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Continuing Education Course #307
Combined Stress and Mohr's Circle

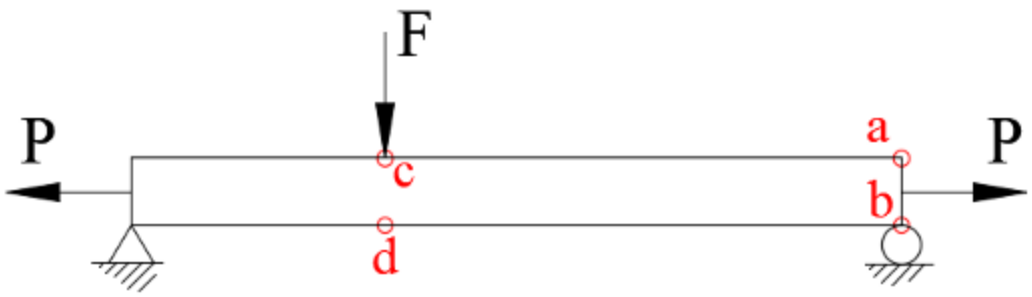
1. In the flexural bending stress equation $\sigma_f = \frac{My}{I}$, the variable y is

- a. bending moment
- b. polar moment of inertia
- c. the location on the cross-section away from the neutral axis
- d. width of the cross-section

2. For combined loading of axial tension and bending, the resulting stress will be the superposition of the two separate stresses.

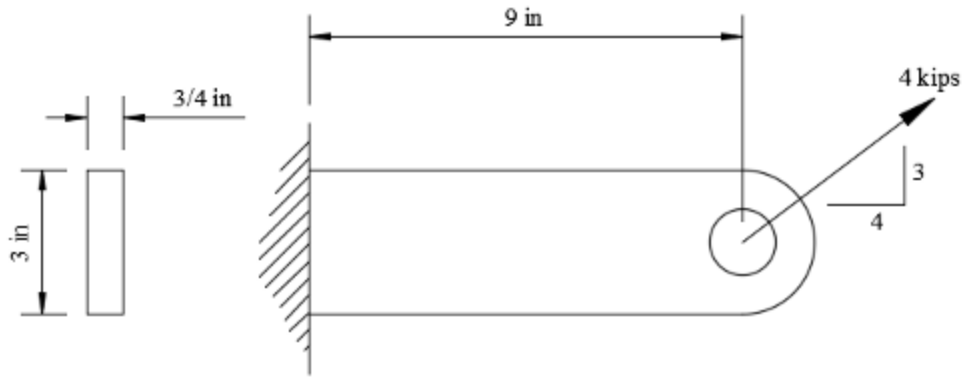
- a. True
- b. False

3. A beam has a combined loading of axial tension and bending as shown. The maximum combined stress will occur at




- a. point a
- b. point b
- c. point c
- d. point d

4. What is the maximum stress in the bar shown?




- a. 26.7 ksi
- b. 20.6 ksi
- c. 19.2 ksi
- d. 17.8 ksi

5. A rectangular beam has a cross-section is 1.5 inches wide by 5 inches tall. The beam is subjected to a uniformly distributed load and an axial tension load. The maximum flexural moment of 6,000 lb-ft. What is the maximum axial tension load if the maximum combined stress is 18 ksi?

- a. 48.6 kips
- b. 67.4 kips
- c. 90.2 kips
- d. 127.8 kips

6. A beam has an eccentric axial load, similar to that shown in Figure 4 (a) on page 10 of the course. The beam has a square cross-section of 3.25 inches, and a length of 10 feet. Using a modulus of elasticity of $30x10^6$ psi, what is the amplification factor if the applied axial compression load is 76 kips?

- a. 4.4
- b. 3.6
- c. 2.4
- d. 1.8

7. A rectangular cross-section beam has a width of 1 inch and a height of 3 inches. What is the ultimate bending moment (plastic moment) if the yield stress is 36 ksi?

- a. 27 kip-in
- b. 72 kip-in
- c. 81 kip-in
- d. 243 kip-in

8. If r is the radius of gyration and L is the column length, L/r is known as

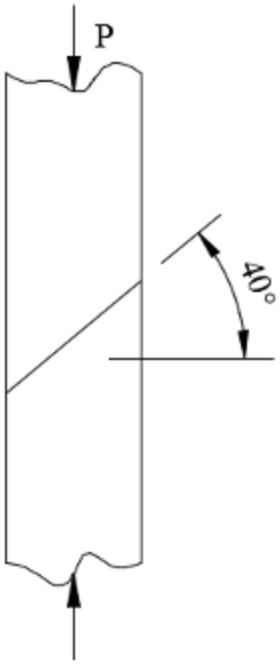
- a. moment of inertia
- b. eccentricity ratio
- c. section modulus
- d. slenderness ratio

9. A beam is loaded in bending and axial compression similar to that shown in Figure 3 on page 10 of the course. The axial load is 90,000 lbs and the critical buckling load is 150,000 lbs. The ultimate bending moment is $M_u = 45,000 \text{in} \cdot \text{lb}$. Assuming that the ultimate axial load is $P_u = P_{cr}$ and using the interaction curve in Figure 6, what moment can be applied that would cause failure?

- a. 20,000 in-lb
- b. 7,200 in-lb

○ c. 4,000 in-lb
○ d. 1,500 in-lb

10. A column has a square cross-section with sides of 3.5 inches. The column contains a splice joint as shown. What is the approximate load P applied if the normal stress at the joint is equal to 6000 psi?




