Q1. In a diamond riveting for a plate of width ‘b’ and rivet diameter ‘d’, the efficiency of the joint is given by

(a) $(b-d)/b$
(b) $(b-2d)/b$
(c) $(b-d)/d$
(d) $(b-2d)/d$

Q2. The diameter of rivet hole in tension member using rivet of diameter more than 25mm will be equal to
(a) rivet diameter +3mm
(b) rivet diameter +2 mm
(c) rivet diameter +1.5 mm
(d) rivet diameter

Q3. If the pitch is 6cm and rivet value is 4 tonnes, the number of rivets required for a riveted connection carrying an eccentric load of 15 tonnes at 30cm from the center line is _____:
(a) 6
(b) 8
(c) 10
(d) 12

Q4. The permissible longitudinal pitch in a riveted joint in tension is
(a) 12t or 200 mm
(b) 20t or 200 mm
(c) 16t or 200 mm
(d) 24t or 200 mm

Q5. Load on connection is not eccentric for
(a) lap joint
(b) single cover butt joint
(c) double cover butt joint
(d) none of the above

Q6. The gross diameter of a rivet is the diameter of-
(a) Rivet hole
(b) Rivet measured before driving
(c) Rivet measured after driving
(d) None of the above

Q7. Bearing strength of single riveted lap joint is equal to:
(a) $d \times t \times f_b$
(b) $2d \times t \times f_b$
(c) $2 \times d^2 \times t \times f_b$
(d) None of the above

Q8. Shear strength in double shear in riveted joints is given by:
(a) $\frac{\pi d^2}{4} f_s$
(b) $\frac{2\pi d^2}{4} f_s$
(c) $\frac{\pi}{4} d f_s$
(d) none of the above

Q9. A plate 10 mm thick is to be jointed to a plate of 12 mm thickness. The nominal diameter of rivet to make connection is
(a) 18 mm
(b) 22 mm
(c) 24 mm
(d) 20 mm

Q10. Rivet value is equal to
(a) strength of rivet in shearing
(b) strength of rivet in bearing
(c) strength of rivet in tension
(d) minimum of (a) and (b

Q11. The throat in a fillet weld is
(a) large side of the triangle of the fillet
(b) hypotenuse of the triangle of the fillet
(c) smaller side of the triangle of the fillet
(d) perpendicular distance from the root to the hypotenuse

Q12. Which one of the following is the mode of failure in a fillet weld material?
(a) Tension
(b) Shear
(c) Bearing
(d) Crushing

Q13. The size of a fillet weld is indicated by:
(a) Throat of the fillet
(b) Length of fillet weld
(c) Size of the plate
(d) Side of the triangle of fillet

Q14. Fillet weld is not recommends if the angle between fusion faces is _____:
A. Less than 45°
B. Greater than 120°
C. Less than 60°
D. Greater than 145°

The correct statement are
(a) A&B
(b) A&D
(c) B&C
(d) C&D

Q15. Which of the following does not describe a weld type?
(a) Butt
(b) Plug
(c) Zig-Zig
(d) Lap

Q16. Maximum size of a fillet weld for a plate of square edge is
(a) 1.5 mm less than the thickness of the plate
(b) one-half of the thickness of the plate
(c) thickness of the plate itself
(d) 1.5 mm more than the thickness of the plate

Q17. The strength of fillet weld is …….
(a) About 80 to 95 percent of the main member
(b) Equal to that of the main member
(c) More than that of the main member
(d) Equal to or more than that of main member

Q18. Two flats (110mm×16mm) and (110mm×12mm) are welded by double V butt weld. If permissible stress is 142 N/mm², the strength of weld will be-
(a) 167.75 KN
(b) 195.56 KN
(c) 187.44 KN
(d) 210.25 KN

Q19. The effective length of fillet weld should not be less than-
(a) two times weld size
(b) Six times weld size
(c) Weld size
(d) Four times weld size

Q20. What shall be the minimum effective throat thickness of a fillet weld in case of structural steel design?
(a) 4 mm
(b) 3 mm
(c) 5 mm
(d) 2 mm

