

PRACTICE EXAM 15: PE MECHANICAL—MACHINE DESIGN AND MATERIALS (100 QUESTIONS)

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

1. A proposed fixture has a fixed fabrication cost of \$96700 and a variable cost of \$1202000 spread over 4840 units. What is the average cost per unit?

- A. 48474.17 \$/unit
- B. 96948.35 \$/unit
- C. 106643.18 \$/unit
- D. 193896.69 \$/unit

2. A component is expected to experience 2421 MPa maximum stress, while its allowable design stress is 613.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.45
- C. 3.95
- D. 7.9

3. A drawing dimension is 1199.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 30454.6 mm
- B. 15227.3 mm
- C. 45681.9 mm
- D. 30480 mm

4. A machine saves 25630 labor-hours annually at \$4851/h. Ignoring interest, its \$250300 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 8862916.43 \$/year
- B. 17797347.14 \$/year
- C. 35451665.71 \$/year
- D. 17725832.86 \$/year

5. A proposed fixture has a fixed fabrication cost of \$96860 and a variable cost of \$1204000 spread over 4848 units. What is the average cost per unit?

- A. 48554.17 \$/unit
- B. 106819.18 \$/unit
- C. 97108.35 \$/unit
- D. 194216.7 \$/unit

6. A component is expected to experience 2425 MPa maximum stress, while its allowable design stress is 614.25 MPa. What design factor is implied?

- A. 3.95
- B. 1.97
- C. 4.45
- D. 7.9

7. A drawing dimension is 1201.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 15252.7 mm
- B. 30505.4 mm
- C. 45758.1 mm
- D. 30530.8 mm

8. A machine saves 25670 labor-hours annually at \$4859/h. Ignoring interest, its \$250700 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 7779989.38 \$/year
- B. 15622653.75 \$/year
- C. 31119957.5 \$/year
- D. 15559978.75 \$/year

9. A proposed fixture has a fixed fabrication cost of \$97020 and a variable cost of \$1206000 spread over 4856 units. What is the average cost per unit?

- A. 48634.18 \$/unit
- B. 97268.35 \$/unit
- C. 106995.19 \$/unit
- D. 194536.71 \$/unit

10. A component is expected to experience 2429 MPa maximum stress, while its allowable design stress is 615.25 MPa. What design factor is implied?

- A. 3.95
- B. 1.97
- C. 4.45
- D. 7.9

11. A drawing dimension is 1203.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 15278.1 mm
- B. 45834.3 mm
- C. 30581.6 mm
- D. 30556.2 mm

12. A machine saves 25710 labor-hours annually at \$4867/h. Ignoring interest, its \$251100 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 10406622.5 \$/year
- B. 20896945 \$/year
- C. 20813245 \$/year
- D. 41626490 \$/year

13. A proposed fixture has a fixed fabrication cost of \$97180 and a variable cost of \$1208000 spread over 4864 units. What is the average cost per unit?

- A. 97428.36 \$/unit
- B. 48714.18 \$/unit
- C. 107171.19 \$/unit
- D. 194856.71 \$/unit

14. A component is expected to experience 2433 MPa maximum stress, while its allowable design stress is 616.25 MPa. What design factor is implied?

- A. 1.97
- B. 3.95
- C. 4.45
- D. 7.9

15. A drawing dimension is 1205.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 15303.5 mm
- B. 45910.5 mm
- C. 30607 mm
- D. 30632.4 mm

16. A machine saves 25750 labor-hours annually at \$4875/h. Ignoring interest, its \$251500 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 8948553.57 \$/year
- B. 17968964.29 \$/year
- C. 35794214.29 \$/year
- D. 17897107.14 \$/year

17. A ductile member has yield strength 12150 MPa and calculated von Mises stress 4855 MPa. What factor of safety against yielding results?

