connecting 12 mm plate in single shear. Assume allowable bearing stress in rivet = 300 MPa and allowable shearing stress in rivet = 100 MPa.

d) State and explain any two modes of failure of axial tension member.

e) Draw plan of gusseted base showing all components.

4. a) **Attempt any THREE of the following:** **12**

(i) Draw neat sketch showing single lacing system. Why lacing is used?

(ii) Draw typical plan and sectional elevation of double riveted lap joint and single cover double riveted butt joint.

Marks

(iii) Calculate the size of fillet weld required for joint shown in following Figure No.1 to carry an axial force of 200 kN.

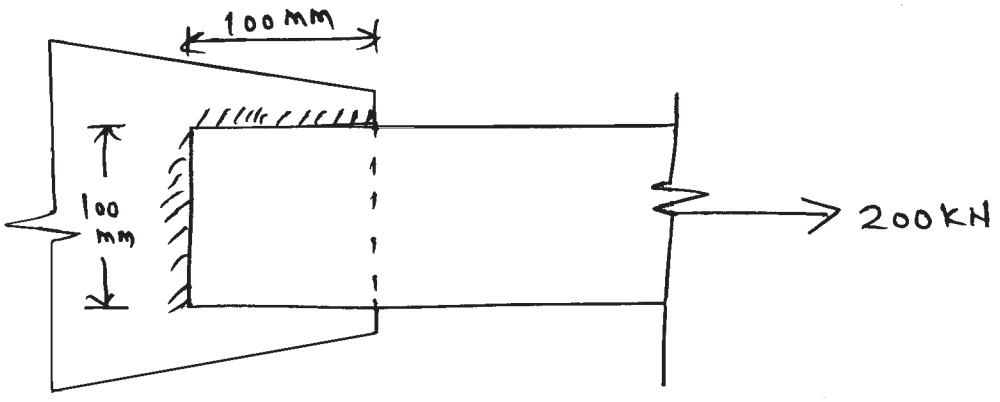

Fig. No. 1

(iv) In a truss, a diagonal consists of an ISA 60 × 60 × 8 mm and it is connected to a gusset plate by one leg only by 18 mm diameter rivets in one chain line along the length of member. Determine the tensile strength of the member.

b) **Attempt any ONE of the following:** **6**

(i) Sketch the any three end conditions of column showing their effective length.

(ii) Draw neat sketch showing elevation and section of gusseted base.

5. Attempt any TWO of the following: **16**

a) Design the suitable fillet weld and size 4 mm to connect a tie bar 80 × 8 mm to a 10 mm thick gusset plate. Joint has to be designed for full strength and the tie bar and welding on all three sides. Draw neat sketch showing lap length. Take - $f_y = 250\ N/mm^2$, $\gamma_{mo} = 1.10$, $f_u = 410\ N/mm^2$, $\gamma_{mw} = 1.50$.

b) Design a double angle section on same side of gusset plate to carry an axial tensile load of 300 kN. Assume 16 mm diameter power driven shop rivet provided. Take $\sigma at = 150$ MPa. Assume tack rivets is provided. Try following sections.

ISA 70 × 70 × 10	1302 mm^2
ISA 80 × 80 × 10	1505 mm^2
ISA 90 × 90 × 8	1379 mm^2

Marks

c) Design a slab base for column ISHB 400@ 82.2 kg/m to carry factored axial compressive load of 2000 kN. The base rests on concrete pedestal of grade M20. For ISHB 400 - b_f = 250 mm, f_y = 250 MPa, γ_{mo} = 1.10, f_u = 410 MPa, t_f = 12.7 mm.

6. Attempt any FOUR of the following: **16**

a) A tie in a truss consist of two angles $90 \times 60 \times 6$ connected on opposite side of gusset plate 8 mm thick. The longer leg is connected. The axial tensile load is 150 kN. Design the riveted connection for 16 mm diameter power driven shop rivet. Assume permissible bearing stress = 300 N/mm^2, permissible shear stress = 100 N/mm^2.

b) Define effective length and slenderness ratio for compression member.

c) State and draw any dour types of welds and their symbols.

d) Write down the design steps for axially loaded tension member.

e) Find the load carrying capacity in axial compression of an angle $65 \times 65 \times 6$ mm having effective length 2.8 m. For single ISA $65 \times 65 \times 6$ – A = 744 mm^2, γ_{min} = 12.6 mm.

λ	210	220	230	240
σac (MPa)	25	23	21	20