

PRACTICE EXAM 20: 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 1623.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 20612.1 mm
- B. 61836.3 mm
- C. 41224.2 mm
- D. 41249.6 mm

2. A machine saves 34110 labor-hours annually at \$6547/h. Ignoring interest, its \$335100 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 18581922.5 \$/year
- B. 37275545 \$/year
- C. 74327690 \$/year
- D. 37163845 \$/year

3. A proposed fixture has a fixed fabrication cost of \$130780 and a variable cost of \$1628000 spread over 6544 units. What is the average cost per unit?

- A. 65514.39 \$/unit
- B. 131028.78 \$/unit
- C. 144131.66 \$/unit
- D. 262057.56 \$/unit

4. A component is expected to experience 3273 MPa maximum stress, while its allowable design stress is 826.25 MPa. What design factor is implied?

- A. 3.96
- B. 1.98
- C. 4.46
- D. 7.92

5. A drawing dimension is 1625.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 20637.5 mm
- B. 61912.5 mm
- C. 41275 mm
- D. 41300.4 mm

6. A machine saves 34150 labor-hours annually at \$6555/h. Ignoring interest, its \$335500 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 31931107.14 \$/year
- B. 15965553.57 \$/year
- C. 32026964.29 \$/year
- D. 63862214.29 \$/year

7. A proposed fixture has a fixed fabrication cost of \$130940 and a variable cost of \$1630000 spread over 6552 units. What is the average cost per unit?

- A. 65594.39 \$/unit
- B. 131188.78 \$/unit
- C. 144307.66 \$/unit
- D. 262377.56 \$/unit

8. A component is expected to experience 3277 MPa maximum stress, while its allowable design stress is 827.25 MPa. What design factor is implied?

- A. 1.98
- B. 4.46
- C. 7.92
- D. 3.96

9. A drawing dimension is 1627.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 41325.8 mm
- B. 20662.9 mm
- C. 61988.7 mm
- D. 41351.2 mm

10. A machine saves 34190 labor-hours annually at \$6563/h. Ignoring interest, its \$335900 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 14003316.88 \$/year
- B. 28006633.75 \$/year
- C. 28090608.75 \$/year
- D. 56013267.5 \$/year

11. A proposed fixture has a fixed fabrication cost of \$131100 and a variable cost of \$1632000 spread over 6560 units. What is the average cost per unit?

- A. 65674.39 \$/unit
- B. 144483.66 \$/unit
- C. 262697.56 \$/unit
- D. 131348.78 \$/unit

12. A component is expected to experience 3281 MPa maximum stress, while its allowable design stress is 828.25 MPa. What design factor is implied?

- A. 1.98
- B. 4.46
- C. 3.96
- D. 7.92

13. A drawing dimension is 1629.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 20688.3 mm
- B. 62064.9 mm
- C. 41376.6 mm
- D. 41402 mm

14. A machine saves 34230 labor-hours annually at \$6571/h. Ignoring interest, its \$336300 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 18715752.5 \$/year
- B. 37543605 \$/year
- C. 74863010 \$/year
- D. 37431505 \$/year

15. A proposed fixture has a fixed fabrication cost of \$131260 and a variable cost of \$1634000 spread over 6568 units. What is the average cost per unit?

- A. 65754.39 \$/unit
- B. 131508.78 \$/unit
- C. 144659.66 \$/unit
- D. 263017.56 \$/unit

16. A component is expected to experience 3285 MPa maximum stress, while its allowable design stress is 829.25 MPa. What design factor is implied?

