Machine Design

1. Machine design begins with:

(A) Need identification

(B) Market analysis

(C) Component drawing

(D) Prototype testing

Answer: A) Need identification

2. A “factor of safety” in design ensures:

(A) Extra margin for unforeseen loads

(B) Minimum weight

(C) Minimum volume

(D) Guaranteed failure

Answer: A) Extra margin for unforeseen loads

3. The main criterion for selecting materials is:

(A) Properties

(B) Cost

(C) Availability

(D) All of these

Answer: D) All of these

4. Stress concentration occurs at:

(A) Notches and holes

(B) Uniform cross sections

(C) Smooth rods

(D) Shaft centers

Answer: A) Notches and holes

5. The Goodman line is used in:

(A) Fatigue analysis

(B) Stress concentration

(C) Thermal analysis

(D) Dimensional analysis

Answer: A) Fatigue analysis

6. A Cotter joint is used to:

(A) Connect two rods under axial load

(B) Connect two gears

(C) Connect two plates

(D) Weld two rods

Answer: A) Connect two rods under axial load

7. For static loading, the preferred theory of failure is:

(A) Maximum normal stress

(B) Maximum shear stress

(C) Maximum principal strain

(D) All of these

Answer: B) Maximum shear stress

8. Endurance limit is related to:

(A) Fatigue strength

(B) Yield strength

(C) Ultimate tensile strength

(D) Creep strength

Answer: A) Fatigue strength

9. Creep in metals is:

(A) Time-dependent deformation under constant load

(B) Sudden fracture

(C) Temperature decrease

(D) Work hardening

Answer: A) Time-dependent deformation under constant load

10. The S-N curve is associated with:

(A) Fatigue failure

(B) Impact loading

(C) Static loading

(D) Shear stress

Answer: A) Fatigue failure

11. Ductile materials fail by:

(A) Yielding

(B) Brittle fracture

(C) Buckling

(D) Crushing

Answer: A) Yielding

12. Rolling contact bearings are usually made from:

(A) High carbon steel

(B) Copper

(C) Aluminum

(D) Lead

Answer: A) High carbon steel

13. The process of shot peening:

(A) Increases fatigue life

(B) Decreases tensile strength

(C) Makes surface rough

(D) Reduces ductility

Answer: A) Increases fatigue life

14. Taper roller bearings carry:

(A) Both radial and axial loads

(B) Only radial load

(C) Only axial load

(D) Only moment load

Answer: A) Both radial and axial loads

15. A knuckle joint is used for:

(A) Tension load

(B) Compression load

(C) Both tension and compression

(D) Only torsion

Answer: A) Tension load

16. The function of a key in shaft coupling is:

(A) Prevent relative rotation

(B) Increase speed

(C) Reduce friction

(D) Allow axial movement

Answer: A) Prevent relative rotation

17. A “rivet” is used for:

(A) Permanent joining

(B) Removable joining

(C) Threading

(D) Temporary fixing

Answer: A) Permanent joining

18. The helix angle of a standard ISO metric thread is about:

(A) 30º

(B) 45º

(C) 60º

(D) 15º

Answer: A) 30º

19. Gear ratio is defined as:

(A) Number of teeth on driven/driver gear

(B) Number of teeth on driver/driven gear

(C) Module of gear

(D) Pitch circle diameter

Answer: A) Number of teeth on driven/driver gear

20. “Pitch” of a screw thread is:

