Visit Suncam.com for more courses

Continuing Education Course #350
Steel Column and Base Plate Design Fundamentals

1. Which of the following statements is not true about slenderness ratio?
- a. It indicates the column's tendency to buckle
- b. It has units of psi
- c. It is expressed as the unbraced length divided by the least radius of gyration
- d. All statements are true

2. A long column has an effective length of 15 feet. The least radius of gyration is 1.2 inches. The modulus of elasticity is 29,000 ksi and the material yield stress is 36 ksi. What is the critical buckling stress?
- a. 11.81 ksi
- b. 12.72 ksi
- c. 14.06 ksi
- d. 23.68 ksi

3. A column has a slenderness ratio of 170. A steel column with a modulus of elasticity of 29,000 ksi and a yield stress of 36 ksi is found to have a critical buckling stress of 9.9 ksi. Increasing the material's yield strength to 50 ksi, while keeping all other properties the same, will
- a. increase the critical buckling stress
- b. decrease the critical buckling stress
- c. have no effect on the critical buckling stress

4. Which of the following statements about intermediate columns is true?
- a. Intermediate columns will fail by both buckling and yielding
- b. Some of the fibers will reach yield stress
- c. An intermediate column's behavior is inelastic buckling
- d. All statements are true

5. A column has a slenderness ratio of 100 and has material properties of E = 30,000 ksi and a yield stress of 50 ksi. Based on equation 6 in the course, this column is considered a long column.
- a. True
- b. False

6. A column is pinned at the base. The top of the column is fixed in rotation but free in translation. What is the column's effective length factor?
- a. 0.8
- b. 1.0
- c. 1.2
- d. 2.0

7. When sidesway is prevented, the effective length will always be greater the unbraced length.

- a. True
- b. False

8. A 5 in x 5 in square tube with 1/4 inch wall thickness is used for a column (radius of gyration equals 1.92 inches). The column is 9 feet in length and pinned on both ends. The material is steel with E=29,000 ksi and yield stress of 36 ksi. What is the allowable stress without any load factors or safety factors?

- a. 35.7 ksi
- b. 32.4 ksi
- c. 26.1 ksi
- d. 19.4 ksi

9. The LRFD method factors loads applied to a structure. Based on the load combination discussed in this course, a combination of dead and live loads result in a factor of ___ times the dead load and ___ times the live load.

- a. 1.4, 1.6
- b. 1.2, 1.4
- c. 1.2, 1.6
- d. 1.0, 1.4

10. Using the ASD method for the design of long columns, the allowable stress is determined from Euler's formula for buckling with a safety factor of

- a. 0.85
- b. 1.92
- c. 3.21
- d. No safety factor is used

11. A column has a modulus of elasticity of 29,000 ksi and a yield stress of 36 ksi. Using ASD, what would be the approximate allowable stress for a slenderness ratio of 80?

- a. 30 ksi
- b. 27 ksi
- c. 15 ksi
- d. 8 ksi

12. Column design using the LRFD method will calculate the ultimate load of $P_u = \phi_c F_{cr} A_g$, where ϕ_c is the resistance factor and has a value of ____ for columns.

- a. 0.85
- b. 0.70
- c. 0.65
- d. 0.30

13. Using the LRFD method, the allowable stress for a slenderness ratio of 160 will be the same for material with a 36 ksi yield stress as it would for a material with a 50 ksi yield stress.

- a. True
- b. False

14. A column has an unbraced length of 18 feet and is fixed on both ends. The cross-sectional area is 21.97 in², and the least radius of gyration is 3.05 in. Using the LRFD method, determine the design strength of the column if the yield stress is 50 ksi.

- a. 800 kips
- b. 740 kips
- c. 600 kips
- d. 480 kips

15. It is possible for thin flanges or webs to experience local buckling before critical stresses are reached in the entire column.

- a. True
- b. False

16. The critical stress for plates is given by $F_{cr} = \dfrac{k\pi^2 E}{12(1-\mu^2)\left(\frac{b}{t}\right)^2}$, where k is

- a. Poisson's ratio
- b. the plate's loaded edge length
- c. a constant based on edge constraints
- d. none of the above

17. _____ sections are those that have sufficient stiffness needed to develop a fully plastic stress (stressed throughout to yield stress) distribution before buckling.

- a. Compact
- b. Noncompact

18. Which of the following statements regarding column applications of localized buckling is not true?

- a. Structural design manuals provide limiting b/t ratios for different conditions, and the limits are expressed as a value divided by the square root of yield stress
- b. The column web would be an example of a stiffened element
- c. Almost all W sections in the steel manual are compact for 50 ksi yield levels, but not for 36 ksi yield levels
- d. None of the statements are true

19. According to the content in this course, the most common anchor bolts are ASTM F1554 grade 105.

- a. True
- b. False

20. When designing a base plate for pure axial compression loading, the base plate dimensions should be selected such that overhanging dimensions m and n (shown in Figure 13 in the course) are approximately equal.

- a. True
- b. False

21. In general, there will be three possible design cases for a base plate designed for pure axial compression loading. The case for no concrete confinement is when

- a. the area of the base plate is greater than the entire area of concrete
- b. the area of the base plate equals the entire area of concrete
- c. the entire area of concrete is over four times that of the base plate
- d. the entire area of concrete is over six times that of the base plate

22. When using wide flange columns subjected only to compressive axial loading, the base plate is commonly welded to the column

- a. with fillet welds on one side of each flange only
- b. with fillet welds on both sides of each flange only
- c. with fillet welds on both sides of the web only
- d. with fillet wilds on one side of each flange and both sides of the web

23. For a column base plate of length N subjected to an axial compression load P and a moment M, a value of _____ would classify as large moment.

- a. M/P < N/6
- b. M/P > N/6

○ c. M/P < 6N
○ d. M/P > 6N

24. For base plates subjected to small moments, the bearing stress distribution will be a superposition of axial stress and bending stress.
○ a. True
○ b. False

25. For base plates subjected to large moments, the bearing stress distribution extends linearly a distance Y along the base plate. Which of the following is a common simplifying assumption used to determine the value of Y?
○ a. The value of Y is assumed to be one-half the length of the base plate
○ b. The value of Y is assumed to be equal to B/6, where B is the base plate width dimension
○ c. The stress distribution's center of gravity (Y/3) coincides with the center of the column flange
○ d. The stress distribution's center of gravity (Y/3) coincides with the center of the anchor bolt