

PRACTICE EXAM 9: PE MECHANICAL—MACHINE DESIGN AND MATERIALS (100 QUESTIONS)

This practice exam contains 100 questions. Select the single best answer for each question. The official NCEES examination contains 80 questions and provides 8 hours of testing time within a 9-hour appointment. Use both SI and U.S. Customary units as indicated.

1. A proposed fixture has a fixed fabrication cost of \$55900 and a variable cost of \$692000 spread over 2800 units. What is the average cost per unit?

- A. 28073.57 \$/unit
- B. 61761.86 \$/unit
- C. 56147.14 \$/unit
- D. 112294.29 \$/unit

2. A component is expected to experience 1401 MPa maximum stress, while its allowable design stress is 358.25 MPa. What design factor is implied?

- A. 3.91
- B. 1.96
- C. 4.41
- D. 7.82

3. A drawing dimension is 689.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 8750.3 mm
- B. 26250.9 mm
- C. 17526 mm
- D. 17500.6 mm

4. A machine saves 15430 labor-hours annually at \$2811/h. Ignoring interest, its \$148300 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 3087530.71 \$/year
- B. 6175061.43 \$/year
- C. 6217432.86 \$/year
- D. 12350122.86 \$/year

5. A proposed fixture has a fixed fabrication cost of \$56060 and a variable cost of \$694000 spread over 2808 units. What is the average cost per unit?

- A. 28153.58 \$/unit
- B. 61937.87 \$/unit
- C. 112614.3 \$/unit
- D. 56307.15 \$/unit

6. A component is expected to experience 1405 MPa maximum stress, while its allowable design stress is 359.25 MPa. What design factor is implied?

- A. 1.96
- B. 4.41
- C. 3.91
- D. 7.82

7. A drawing dimension is 691.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 17551.4 mm
- B. 8775.7 mm
- C. 26327.1 mm
- D. 17576.8 mm

8. A machine saves 15470 labor-hours annually at \$2819/h. Ignoring interest, its \$148700 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 2716326.88 \$/year
- B. 5432653.75 \$/year
- C. 5469828.75 \$/year
- D. 10865307.5 \$/year

9. A proposed fixture has a fixed fabrication cost of \$56220 and a variable cost of \$696000 spread over 2816 units. What is the average cost per unit?

- A. 28233.58 \$/unit
- B. 62113.88 \$/unit
- C. 56467.16 \$/unit
- D. 112934.32 \$/unit

10. A component is expected to experience 1409 MPa maximum stress, while its allowable design stress is 360.25 MPa. What design factor is implied?

- A. 1.96
- B. 3.91
- C. 4.41
- D. 7.82

11. A drawing dimension is 693.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 8801.1 mm
- B. 26403.3 mm
- C. 17627.6 mm
- D. 17602.2 mm

12. A machine saves 15510 labor-hours annually at \$2827/h. Ignoring interest, its \$149100 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 7282945 \$/year
- B. 3641472.5 \$/year
- C. 7332645 \$/year
- D. 14565890 \$/year

13. A proposed fixture has a fixed fabrication cost of \$56380 and a variable cost of \$698000 spread over 2824 units. What is the average cost per unit?

- A. 28313.58 \$/unit
- B. 56627.17 \$/unit
- C. 62289.88 \$/unit
- D. 113254.33 \$/unit

14. A component is expected to experience 1413 MPa maximum stress, while its allowable design stress is 361.25 MPa. What design factor is implied?

- A. 1.96
- B. 4.41
- C. 3.91
- D. 7.82

15. A drawing dimension is 695.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 17653 mm
- B. 8826.5 mm
- C. 26479.5 mm
- D. 17678.4 mm

16. A machine saves 15550 labor-hours annually at \$2835/h. Ignoring interest, its \$149500 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 3138196.43 \$/year
- B. 6319107.14 \$/year
- C. 12552785.71 \$/year
- D. 6276392.86 \$/year

17. A prismatic bar carries 2760 kN axial tension over a net area of 7150 mm². What is the average normal stress?

- A. 193.01 MPa
- B. 386.01 MPa
- C. 193.42 MPa
- D. 579.02 MPa

18. A solid circular shaft of diameter 52 mm transmits 28120 N·m torque. What is its maximum torsional shear stress?

- A. 1018.53 MPa
- B. 509.27 MPa
- C. 2037.07 MPa
- D. 2037.62 MPa

19. A rectangular beam 2804 mm wide and 2864 mm deep carries a maximum bending moment of 693.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.09 MPa
- B. 0.5 MPa
- C. 0.64 MPa

D. 0.18 MPa

20. A steel tie, length 28460 mm and area 7315 mm², carries 2776 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 27 mm
- B. 108 mm
- C. 54 mm
- D. 27.55 mm

21. A ductile member has yield strength 7070 MPa and calculated von Mises stress 2823 MPa. What factor of safety against yielding results?

