



**POSTAL
BOOK PACKAGE**

2025

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**CIVIL
ENGINEERING**

Objective Practice Sets

Design of Steel Structures

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Introduction

- Q.1 Statement (I):** Steel is particularly useful for carrying heavy loads with relatively small sections as compared to other structural materials.
- Statement (II) :** As compared to other structural materials, steel has high strength to weight ratio.
- (a) Both Statement (I) and Statement (II) are individually true; and Statement (II) is the correct explanation of Statement (I)
- (b) Both Statement (I) and Statement (II) are individually true; but Statement (II) is NOT the correct explanation of Statement (I)
- (c) Statement (I) is true; but Statement (II) is false
- (d) Statement (I) is false; but Statement (II) is true
- Q.2** For steel in contact with water and soil and those subjected to alternate wetting and drying, how much additional thickness should be provided in steel sections?
- (a) 1 mm (b) 1.5 mm
(c) 2 mm (d) 2.5 mm
- Q.3** Which of the following statement is true for compact sections?
- (a) The stress distribution for such sections is triangular.
- (b) These can develop plastic hinges and have rotation capacity required for failure of structure by formation of plastic hinges.
- (c) These can develop plastic moment of resistance, but have inadequate plastic hinge rotation capacity for formation of a plastic mechanism before buckling.
- (d) None of the above
- Q.4** Which code is used to calculate earthquake load on structure?
- (a) IS 875 Part IV (b) IS 875 Part III
(c) IS 1839 (d) IS 1893
- Q.5** Which of the following methods of design would be suitable for metal structures subjected to stress reversals and impact?
- Simple working stress design
 - Rigid-plastic design
 - Semirigid design
 - Elastic rigid design
- Select the correct answer using the codes given below:
- (a) 1, 2 and 4 (b) 1, 3 and 4
(c) 1, 2 and 3 (d) 2, 3 and 4
- Q.6** Consider the following statements:
Aluminum is being increasingly used for structural purposes because
- its modulus of elasticity is double that of steel
 - its coefficient of thermal expansion is half that of steel
 - it requires less maintenance
 - the strength to unit weight ratio of aluminum is high
- Which of these statements are correct?
- (a) 1 and 4 (b) 2 and 4
(c) 1, 2 and 3 (d) 3 and 4
- Q.7** In the context of the ultimate load theory for steel, the stress-strain curve for steel is idealized as
- a single straight line
 - bilinear
 - a quadratic parabola
 - a circular arc
- Q.8** Unit mass of steel and modulus of elasticity (as per IS 800 : 2007)
- $7850 \text{ kg/m}^3, 2 \times 10^5 \text{ N/mm}^2$
 - $7850 \text{ kg/m}^3, 2.1 \times 10^6 \text{ N/mm}^2$
 - $7500 \text{ kg/m}^3, 2 \times 10^5 \text{ N/mm}^2$
 - $7850 \text{ kg/m}^3, 2.1 \times 10^5 \text{ N/mm}^2$
- Q.9** As per IS : 875, for the purpose of specifying basic wind velocity, the country has been divided into
- 4 zones (b) 5 zones
(c) 6 zones (d) 7 zones

Answers**Introduction**

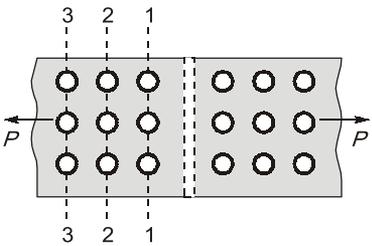
1. (a) 2. (b) 3. (c) 4. (d) 5. (b) 6. (d) 7. (b) 8. (a) 9. (c)

Explanations**Introduction**

1. (a)
As compared to other structural materials, steel has high strength to weight ratio. It implies, steel possess very high strength and results in smaller sections as compared to other structural materials. Thus steel is particularly useful for carrying heavy loads with relatively small sections.
2. (b)
An additional thickness of 1.5 mm should be provided in steel which is in contact with soil and water and is subjected to alternate wetting and drying.
3. (c)
Stress distribution of compact sections is rectangular.
4. (d)
IS 1893 is used for earthquake load on a structure.
IS 875 part I to V are used to calculate dead load, live load, wind load, snow load, and various possible load combinations respectively and IS 1893 is used for earthquake load.
5. (b)
Working stress design, elastic rigid design, semirigid design are suitable design methods for metal structures subjected to stress reversals and impact.
6. (d)
Aluminium is increasingly used because it requires less maintenance and its strength to unit weight ratio of aluminium is high.
9. (c)
6 basic wind speeds considered for zoning are:
55 m/sec (198 km/h) Very high damage risk zone-A
50 m/sec (180 km/h) Very high damage risk zone-B
47 m/sec (169.2 km/h) High damage risk zone-C
44 m/sec (158.4 km/h) Moderate damage risk zone-A
39 m/sec (140.4 km/h) Moderate damage risk zone-B
33 m/sec (118.8 km/h) Low damage risk zone