Q21. A steel plate is 30 cm wide and 10 mm thick. A river of nominal diameter of 18 mm is driver. The net sectional area of plate is
(a) 18.00 cm²
(b) 28.20 cm²
(c) 28.05 cm²
(d) 32.42 cm²

Q22. Two angles section are connected by only one leg of each angle to the same side of a gusset plate. The net effective area is $A_1 + K\,A_2$ where K is taken as
Where, $A_1 \rightarrow$ Area of connected leg
$A_2 \rightarrow$ Area of outstanding leg
(a) $\frac{5A_1}{5A_1+A_2}$
(b) $\frac{3A_1}{3A_1+A_2}$
(c) $\frac{5A_1+A_2}{5A_1}$
(d) $\frac{3A_1+A_2}{3A_1}$

Q23. In a structure, cable and wire are used generally
(a) To resist shears stress
(b) Flexible member
(c) Tension member
(d) compression member

Q24. As per IS 800, what is the maximum allowable effective slenderness ratio for structural steel that is always under tension?
(a) 300
(b) 180
(c) 400
(d) 450

Q25. Net sectional area of tension member is equal to its gross sectional area
(a) Plus the area of rivet holes
(b) Divided by the area of the rivet holes
(c) Multiplied by the area of the rivet holes
(d) Minus the area of the rivet holes

Q26. As per the code, the permissible stress in axial tension in N/mm² on the net effective are of the sections shall not exceed (where, f_y is the minimum yield stress of steel in N/mm²):
(a) 0.5 f_y
(b) 0.6 f_y
(c) 0.75 f_y
(d) 0.8 f_y

Q27. In a tension splice the number of rivets carrying calculated shear stress through a packing greater than 6mm thick, is to be increased by 2.5% for each _____ thickness of packing.

(a) 1 mm
(b) 1.5 mm
(c) 2 mm
(d) 2.5 mm

Q28. When a member is subjected to axial tensile load, the greatest normal stress is equal to
(a) Half the maximum shear stress
(b) Maximum shear stress
(c) Twice the maximum shear stress
(d) None of these

Q29. The working stress for structural steel in tension is of the order of
(a) 15 N/mm²
(b) 75 N/mm²
(c) 150 N/mm²
(d) 750 N/mm²

Q30. Permissible stress may also be known as
(a) Ultimate stress
(b) working stress
(c) limit stress
(d) yield stress

Q31. A tie is a
(a) Flexible member
(b) Compression member
(c) Torsion member
(d) Tension member

Q32. In plate girders vertical stiffeners are required when the ratio of clear depth of web (d) to web thickness (t)
(a) $\frac{d}{t} > 25$
(b) $\frac{d}{t} > 75$
(c) $\frac{d}{t} > 85$
(d) $\frac{d}{t} > 95$

Q33. Horizontal stiffeners are needed in plate girders if the Thickness of web is less than
(a) 6 mm
(b) Depth/200
(c) Span/500
(d) Flange thickness

Q34. Web crippling in beams generally occurs at the point where-
(a) Concentrated load act

(b) Shear force is maximum
(c) bending moment is maximum
(d) deflection is maximum

Q35. If $'I_b'$ is moment of inertia of the rolled beam section, $'A_p'$ is area of cover plates in one flange and $'h'$ is the distance between the centroid of the top and bottom flange plates, moment of inertia of built up plate girder is given by-

(a) $I = \left[I_b + 2A_p \left(\frac{h}{2}\right)^2\right]$

(b) $I = \left[I_b + 2A_p \left(\frac{h}{2}\right)^3\right]$

(c) $I = \left[I_b + 2A_p \left(\frac{h}{2}\right)\right]$

(d) $I = \left[I_b + 3A_p \left(\frac{h}{2}\right)^2\right]$

Q36. The shape factor for a solid circular section is
(a) 1.5
(b) 2.0
(c) 1.697
(d) 2.346

Q37. The purpose of stiffeners in a plate girder is to:
(a) take care of bearing stress
(b) increases the moment carrying capacity of the girder
(c) prevent buckling of web plate
(d) reduce the shear stress

