

PRACTICE EXAM 14: 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 drawing dimension is 1113.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 14135.1 mm
- B. 42405.3 mm
- C. 28270.2 mm
- D. 28295.6 mm

2. A machine saves 23910 labor-hours annually at \$4507/h. Ignoring interest, its \$233100 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 8960772.5 \$/year
- B. 17999245 \$/year
- C. 35843090 \$/year
- D. 17921545 \$/year

3. A proposed fixture has a fixed fabrication cost of \$89980 and a variable cost of \$1118000 spread over 4504 units. What is the average cost per unit?

- A. 90228.22 \$/unit
- B. 45114.11 \$/unit
- C. 99251.05 \$/unit
- D. 180456.45 \$/unit

4. A component is expected to experience 2253 MPa maximum stress, while its allowable design stress is 571.25 MPa. What design factor is implied?

- A. 1.97
- B. 3.94
- C. 4.44
- D. 7.89

5. A drawing dimension is 1115.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 28321 mm
- B. 14160.5 mm
- C. 42481.5 mm
- D. 28346.4 mm

6. A machine saves 23950 labor-hours annually at \$4515/h. Ignoring interest, its \$233500 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 7707196.43 \$/year
- B. 15481107.14 \$/year
- C. 15414392.86 \$/year
- D. 30828785.71 \$/year

7. A proposed fixture has a fixed fabrication cost of \$90140 and a variable cost of \$1120000 spread over 4512 units. What is the average cost per unit?

- A. 45194.11 \$/unit
- B. 90388.23 \$/unit
- C. 99427.05 \$/unit
- D. 180776.45 \$/unit

8. A component is expected to experience 2257 MPa maximum stress, while its allowable design stress is 572.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.44
- C. 7.89
- D. 3.94

9. A drawing dimension is 1117.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 14185.9 mm
- B. 42557.7 mm
- C. 28397.2 mm
- D. 28371.8 mm

10. A machine saves 23990 labor-hours annually at \$4523/h. Ignoring interest, its \$233900 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 6767054.38 \$/year
- B. 13592583.75 \$/year
- C. 13534108.75 \$/year
- D. 27068217.5 \$/year

11. A proposed fixture has a fixed fabrication cost of \$90300 and a variable cost of \$1122000 spread over 4520 units. What is the average cost per unit?

- A. 45274.12 \$/unit
- B. 90548.23 \$/unit
- C. 99603.05 \$/unit
- D. 181096.46 \$/unit

12. A component is expected to experience 2261 MPa maximum stress, while its allowable design stress is 573.25 MPa. What design factor is implied?

- A. 3.94
- B. 1.97
- C. 4.44
- D. 7.89

13. A drawing dimension is 1119.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 14211.3 mm
- B. 28422.6 mm
- C. 42633.9 mm
- D. 28448 mm

14. A machine saves 24030 labor-hours annually at \$4531/h. Ignoring interest, its \$234300 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 18107605 \$/year
- B. 9053802.5 \$/year
- C. 18185705 \$/year
- D. 36215210 \$/year

15. A proposed fixture has a fixed fabrication cost of \$90460 and a variable cost of \$1124000 spread over 4528 units. What is the average cost per unit?

- A. 45354.12 \$/unit
- B. 99779.06 \$/unit
- C. 181416.47 \$/unit
- D. 90708.23 \$/unit

16. A component is expected to experience 2265 MPa maximum stress, while its allowable design stress is 574.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.44
- C. 3.94
- D. 7.89

17. A rectangular beam 4500 mm wide and 4560 mm deep carries a maximum bending moment of 1117.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.07 MPa
- B. 0.04 MPa
- C. 0.45 MPa
- D. 0.59 MPa

18. A steel tie, length 45420 mm and area 11555 mm², carries 4472 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 43.95 mm
- B. 175.78 mm
- C. 44.5 mm
- D. 87.89 mm

19. A ductile member has yield strength 11310 MPa and calculated von Mises stress 4519 MPa. What factor of safety against yielding results?

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

D. 3.5

20. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 229300000 \text{ mm}^4$, and length 57525 mm . What is its Euler critical load?

A. 547.12 kN

B. 136.78 kN

C. 34.19 kN

D. 43.54 kN

21. At a point, $\sigma_x = 4508 \text{ MPa}$, $\sigma_y = 2244 \text{ MPa}$, and $\tau_{xy} = 1132.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

A. 5035.63 MPa

B. 2264 MPa

C. 4368.74 MPa

D. 2184.37 MPa

22. A part has alternating stress 4540 MPa and mean stress 2285 MPa . With $S_e = 6845 \text{ MPa}$ and $S_{ut} = 11575 \text{ MPa}$, what Goodman fatigue factor of safety applies?