Riveted, Bolted and Pinned Connections

- Q.1** The yield stress of mild steel of normally rolled structural steel is about (in N/mm^2):
 (a) 240 to 260 (b) 330 to 360
 (c) 420 (d) 550
- Q.2** If same number of bolts has been used in the joints, then which of the following patterns will yield highest efficiency?
 (a) Chain (b) Staggered
 (c) Diamond (d) Staggered diamond
- Q.3** For reversal of stress, the most suited bolt is
 (a) black (b) turned
 (c) friction grip (d) ordinary
- Q.4** High strength bolts are designed on the basis of
 (a) friction (b) tension
 (c) compression (d) shear
- Q.5** Two steel plates each of 10 mm thickness are connected by double cover butt joint by bolts as shown in figure. If the bolt diameter is 20 mm and steel is of grade Fe 410, then which one of the following section is the most critical section for the main plate?
- 
- (a) Section 1-1
 (b) Section 2-2
 (c) Section 3-3
 (d) Both section 1-1 and section 3-3
- Q.6** When the axis of load lies in the plane of rivet group, then the rivets are subjected to
 (a) only shear stresses
 (b) only tensile stresses
 (c) only compressive stresses
 (d) torsional moment
- Q.7** Which of the following types of riveted joint is free from bending stresses?
 (a) Lap joint
 (b) Butt joint with single cover plate
 (c) Butt joint with double cover plates
 (d) None of the above
- Q.8** As compared to field rivets, the shop rivets are,
 (a) stronger (b) weaker
 (c) equally strong (d) any of the above
- Q.9** Which of the following statement is correct?
 (a) Material cost of a rivet is higher than that of a bolt.
 (b) Tensile strength of a bolt is lesser than that of a rivet.
 (c) Bolts are used as temporary fastenings whereas rivets are used as permanent fastenings.
 (d) Riveting is less noisy than bolting
- Q.10** Minimum pitch of the rivets shall not be less than
 (a) $1.5d$ (b) $2.0d$
 (c) $2.5d$ (d) $3.0d$
- Q.11** As per IS : 800, the rivets subjected to combined tensile and shear stresses are proportioned such that
- (a) $\left(\frac{f_s}{p_s}\right)^2 + \left(\frac{f_t}{p_t}\right)^2 \leq 1.4$
 (b) $\left(\frac{f_s}{p_s}\right) + \left(\frac{f_t}{p_t}\right) \leq 1.4$
 (c) $\left(\frac{f_s}{p_s}\right)^2 + \left(\frac{f_t}{p_t}\right)^2 \leq 1.4$
 (d) $\left(\frac{f_s}{p_s}\right)^2 + \left(\frac{f_t}{p_t}\right)^2 \geq 1.4$

where f_s and f_t are respectively actual shear and tensile stresses in a rivet and p_s and p_t are respectively permissible shear and tensile stresses in the rivet.

Q.12 What is the maximum permissible longitudinal pitch in staggered riveted compression joints?

- (a) 500 mm (b) 400 mm
(c) 300 mm (d) 100 mm

Q.13 Match **List-I** (Failure mode) with **List-II** (Reason) and select the correct answer using the codes given below the lists:

List-I

- A. Shear failure of plates
B. Bearing failure of plates
C. Tearing failure of plates
D. Splitting failure of plates

List-II

1. Insufficient edge distance
2. Strength of plate is less than that of the rivets

Codes:

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

Q.14 20 mm diameter rivets are used to connect 10 mm thick plates. The permissible stresses for rivets in shear and bearing are 80 MPa and 250 MPa respectively. The difference of rivet value in single shear and double shear is

- (a) 27.6 kN (b) 24.7 kN
(c) 32.5 kN (d) 34.2 kN

Q.15 According to IS specifications, the maximum pitch of rivets in compression is

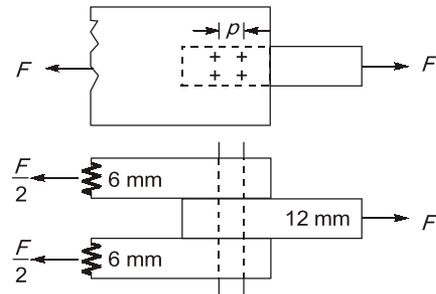
- (a) lesser of 200 mm and $12t$
(b) lesser of 200 mm and $16t$
(c) lesser of 300 mm and $32t$
(d) lesser of 300 mm and $24t$

where t is thickness of thinnest outside plate or angle.

Q.16 What is the ratio of the yield stress in power driven shop rivets relative to the permissible bearing stress of mild steel?

