

OPSC 2019

Odisha Public Service Commission

Civil Engineering

Objective Practice Sets

Design of Steel Structures

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Introduction

Q.1 Consider the following statements :

Assertion (A) : Steel is particularly useful for carrying heavy loads with relatively small sections as compared to other structural materials.

Reason (R) : As compared to other structural materials, steel has high strength to weight ratio. Of these statements :

- (a) both A and R are true and R is the correct explanation of A
- (b) both A and R are true but R is not a correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

Q.2 Which of the following statement is false?

- (a) Steel can be reused.
- (b) Being heavy, it is quite difficult to transport.
- (c) Steel has a very long life when maintained properly.
- (d) Steel is a ductile material.

Q.3 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.4 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.5 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.6 For a moment-resisting frame building, fundamental natural period, T_a is given as,

- (a) $T_a = \frac{2h}{d}$
- (b) $\frac{4h}{d}$
- (c) $0.07 \frac{h}{d}$
- (d) $0.09 \frac{h}{d}$

Q.7 The yield strength for a mild steel specimen was found to be 250 N/mm². What will be the working stress, if the factor of safety to be taken is 2.5?

- (a) 75 N/mm²
- (b) 100 N/mm²
- (c) 125 N/mm²
- (d) 625 N/mm²

Q.8 The heaviest I-section for same depth is

- (a) ISMB
- (b) ISLB
- (c) ISHB
- (d) ISWB

Q.9 Load factor is defined as

- (a) $\frac{\text{ultimate load}}{\text{yield load}}$
- (b) $\frac{\text{yield load}}{\text{working load}}$
- (c) $\frac{\text{ultimate load}}{\text{working load}}$
- (d) None of the above

Q.10 Which of the following methods of design would be suitable for metal structures subjected to stress reversals and impact?

1. Simple working stress design
2. Rigid-plastic design
3. Semirigid design
4. 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.11 Consider the following statements regarding tensile test diagrams for carbon steel with varying carbon contents:

As the carbon content increases

1. the ultimate strength of steel decreases
2. the elongation before fracture increases
3. the ductility of the metal decreases
4. the ultimate strength increases

Which of these statements are correct?

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

Q.12 Consider the following statements:

Aluminum is being increasingly used for structural purposes because

1. its modulus of elasticity is double that of steel
2. its coefficient of thermal expansion is half that of steel
3. it requires less maintenance
4. 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.13 In the context of the ultimate load theory for steel, the stress-strain curve for steel is idealized as

- (a) a single straight line
(b) bilinear
(c) a quadratic parabola
(d) a circular arc

Q.14 Unit mass of steel and modulus of elasticity (as per IS 800 : 2007)

- (a) 7850 kg/m^3 , $2 \times 10^5 \text{ N/mm}^2$
(b) 7850 kg/m^3 , $2.1 \times 10^6 \text{ N/mm}^2$
(c) 7500 kg/m^3 , $2 \times 10^5 \text{ N/mm}^2$
(d) 7850 kg/m^3 , $2.1 \times 10^5 \text{ N/mm}^2$

Q.15 As per IS : 875, for the purpose of specifying basic wind velocity, the country has been divided into

- (a) 4 zones (b) 5 zones
(c) 6 zones (d) 7 zones

Q.16 IS 800 : 2007 is based on

- (a) elastic design method
(b) ultimate load method
(c) working stress method
(d) limit state method

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Answers

Introduction

1. (a) 2. (b) 3. (b) 4. (c) 5. (d) 6. (d) 7. (b) 8. (c) 9. (a) 10. (b)
11. (a) 12. (d) 13. (b) 14. (a) 15. (c) 16. (d)

Explanations	Introduction
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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)

Being light, steel can be handled conveniently and thus it offers ease in transportation.

4. (c)

Stress distribution of compact sections is rectangular.

5. (d)

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.

6. (d)

Fundamental natural period for a moment-resisting frame building is given as,

$$T_a = \frac{0.09h}{d}$$

where, h = height of building in metres

d = Base dimension of building at plinth level, in metres, along the considered direction of lateral force.

7. (b)

$$\begin{aligned} \text{Working Stress} &= \frac{\text{Yield strength}}{\text{Factor of safety}} \\ &= \frac{250}{2.5} = 100 \text{ N/mm}^2 \end{aligned}$$

11. (a)

Carbon has the maximum influence on the mechanical properties of steel. Iron carbon alloys containing upto 2 per cent carbon are called carbon steel while those having more than 2% are called cast steel. With increase in carbon content, the tensile strength of steel increases but the ductility decreases.

12. (d)

Aluminium has greater strength to unit weight ratio compared to steel, therefore they are being increasingly used for structural purposes. The modulus of elasticity of aluminium is about one third that of steel while its coefficient of thermal expansion is double to that of steel.

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