Q38. According to IS 800, in case of structural steel design, the span length of a flexural member in a continuous frame system shall be taken as the distance between:
(a) diametrically opposite ends of the support
(b) centre to centre of the support + twice the eccentricity
(c) centre to centre of the support
(d) edge to edge of the support

Q39. Which one of the following stresses is independent of yield stress as a permissible stress for steel member-
A. Axial tensile stress
B. Maximum shear stress
C. Bearing stress
D. Stress in slab base
(a) A
(b) B
(c) C
(d) D

Q40. The distance between C.G. of compression flange and C.G. of tension flange of a plate girder, is known as:

(a) Gross depth
(b) Net depth
(c) Effective depth
(d) Clear depth

Q41. In a plate girder, the shear force in the girder at any section is taken up by:
(a) the web only
(b) the flange only
(c) part of web and part of flange
(d) the whole section

Q42. A vertical plate of a plate girder is called
(a) Web plate
(b) Flange plate
(c) Cover plate
(d) None of these

Q43. In a plate girder, bending moment is resist of-
(a) Web plate
(b) Flange plate only
(c) Flange angle only
(d) flange plate and flange angle

Q44. If a rolled steel flat designated as 55 I.S.F. 12 mm is used as lacing, then minimum radius of gyration will be ……..
(a) 3 mm
(b) 6 mm
(c) 3.46 mm
(d) 3.8 mm

Q45. A welded steel plate girder consisting of two flange plates of 350mm×16mm and a web plate of 1000 mm×6mm requires_____:
(a) No stiffeners
(b) Vertical stiffeners
(c) Intermediate vertical stiffeners
(d) Vertical and horizontal stiffeners

Q46. The minimum distance between centre of fasteners in structural steel design shall not be less than X times the nominal diameter of the fastener, where X is:
(a) 2
(b) 2.5
(c) 3
(d) 3.5

Q47. Find the area of cross section of bolts if a bracket is connected to a tie bar by means of 5 bolts, given shear stress = 150 N/mm². and load = 55kN.
(a) 366 mm²

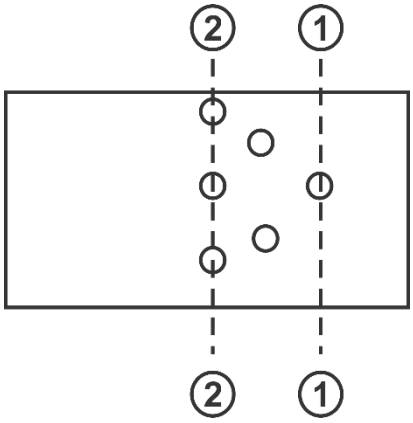
(b) 368 mm²
(c) 370 mm²
(d) 372 mm²

Q48. The in-plane shear deformation effect by which concentrated forces tangential to the surface of a plate get distributed over the entire section perpendicular to the load over a finite length of the plate along the direction of the load is called:
(a) Shear force
(b) Point of contra flexure
(c) Angle of repose
(d) shear lag

Q49. Where the imposed load is variable and exceeds three-quarters of the dead load, arrangements of live load acting on the floor under consideration shall not include which of the following case?
(a) Imposed load on all spans
(b) imposed load on two adjacent spans
(c) Imposed load on alternate spans
(d) Imposed load on spans under consideration

Q50. The maximum width of a covered steel building section should preferably be restricted to X m beyond which suitable provisions for the expansion joint may be made, where X is:
(a) 50
(b) 150
(c) 90
(d) 200

S1. Ans.(a)
Sol.



Width of plate = b
Diameter of rivet = d
Strength of plate at (1) – (1)

$$(b-d)t\,\sigma_t ----(1)$$

Strength of plate at (2) – (2)

$$= (b - 3d)t \times \sigma_t - -(2)$$

$\sigma_t =$ permissible tensile stress

$$\boxed{\sigma_t = 0.6\, fy}$$

Gross strength of plate ⇒ b.t.σ_t –----(3)

Efficiency (η) = $\frac{Min\ of\ (1)\&\ (2)}{(3)}$

$$\eta = \frac{(b-d)t.\sigma_t}{bt\ \ \sigma_t}$$

$$\boxed{\eta = \frac{b-d}{b}}$$

S2. Ans.(b)

Sol. <u>in case of rivet</u>

→ if rivet diameter is less than 25 mm then diameter of hole equal to diameter of rivet plus 1.5 mm.