- A. 1.25
- B. 1.5
- C. 2.5
- D. 3.5

22. A pin-ended column has $E = 200,000$ MPa, $I = 144500000$ mm⁴, and length 36325 mm. What is its Euler critical load?

- A. 216.17 kN
- B. 864.66 kN
- C. 54.04 kN
- D. 68.81 kN

23. At a point, $\sigma_x = 2812$ MPa, $\sigma_y = 1396$ MPa, and $\tau_{xy} = 708.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 3139.45 MPa
- B. 1416 MPa

- C. 1363.3 MPa
- D. 2726.61 MPa

24. A part has alternating stress 2844 MPa and mean stress 1437 MPa. With $S_e = 4301$ MPa and $S_{ut} = 7335$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 1.17
- C. 5.1
- D. 1.39

25. A prismatic bar carries 2776 kN axial tension over a net area of 7190 mm². What is the average normal stress?

- A. 193.05 MPa
- B. 386.09 MPa
- C. 193.46 MPa
- D. 579.14 MPa

26. A solid circular shaft of diameter 58 mm transmits 28280 N·m torque. What is its maximum torsional shear stress?

- A. 369.09 MPa
- B. 1476.37 MPa
- C. 1476.92 MPa
- D. 738.19 MPa

27. A rectangular beam 2820 mm wide and 2880 mm deep carries a maximum bending moment of 697.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.09 MPa

- B. 0.5 MPa
- C. 0.18 MPa
- D. 0.64 MPa

28. A steel tie, length 28620 mm and area 7355 mm², carries 2792 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 54.32 mm
- B. 27.16 mm
- C. 108.64 mm
- D. 27.71 mm

29. A ductile member has yield strength 7110 MPa and calculated von Mises stress 2839 MPa. What factor of safety against yielding results?

- A. 1.25
- B. 1.5
- C. 3.5
- D. 2.5

30. A pin-ended column has $E = 200,000$ MPa, $I = 145300000$ mm⁴, and length 36525 mm. What is its Euler critical load?

- A. 859.95 kN
- B. 214.99 kN
- C. 53.75 kN
- D. 68.43 kN

31. At a point, $\sigma_x = 2828$ MPa, $\sigma_y = 1404$ MPa, and $\tau_{xy} = 712.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 2742.1 MPa
- B. 3157.34 MPa
- C. 1424 MPa
- D. 1371.05 MPa

32. A part has alternating stress 2860 MPa and mean stress 1445 MPa. With $S_e = 4325$ MPa and $S_{ut} = 7375$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.1
- C. 1.17
- D. 1.39

33. A prismatic bar carries 2792 kN axial tension over a net area of 7230 mm². What is the average normal stress?

- A. 386.17 MPa
- B. 193.08 MPa
- C. 193.49 MPa
- D. 579.25 MPa

34. A solid circular shaft of diameter 54 mm transmits 28440 N·m torque. What is its maximum torsional shear stress?

- A. 459.93 MPa
- B. 1839.71 MPa
- C. 919.85 MPa
- D. 1840.26 MPa

35. A rectangular beam 2836 mm wide and 2896 mm deep carries a maximum bending moment of 701.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.09 MPa
- B. 0.18 MPa
- C. 0.5 MPa
- D. 0.64 MPa

36. A steel tie, length 28780 mm and area 7395 mm², carries 2808 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 27.32 mm
- B. 109.28 mm
- C. 27.87 mm
- D. 54.64 mm

37. A ductile member has yield strength 7150 MPa and calculated von Mises stress 2855 MPa. What factor of safety against yielding results?