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

18. A pin-ended column has $E = 200,000$ MPa, $I = 246100000$ mm⁴, and length 61725 mm. What is its Euler critical load?

- A. 510.01 kN
- B. 31.88 kN
- C. 127.5 kN
- D. 40.59 kN

19. At a point, $\sigma_x = 4844$ MPa, $\sigma_y = 2412$ MPa, and $\tau_{xy} = 1216.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5411.29 MPa
- B. 4694.07 MPa
- C. 2432 MPa

D. 2347.04 MPa

20. A part has alternating stress 4876 MPa and mean stress 2453 MPa. With $S_e = 7349$ MPa and $S_{ut} = 12415$ MPa, what Goodman fatigue factor of safety applies?

A. 1.16

B. 1.51

C. 5.06

D. 1.38

21. A prismatic bar carries 4808 kN axial tension over a net area of 12270 mm². What is the average normal stress?

A. 195.93 MPa

B. 196.34 MPa

C. 587.78 MPa

D. 391.85 MPa

22. A solid circular shaft of diameter 50 mm transmits 48600 N·m torque. What is its maximum torsional shear stress?

A. 990.07 MPa

B. 3960.28 MPa

C. 1980.14 MPa

D. 3960.83 MPa

23. A rectangular beam 4852 mm wide and 4912 mm deep carries a maximum bending moment of 1205.0 kN·m. What is the extreme-fiber bending stress?

A. 0.03 MPa

B. 0.06 MPa

- C. 0.44 MPa
- D. 0.58 MPa

24. A steel tie, length 48940 mm and area 12435 mm², carries 4824 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 47.46 mm
- B. 189.86 mm
- C. 94.93 mm
- D. 48.01 mm

25. A ductile member has yield strength 12190 MPa and calculated von Mises stress 4871 MPa. What factor of safety against yielding results?

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

26. A pin-ended column has $E = 200,000$ MPa, $I = 246900000$ mm⁴, and length 61925 mm. What is its Euler critical load?

- A. 508.37 kN
- B. 31.77 kN
- C. 40.45 kN
- D. 127.09 kN

27. At a point, $\sigma_x = 4860$ MPa, $\sigma_y = 2420$ MPa, and $\tau_{xy} = 1220.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 4709.56 MPa

- B. 5429.18 MPa
- C. 2440 MPa
- D. 2354.78 MPa

28. A part has alternating stress 4892 MPa and mean stress 2461 MPa. With $S_e = 7373$ MPa and $S_{ut} = 12455$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 1.16
- C. 5.06
- D. 1.38

29. A prismatic bar carries 4824 kN axial tension over a net area of 12310 mm². What is the average normal stress?

- A. 195.94 MPa
- B. 196.35 MPa
- C. 391.88 MPa
- D. 587.81 MPa

30. A solid circular shaft of diameter 56 mm transmits 48760 N·m torque. What is its maximum torsional shear stress?

- A. 707.03 MPa
- B. 2828.13 MPa
- C. 2828.68 MPa
- D. 1414.07 MPa

31. A rectangular beam 4868 mm wide and 4928 mm deep carries a maximum bending moment of 1209.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.06 MPa
- B. 0.03 MPa
- C. 0.44 MPa
- D. 0.58 MPa

32. A steel tie, length 49100 mm and area 12475 mm², carries 4840 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 47.62 mm
- B. 95.25 mm
- C. 190.5 mm
- D. 48.17 mm

33. A ductile member has yield strength 12230 MPa and calculated von Mises stress 4887 MPa. What factor of safety against yielding results?