→ if rivet diameter is more than 25 mm then diameter of hole equal to diameter of rivet plus 2 mm.

S3. Ans.(b)

Sol. Pitch (P) = 6cm

Rivet value (Rv) = 4 tonnes

Load = 15 tones

Eccentricity (e) = 30 cm.

Moment (m) = p.e

$$= 15 \times 30$$

No. of rivet (n) = $\sqrt{\frac{6M}{mPRv}}$

M = moment

m = no. of row (m = 2)

P = pitch

Rv = Rivet value

$$n = \sqrt{\frac{6 \times 15 \times 30}{2 \times 6 \times 4}}$$

$$n = \sqrt{56.25}$$

$$\boxed{n = 7.5}$$

S4. Ans.(c)

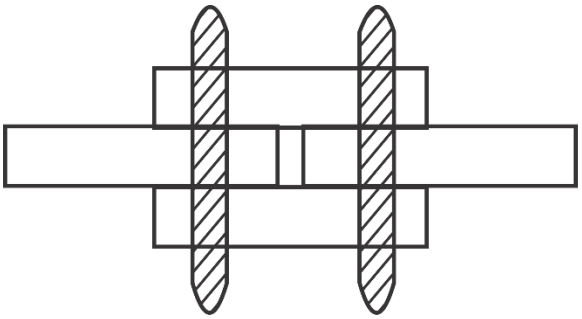
Sol.

→ Permissible longitudinal pitch in tension is (16 t, 200 mm) whichever is less

→ Permissible longitudinal pitch in compression is (12 t, 200 mm) whichever is less

Where, t = thickness of thinner outside plate

S5. Ans.(c)
Sol.



→ in double cover butt joint connection is not eccentric

S6. Ans.(a)
Sol. Gross diameter of a rivet is the diameter of rivet hole.
In WSM

Nominal diameter (d)	Gross diameter (do)
d ≤ 25 mm	do = d + 1.5 mm
d > 25 mm	do = d +2 mm

In LSM

Nominal diameter (d)	Gross diameter (do)
d = 12mm to 14 mm	do = d +1mm
d = 16mm to 24 mm	do = d + 2 mm
d > 24 mm	do = d + 2 mm

S7. Ans.(a)
Sol. Bearing strength of rivet joint

$$(d \times t \times \sigma_{bp})$$

σ_{bp} → permissible bearing stress in rivet.

S8. Ans.(b)
Sol. shear strength in double shear rivetted joint

$$= 2 \times \frac{\pi}{4} d^2 \times \sigma_{Sp}$$

d → gross diameter
σ_{sp} → permissible shear stress.

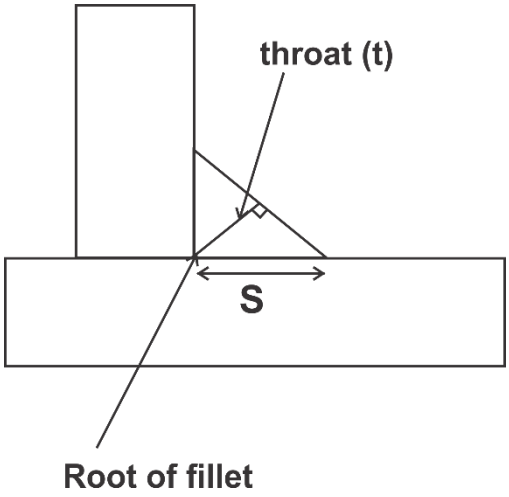
S9. Ans.(d)
Sol. Nominal diameter of rivet.
According to Unwin's formula

$$d = 6.05\sqrt{t} \qquad (Wherer\ t - \ mm)$$
$$d = 6.05\sqrt{10}$$
$$\boxed{d = 19.13\ mm}$$