- A. 3.96
- B. 1.98
- C. 4.46
- D. 7.92

17. At a point, $\sigma_x = 6540$ MPa, $\sigma_y = 3260$ MPa, and $\tau_{xy} = 1640.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 7307.48 MPa
- B. 6336.21 MPa
- C. 3280 MPa
- D. 3168.11 MPa

18. A part has alternating stress 6572 MPa and mean stress 3301 MPa. With $S_e = 9893$ MPa and $S_{ut} = 16655$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.05
- C. 1.37
- D. 1.16

19. A prismatic bar carries 6504 kN axial tension over a net area of 16510 mm². What is the average normal stress?

- A. 196.97 MPa
- B. 197.38 MPa
- C. 393.94 MPa

D. 590.91 MPa

20. A solid circular shaft of diameter 56 mm transmits 65560 N·m torque. What is its maximum torsional shear stress?

A. 1901.28 MPa

B. 950.64 MPa

C. 3802.55 MPa

D. 3803.1 MPa

21. A rectangular beam 6548 mm wide and 6608 mm deep carries a maximum bending moment of 1629.0 kN·m. What is the extreme-fiber bending stress?

A. 0.03 MPa

B. 0.02 MPa

C. 0.43 MPa

D. 0.57 MPa

22. A steel tie, length 65900 mm and area 16675 mm², carries 6520 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

A. 64.42 mm

B. 257.67 mm

C. 128.84 mm

D. 64.97 mm

23. A ductile member has yield strength 16430 MPa and calculated von Mises stress 6567 MPa. What factor of safety against yielding results?

A. 1.25

B. 1.5

- C. 3.5
- D. 2.5

24. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 331700000 \text{ mm}^4$, and length 83125 mm . What is its Euler critical load?

- A. 379.03 kN
- B. 94.76 kN
- C. 23.69 kN
- D. 30.16 kN

25. At a point, $\sigma_x = 6556 \text{ MPa}$, $\sigma_y = 3268 \text{ MPa}$, and $\tau_{xy} = 1644.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 7325.36 MPa
- B. 3288 MPa
- C. 6351.71 MPa
- D. 3175.85 MPa

26. A part has alternating stress 6588 MPa and mean stress 3309 MPa . With $S_e = 9917 \text{ MPa}$ and $S_{ut} = 16695 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.05
- C. 1.37
- D. 1.16

27. A prismatic bar carries 6520 kN axial tension over a net area of 16550 mm^2 . What is the average normal stress?

- A. 393.96 MPa

- B. 196.98 MPa
- C. 197.39 MPa
- D. 590.94 MPa

28. A solid circular shaft of diameter 52 mm transmits 65720 N·m torque. What is its maximum torsional shear stress?

- A. 1190.22 MPa
- B. 2380.44 MPa
- C. 4760.88 MPa
- D. 4761.43 MPa

29. A rectangular beam 6564 mm wide and 6624 mm deep carries a maximum bending moment of 1633.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.03 MPa
- C. 0.43 MPa
- D. 0.57 MPa

30. A steel tie, length 66060 mm and area 16715 mm², carries 6536 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 64.58 mm
- B. 258.31 mm
- C. 129.16 mm
- D. 65.13 mm

31. A ductile member has yield strength 16470 MPa and calculated von Mises stress 6583 MPa. What factor of safety against yielding results?

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

32. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 332500000 \text{ mm}^4$, and length 83325 mm . What is its Euler critical load?

- A. 378.12 kN
- B. 23.63 kN
- C. 30.09 kN
- D. 94.53 kN

33. At a point, $\sigma_x = 6572 \text{ MPa}$, $\sigma_y = 3276 \text{ MPa}$, and $\tau_{xy} = 1648.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 7343.25 MPa
- B. 3296 MPa
- C. 3183.6 MPa
- D. 6367.2 MPa

34. A part has alternating stress 6604 MPa and mean stress 3317 MPa . With $S_e = 9941 \text{ MPa}$ and $S_{ut} = 16735 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.05
- D. 1.37