- (a) 1.0 (b) 0.8
(c) 0.6 (d) 0.4

Q.17 Consider the riveted joint shown in figure. The maximum permissible value of 'p' (rivet diameter 20 mm) is



- (a) 50 mm (b) 60 mm
(c) 72 mm (d) 96 mm

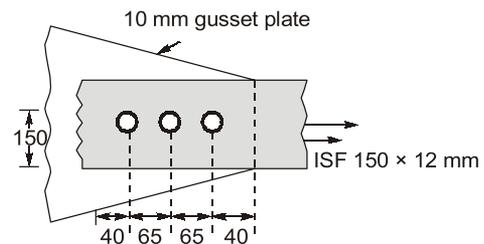
Q.18 Two 10 mm thick plates are connected by lap joint to transmit a factored load of 100 kN using black bolts of 12 mm diameter and grade 4.6. The minimum number of bolts required for safe design would be (given $f_u = 410$ MPa)

- (a) 3 (b) 4
(c) 5 (d) 6

Q.19 If diameter of a bolt is 22 mm, then maximum number of bolt (s) that can be accommodated in one row in 150 mm wide plate is (are)

- (a) 1 (b) 2
(c) 3 (d) 4

Q.20 For the connection as shown in the figure, the bolt value will be



(Take diameter of bolt as 20 mm and grade 4.6)

- (a) 35.7 kN (b) 70.2 kN
(c) 135.7 kN (d) 109.3 kN

Q.21 If the thickness of plate to be connected by a rivet is 15 mm, then suitable size as per Unwin's formula will be

- (a) 15 mm (b) 16.5 mm
(c) 22 mm (d) 24 mm

Q.22 For field rivets, the permissible stresses are reduced by what percentage?

- (a) 10% (b) 15%
(c) 25% (d) $33\frac{1}{3}\%$

Q.23 In which of the following cases a structural is fastener over designed?

1. When design is based on Unwin's formula
2. Long sustained loading leading to creep.
3. When reversal of stresses takes place.
4. In fatigue loadings.

Select the correct answer using the codes given below

- (a) 1, 3 and 4 (b) 2 and 4
(c) 3 and 4 (d) none of these

Q.24 Efficiency of a riveted joint, having the minimum pitch is

- (a) 40% (b) 50%
(c) 60% (d) 70%

Q.25 If 'A' is the area of cross-section of a bar, the gauge length for the measurement of ductility will be

- (a) $5.65 \times A^{1/2}$ (b) $5.65 \times A$
(c) $6.56 \times A^{1/2}$ (d) $6.56 \times A$

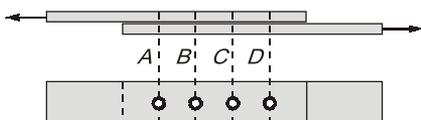
Q.26 If d and b are rivet diameter and width of plate, the efficiency (η) of the riveted joint, is given by

- (a) $\eta = \frac{p}{d-b}$ (b) $\eta = \frac{d}{b+d}$
(c) $\eta = \frac{b-d}{b}$ (d) $\eta = \frac{b+d}{b}$

Q.27 When the effect of wind or earthquake load is considered in the design of rivets and bolts for steel structures, by what percentage the permissible stresses may be exceeded?

- (a) 15% (b) 25%
(c) 33.33% (d) 50%

Q.28 Which one of the following statements regarding the riveted joint as shown in the given figure is correct?



- (a) In elastic theory all rivets carry equal forces
(b) In plastic theory all rivets carry equal forces
(c) Both in elastic and plastic theories all rivets carry equal forces
(d) In plastic theory the outer rivets A and D carry greater proportion of load

Q.29 Which of the following factors are considered correct regarding pin connections?

- (i) Pin connections are rigid.
(ii) Secondary stresses do not occur.
(iii) Moment pin connection is zero.
(iv) Only one pin is used in the connection.
(a) (i), (ii), (iii) only (b) (ii), (iii), (iv) only
(c) (i), (iii), (iv) only (d) All of the above

Q.30 The strength of a 20 mm diameter bolt of grade 4.6 for double cover butt joint, each cover plate being 8 mm thick. The main plates to be jointed are 12 mm thick.

Assume $A_{nb} = 245 \text{ mm}^2$, $f_{ub} = 400$,
 $Y_{mb} = 1.25$, $K_b = 0.50$.

- (a) 90.52 kN (b) 86 kN
(c) 80.52 kN (d) 96 kN

Directions : Each of the next items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

- (a) Both Statement (I) and Statement (II) are individually true; and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true; but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true; but Statement (II) is false
(d) Statement (I) is false; but Statement (II) is true

Q.31 Statement (I): Deflection of a beam with bolted connections is greater than that of a beam with riveted connections.

Statement (II): Bolted connections allow greater slip between components than riveted connections.

Q.32 Statement (I) : In structural bearing type joints, each connection is assumed to transmit its proportional share of the applied load.