Test

Steel Structures

Time: 60 Minutes

1. How are the most commonly produced and used structural elements in frames, floor beams, with high moment of inertia about *X*-axis, are designated?
(A) ISWB–section
(B) ISLB–section
(C) ISMB–section
(D) ISHB–section

2. Match Group A with Group B and select the correct answers

	Group A		Group B
P.	Used when two plates are placed one below the other	1.	Fillet weld
Q.	Pressure applied continuously	2.	Plug weld
R.	Member subjected to direct axial loads	3.	Slot weld
S.	Joining two surfaces in two different planes	4.	Seam weld
		5.	Butt weld

Codes:

	P	Q	R	S		P	Q	R	S
(A)	4	5	3	2	(B)	4	3	2	1
(C)	5	4	1	2	(D)	3	4	5	3

3. For economical spacing of roof truss, if t, p, r are the cost of truss, purlin and roof coverings respectively, then
(A) $t = p + r$ (B) $t = 2p + r$
(C) $t = p + 3r$ (D) $t = p + 2r$

4. Gantry girders are usually designed
(A) for multistorey buildings.
(B) using channel sections only.
(C) as laterally supported beams.
(D) as laterally unsupported beams.

5. Bearing stiffners in a plate girder is used wherever there is concentrated load to
(A) increase shear resistance.
(B) prevent excessive deflection.
(C) prevent buckling of web.
(D) to transfer the load from compression flange to the tension flange.

6. Which of the bolted connections have maximum efficiency?
(A) Zig-zag (B) Diamond
(C) Chain (D) Both A and B

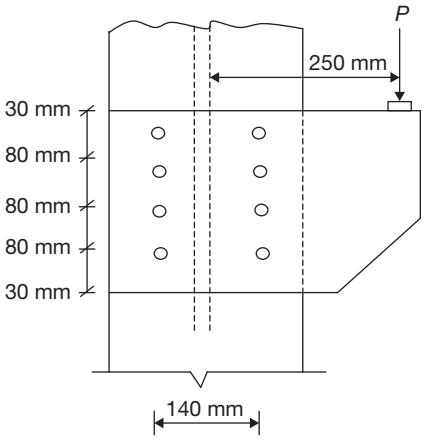
7. _____ beams are used for large spans and light loads.
(A) ISLB
(B) Tubular beams
(C) Castellated beams
(D) ISWB

8. A steel c/s has less capacity to resist torsion, when
(A) shear center is above center of gravity.
(B) shear center is below center of gravity.
(C) shear center coincides with center of gravity.
(D) not related with their locations.

9. The design normal strength of a fillet weld is
(A) f_u
(B) $\dfrac{f_y}{\sqrt{3}}$
(C) f_y
(D) $\dfrac{f_u}{\sqrt{3}\gamma_{mw}}$

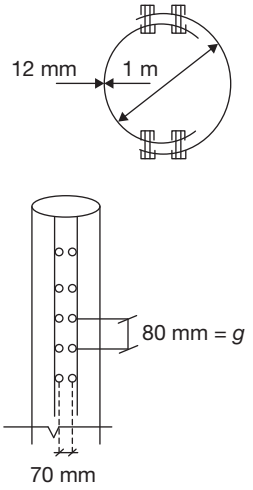
10. Maximum pitch for a tension member whose thickness is 't' is
(A) $12t$ or 200 mm.
(B) $16t$ or 200 mm.
(C) Least of (A) and (B).
(D) Only 200 mm.

11. Determine the safe load P that can be carried by the joint shown in the given figure. The bolts used are 20 mm diameter of grade 4.6. The thickness of flange of I-section is 9 mm and that of bracket plate is 10 mm.



(A) 93.68 kN
(B) 89.49 kN
(C) 65.68 kN
(D) 72.92 kN

12. Boiler plates of t = 15 mm thickness are lap jointed with bolts 18 Φ of 4.6 Grade. If the diameter of boiler is 1 m, determine maximum pressure that can be allowed in boiler.