(A) Distance between two adjacent threads

(B) Height of thread

(C) Diameter of thread

(D) Depth of thread

Answer: A) Distance between two adjacent threads

21. Cast iron is generally used for:

(A) Machine frames

(B) Ball bearings

(C) Gears

(D) Bolts

Answer: A) Machine frames

22. Allowable stress is:

(A) Yield stress divided by factor of safety

(B) Ultimate stress multiplied by safety factor

(C) Modulus/prominence

(D) None

Answer: A) Yield stress divided by factor of safety

23. Yield point denotes:

(A) Beginning of plastic deformation

(B) Rupture

(C) Elastic limit

(D) Fatigue limit

Answer: A) Beginning of plastic deformation

24. Typical value of Poisson's ratio for steel is:

(A) 0.3

(B) 0.5

(C) 2.0

(D) 0.7

Answer: A) 0.3

25. Torsional rigidity of shaft is:

(A) GJ/L

(B) E × I

(C) M/I

(D) T × L

Answer: A) GJ/L

26. Runout in shafts refers to:

(A) Lack of roundness/straightness

(B) Excessive torque

(C) High velocity

(D) Bending

Answer: A) Lack of roundness/straightness

27. The modulus of resilience is important in:

(A) Spring design

(B) Bolt design

(C) Frame design

(D) Wheel design

Answer: A) Spring design

28. The basic fastening element in a nut-bolt pair is:

(A) Thread

(B) Head

(C) Body

(D) Shank

Answer: A) Thread

29. The most commonly used key is:

(A) Square key

(B) Woodruff key

(C) Feather key

(D) Round key

Answer: A) Square key

30. The ratio of tangential to radial force in helical gears is called:

(A) Tooth force ratio

(B) Helix angle ratio

(C) Pressure angle

(D) Load angle

Answer: C) Pressure angle

31. The “lead” of a single start thread is:

(A) Equal to pitch

(B) Twice pitch

(C) Half pitch

(D) Varies

Answer: A) Equal to pitch

32. Soderberg theory is used for:

(A) Fatigue design under combined stresses

(B) Shear designs

(C) Only static load

(D) Friction

Answer: A) Fatigue design under combined stresses

33. Stress reversal is important in:

(A) Fatigue loading

(B) Static loading

(C) Impact loading

(D) Torsion only

Answer: A) Fatigue loading

34. Bending rigidity depends upon:

(A) $E \times I$

(B) EI/L

(C) L/I

(D) None

Answer: A) $E \times I$

35. The main function of a cotter is:

(A) Temporary fastening

(B) Permanent fixing

(C) Increase friction

(D) Allow sliding

Answer: A) Temporary fastening

36. A “bushed pin flexible coupling” accommodates:

(A) Small misalignments

(B) Large axial loads

(C) Large misalignments

(D) None

Answer: A) Small misalignments

37. Wear resistance of surface is improved by:

(A) Case hardening

(B) Annealing

(C) Tempering

(D) Quenching

Answer: A) Case hardening

38. The weld made at corner of two plates is:

(A) Fillet weld

(B) Butt weld

(C) Spot weld

(D) Seam weld

Answer: A) Fillet weld

39. Endurance limit for steel is approximately:

(A) 0.5 × ultimate tensile strength

(B) 2 × yield strength

(C) Equal to yield strength

(D) None

Answer: A) 0.5 × ultimate tensile strength

40. Lubrication in rolling contact bearings is applied to:

(A) Reduce friction and wear

(B) Increase friction

(C) Faster rotation

(D) Generate heat

Answer: A) Reduce friction and wear

41. Minimum number of balls in ball bearing is:

(A) 7

(B) 1

(C) 2

(D) 3

Answer: D) 3

42. The minimum number of teeth required for a pinion to avoid interference is:

(A) Depends on pressure angle

(B) Always 8

(C) Always 40

(D) Always 2

Answer: A) Depends on pressure angle

43. Which bearing can take radial and axial loads?

(A) Taper roller bearing

(B) Deep groove ball bearing

(C) Thrust bearing

(D) Spherical bearing

Answer: A) Taper roller bearing

44. The term “wear” refers to:

(A) Surface material loss

(B) Ductility

(C) Strength

(D) Creep

Answer: A) Surface material loss

45. Spring index is defined as:

(A) Mean coil diameter/wire diameter

(B) Wire diameter/coil diameter

(C) Number of coils/diameter

(D) None

Answer: A) Mean coil diameter/wire diameter

46. Leaf spring is mainly used for:

(A) Absorbing shock loads

(B) Providing constant pressure

(C) High speed rotation

(D) None

Answer: A) Absorbing shock loads

47. Keys fail under:

(A) Shear and/or crushing

(B) Fatigue

(C) Elastic deformation

(D) All

Answer: A) Shear and/or crushing

48. Spline is:

(A) Keyway with multiple keys

(B) Key of round cross-section

(C) Rotating shaft

(D) Bearing

Answer: A) Keyway with multiple keys

49. The maximum normal stress theory is also called:

(A) Rankine’s theory

(B) Tresca’s theory

(C) Von Mises theory

(D) Soderberg’s theory

Answer: A) Rankine’s theory

50. The efficiency of square thread is:

(A) Higher than trapezoidal thread

(B) Less than trapezoidal

(C) Same as trapezoidal

(D) None

Answer: A) Higher than trapezoidal thread

51. ISO metric threads have an included angle of:

(A) 60º

(B) 55º

(C) 90º

(D) 30º

Answer: A) 60º

52. For power transmission, the chain drive should have a minimum number of teeth on sprocket:

(A) 15–17

(B) 7–9

(C) 40–46

(D) 5–6

Answer: A) 15–17

53. Flexible couplings are used to join:

(A) Slightly misaligned shafts

(B) Non-rotating parts

(C) Rigid assemblies

(D) None

Answer: A) Slightly misaligned shafts

54. The material suitable for high speed gears is:

(A) Alloy steels

(B) Cast iron

(C) Aluminum

(D) Brass

Answer: A) Alloy steels

55. Wear of wire ropes is minimized by:

(A) Lubrication

(B) Annealing

(C) Quenching

(D) Shot blasting

Answer: A) Lubrication

56. A dynamically balanced shaft will:

(A) Not vibrate

(B) Vibrate

(C) Fail early

(D) Rotate slowly

Answer: A) Not vibrate

57. Creep failure is predominant at:

(A) High temperature

(B) Low temperature

(C) Room temperature

(D) None

Answer: A) High temperature

58. ISO metric thread profiles:

(A) Equilateral triangle

(B) Isosceles triangle

(C) Right angled triangle

(D) Circular arc

Answer: A) Equilateral triangle

59. The function of a thrust bearing is to:

(A) Take axial load

(B) Take radial load

(C) Take moment load

(D) Rotate shaft

Answer: A) Take axial load

60. Power screws are commonly used for:

(A) Translating rotary to linear motion

(B) Coupling

(C) Gears

(D) Cams

Answer: A) Translating rotary to linear motion

61. Cams are widely used in:

(A) Automobiles

(B) Ships

(C) Trains

(D) Cranes

Answer: A) Automobiles

62. For maximum strength, the key should be fitted:

(A) Tight in keyway

(B) Loose

(C) Welded

(D) No need

Answer: A) Tight in keyway

63. The fatigue limit of steel is approximately:

(A) 0.5 × ultimate strength

(B) 2 × yield strength

(C) 0.2 × ultimate strength

(D) 1 × yield strength

Answer: A) 0.5 × ultimate strength

64. A self-locking screw has:

(A) Efficiency less than 50%

(B) Efficiency more than 60%

(C) More than 100%

(D) None

Answer: A) Efficiency less than 50%

65. The crowning of a pulley helps:

(A) Keep the belt in center

(B) Prevent belt wear

(C) Increase speed

(D) Increase temperature

Answer: A) Keep the belt in center

66. Spring steel should have:

(A) High yield strength

(B) High ductility

(C) Low hardness

(D) Low modulus

Answer: A) High yield strength

67. The key used in gear box is:

(A) Woodruff key

(B) Square key

(C) Splined key

(D) Saddle key

Answer: C) Splined key

68. High lead in screw thread increases:

(A) Linear movement per revolution

(B) Strength

(C) Diameter

(D) Wear

Answer: A) Linear movement per revolution

69. Fillet in shaft shoulder reduces:

(A) Stress concentration

(B) Weight

(C) Hardness

(D) Modulus

Answer: A) Stress concentration

70. “Module” of gear is:

(A) Pitch circle diameter/number of teeth

(B) Number of teeth × pitch

(C) Pressure angle

(D) Dedendum

Answer: A) Pitch circle diameter/number of teeth

71. Shrink fit is used for:

(A) Permanent joining

(B) Temporary joining

(C) Reducing noise

(D) Increasing speed

Answer: A) Permanent joining

72. A “Lap joint” is a type of:

(A) Riveted joint

(B) Key joint

(C) Pin joint

(D) Butt joint

Answer: A) Riveted joint

73. Plane keys fail mainly in:

(A) Shear

(B) Cracking

(C) Fatigue

(D) Wear

Answer: A) Shear

74. Morton diagram is used for:

(A) Tolerance analysis

(B) Gear design

(C) Spline design

(D) Key design

Answer: A) Tolerance analysis

75. Form factor in gear design is for:

(A) Stress calculation

(B) Pitch calculation

(C) Angle calculation

(D) None

Answer: A) Stress calculation

76. Stiffness in spring is defined as:

(A) Load per unit deflection

(B) Stress per load

(C) Strain per load

(D) Length per stress

Answer: A) Load per unit deflection

77. Wear in sliding contact bearings is minimized by:

(A) Oil film formation

(B) High load

(C) No lubrication

(D) Rough surface

Answer: A) Oil film formation

78. The contact ratio in gears should be:

(A) Greater than 1

(B) Less than 1

(C) Zero

(D) infinite

Answer: A) Greater than 1

79. The life of a ball bearing is usually expressed in:

(A) Number of revolutions

(B) Number of hours at given speed

(C) Both A and B

(D) None

Answer: C) Both A and B

80. The function of splined shaft is:

(A) Transmit torque and allow axial movement

(B) Only transmit torque

(C) Only axial movement

(D) Prevent axial movement

Answer: A) Transmit torque and allow axial movement

81. Sprocket is used with:

(A) Chain drive

(B) Gear drive

(C) Belt drive

(D) Rope drive

Answer: A) Chain drive

82. Differential screw is used for:

(A) Fine adjustments

(B) Transmit power

(C) Hold together

(D) None

Answer: A) Fine adjustments

83. Norton's equivalent is used in:

(A) Mechanism design

(B) Circuits

(C) Gear design

(D) Bolt design

Answer: A) Mechanism design

84. The Herringbone gear is:

(A) Double helical gear

(B) Spur gear

(C) Bevel gear

(D) Worm gear

Answer: A) Double helical gear

85. The shaft subjected to twisting moment only experiences:

(A) Shear stress

(B) Bending stress

(C) Axial stress

(D) Direct stress

Answer: A) Shear stress

86. Spigot and socket joint is used for:

(A) Joining pipes

(B) Joining beams

(C) Joining gears

(D) Joining ropes

Answer: A) Joining pipes

87. Flange coupling is:

(A) Rigid

(B) Flexible

(C) Semi-rigid

(D) None

Answer: A) Rigid

88. Most commonly used bearing in bicycle is:

(A) Ball bearing

(B) Journal bearing

(C) Roller bearing

(D) Thrust bearing

Answer: A) Ball bearing

89. Wear in gear is maximum at:

(A) Tip of tooth

(B) Pitch point

(C) Root

(D) Flank

Answer: A) Tip of tooth

90. A “cotter” is used in:

(A) Axial loaded joints

(B) Riveted joints

(C) Bolted joints

(D) Gears

Answer: A) Axial loaded joints

91. Tolerance in design is:

(A) Allowable variation in dimension

(B) Error

(C) Clearance

(D) None

Answer: A) Allowable variation in dimension

92. The process of making a thread by cutting is called:

(A) Threading

(B) Tapping

(C) Forming

(D) Rolling

Answer: A) Threading

93. Parallel keys are:

(A) Square or rectangular

(B) Round

(C) Tapered

(D) Riveted

Answer: A) Square or rectangular

94. The most common type of welded joint is:

(A) Butt joint

(B) Corner joint

(C) Lap joint

(D) T-joint

Answer: A) Butt joint

95. Helical spring used in vehicles is generally:

(A) Compression spring

(B) Tension spring

(C) Torsion spring

(D) None

Answer: A) Compression spring

96. Strain energy in a loaded shaft is maximum at:

(A) Surface

(B) Center

(C) Both ends

(D) Any point

Answer: A) Surface

97. Contact fatigue failure in gears is called:

(A) Pitting

(B) Spalling

(C) Scoring

(D) None

Answer: A) Pitting

98. A cotter is:

(A) Wedge-shaped

(B) Flat bar

(C) Cylindrical pin

(D) Key

Answer: A) Wedge-shaped

99. Needle bearing is suitable for:

(A) Small radial space

(B) Large radial load

(C) Large axial load

(D) None

Answer: A) Small radial space

100. Stress concentration in shaft is reduced by:

(A) Fillets

(B) Sharp corners

(C) Keyways

(D) Notches

Answer: A) Fillets

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