- A. 1.25
- B. 2.5
- C. 1.5
- D. 3.5

38. A pin-ended column has $E = 200,000$ MPa, $I = 146100000$ mm⁴, and length 36725 mm. What is its Euler critical load?

- A. 213.82 kN
- B. 855.3 kN
- C. 53.46 kN
- D. 68.06 kN

39. At a point, $\sigma_x = 2844$ MPa, $\sigma_y = 1412$ MPa, and $\tau_{xy} = 716.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 3175.23 MPa
- B. 1432 MPa
- C. 1378.8 MPa
- D. 2757.59 MPa

40. A part has alternating stress 2876 MPa and mean stress 1453 MPa. With $S_e = 4349$ MPa and $S_{ut} = 7415$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.1
- C. 1.17
- D. 1.39

41. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 2765 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 17961.77 MPa
- B. 2245.22 MPa
- C. 8980.89 MPa
- D. 4490.44 MPa

42. A bolt transfers 2782 kN through a plate 12 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 3689.74 MPa
- B. 11591.67 MPa
- C. 5795.83 MPa
- D. 23183.33 MPa

43. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 13900 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 4344.02 kN
- B. 6515.62 kN
- C. 4343.75 kN
- D. 868.75 kN

44. Two parallel fillet welds, each 2806 mm long with 7 mm leg size, carry 1383 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 49.8 MPa
- B. 70.41 MPa
- C. 35.21 MPa
- D. 99.59 MPa

45. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 2773 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 13791.77 MPa
- B. 3447.94 MPa
- C. 1723.97 MPa
- D. 6895.89 MPa

46. A bolt transfers 2790 kN through a plate 10 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 13950 MPa
- B. 4440.42 MPa
- C. 6975 MPa
- D. 27900 MPa

47. Using the relation $T = KFd$, estimate bolt preload when installation torque is 13940 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 4100.27 kN
- B. 6150 kN
- C. 820 kN
- D. 4100 kN

48. Two parallel fillet welds, each 2814 mm long with 8 mm leg size, carry 1387 kN direct shear. Using $\text{throat} = 0.707h$, what average weld throat stress results?

- A. 61.61 MPa
- B. 30.81 MPa
- C. 43.57 MPa
- D. 87.15 MPa

49. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 2781 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 24589.44 MPa
- B. 6147.36 MPa
- C. 3073.68 MPa
- D. 12294.72 MPa

50. A bolt transfers 2798 kN through a plate 11 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 12718.18 MPa
- B. 4048.32 MPa
- C. 6359.09 MPa
- D. 25436.36 MPa

51. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 13980 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 3883.6 kN
- B. 5825 kN
- C. 3883.33 kN
- D. 776.67 kN

52. Two parallel fillet welds, each 2822 mm long with 6 mm leg size, carry 1391 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 82.15 MPa
- B. 41.08 MPa
- C. 116.2 MPa
- D. 58.1 MPa

53. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 2789 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 18117.68 MPa
- B. 2264.71 MPa
- C. 4529.42 MPa
- D. 9058.84 MPa

54. A 18-tooth pinion rotating at 15350 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 2558.33 rpm
- B. 10233.33 rpm
- C. 15350 rpm
- D. 5116.67 rpm

55. A shaft transmits 1376 hp at 28420 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1525.73 in·lbf
- B. 3051.46 in·lbf
- C. 4577.19 in·lbf
- D. 6102.91 in·lbf

56. An open belt connects a 120-mm driver at 14520 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5808 rpm
- B. 2904 rpm
- C. 8712 rpm
- D. 14520 rpm

57. A collar bearing supports 689.5 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 2461.52 N·m
- B. 1846.14 N·m
- C. 1230.76 N·m
- D. 2462.07 N·m

58. A power screw has lead 8 mm, input torque 2773 N·m, and raising efficiency 0.32. What axial load can it raise?

- A. 696.93 kN
- B. 348.47 kN
- C. 1045.4 kN
- D. 1393.86 kN

59. A 19-tooth pinion rotating at 15400 rpm drives a 56-tooth gear. Neglecting slip, what is the gear speed?

- A. 2612.5 rpm
- B. 10175 rpm
- C. 15400 rpm
- D. 5225 rpm

60. A shaft transmits 1381 hp at 28520 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1525.9 in·lbf
- B. 3051.81 in·lbf
- C. 4577.71 in·lbf
- D. 6103.61 in·lbf

61. An open belt connects a 130-mm driver at 14570 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 2959.53 rpm
- B. 5919.06 rpm
- C. 8650.94 rpm
- D. 14570 rpm

62. A collar bearing supports 692.0 kN at mean friction radius 0.020 m with friction coefficient 0.080. What friction torque must be overcome?