○ a. 52.8 kips
○ b. 70.3 kips
○ c. 125.2 kips
○ d. 96.0 kips

11. For the column in question 10, let P = 50 kips. Determine the shear stress on the joint.
○ a. 946 psi
○ b. 1312 psi
○ c. 2010 psi
○ d. None of the above

12. Which of the following statements is true?
○ a. Maximum normal stress occurs when shearing stress is maximum
○ b. Minimum normal stress occurs when shearing stress is minimum
○ c. Maximum and minimum normal stress occur on planes of zero shearing stress
○ d. All statements are true

13. A stress element has a normal stress of 2000 psi in tension in the x-axis direction and 4000 psi in compression in the y-axis direction. The center of Mohr's circle will be located at a normal stress value of which of following.
○ a. 1000 psi
○ b. -1000 psi
○ c. 3000 psi
○ d. -3000psi

14. A stress element gives a Mohr's circle with a center located at 650 psi. If the maximum principal stress equals 1077.2 psi, what is the minimum principal stress?

- a. 222.8 psi
- b. 118.4 psi
- c. 0 psi
- d. None of the above

15. A stress element is subject to $\sigma_y = 50$ksi and $\tau_{xy} = 30$ksi. What is the value of the principal stress $\sigma 1$?

- a. 64 ksi
- b. 39 ksi
- c. 25 ksi
- d. None of the above

16. Mohr's circle for a particular stress element has a center located at zero normal stress and has a radius of 25 ksi. If the stress element is subjected to $\sigma_x = 25$ksi, which of the following must be true?

- a. $\sigma_y = -25$ksi
- b. $\tau_{xy} = 0$
- c. $\sigma 1 = 25$ksi
- d. All statements are true

17. When drawing Mohr's circle for plane stress, it is not possible to have a case where both principal stress values are negative.

- a. True
- b. False

18. If the principal stresses for a stress element are $\sigma 1 = 1250$psi and $\sigma 2 = -750$psi, what is the maximum in-plane shear stress?

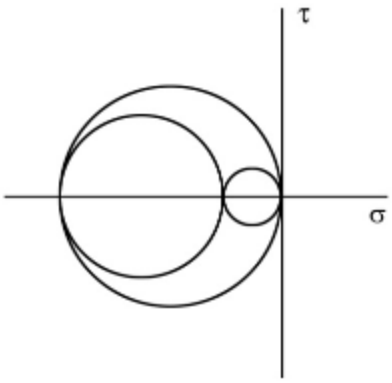
- a. 500 psi
- b. 1000 psi
- c. 1500 psi
- d. 2000 psi

19. A stress element is subject to $\sigma_x = -18$ksi, $\sigma_y = 16$ksi, and $\tau_{xy} = 10$ksi. What is the value of the principal stress $\sigma 1$?

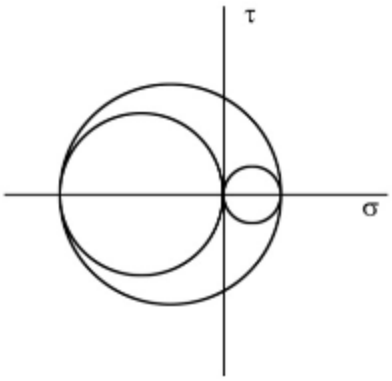
- a. 18.7 ksi
- b. 24.6 ksi
- c. 30.5 ksi
- d. None of the above

20. Which of the following graphs best represents Mohr's three-circle diagram for $\sigma_x$ = -80 and $\sigma_y$ = -30?

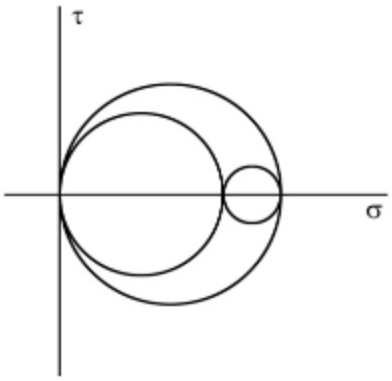
- a.




○ b.




○ c.




○ d. None of the above

21. For a state of plane stress $\sigma 1 = 40$ksi and $\sigma 2 = 30$ksi. What is the absolute maximum shearing stress?

○ a. 5 ksi
○ b. 15 ksi
○ c. 20 ksi
○ d. 25 ksi

22. A 1.75-inch diameter shaft has an axial loading of 18 kips and a torsional loading of 600 ft·lb. What is the maximum principal stress $\sigma 1$?

- a. 11,540 psi
- b. 9,357 psi
- c. 7,484 psi
- d. 0 psi

23. A 4-inch diameter shaft is subjected to an axial tension load of 230 kips and a torque of 3,500 ft·lb. The allowable normal stress is 18 ksi and the allowable in-plane shear stress is 13 ksi. Which of the following statements is true?

- a. The loading exceeds the allowable normal stress but does not exceed the allowable shear stress
- b. The loading exceeds the allowable shear stress but does not exceed the allowable normal stress
- c. The loading does not exceed either the normal stress or the shear stress
- d. The loading exceeds both the normal stress and the shear stress

24. A 6-inch diameter shaft is subjected to a bending moment of 57,600 in-lb and a torque of 74,880 in-lb. What is the maximum principal stress?

- a. 12340 psi
- b. 7171 psi
- c. 5965 psi
- d. 3585 psi

25. A round shaft is subjected to a bending moment of 7000 ft·lb and a torsion of 4000 ft·lb. What is the minimum diameter of the shaft if the allowable normal stress is 10 ksi and the allowable shear stress is 8 ksi?

- a. 3.5 in
- b. 3.9 in
- c. 4.1 in
- d. 4.5 in