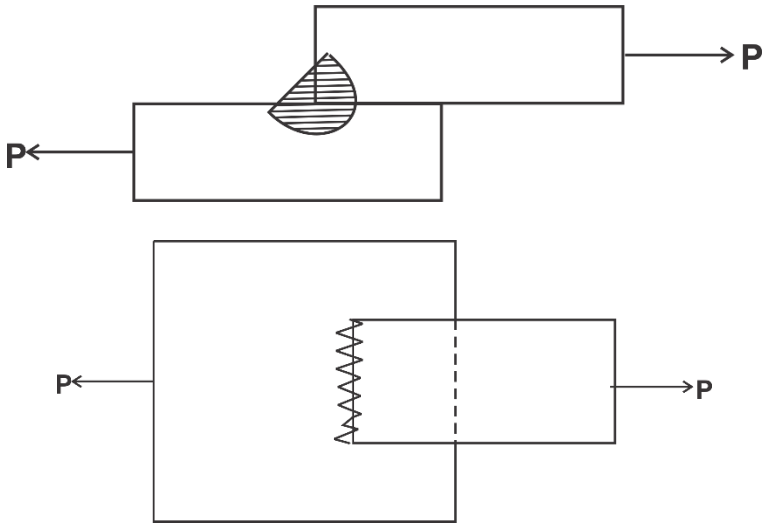
→ in question two thickness of plate given but in Unwin's formula minimum thickness used

S10. Ans.(d)
Sol. Rivet value is equal to minimum of shearing strength & bearing strength of rivet.

S11. Ans.(d)
Sol.



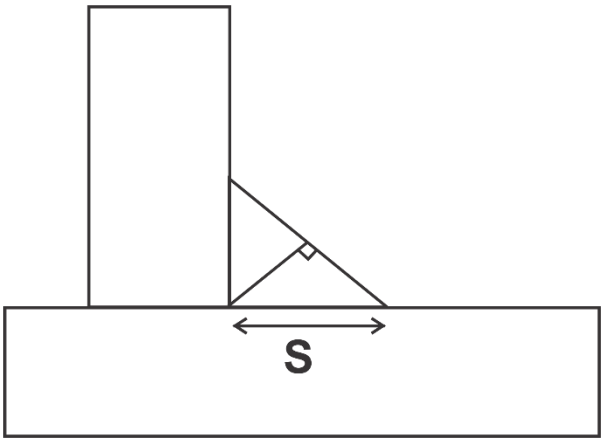
S12. Ans.(b)
Sol.



→ fillet weld failed due to shear failure
→ fillet weld have maximum strength in tension.

S13. Ans.(d)

Sol.



→ Size (S) in the fillet weld is indicated by side of the triangle of fillet

S14. Ans.(c)
Sol.

Angle between fusion faces	Throat coefficient
60 – 90	0.7
91 – 100	0.65
101 – 106	0.6
107 – 113	0.55
114 – 120	0.5

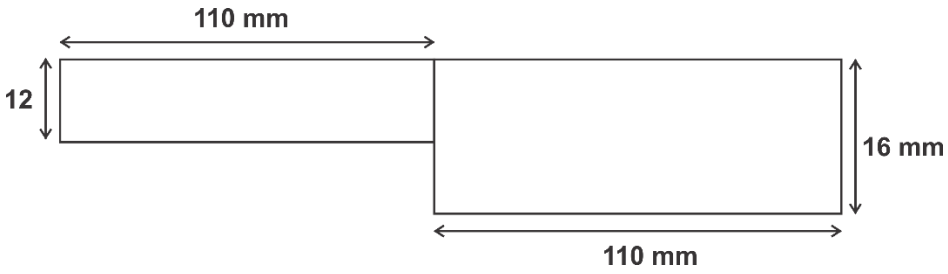
S15. Ans.(c)
Sol. Types of welds.

(i) Fillet weld
(ii) Butt weld
(iii) Plug weld
(iv) Slot weld

S16. Ans.(a)
Sol. Refer solution of Question number (3)

S17. Ans.(d)
Sol. Strength of fillet weld is equal to or more than that of main member

S18. Ans.(c)
Sol.