35. A prismatic bar carries 6536 kN axial tension over a net area of 16590 mm^2 . What is the average normal stress?

- A. 196.99 MPa
- B. 197.4 MPa
- C. 393.97 MPa
- D. 590.96 MPa

36. A solid circular shaft of diameter 58 mm transmits 65880 N·m torque. What is its maximum torsional shear stress?

- A. 859.82 MPa
- B. 1719.65 MPa
- C. 3439.3 MPa
- D. 3439.85 MPa

37. A rectangular beam 6580 mm wide and 6640 mm deep carries a maximum bending moment of 1637.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.03 MPa
- C. 0.43 MPa
- D. 0.57 MPa

38. A steel tie, length 66220 mm and area 16755 mm², carries 6552 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 64.74 mm
- B. 258.95 mm
- C. 65.29 mm
- D. 129.48 mm

39. A ductile member has yield strength 16510 MPa and calculated von Mises stress 6599 MPa. What factor of safety against yielding results?

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

40. A pin-ended column has $E = 200,000$ MPa, $I = 333300000$ mm⁴, and length 83525 mm. What is its Euler critical load?

- A. 94.3 kN
- B. 377.22 kN
- C. 23.58 kN
- D. 30.02 kN

41. Using the relation $T = KFd$, estimate bolt preload when installation torque is 32580 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 9050 kN
- B. 9050.27 kN
- C. 13575 kN
- D. 1810 kN

42. Two parallel fillet welds, each 6542 mm long with 6 mm leg size, carry 3251 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 82.82 MPa
- B. 41.41 MPa
- C. 58.57 MPa
- D. 117.15 MPa

43. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 6509 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 42283.25 MPa
- B. 5285.41 MPa
- C. 21141.62 MPa
- D. 10570.81 MPa

44. A bolt transfers 6526 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. 8655.38 MPa
- B. 27191.67 MPa
- C. 13595.83 MPa
- D. 54383.33 MPa

45. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 32620 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 10194.02 kN
- B. 15290.62 kN
- C. 2038.75 kN
- D. 10193.75 kN

46. Two parallel fillet welds, each 6550 mm long with 7 mm leg size, carry 3255 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.99 MPa
- B. 50.21 MPa
- C. 35.5 MPa
- D. 100.41 MPa

47. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 6517 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 8103.22 MPa
- B. 32412.9 MPa
- C. 4051.61 MPa
- D. 16206.45 MPa

48. A bolt transfers 6534 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. 10399.18 MPa
- B. 16335 MPa
- C. 32670 MPa
- D. 65340 MPa

49. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 32660 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 9606.15 kN
- B. 14408.82 kN
- C. 1921.18 kN
- D. 9605.88 kN

50. Two parallel fillet welds, each 6558 mm long with 8 mm leg size, carry 3259 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 62.12 MPa
- B. 31.06 MPa
- C. 43.93 MPa
- D. 87.86 MPa

51. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 6525 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 57693.67 MPa
- B. 14423.42 MPa
- C. 7211.71 MPa
- D. 28846.83 MPa

52. A bolt transfers 6542 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. 29736.36 MPa
- B. 9465.38 MPa
- C. 14868.18 MPa
- D. 59472.73 MPa

53. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 32700 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 9083.6 kN
- B. 13625 kN
- C. 1816.67 kN
- D. 9083.33 kN

54. A 20-tooth pinion rotating at 34050 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 5870.69 rpm
- B. 11741.38 rpm
- C. 22308.62 rpm
- D. 34050 rpm

55. A shaft transmits 3246 hp at 65820 rpm. Using $T(\text{in} \cdot \text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3108.16 in·lbf
- B. 1554.08 in·lbf
- C. 4662.24 in·lbf
- D. 6216.32 in·lbf

56. An open belt connects a 125-mm driver at 33220 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 6697.58 rpm
- B. 19824.84 rpm
- C. 13395.16 rpm
- D. 33220 rpm

57. A collar bearing supports 1624.5 kN at mean friction radius 0.022 m with friction coefficient 0.090. What friction torque must be overcome?