- A. 2214.4 N·m
- B. 1660.8 N·m
- C. 2214.95 N·m
- D. 1107.2 N·m

63. A power screw has lead 7 mm, input torque 2783 N·m, and raising efficiency 0.33. What axial load can it raise?

- A. 412.17 kN
- B. 1236.52 kN
- C. 824.34 kN
- D. 1648.69 kN

64. A 20-tooth pinion rotating at 15450 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 5327.59 rpm
- B. 2663.79 rpm
- C. 10122.41 rpm
- D. 15450 rpm

65. A shaft transmits 1386 hp at 28620 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1526.08 in·lbf
- B. 3052.15 in·lbf
- C. 4578.23 in·lbf
- D. 6104.31 in·lbf

66. An open belt connects a 125-mm driver at 14620 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 2947.58 rpm
- B. 8724.84 rpm
- C. 5895.16 rpm
- D. 14620 rpm

67. An undamped single-degree system has mass 1378 kg and stiffness 704000 N/m. What is its natural frequency in hertz?

- A. 3.6 Hz
- B. 1.8 Hz
- C. 5.4 Hz
- D. 7.19 Hz

68. A hydraulic cylinder must produce 692.5 kN using a piston area of 14510 mm². Neglecting losses, what gauge pressure is required?

- A. 23.86 MPa
- B. 24.27 MPa
- C. 95.45 MPa
- D. 47.73 MPa

69. A simply supported beam of span 2.6 m carries a central point load of 1380 kN. What is the maximum bending moment?

- A. 1794 kN·m
- B. 448.5 kN·m
- C. 897 kN·m
- D. 530.77 kN·m

70. A lever has an effort arm of 4209 mm and a load arm of 2766 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.28
- C. 3.04
- D. 1.52

71. A 412-V DC source is applied across a 10-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 41.2 A
- B. 20.6 A
- C. 61.8 A
- D. 82.4 A

72. A thin-walled cylindrical vessel has internal pressure 139.5 MPa, inside diameter 7225 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 20997.66 MPa
- B. 41995.31 MPa
- C. 83990.62 MPa
- D. 20998.21 MPa

73. A linear spring has stiffness 1391 kN/m and is compressed 44 mm. What force does it exert?

- A. 61204 N
- B. 30602 N
- C. 91806 N
- D. 30602.55 N

74. An undamped single-degree system has mass 1385 kg and stiffness 707500 N/m. What is its natural frequency in hertz?

- A. 1.8 Hz
- B. 5.4 Hz
- C. 7.19 Hz
- D. 3.6 Hz

75. A hydraulic cylinder must produce 696.0 kN using a piston area of 14580 mm². Neglecting losses, what gauge pressure is required?

- A. 23.87 MPa
- B. 47.74 MPa
- C. 24.28 MPa
- D. 95.47 MPa

76. A simply supported beam of span 2.5 m carries a central point load of 1387 kN. What is the maximum bending moment?

- A. 1733.75 kN·m
- B. 433.44 kN·m
- C. 866.88 kN·m
- D. 554.8 kN·m

77. A lever has an effort arm of 4230 mm and a load arm of 2780 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.28
- C. 3.04
- D. 1.52

78. A 414-V DC source is applied across a 7- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 29.57 A
- B. 88.71 A
- C. 59.14 A
- D. 118.29 A

79. A thin-walled cylindrical vessel has internal pressure 140.2 MPa, inside diameter 7260 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 19574.08 MPa
- B. 39148.15 MPa
- C. 78296.31 MPa
- D. 19574.63 MPa

80. A linear spring has stiffness 1398 kN/m and is compressed 42 mm. What force does it exert?

- A. 58716 N
- B. 29358 N
- C. 88074 N
- D. 29358.55 N

81. An undamped single-degree system has mass 1392 kg and stiffness 711000 N/m. What is its natural frequency in hertz?

- A. 1.8 Hz
- B. 3.6 Hz
- C. 5.4 Hz
- D. 7.19 Hz

82. A hydraulic cylinder must produce 699.5 kN using a piston area of 14650 mm². Neglecting losses, what gauge pressure is required?