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

34. A pin-ended column has $E = 200,000$ MPa, $I = 247700000$ mm⁴, and length 62125 mm. What is its Euler critical load?

- A. 506.74 kN
- B. 31.67 kN
- C. 40.32 kN
- D. 126.68 kN

35. At a point, $\sigma_x = 4876$ MPa, $\sigma_y = 2428$ MPa, and $\tau_{xy} = 1224.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5447.07 MPa
- B. 2448 MPa
- C. 4725.06 MPa
- D. 2362.53 MPa

36. A part has alternating stress 4908 MPa and mean stress 2469 MPa. With $S_e = 7397$ MPa and $S_{ut} = 12495$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.06
- D. 1.38

37. A prismatic bar carries 4840 kN axial tension over a net area of 12350 mm². What is the average normal stress?

- A. 391.9 MPa
- B. 195.95 MPa
- C. 196.36 MPa
- D. 587.85 MPa

38. A solid circular shaft of diameter 52 mm transmits 48920 N·m torque. What is its maximum torsional shear stress?

- A. 885.96 MPa
- B. 3543.86 MPa
- C. 1771.93 MPa
- D. 3544.41 MPa

39. A rectangular beam 4884 mm wide and 4944 mm deep carries a maximum bending moment of 1213.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.03 MPa
- B. 0.44 MPa
- C. 0.58 MPa
- D. 0.06 MPa

40. A steel tie, length 49260 mm and area 12515 mm², carries 4856 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 47.78 mm
- B. 95.57 mm
- C. 191.14 mm
- D. 48.33 mm

41. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 4805 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 31213.86 MPa
- B. 3901.73 MPa
- C. 15606.93 MPa
- D. 7803.46 MPa

42. A bolt transfers 4822 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. 6395.38 MPa
- B. 10045.83 MPa
- C. 20091.67 MPa
- D. 40183.33 MPa

43. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 24100 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 7531.25 kN
- B. 7531.52 kN
- C. 11296.88 kN
- D. 1506.25 kN

44. Two parallel fillet welds, each 4846 mm long with 7 mm leg size, carry 2403 kN direct shear. Using $\text{throat} = 0.707h$, what average weld throat stress results?

- A. 70.84 MPa
- B. 50.1 MPa
- C. 35.42 MPa
- D. 100.2 MPa

45. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 4813 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 23937.9 MPa
- B. 5984.47 MPa
- C. 2992.24 MPa
- D. 11968.95 MPa

46. A bolt transfers 4830 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. 7687.18 MPa
- B. 12075 MPa
- C. 48300 MPa
- D. 24150 MPa

47. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 24140 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 7100 kN
- B. 7100.27 kN
- C. 10650 kN
- D. 1420 kN

48. Two parallel fillet welds, each 4854 mm long with 8 mm leg size, carry 2407 kN direct shear. Using $\text{throat} = 0.707h$, what average weld throat stress results?

- A. 61.98 MPa
- B. 30.99 MPa
- C. 43.84 MPa
- D. 87.67 MPa

49. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 4821 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 42627 MPa
- B. 5328.37 MPa
- C. 10656.75 MPa
- D. 21313.5 MPa

50. A bolt transfers 4838 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. 6999.92 MPa
- B. 10995.45 MPa
- C. 43981.82 MPa
- D. 21990.91 MPa

51. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 24180 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 6716.67 kN
- B. 6716.94 kN
- C. 10075 kN
- D. 1343.33 kN

52. Two parallel fillet welds, each 4862 mm long with 6 mm leg size, carry 2411 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 82.65 MPa
- B. 58.45 MPa
- C. 41.32 MPa
- D. 116.9 MPa

53. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 4829 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 31369.76 MPa
- B. 3921.22 MPa
- C. 15684.88 MPa
- D. 7842.44 MPa

54. A 18-tooth pinion rotating at 25550 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 8516.67 rpm
- B. 4258.33 rpm
- C. 17033.33 rpm
- D. 25550 rpm

55. A shaft transmits 2396 hp at 48820 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1546.58 in·lbf
- B. 3093.16 in·lbf
- C. 4639.73 in·lbf
- D. 6186.31 in·lbf

56. An open belt connects a 120-mm driver at 24720 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 4944 rpm
- B. 14832 rpm
- C. 9888 rpm
- D. 24720 rpm