- A. 6433.02 N·m
- B. 4824.76 N·m
- C. 6433.57 N·m
- D. 3216.51 N·m

58. A power screw has lead 6 mm, input torque 6513 N·m, and raising efficiency 0.34. What axial load can it raise?

- A. 1159.47 kN
- B. 2318.94 kN
- C. 3478.4 kN
- D. 4637.87 kN

59. A 21-tooth pinion rotating at 34100 rpm drives a 60-tooth gear. Neglecting slip, what is the gear speed?

- A. 5967.5 rpm
- B. 22165 rpm
- C. 11935 rpm
- D. 34100 rpm

60. A shaft transmits 3251 hp at 65920 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3108.23 in·lbf
- B. 1554.11 in·lbf
- C. 4662.34 in·lbf
- D. 6216.45 in·lbf

61. An open belt connects a 120-mm driver at 33270 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 6654 rpm
- B. 19962 rpm
- C. 13308 rpm
- D. 33270 rpm

62. A collar bearing supports 1627.0 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 5808.39 N·m
- B. 4356.29 N·m
- C. 5808.94 N·m
- D. 2904.2 N·m

63. A power screw has lead 8 mm, input torque 6523 N·m, and raising efficiency 0.35. What axial load can it raise?

- A. 1793.1 kN
- B. 896.55 kN
- C. 2689.65 kN
- D. 3586.21 kN

64. A 18-tooth pinion rotating at 34150 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 5691.67 rpm
- B. 11383.33 rpm
- C. 22766.67 rpm
- D. 34150 rpm

65. A shaft transmits 3256 hp at 66020 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1554.15 in·lbf
- B. 4662.44 in·lbf
- C. 3108.29 in·lbf
- D. 6216.58 in·lbf

66. An open belt connects a 130-mm driver at 33320 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 6768.12 rpm
- B. 13536.25 rpm
- C. 19783.75 rpm
- D. 33320 rpm

67. A hydraulic cylinder must produce 1627.0 kN using a piston area of 33200 mm². Neglecting losses, what gauge pressure is required?

- A. 49.01 MPa
- B. 24.5 MPa
- C. 24.91 MPa
- D. 98.01 MPa

68. A simply supported beam of span 2.7 m carries a central point load of 3249 kN. What is the maximum bending moment?

- A. 4386.15 kN·m
- B. 1096.54 kN·m
- C. 1203.33 kN·m
- D. 2193.08 kN·m

69. A lever has an effort arm of 9816 mm and a load arm of 6504 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 1.51
- B. 0.66
- C. 2.26
- D. 3.02

70. A 946-V DC source is applied across a 9- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 52.56 A
- B. 157.67 A
- C. 210.22 A
- D. 105.11 A

71. A thin-walled cylindrical vessel has internal pressure 326.4 MPa, inside diameter 16570 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 112676 MPa
- B. 450704 MPa
- C. 225352 MPa
- D. 112676.55 MPa

72. A linear spring has stiffness 3260 kN/m and is compressed 46 mm. What force does it exert?

- A. 74980 N
- B. 149960 N
- C. 224940 N
- D. 74980.55 N

73. An undamped single-degree system has mass 3254 kg and stiffness 1642000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.36 Hz
- C. 3.58 Hz
- D. 7.15 Hz

74. A hydraulic cylinder must produce 1630.5 kN using a piston area of 33270 mm². Neglecting losses, what gauge pressure is required?