- A. 23.87 MPa
- B. 24.28 MPa
- C. 95.49 MPa
- D. 47.75 MPa

83. A simply supported beam of span 2.4 m carries a central point load of 1394 kN. What is the maximum bending moment?

- A. 836.4 kN·m
- B. 1672.8 kN·m
- C. 418.2 kN·m
- D. 580.83 kN·m

84. A lever has an effort arm of 4251 mm and a load arm of 2794 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.28
- C. 1.52
- D. 3.04

85. A 416-V DC source is applied across a 9- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 23.11 A
- B. 69.33 A
- C. 92.44 A
- D. 46.22 A

86. A thin-walled cylindrical vessel has internal pressure 140.9 MPa, inside diameter 7295 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 18354.74 MPa
- B. 73418.96 MPa
- C. 36709.48 MPa
- D. 18355.29 MPa

87. A linear spring has stiffness 1405 kN/m and is compressed 40 mm. What force does it exert?

- A. 56200 N
- B. 28100 N
- C. 84300 N
- D. 28100.55 N

88. An undamped single-degree system has mass 1399 kg and stiffness 714500 N/m. What is its natural frequency in hertz?

- A. 1.8 Hz
- B. 3.6 Hz
- C. 5.4 Hz
- D. 7.19 Hz

89. A hydraulic cylinder must produce 703.0 kN using a piston area of 14720 mm². Neglecting losses, what gauge pressure is required?

- A. 23.88 MPa
- B. 47.76 MPa
- C. 24.29 MPa
- D. 95.52 MPa

90. A mating hole measures 1385.05 mm and its shaft measures 1384.98 mm. What diametral clearance exists?

- A. 0.05 mm
- B. 0.02 mm
- C. 0.03 mm
- D. 0.07 mm

91. Inspection accepts 7285 of 7305 manufactured parts. What is the observed percent yield?

- A. 49.86 %
- B. 149.59 %
- C. 99.73 %
- D. 100.27 %

92. A machining operation reduces a diameter from 1394 mm to 1390 mm. What percent reduction in diameter occurs?

- A. 0.29 %
- B. 0.56 %
- C. 0.43 %
- D. 0.57 %

93. Four repeated measurements are 63.65, 63.61, 63.64, and 63.62 mm. What is their arithmetic mean?

- A. 31.82 mm
- B. 254.52 mm
- C. 63.63 mm
- D. 63.65 mm

94. A mating hole measures 1389.06 mm and its shaft measures 1388.98 mm. What diametral clearance exists?

- A. 0.06 mm
- B. 0.02 mm
- C. 0.04 mm
- D. 0.08 mm

95. Inspection accepts 7305 of 7325 manufactured parts. What is the observed percent yield?

- A. 49.86 %

- B. 99.73 %
- C. 149.59 %
- D. 100.27 %

96. A machining operation reduces a diameter from 1398 mm to 1394 mm. What percent reduction in diameter occurs?

- A. 0.29 %
- B. 0.56 %
- C. 0.43 %
- D. 0.57 %

97. Four repeated measurements are 63.69, 63.65, 63.68, and 63.66 mm. What is their arithmetic mean?

- A. 31.84 mm
- B. 63.67 mm
- C. 254.68 mm
- D. 63.69 mm

98. A mating hole measures 1393.04 mm and its shaft measures 1392.98 mm. What diametral clearance exists?

- A. 0.06 mm
- B. 0.04 mm
- C. 0.02 mm
- D. 0.03 mm

99. Inspection accepts 7325 of 7345 manufactured parts. What is the observed percent yield?

- A. 49.86 %
- B. 149.59 %

- C. 100.27 %
- D. 99.73 %

100. A machining operation reduces a diameter from 1402 mm to 1398 mm. What percent reduction in diameter occurs?

- A. 0.56 %
- B. 0.43 %
- C. 0.29 %
- D. 0.57 %

Practice Exam 9: Answer Key and Explanations

1. C — C — Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 56147.14 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

2. A — A — The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.91 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

3. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 17500.6 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