(A) 0.12 N/mm^2 (B) 0.26 N/mm^2
(C) 0.38 N/mm^2 (D) 0.45 N/mm^2

13. Match List I of types of sections of beams with List II the cases for which beams are designed.

	List I		List II
P.	Plastic section	**1.**	Elastic design
Q.	Compact section	**2.**	Indeterminate frames
R.	Semi-compact section	**3.**	Plate girdes
S.	Slender section	**4.**	Simply supported beams

Codes:

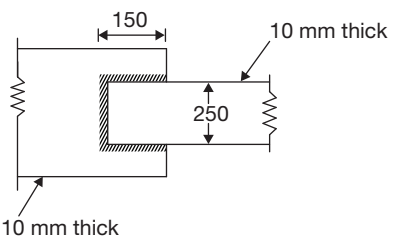
	P	Q	R	S		P	Q	R	S
(A)	2	4	1	3	(B)	4	2	3	1
(C)	3	1	2	4	(D)	1	3	4	2

14. **Statement I:** In long columns the axial buckling stress remains below the proportional limit and they buckle elastically.

Statement II: The failure loads for such columns are proportional to the flexural rigidity (*EI*) of the column and independent of the strength of steel.

(A) Both I and II are true and II is correct explanation of I
(B) Both I and II are true and II is not correct explanation of I
(C) I is true and II is false
(D) Both I and II are false

15. Determine the block shear strength of the welded tension member shown in figure. Plates are of Fe410 grade
PSF for yielding = 1.1
PSF for ultimate stress = 1.25



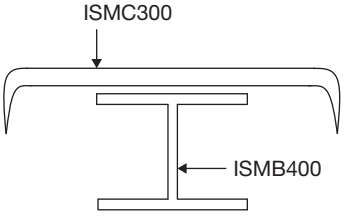
(A) 1543 kN (B) 1728 kN
(C) 1648 kN (D) 1483 kN

16. Determine the flenural design strength of the following welded members. The girders are simply supported and have continuous lateral support. Consider that only flanges resist BM.
Flanges: 250 × 12 mm
Web: 1200 × 8 mm
Span: 12 m

(A) 1652.72 kN (B) 826.36 kN
(C) 727.19 kN (D) 1454.38 kN

17. A built up section is composed of an I section ISMB400 and C section ISMC300 connected on top of I section as shown in figure. The minimum radius of gyration of built up section in cm is _____.

ISMB400	ISMC300
I_{zz} = 20458.4 cm^4	I_{zz} = 6362.6 cm^4
I_{yy} = 422.1 cm^4	I_{yy} = 310.8 cm^4
A = 78.46 cm^2	C_{yy} = 2.36 cm
	t_w = 7.6 cm
	A = 45.64 cm^2



(A) 10.6 cm (B) 13.5 cm
(C) 12.1 cm (D) 14.7 cm

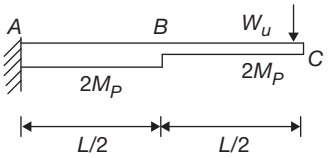
18. Match List I with List II and select the correct answer using the codes given below the lists:

	List I (Methods of Analysis)		List II (Conditions Satisfied)
a.	Exact plastic analysis	**1.**	Equilibrium, sufficient plastic hindges and non-violation of plastic moment capacity
b.	Mechanism method of plastic analysis	**2.**	Equilibrium and non-violation of plastic moment capacity
c.	Equilibrium method of plastic analysis	**3.**	Equilibrium, continuity and non-violation of plastic moment capacity
		4.	Equilibrium and sufficient plastic hindges

Codes:

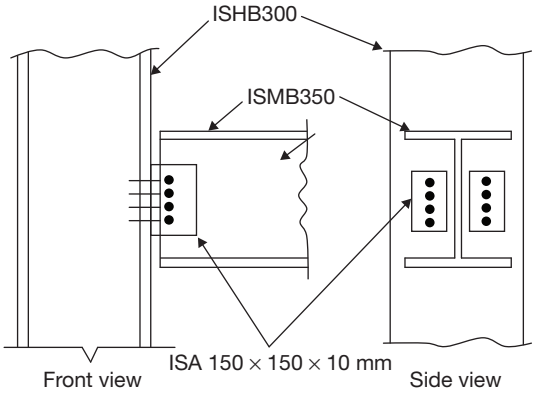
	a	b	c		a	b	c
(A)	3	1	2	(B)	1	2	4
(C)	3	4	2	(D)	1	4	2