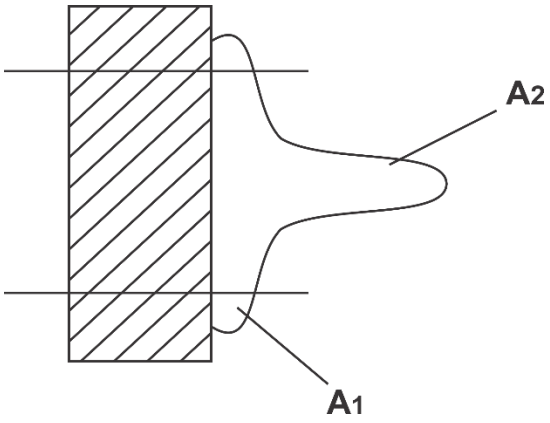
Strength of butt weld = $L \times t_{min} \times \sigma_{SP}$
= 110×12×142
= 187.44 kN

S19. Ans.(d)
Sol. According to IS. 800-2007
→ effective length of fillet weld should not be less than four time of weld size.

S20. Ans.(d)
Sol. $\boxed{throat\ thickness\ (t) = kS}$
K → Throat coefficient
S → size of weld.

S21. Ans.(c)
Sol. plate thickness (t) = 10 mm
Width of plate (B) = 30 cm = 300 mm
Diameter of rivet (d) = 18 mm
Diameter of hole (do) = 18+1.5
= 19.5 mm
Net sectional area (A_{net}) = (B – do) × t
= (300 – 19.5) ×10
= 280.5 ×10
= 280.5 mm²
= 28.05 cm²

S22. Ans.(a) (When both the angles are tack rivetted)
Sol.



$$A_1 = \left(l_1 - \frac{t}{2} - do\right) \times t \times 2$$
$$A_2 = \left(l_2 - \frac{t}{2}\right) \times t \times 2$$
$$A_{total} = A_1 + kA_2$$
$$\boxed{k = \frac{5A_1}{5A_1 + A_2}}$$

S23. Ans.(c)
Sol. Cable & wire are used generally to resist tension force.

S24. Ans.(c)
Sol. maximum slenderness ratio for tension member.

S.No.	Description	Maximum slenderness Ratio
1.	A tension member in which reverses of direct stress occurs due to load other than wind load or earthquake load	180
2.	A member normally acting as a tie member in a roof truss system or bracing system but subjected to possible reversal of stresses resulting from the action of wind load or earthquake load	350
3.	Members always under tension	400

S25. Ans.(d)
Sol. $\boxed{Net\ sectional\ area = gross\ area - area\ of\ rivet\ hole}$

S26. Ans.(b)
Sol. According to IS: 800.1984 (Permissible stress)-

(i) Axial tension & compression → 0.60 fy
(ii) Bending → 0.66 fy
(iii) Bearing → 0.75 fy
(iv) Average shear → 0.40 fy
(v) Maximum shear → 0.45 fy

S27. Ans.(c)

Sol. In tension splice the number of rivets carrying shear stress through a packing greater than 6 mm thick is to be increased by 2.5% for each 2 mm thickness of packing.

S28. Ans.(c)
Sol.

$$\boxed{\tau_{max} = \frac{\sigma_1 - \sigma_3}{2}}$$

$$for\ \sigma_3 = 0$$

$$\boxed{\tau_{max} = \frac{\sigma_{max}}{2}}$$

τ_{max} = maximum shear stress
σ_{max} = maximum normal stress
⇒ Maximum normal stress equal to twice the maximum shear stress.

S29. Ans.(c)
Sol. working (Permissible) stress for steel in
Tension = 0.60 fy
= 0.60 ×250
= 150 N/mm²

S30. Ans.(b)
Sol. permissible stress also known as working stress

S31. Ans.(d)
Sol. A tie is a tension member. In a truss tie is a horizontal beam connecting two rafter
S32. Ans.(c)
Sol. in plate girders, vertical stiffeners are required when the ratio of clear depth of web (d) to web thickness is greater than 85. its normal distance kept between 0.33 d to 1.5d.

$$\boxed{\frac{d}{t} > 85}$$

S33. Ans.(b)
Sol. in plate girders, horizontal stiffeners are needed when the thickness of web is less than $\frac{depth}{200}$.

$$\boxed{t < \frac{d}{200}}$$

S34. Ans.(a)
Sol. A beam is designed to resist maximum bending moment and is checked for shear stress and deflection, and also for web crippling and web buckling. web crippling in beams is generally occur at the point where concentrated load act.