57. A collar bearing supports 1199.5 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 4282.22 N·m
- B. 3211.66 N·m
- C. 4282.77 N·m
- D. 2141.11 N·m

58. A power screw has lead 8 mm, input torque 4813 N·m, and raising efficiency 0.32. What axial load can it raise?

- A. 604.82 kN
- B. 1209.64 kN
- C. 1814.46 kN
- D. 2419.28 kN

59. A 19-tooth pinion rotating at 25600 rpm drives a 56-tooth gear. Neglecting slip, what is the gear speed?

- A. 8685.71 rpm
- B. 4342.86 rpm
- C. 16914.29 rpm
- D. 25600 rpm

60. A shaft transmits 2401 hp at 48920 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1546.64 in·lbf
- B. 4639.91 in·lbf
- C. 3093.28 in·lbf
- D. 6186.55 in·lbf

61. An open belt connects a 130-mm driver at 24770 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 10062.81 rpm
- B. 5031.41 rpm
- C. 14707.19 rpm
- D. 24770 rpm

62. A collar bearing supports 1202.0 kN at mean friction radius 0.020 m with friction coefficient 0.080. What friction torque must be overcome?

- A. 3846.4 N·m
- B. 2884.8 N·m
- C. 3846.95 N·m
- D. 1923.2 N·m

63. A power screw has lead 7 mm, input torque 4823 N·m, and raising efficiency 0.33. What axial load can it raise?

- A. 714.3 kN
- B. 2142.91 kN
- C. 1428.61 kN
- D. 2857.22 kN

64. A 20-tooth pinion rotating at 25650 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 4422.41 rpm
- B. 8844.83 rpm
- C. 16805.17 rpm
- D. 25650 rpm

65. A shaft transmits 2406 hp at 49020 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1546.7 in·lbf
- B. 4640.09 in·lbf
- C. 6186.79 in·lbf
- D. 3093.39 in·lbf

66. An open belt connects a 125-mm driver at 24820 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5004.03 rpm
- B. 14811.94 rpm
- C. 10008.06 rpm
- D. 24820 rpm

67. A thin-walled cylindrical vessel has internal pressure 241.0 MPa, inside diameter 12300 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 114011.54 MPa
- B. 57005.77 MPa
- C. 228023.08 MPa
- D. 57006.32 MPa

68. A linear spring has stiffness 2406 kN/m and is compressed 42 mm. What force does it exert?

- A. 50526 N
- B. 101052 N
- C. 151578 N
- D. 50526.55 N

69. An undamped single-degree system has mass 2400 kg and stiffness 1215000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.37 Hz
- C. 7.16 Hz
- D. 3.58 Hz

70. A hydraulic cylinder must produce 1203.5 kN using a piston area of 24730 mm². Neglecting losses, what gauge pressure is required?

- A. 48.67 MPa
- B. 24.33 MPa
- C. 24.74 MPa
- D. 97.33 MPa

71. A simply supported beam of span 2.4 m carries a central point load of 2402 kN. What is the maximum bending moment?

- A. 2882.4 kN·m
- B. 720.6 kN·m
- C. 1441.2 kN·m
- D. 1000.83 kN·m

72. A lever has an effort arm of 7275 mm and a load arm of 4810 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.02

73. A 704-V DC source is applied across a 7- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 50.29 A
- B. 150.86 A
- C. 201.14 A
- D. 100.57 A

74. A thin-walled cylindrical vessel has internal pressure 241.7 MPa, inside diameter 12335 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 53238.74 MPa
- B. 106477.48 MPa
- C. 212954.96 MPa
- D. 53239.29 MPa

75. A linear spring has stiffness 2413 kN/m and is compressed 40 mm. What force does it exert?

- A. 48260 N
- B. 144780 N
- C. 96520 N
- D. 48260.55 N

76. An undamped single-degree system has mass 2407 kg and stiffness 1218500 N/m. What is its natural frequency in hertz?

- A. 3.58 Hz
- B. 1.79 Hz
- C. 5.37 Hz
- D. 7.16 Hz

77. A hydraulic cylinder must produce 1207.0 kN using a piston area of 24800 mm². Neglecting losses, what gauge pressure is required?