A. 1.51

B. 5.07

C. 1.38

D. 1.16

23. A prismatic bar carries 4472 kN axial tension over a net area of 11430 mm^2 . What is the average normal stress?

A. 195.63 MPa

B. 391.25 MPa

- C. 196.04 MPa
- D. 586.88 MPa

24. A solid circular shaft of diameter 54 mm transmits 45240 N·m torque. What is its maximum torsional shear stress?

- A. 1463.23 MPa
- B. 731.61 MPa
- C. 2926.45 MPa
- D. 2927 MPa

25. A rectangular beam 4516 mm wide and 4576 mm deep carries a maximum bending moment of 1121.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.07 MPa
- B. 0.04 MPa
- C. 0.45 MPa
- D. 0.59 MPa

26. A steel tie, length 45580 mm and area 11595 mm², carries 4488 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 44.11 mm
- B. 176.42 mm
- C. 44.66 mm
- D. 88.21 mm

27. A ductile member has yield strength 11350 MPa and calculated von Mises stress 4535 MPa. What factor of safety against yielding results?

- A. 1.25

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

28. A pin-ended column has $E = 200,000$ MPa, $I = 230100000$ mm⁴, and length 57725 mm. What is its Euler critical load?

- A. 545.23 kN
- B. 34.08 kN
- C. 136.31 kN
- D. 43.39 kN

29. At a point, $\sigma_x = 4524$ MPa, $\sigma_y = 2252$ MPa, and $\tau_{xy} = 1136.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5053.52 MPa
- B. 2272 MPa
- C. 4384.24 MPa
- D. 2192.12 MPa

30. A part has alternating stress 4556 MPa and mean stress 2293 MPa. With $S_e = 6869$ MPa and $S_{ut} = 11615$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.07
- D. 1.38

31. A prismatic bar carries 4488 kN axial tension over a net area of 11470 mm². What is the average normal stress?

- A. 195.64 MPa
- B. 391.28 MPa
- C. 196.05 MPa
- D. 586.92 MPa

32. A solid circular shaft of diameter 50 mm transmits 45400 N·m torque. What is its maximum torsional shear stress?

- A. 924.88 MPa
- B. 3699.52 MPa
- C. 3700.07 MPa
- D. 1849.76 MPa

33. A rectangular beam 4532 mm wide and 4592 mm deep carries a maximum bending moment of 1125.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.04 MPa
- B. 0.07 MPa
- C. 0.45 MPa
- D. 0.59 MPa

34. A steel tie, length 45740 mm and area 11635 mm², carries 4504 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 88.53 mm
- B. 44.27 mm
- C. 177.06 mm
- D. 44.82 mm

35. A ductile member has yield strength 11390 MPa and calculated von Mises stress 4551 MPa. What factor of safety against yielding results?

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

36. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 230900000 \text{ mm}^4$, and length 57925 mm . What is its Euler critical load?

- A. 543.35 kN
- B. 33.96 kN
- C. 43.24 kN
- D. 135.84 kN

37. At a point, $\sigma_x = 4540 \text{ MPa}$, $\sigma_y = 2260 \text{ MPa}$, and $\tau_{xy} = 1140.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 5071.41 MPa
- B. 2280 MPa
- C. 4399.73 MPa
- D. 2199.86 MPa

38. A part has alternating stress 4572 MPa and mean stress 2301 MPa . With $S_e = 6893 \text{ MPa}$ and $S_{ut} = 11655 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 1.16
- C. 5.07
- D. 1.38

39. A prismatic bar carries 4504 kN axial tension over a net area of 11510 mm^2 . What is the average normal stress?

- A. 195.66 MPa
- B. 196.07 MPa
- C. 586.97 MPa
- D. 391.31 MPa

40. A solid circular shaft of diameter 56 mm transmits 45560 N·m torque. What is its maximum torsional shear stress?

- A. 1321.26 MPa
- B. 660.63 MPa
- C. 2642.53 MPa
- D. 2643.08 MPa

41. Using the relation $T = KFd$, estimate bolt preload when installation torque is 22380 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 6216.94 kN
- B. 9325 kN
- C. 1243.33 kN
- D. 6216.67 kN

42. Two parallel fillet welds, each 4502 mm long with 6 mm leg size, carry 2231 kN direct shear. Using throat = $0.707h$, what average weld throat stress results?