- A. 24.5 MPa
- B. 24.91 MPa
- C. 98.02 MPa
- D. 49.01 MPa

75. A simply supported beam of span 2.6 m carries a central point load of 3256 kN. What is the maximum bending moment?

- A. 2116.4 kN·m
- B. 4232.8 kN·m
- C. 1058.2 kN·m
- D. 1252.31 kN·m

76. A lever has an effort arm of 9837 mm and a load arm of 6518 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.26
- D. 3.02

77. A 948-V DC source is applied across a 6- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 79 A
- B. 237 A
- C. 316 A
- D. 158 A

78. A thin-walled cylindrical vessel has internal pressure 327.1 MPa, inside diameter 16605 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 104451.84 MPa
- B. 417807.35 MPa
- C. 208903.67 MPa
- D. 104452.39 MPa

79. A linear spring has stiffness 3267 kN/m and is compressed 44 mm. What force does it exert?

- A. 143748 N
- B. 71874 N
- C. 215622 N
- D. 71874.55 N

80. An undamped single-degree system has mass 3261 kg and stiffness 1645500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.36 Hz
- D. 7.15 Hz

81. A hydraulic cylinder must produce 1634.0 kN using a piston area of 33340 mm². Neglecting losses, what gauge pressure is required?

- A. 24.51 MPa
- B. 49.01 MPa
- C. 24.92 MPa
- D. 98.02 MPa

82. A simply supported beam of span 2.5 m carries a central point load of 3263 kN. What is the maximum bending moment?

- A. 4078.75 kN·m
- B. 1019.69 kN·m
- C. 1305.2 kN·m
- D. 2039.38 kN·m

83. A lever has an effort arm of 9858 mm and a load arm of 6532 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 1.51
- B. 0.66
- C. 2.26
- D. 3.02

84. A 950-V DC source is applied across a 8- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 59.38 A
- B. 178.12 A
- C. 118.75 A
- D. 237.5 A

85. A thin-walled cylindrical vessel has internal pressure 327.8 MPa, inside diameter 16640 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 97403.43 MPa
- B. 389613.71 MPa
- C. 194806.86 MPa
- D. 97403.98 MPa

86. A linear spring has stiffness 3274 kN/m and is compressed 42 mm. What force does it exert?

- A. 68754 N
- B. 137508 N
- C. 206262 N
- D. 68754.55 N

87. An undamped single-degree system has mass 3268 kg and stiffness 1649000 N/m. What is its natural frequency in hertz?

- A. 3.58 Hz
- B. 1.79 Hz
- C. 5.36 Hz
- D. 7.15 Hz

88. A hydraulic cylinder must produce 1637.5 kN using a piston area of 33410 mm². Neglecting losses, what gauge pressure is required?