- A. 24.33 MPa
- B. 24.74 MPa
- C. 48.67 MPa
- D. 97.34 MPa

78. A simply supported beam of span 2.7 m carries a central point load of 2409 kN. What is the maximum bending moment?

- A. 1626.08 kN·m
- B. 3252.15 kN·m
- C. 813.04 kN·m
- D. 892.22 kN·m

79. A lever has an effort arm of 7296 mm and a load arm of 4824 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 3.02
- D. 1.51

80. A 706-V DC source is applied across a 9- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 39.22 A
- B. 78.44 A
- C. 117.67 A
- D. 156.89 A

81. A thin-walled cylindrical vessel has internal pressure 242.4 MPa, inside diameter 12370 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 62468.5 MPa
- B. 249874 MPa
- C. 124937 MPa
- D. 62469.05 MPa

82. A linear spring has stiffness 2420 kN/m and is compressed 46 mm. What force does it exert?

- A. 55660 N
- B. 166980 N
- C. 55660.55 N
- D. 111320 N

83. An undamped single-degree system has mass 2414 kg and stiffness 1222000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.37 Hz
- D. 7.16 Hz

84. A hydraulic cylinder must produce 1210.5 kN using a piston area of 24870 mm². Neglecting losses, what gauge pressure is required?

- A. 48.67 MPa
- B. 24.34 MPa
- C. 24.75 MPa
- D. 97.35 MPa

85. A simply supported beam of span 2.6 m carries a central point load of 2416 kN. What is the maximum bending moment?

- A. 3140.8 kN·m
- B. 785.2 kN·m
- C. 1570.4 kN·m
- D. 929.23 kN·m

86. A lever has an effort arm of 7317 mm and a load arm of 4838 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.02

87. A 708-V DC source is applied across a 6-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 118 A
- B. 59 A
- C. 177 A
- D. 236 A

88. A thin-walled cylindrical vessel has internal pressure 243.1 MPa, inside diameter 12405 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 57993.38 MPa
- B. 231973.5 MPa
- C. 57993.93 MPa
- D. 115986.75 MPa