- A. 82.59 MPa
- B. 58.41 MPa
- C. 41.3 MPa
- D. 116.82 MPa

43. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 4469 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 7257.79 MPa
- B. 29031.16 MPa
- C. 3628.9 MPa
- D. 14515.58 MPa

44. A bolt transfers 4486 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. 5949.74 MPa
- B. 9345.83 MPa
- C. 18691.67 MPa
- D. 37383.33 MPa

45. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 22420 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 7006.52 kN
- B. 10509.38 kN
- C. 7006.25 kN
- D. 1401.25 kN

46. Two parallel fillet welds, each 4510 mm long with 7 mm leg size, carry 2235 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.8 MPa
- B. 50.07 MPa
- C. 35.4 MPa
- D. 100.13 MPa

47. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 4477 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 22266.77 MPa
- B. 2783.35 MPa
- C. 11133.39 MPa
- D. 5566.69 MPa

48. A bolt transfers 4494 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. 22470 MPa
- B. 7152.42 MPa
- C. 11235 MPa
- D. 44940 MPa

49. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 22460 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 6606.15 kN
- B. 9908.82 kN
- C. 1321.18 kN
- D. 6605.88 kN

50. Two parallel fillet welds, each 4518 mm long with 8 mm leg size, carry 2239 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 61.95 MPa
- B. 43.81 MPa
- C. 30.97 MPa
- D. 87.62 MPa

51. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 4485 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 39656.11 MPa
- B. 4957.01 MPa
- C. 9914.03 MPa
- D. 19828.05 MPa

52. A bolt transfers 4502 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. 20463.64 MPa
- B. 6513.78 MPa
- C. 10231.82 MPa
- D. 40927.27 MPa

53. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 22500 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 6250.27 kN
- B. 9375 kN
- C. 1250 kN
- D. 6250 kN

54. A 20-tooth pinion rotating at 23850 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 4112.07 rpm
- B. 15625.86 rpm
- C. 8224.14 rpm
- D. 23850 rpm

55. A shaft transmits 2226 hp at 45420 rpm. Using $T(\text{in} \cdot \text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3088.81 in·lbf
- B. 1544.4 in·lbf
- C. 4633.21 in·lbf
- D. 6177.62 in·lbf

56. An open belt connects a 125-mm driver at 23020 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 4641.13 rpm
- B. 9282.26 rpm
- C. 13737.74 rpm
- D. 23020 rpm

57. A collar bearing supports 1114.5 kN at mean friction radius 0.022 m with friction coefficient 0.090. What friction torque must be overcome?

- A. 4413.42 N·m
- B. 3310.06 N·m
- C. 4413.97 N·m
- D. 2206.71 N·m

58. A power screw has lead 6 mm, input torque 4473 N·m, and raising efficiency 0.34. What axial load can it raise?

- A. 796.3 kN
- B. 1592.6 kN
- C. 2388.9 kN
- D. 3185.2 kN

59. A 21-tooth pinion rotating at 23900 rpm drives a 60-tooth gear. Neglecting slip, what is the gear speed?

- A. 8365 rpm
- B. 4182.5 rpm
- C. 15535 rpm
- D. 23900 rpm

60. A shaft transmits 2231 hp at 45520 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1544.47 in·lbf
- B. 4633.42 in·lbf
- C. 3088.94 in·lbf
- D. 6177.89 in·lbf

61. An open belt connects a 120-mm driver at 23070 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 4614 rpm
- B. 13842 rpm
- C. 9228 rpm
- D. 23070 rpm

62. A collar bearing supports 1117.0 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 3987.69 N·m
- B. 1993.85 N·m
- C. 2990.77 N·m
- D. 3988.24 N·m

63. A power screw has lead 8 mm, input torque 4483 N·m, and raising efficiency 0.35. What axial load can it raise?

- A. 1232.33 kN
- B. 616.16 kN
- C. 1848.49 kN
- D. 2464.66 kN

64. A 18-tooth pinion rotating at 23950 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 3991.67 rpm
- B. 15966.67 rpm
- C. 23950 rpm
- D. 7983.33 rpm

65. A shaft transmits 2236 hp at 45620 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1544.54 in·lbf
- B. 4633.62 in·lbf
- C. 3089.08 in·lbf
- D. 6178.16 in·lbf

66. An open belt connects a 130-mm driver at 23120 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 9392.5 rpm
- B. 4696.25 rpm
- C. 13727.5 rpm
- D. 23120 rpm

67. A lever has an effort arm of 6750 mm and a load arm of 4460 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 3.03
- D. 1.51

68. A 654-V DC source is applied across a 7- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 46.71 A
- B. 93.43 A
- C. 140.14 A
- D. 186.86 A

69. A thin-walled cylindrical vessel has internal pressure 224.2 MPa, inside diameter 11460 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 98820.46 MPa
- B. 49410.23 MPa
- C. 197640.92 MPa
- D. 49410.78 MPa

70. A linear spring has stiffness 2238 kN/m and is compressed 42 mm. What force does it exert?

- A. 46998 N
- B. 140994 N
- C. 93996 N
- D. 46998.55 N

71. An undamped single-degree system has mass 2232 kg and stiffness 1131000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.37 Hz
- D. 7.17 Hz

72. A hydraulic cylinder must produce 1119.5 kN using a piston area of 23050 mm². Neglecting losses, what gauge pressure is required?