19. Find out the collapse load for the following cantilever beam in the following figure:



(A) $0.75\ M_p/L$ (B) M_p/L
(C) $2\ M_p/L$ (D) $1.5\ M_p/L$

20. Two framing angles ISA 150 × 150 × 10 mm are used to make beam to column connection. One angle is placed on either side of the web of the beam as in figure. 3 bolts of 16 mm diameter of 4.6 Grades are used to connect the angle legs to the beam web. Determine the reaction that can be transferred through the joint. Given pitch P = 65 mm and end distance e = 40 mm.
Column ISHB300 @ 618.03 N/m t_f = 10.6 mm
Beam section ISMB350 @ 514.04 N/m t_w = 8.1 mm
Grade of steel is Fe410

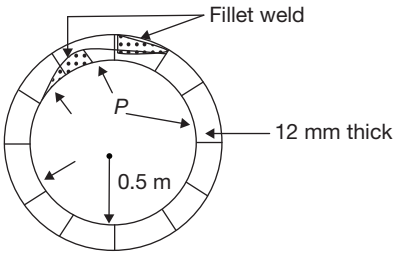


(A) 198.36 kN (B) 174.14 kN
(C) 200.68 kN (D) 183.42 kN

21. A circular plate, 200 mm in diameter is welded to another plate by means of 6 mm fillet weld. Calculate the ultimate twisting moment capacity that can be resisted by the weld use steel grade Fe410 and shop welding.

(A) 49.97 kN-m (B) 36.31 kN-m
(C) 57.68 kN-m (D) 61.31 kN-m

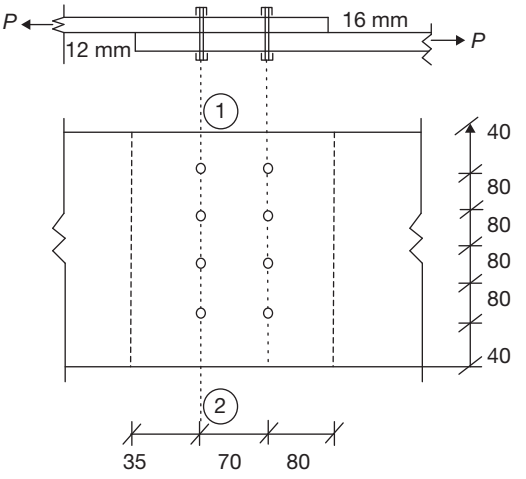
22. A circular penstock of mild steel of grade Fe410, 1.0 m diameter is fabricated in works shop with 12 mm thick plates. The plates are secured by 8 mm size fillet weld provided on inside and outside of lapped ends as shown in the figure. Determine safe internal pressure than can be allowed in the penstock. (in N/mm^2).



(A) 3.55 (B) 7.01
(C) 4.24 (D) 2.36

Direction for questions 23 and 24:

23. Find the design strength of Lap joint between 2 plates shown in the figure. Bolts 20 Φ, 4.6 Grade plates E 250 Fe410 are used.



(A) 271 kN (B) 362 kN
(C) 308 kN (D) 420 kN

24. Find the efficiency for the bolted connection in problem no 23.

(A) 82% (B) 50% (C) 32% (D) 41%

25. Match List I (Different types of structural beams) List II (Functions of the beams)

	List I		List II
a.	Girder	**1.**	Provided in buildings to support roofs
b.	Purlins	**2.**	These carry roof loads in trusses
c.	Joists	**3.**	Supports a number of joists
d.	Spandrels	**4.**	Carry part of floor that of the exterior wall

Codes:

	a	b	c	d
(A)	1	2	3	4
(B)	2	1	4	3
(C)	3	2	1	4
(D)	2	3	4	1

Answer Keys

1. C	**2.** D	**3.** B	**4.** D	**5.** C	**6.** B	**7.** C	**8.** C	**9.** D	**10.** B
11. D	**12.** B	**13.** A	**14.** A	**15.** C	**16.** B	**17.** D	**18.** D	**19.** C	**20.** A
21. A	**22.** C	**23.** B	**24.** D	**25.** C					