4. B — B — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 6175061.43 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

5. D — D — Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 56307.15 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

- 6. C — C —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.91 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 7. A — A —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 17551.4 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 8. B — B —** Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 5432653.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 9. C — C —** Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 56467.16 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 10. B — B —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.91 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 11. D — D —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 17602.2 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 12. A — A —** Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 7282945 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 13. B — B —** Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 56627.17 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 14. C — C —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.91 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

15. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 17653 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

16. D — D — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 6276392.86 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

17. B — B — Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 386.01 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

18. A — A — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1018.53 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

19. D — D — Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

20. C — C — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 54 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

21. C — C — For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign

22. A — A — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $P = \frac{\pi^2 EI}{L^2}$. Substitution gives 216.17 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

23. D — D — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 2726.61 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

24. B — B — The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.17 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

25. B — B — Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 386.09 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

26. D — D — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 738.19 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

27. C — C — Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

28. A — A — Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 54.32 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

29. D — D — For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign

30. B — B — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 214.99 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

31. A — A — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 2742.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

32. C — C — The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.17 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

- 33. A — A —** Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 386.17 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 34. C — C —** For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 919.85 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 35. B — B —** Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving
- 36. D — D —** Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 54.64 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,
- 37. B — B —** For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign
- 38. A — A —** Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 213.82 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,
- 39. D — D —** Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 2757.59 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,
- 40. C — C —** The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.17. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 41. D — D —** Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 4490.44 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

42. B — B — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 11591.67 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

43. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 4343.75 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

44. A — A — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 49.8 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

45. B — B — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 3447.94 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

46. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 13950 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

47. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 4100 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

48. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.57 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

49. B — B — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 6147.36 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

50. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 12718.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

51. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 3883.33 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

52. D — D — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

53. C — C — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 4529.42 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

54. D — D — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 5116.67 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

55. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3051.46 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

56. A — A — Equal belt speed at both pulley rims gives $N_1 D_1$ equal to $N_2 D_2$, so driven speed is driver speed times the diameter ratio. Substitution gives 5808 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

57. C — C — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 1230.76 N·m. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

58. A — A — Efficiency is output work divided by input work per revolution. Equating output F times lead to efficiency times 2π torque gives the load. Substitution gives 696.93 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. D — D — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 5225 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

60. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3051.81 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

61. B — B — Equal belt speed at both pulley rims gives N_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 5919.06 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

62. D — D — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 1107.2 N·m. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

63. C — C — Efficiency is output work divided by input work per revolution. Equating output F times lead to efficiency times 2π torque gives the load. Substitution gives 824.34 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

64. A — A — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 5327.59 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

65. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3052.15 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

66. C — C — Equal belt speed at both pulley rims gives N_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 5895.16 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

67. A — A — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2π converts it to cycles per second. Substitution gives 3.6 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

68. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 47.73 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

69. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives $897 \text{ kN}\cdot\text{m}$. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

70. D — D — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.52 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

71. A — A — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 41.2 A . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

72. B — B — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 41995.31 MPa . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

73. A — A — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 61204 N . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

74. D — D — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2π converts it to cycles per second. Substitution gives 3.6 Hz . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

75. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 47.74 MPa . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

76. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives $866.88 \text{ kN}\cdot\text{m}$. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

77. D — D — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.52 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

78. C — C — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 59.14 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

79. B — B — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 39148.15 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

80. A — A — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 58716 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

81. B — B — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2π converts it to cycles per second. Substitution gives 3.6 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

82. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 47.75 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

83. A — A — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 836.4 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

84. C — C — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.52 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

85. D — D — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 46.22 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

86. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 36709.48 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

87. A — A — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 56200 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

88. B — B — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2 pi converts it to cycles per second. Substitution gives 3.6 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

89. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 47.76 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

90. D — D — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.07 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

91. C — C — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.73 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

92. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.29 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

93. C — C — The arithmetic mean is the sum of all readings divided by their count. Range and total are not estimates of the central measured value. Substitution gives 63.63 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

94. D — D — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.08 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

95. B — B — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.73 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

96. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.29 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

97. B — B — The arithmetic mean is the sum of all readings divided by their count. Range and total are not estimates of the central measured value. Substitution gives 63.67 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

98. A — A — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.06 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

99. D — D — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.73 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

100. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.29 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the