- A. 24.28 MPa
- B. 24.69 MPa
- C. 97.14 MPa
- D. 48.57 MPa

73. A simply supported beam of span 2.4 m carries a central point load of 2234 kN. What is the maximum bending moment?

- A. 2680.8 kN·m
- B. 670.2 kN·m
- C. 930.83 kN·m
- D. 1340.4 kN·m

74. A lever has an effort arm of 6771 mm and a load arm of 4474 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.03

75. A 656-V DC source is applied across a 9-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 36.44 A
- B. 109.33 A
- C. 72.89 A
- D. 145.78 A

76. A thin-walled cylindrical vessel has internal pressure 224.9 MPa, inside diameter 11495 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 92329.48 MPa
- B. 46164.74 MPa
- C. 184658.96 MPa
- D. 46165.29 MPa

77. A linear spring has stiffness 2245 kN/m and is compressed 40 mm. What force does it exert?

- A. 44900 N
- B. 134700 N
- C. 44900.55 N
- D. 89800 N

78. An undamped single-degree system has mass 2239 kg and stiffness 1134500 N/m. What is its natural frequency in hertz?

- A. 3.58 Hz
- B. 1.79 Hz
- C. 5.37 Hz
- D. 7.17 Hz

79. A hydraulic cylinder must produce 1123.0 kN using a piston area of 23120 mm². Neglecting losses, what gauge pressure is required?

- A. 24.29 MPa
- B. 24.7 MPa
- C. 48.57 MPa
- D. 97.15 MPa

80. A simply supported beam of span 2.7 m carries a central point load of 2241 kN. What is the maximum bending moment?

- A. 3025.35 kN·m
- B. 1512.68 kN·m
- C. 756.34 kN·m
- D. 830 kN·m

81. A lever has an effort arm of 6792 mm and a load arm of 4488 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.03

82. A 658-V DC source is applied across a 6-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 54.83 A
- B. 164.5 A
- C. 219.33 A
- D. 109.67 A

83. A thin-walled cylindrical vessel has internal pressure 225.6 MPa, inside diameter 11530 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 54191 MPa
- B. 216764 MPa
- C. 108382 MPa
- D. 54191.55 MPa

84. A linear spring has stiffness 2252 kN/m and is compressed 46 mm. What force does it exert?

- A. 103592 N
- B. 51796 N
- C. 155388 N
- D. 51796.55 N

85. An undamped single-degree system has mass 2246 kg and stiffness 1138000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.37 Hz
- C. 7.17 Hz
- D. 3.58 Hz

86. A hydraulic cylinder must produce 1126.5 kN using a piston area of 23190 mm². Neglecting losses, what gauge pressure is required?

- A. 24.29 MPa
- B. 24.7 MPa
- C. 48.58 MPa
- D. 97.15 MPa

87. A simply supported beam of span 2.6 m carries a central point load of 2248 kN. What is the maximum bending moment?

- A. 1461.2 kN·m
- B. 2922.4 kN·m
- C. 730.6 kN·m
- D. 864.62 kN·m

88. A lever has an effort arm of 6813 mm and a load arm of 4502 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.03

89. A 660-V DC source is applied across a 8- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 41.25 A
- B. 82.5 A
- C. 123.75 A
- D. 165 A