S35. Ans.(a)
Sol. Given,
Moment of inertia of the rolled beam section $= I_b$
Area a of flange $= A_P$

Distance between flange = h
Moment of inertia of plate girder (I) is given by-
I = (moment of inertia for rolled beam section) + (2 × moment of inertial of flange plate on CG)

$$I = I_b + 2 \times A \times \left(\frac{h}{2}\right)^2$$

S36. Ans.(c)
Sol.

Shape	Shape factor
Diamond	2.0
Solid circular	1.697 ~ 1.70
Rectangle	1.50
Hollow circular	1.27
I – section	1.12-1.14
Triangle	2.34

S37. Ans.(c)
Sol. Stiffeners are typically plate welded to the web. These plate increases the moment of inertia of plate girder which enhance the rigidity in turns it prevent bucking of web plate. The stiffeners in standing position called vertical stiffeners and stiffeners in horizontal position called horizontal stiffeners.

S38. Ans.(c)
Sol. According to IS 800, in case of structural steel design, the span length of a flexural member in continuous frame system shall be taken as the distance between centre to centre distance of the support.

S39. Ans.(d)
Sol. Stress in slab base is independent of yield stress as a permissible stress for steel member. This stress is caused by soil.

S40. Ans.(c)
Sol. effective depth is the distance between centre of gravity of compression flange and center of gravity of tension flange of a plate girder.

S41. Ans.(c)
Sol. in plate girder, the shear force in the girder at any section is taken up by part of web and part of flange. The main purpose of flange plate in plate girders is to resist the bending moment acting on the girder.

S42. Ans.(a)
Sol. A vertical plate of a plate girder is called web plate. The thickness and depth of web plate depends upon bending moment and shear stress acting on the plate.

S43. Ans.(b)
Sol. the main purpose of flange plate in plate girders is to resist the bending moment acting on the girders.

S44. Ans.(c)
Sol. given,
Thickness of rolled steel (t) = 12 mm
Width of rolled steel (b)= 55
Minimum Radius of gyration (k) $= \sqrt{\frac{I}{A}}$

$$Where\ I\ = \frac{bt^3}{12}$$
$$= \frac{55 \times (12)^3}{12}$$
$$\boxed{I = 7920\ mm^4}$$
$$A = b.t$$
$$= 12 \times 55$$
$$\boxed{A = 660\ mm^2}$$

Now,

$$k = \sqrt{\frac{7920\ mm^4}{660\ mm^2}}$$
$$\boxed{k = 3.46\ mm}$$

S45. Ans.(c)
Sol.
Here, depth of web plate (d) = 1000 mm.
Thickness of web plate (t)= 6 mm.

$$\frac{d}{t} = \frac{1000}{6} = 166.66$$
$$85 < 166.66 < 200$$

Hence, only intermediate vertical stiffeners are provided.

S46. Ans.(b)
Sol. the minimum distance between centre of fasteners in structural steel design shall not be less than 2.5 times the nominal diameter of the fastener.

S47. Ans.(a)
Sol. Given,
Shear stress = 150 N/mm²
Load = 55kN
= 55 × 10³ N

Area (A) = ?

$$Shear\ stress\ = \frac{Load}{Area}$$

$$Area\ (A) = \frac{55 \times 10^3}{150}$$

$$= 366.67\ mm^2$$

S48. Ans.(d)
Sol.

S49. Ans.(a)
Sol. Where the imposed load is variable and exceeds $\frac{3}{4}$ of the dead load, Arrangements of live load acting on the floor under consideration shall not include imposed load on all spans.

S50. Ans.(c)
Sol. the maximum width of a covered steel building section should preferably be restricted to 150 m. beyond which suitable provision for the expansion joint may be made