- A. 24.51 MPa
- B. 24.92 MPa
- C. 98.02 MPa
- D. 49.01 MPa

89. A simply supported beam of span 2.4 m carries a central point load of 3270 kN. What is the maximum bending moment?

- A. 3924 kN·m
- B. 1962 kN·m
- C. 981 kN·m
- D. 1362.5 kN·m

90. A machining operation reduces a diameter from 3262 mm to 3258 mm. What percent reduction in diameter occurs?

- A. 0.12 %
- B. 0.39 %
- C. 0.18 %
- D. 0.25 %

91. Four repeated measurements are 82.33, 82.29, 82.32, and 82.30 mm. What is their arithmetic mean?

- A. 41.16 mm
- B. 329.24 mm
- C. 82.33 mm
- D. 82.31 mm

92. A mating hole measures 3257.05 mm and its shaft measures 3256.98 mm. What diametral clearance exists?

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

93. Inspection accepts 16645 of 16665 manufactured parts. What is the observed percent yield?

- A. 99.88 %
- B. 49.94 %
- C. 149.82 %
- D. 100.12 %

94. A machining operation reduces a diameter from 3266 mm to 3262 mm. What percent reduction in diameter occurs?

- A. 0.39 %
- B. 0.12 %
- C. 0.18 %
- D. 0.24 %

95. Four repeated measurements are 82.37, 82.33, 82.36, and 82.34 mm. What is their arithmetic mean?

- A. 41.17 mm

- B. 329.4 mm
- C. 82.35 mm
- D. 82.37 mm

96. A mating hole measures 3261.06 mm and its shaft measures 3260.98 mm. What diametral clearance exists?

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

97. Inspection accepts 16665 of 16685 manufactured parts. What is the observed percent yield?

- A. 99.88 %
- B. 49.94 %
- C. 149.82 %
- D. 100.12 %

98. A machining operation reduces a diameter from 3270 mm to 3266 mm. What percent reduction in diameter occurs?

- A. 0.39 %
- B. 0.18 %
- C. 0.24 %
- D. 0.12 %

99. Four repeated measurements are 82.41, 82.37, 82.40, and 82.38 mm. What is their arithmetic mean?

- A. 41.2 mm
- B. 329.56 mm

- C. 82.39 mm
- D. 82.41 mm

100. A mating hole measures 3265.04 mm and its shaft measures 3264.98 mm. What diametral clearance exists?

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

Practice Exam 20: 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 41224.2 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 37163845 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

3. 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 131028.78 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

4. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

5. C — C — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 41275 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. 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 31931107.14 \$/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 131188.78 \$/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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

9. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 41325.8 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. 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 28006633.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

11. 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 131348.78 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

12. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

13. C — C — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 41376.6 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. 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 37431505 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

15. 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 131508.78 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

16. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

17. B — B — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 6336.21 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,

18. 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

19. C — C — 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 393.94 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

20. 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 1901.28 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

21. A — A — Using σ_c equals $M c$ over I for a rectangle reduces to $6M$ divided by $b h$ squared. The moment must be expressed in newton-millimeters. Substitution gives 0.03 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

22. C — C — Elastic axial elongation follows PL divided by AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 128.84 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,

23. 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

- 24. B — B —** Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 94.76 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,
- 25. 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 6351.71 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,
- 26. 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
- 27. 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 393.96 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 28. B — B —** 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 2380.44 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 29. 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 0.03 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving
- 30. C — C —** Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 129.16 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,
- 31. A — A —** 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
- 32. D — D —** Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 94.53 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

- 33. 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 6367.2 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,
- 34. 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
- 35. C — C —** 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 393.97 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 36. B — B —** 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 1719.65 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load
- 37. B — B —** Using $\sigma = Mc/I$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.03 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving
- 38. D — D —** Elastic axial elongation follows PL/AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 129.48 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,
- 39. 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
- 40. A — A —** Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI/L^2$. Substitution gives 94.3 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,
- 41. A — A —** Rearranging the torque-preload approximation gives preload F equal to T/Kd , with diameter expressed in meters. Substitution gives 9050 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. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.57 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

43. 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 10570.81 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

44. B — B — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 27191.67 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. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 10193.75 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

46. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.21 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. 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 8103.22 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. C — C — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 32670 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 9605.88 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. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.93 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. 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 14423.42 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

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 29736.36 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting 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 9083.33 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

54. B — B — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 11741.38 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 3108.16 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. C — C — 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 13395.16 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 3216.51 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 2318.94 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. C — C — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 11935 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. 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 3108.23 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 13308 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 2904.2 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. 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 1793.1 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the
- 64. B — B —** For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 11383.33 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 3108.29 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. 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 13536.25 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 —** Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 49.01 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
- 68. 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 2193.08 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

69. A — A — 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,

70. 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 105.11 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

71. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 225352 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

72. B — B — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 149960 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

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

74. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 49.01 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

75. 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 2116.4 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

76. 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,

77. 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 158 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

78. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 208903.67 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

79. 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 143748 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

80. 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

81. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 49.01 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

82. 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 2039.38 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

83. A — A — 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,

84. 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 118.75 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

85. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 194806.86 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

86. B — B — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 137508 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

87. 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

88. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 49.01 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

89. 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 1962 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

90. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.12 %. 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 82.31 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. A — A — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.88 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

94. B — B — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.12 %. 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. 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 82.35 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

96. 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,

97. A — A — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.88 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

98. D — D — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.12 %. 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. 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 82.39 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

100. B — B — 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,