90. A machining operation reduces a diameter from 2242 mm to 2238 mm. What percent reduction in diameter occurs?

- A. 0.18 %
- B. 0.45 %
- C. 0.27 %
- D. 0.36 %

91. Four repeated measurements are 72.13, 72.09, 72.12, and 72.10 mm. What is their arithmetic mean?

- A. 36.05 mm
- B. 288.44 mm
- C. 72.13 mm
- D. 72.11 mm

92. A mating hole measures 2237.05 mm and its shaft measures 2236.98 mm. What diametral clearance exists?

- A. 0.05 mm
- B. 0.02 mm
- C. 0.07 mm
- D. 0.04 mm

93. Inspection accepts 11545 of 11565 manufactured parts. What is the observed percent yield?

- A. 49.91 %
- B. 99.83 %
- C. 149.74 %
- D. 100.17 %

94. A machining operation reduces a diameter from 2246 mm to 2242 mm. What percent reduction in diameter occurs?

- A. 0.45 %
- B. 0.27 %
- C. 0.18 %
- D. 0.36 %

95. Four repeated measurements are 72.17, 72.13, 72.16, and 72.14 mm. What is their arithmetic mean?

- A. 36.08 mm

- B. 288.6 mm
- C. 72.17 mm
- D. 72.15 mm

96. A mating hole measures 2241.06 mm and its shaft measures 2240.98 mm. What diametral clearance exists?

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

97. Inspection accepts 11565 of 11585 manufactured parts. What is the observed percent yield?

- A. 49.91 %
- B. 149.74 %
- C. 100.17 %
- D. 99.83 %

98. A machining operation reduces a diameter from 2250 mm to 2246 mm. What percent reduction in diameter occurs?

- A. 0.45 %
- B. 0.27 %
- C. 0.18 %
- D. 0.36 %

99. Four repeated measurements are 72.21, 72.17, 72.20, and 72.18 mm. What is their arithmetic mean?

- A. 36.09 mm
- B. 72.19 mm

- C. 288.76 mm
- D. 72.21 mm

100. A mating hole measures 2245.04 mm and its shaft measures 2244.98 mm. What diametral clearance exists?

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

Practice Exam 14: Answer Key and Explanations

1. C — C — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 28270.2 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

2. 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 17921545 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

3. A — A — 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 90228.22 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

4. 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 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

5. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 28321 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

6. C — C — 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 15414392.86 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

7. 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 90388.23 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

8. D — D — The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

9. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 28371.8 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

10. C — C — 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 13534108.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

11. 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 90548.23 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

12. 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 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

13. B — B — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 28422.6 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

14. 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 18107605 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

15. 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 90708.23 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

16. 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 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

17. A — A — Using $\sigma = \frac{M c}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.07 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

18. D — D — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 87.89 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,

19. 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

20. B — B — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $P = \frac{\pi^2 EI}{L^2}$. Substitution gives 136.78 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

21. C — C — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4368.74 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,

22. D — D — 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 1.16 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

23. 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 391.25 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

24. 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 1463.23 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

25. A — A — 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 0.07 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

26. D — D — Elastic axial elongation follows PL divided by AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 88.21 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,

27. 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

28. C — C — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 136.31 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

29. C — C — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4384.24 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,

30. A — A — 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 1.16 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

31. 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 391.28 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

32. 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 1849.76 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

33. 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 0.07 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

34. A — A — Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 88.53 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,

35. 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

36. D — D — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 135.84 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

37. C — C — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4399.73 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,

38. 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 1.16. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

39. D — D — 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 391.31 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

40. A — A — For a solid circular shaft, maximum shear stress is $\frac{16T}{\pi d^3}$. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1321.26 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

41. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6216.67 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

42. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.41 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

43. A — A — 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 7257.79 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

44. C — C — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 18691.67 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

45. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 7006.25 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

46. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.07 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

47. 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 5566.69 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

48. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 22470 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

49. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6605.88 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

50. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.81 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

51. 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 9914.03 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

52. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 20463.64 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

53. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6250 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

54. C — C — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 8224.14 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. A — A — 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 3088.81 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

56. B — B — 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 9282.26 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

57. D — D — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 2206.71 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. B — B — 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 1592.6 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. A — A — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 8365 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. C — C —** 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 3088.94 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. 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 9228 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship
- 62. B — B —** Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 1993.85 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. 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 1232.33 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the
- 64. D — D —** For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7983.33 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. C — C —** 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 3089.08 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. A — A —** 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 9392.5 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship
- 67. 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 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,
- 68. B — B —** 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 93.43 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

69. A — A — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 98820.46 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

70. C — C — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 93996 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

71. 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 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

72. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.57 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

73. D — D — 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 1340.4 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

74. B — B — 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 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

75. 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 72.89 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

76. A — A — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 92329.48 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

77. D — D — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 89800 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

78. 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 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

79. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.57 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

80. B — B — 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 1512.68 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

81. B — B — 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 1.51. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

82. 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 109.67 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

83. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 108382 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

84. 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 103592 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

85. 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 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

86. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.58 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

87. 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 1461.2 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

88. B — B — 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 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

89. B — B — 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 82.5 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

90. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.18 %. 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

91. D — D — 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 72.11 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

92. C — C — 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,

93. 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 99.83 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

94. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.18 %. 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

95. D — D — 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 72.15 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

96. 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 0.08 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

97. 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 99.83 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

98. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.18 %. 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

99. 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 72.19 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

100. 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,