89. A linear spring has stiffness 2427 kN/m and is compressed 44 mm. What force does it exert?

- A. 53394 N
- B. 160182 N
- C. 53394.55 N
- D. 106788 N

90. A mating hole measures 2405.05 mm and its shaft measures 2404.98 mm. What diametral clearance exists?

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

91. Inspection accepts 12385 of 12405 manufactured parts. What is the observed percent yield?

- A. 49.92 %

- B. 149.76 %
- C. 99.84 %
- D. 100.16 %

92. A machining operation reduces a diameter from 2414 mm to 2410 mm. What percent reduction in diameter occurs?

- A. 0.44 %
- B. 0.17 %
- C. 0.25 %
- D. 0.33 %

93. Four repeated measurements are 73.85, 73.81, 73.84, and 73.82 mm. What is their arithmetic mean?

- A. 73.83 mm
- B. 36.92 mm
- C. 295.32 mm
- D. 73.85 mm

94. A mating hole measures 2409.06 mm and its shaft measures 2408.98 mm. What diametral clearance exists?

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

95. Inspection accepts 12405 of 12425 manufactured parts. What is the observed percent yield?

- A. 49.92 %
- B. 149.76 %

- C. 100.16 %
- D. 99.84 %

96. A machining operation reduces a diameter from 2418 mm to 2414 mm. What percent reduction in diameter occurs?

- A. 0.44 %
- B. 0.17 %
- C. 0.25 %
- D. 0.33 %

97. Four repeated measurements are 73.89, 73.85, 73.88, and 73.86 mm. What is their arithmetic mean?

- A. 36.94 mm
- B. 295.48 mm
- C. 73.89 mm
- D. 73.87 mm

98. A mating hole measures 2413.04 mm and its shaft measures 2412.98 mm. What diametral clearance exists?

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

99. Inspection accepts 12425 of 12445 manufactured parts. What is the observed percent yield?

- A. 49.92 %
- B. 99.84 %
- C. 149.76 %

D. 100.16 %

100. A machining operation reduces a diameter from 2422 mm to 2418 mm. What percent reduction in diameter occurs?

A. 0.44 %

B. 0.25 %

C. 0.17 %

D. 0.33 %

Practice Exam 15: Answer Key and Explanations

1. 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 96948.35 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

2. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

3. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 30454.6 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

4. 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 17725832.86 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

5. C — C — Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 97108.35 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

6. 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 3.95 . Keeping the calculation consistent with

the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

7. B — B — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 30505.4 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

8. 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 15559978.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

9. 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 97268.35 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

10. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

11. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 30556.2 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

12. 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 20813245 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

13. 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 97428.36 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

14. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

15. C — C — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 30607 mm. Keeping the calculation consistent

with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

16. D — D — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 17897107.14 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

17. 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

18. 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 127.5 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

19. 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 4694.07 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,

20. 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

21. 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 391.85 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

22. C — C — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1980.14 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

23. B — B — Using σ equals $M c$ over I for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.06 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

24. C — C — Elastic axial elongation follows PL divided by AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 94.93 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,

25. 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

26. 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 127.09 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

27. A — A — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4709.56 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,

28. 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

29. 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 391.88 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

30. 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 1414.07 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

31. A — A — 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 0.06 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

32. B — B — Elastic axial elongation follows PL/AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 95.25 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,

33. 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

34. 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 126.68 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

35. 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 4725.06 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,

36. 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

37. 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 391.9 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

38. C — C — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1771.93 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

39. D — D — 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 0.06 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

40. B — B — Elastic axial elongation follows PL/AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 95.57 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,

41. D — D — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 7803.46 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

42. C — C — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 20091.67 MPa. Keeping the calculation

consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

43. A — A — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 7531.25 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

44. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

45. B — B — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 5984.47 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

46. D — D — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 24150 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

47. A — A — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 7100 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

48. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.84 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

49. 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 10656.75 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

50. D — D — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 21990.91 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

51. A — A — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6716.67 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

52. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.45 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

53. 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 7842.44 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

54. A — A — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 8516.67 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

55. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3093.16 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_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 9888 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 2141.11 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 1209.64 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 8685.71 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 3093.28 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. 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 10062.81 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 1923.2 N·m. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

63. C — C — Efficiency is output work divided by input work per revolution. Equating output F times lead to efficiency times 2π torque gives the load. Substitution gives 1428.61 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 8844.83 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. D — D — 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 3093.39 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

66. C — C — Equal belt speed at both pulley rims gives N_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 10008.06 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 — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 114011.54 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

68. 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 101052 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

69. 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

70. A — A — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.67 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 shift a close design

71. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1441.2 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

72. 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,

73. 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 100.57 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

74. B — B — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 106477.48 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

75. 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 96520 N. 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 — 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

77. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.67 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 shift a close design

78. 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 1626.08 kN·m. Keeping the

calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

79. 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,

80. 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 78.44 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

81. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 124937 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

82. 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 111320 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

83. 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

84. A — A — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.67 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 shift a close design

85. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1570.4 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

86. 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,

87. A — A — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 118 A. Keeping

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

88. D — D — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 115986.75 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

89. 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 106788 N. 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 — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.07 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

91. C — C — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.84 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

92. B — B — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.17 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

93. A — A — 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 73.83 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

94. 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 0.08 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

95. 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 99.84 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

96. B — B — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.17 %. Keeping the calculation consistent with

the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

97. 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 73.87 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

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

99. 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 99.84 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

100. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.17 %. 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