Theory of Machines

1. The study of relative motion between parts of a machine is called:

(A) Kinematics

(B) Dynamics

(C) Statics

(D) Thermodynamics

Answer: A) Kinematics

2. The mechanism that converts rotary motion into linear motion is:

(A) Slider-crank

(B) Four-bar chain

(C) Cam-follower

(D) Gear train

Answer: A) Slider-crank

3. A rigid body has how many degrees of freedom in a plane?

(A) 1

(B) 2

(C) 3

(D) 6

Answer: C) 3

4. The term “link” in a mechanism refers to:

(A) Rigid member connecting other links

(B) Flexible part

(C) Rotating shaft

(D) Connecting rod only

Answer: A) Rigid member connecting other links

5. The total number of instantaneous centers in a four-bar mechanism is:

(A) 2

(B) 4

(C) 5

(D) 6

Answer: D) 6

6. Geneva mechanism is used in:

(A) Intermittent motion

(B) Continuous rotation

(C) Harmonic motion

(D) None

Answer: A) Intermittent motion

7. The input link of a crank and slotted lever mechanism is:

(A) Crank

(B) Connecting rod

(C) Ram

(D) Slider

Answer: A) Crank

8. Gears are used to:

(A) Transmit motion by contact of teeth

(B) Convey fluids

(C) Operate valves

(D) Provide friction

Answer: A) Transmit motion by contact of teeth

9. The velocity ratio of a pair of gears is:

(A) Inverse of speed ratio

(B) Equal to speed ratio

(C) Product of diametral pitch

(D) Difference of tooth number

Answer: B) Equal to speed ratio

10. In a cam-follower mechanism, the follower is:

(A) Driven element

(B) Driving element

(C) Stationary

(D) Flexible

Answer: A) Driven element

11. The Grashof's law is applicable for:

(A) Four-bar chain

(B) Cam mechanisms

(C) Gear trains

(D) Linkages with five links

Answer: A) Four-bar chain

12. A lower pair has:

(A) Surface contact

(B) Line contact

(C) Point contact

(D) None

Answer: A) Surface contact

13. A higher pair has:

(A) Point or line contact

(B) Surface contact

(C) Both

(D) None

Answer: A) Point or line contact

14. A single Hooke’s joint permits a maximum angle of:

(A) 20–25°

(B) 60–90°

(C) Less than 10°

(D) Any angle

Answer: A) 20–25°

15. The function of a flywheel is to:

(A) Regulate speed fluctuations

(B) Store electrical energy

(C) Reduce friction

(D) Regulate pressure

Answer: A) Regulate speed fluctuations

16. Gyroscopic effect is prominent in:

(A) Fast turning vehicles

(B) Reciprocating engines

(C) Slow moving parts

(D) Stationary engines

Answer: A) Fast turning vehicles

17. D’Alembert’s principle allows dynamic problems to be treated as:

(A) Static

(B) Kinematic

(C) Hydrodynamic

(D) Electrical

Answer: A) Static

18. Involute profile is preferred for gear teeth because:

(A) Easy to manufacture

(B) Maintains constant velocity ratio

(C) Reduces friction

(D) Increases strength

Answer: B) Maintains constant velocity ratio

19. The order of a gear train is determined by:

(A) Number of pairs

(B) Number of axes

(C) Number of gears

(D) Number of teeth

Answer: C) Number of gears

20. The main function of a governor is to:

(A) Maintain constant speed

(B) Transmit power

(C) Absorb vibrations

(D) Transmit motion

Answer: A) Maintain constant speed

21. Sensitiveness of a governor is:

(A) Change of speed/load ratio

(B) Ability to maintain constant speed

(C) Change of speed per unit change in load

(D) Range of speed

Answer: C) Change of speed per unit change in load

22. Watt governor is a type of:

(A) Centrifugal governor

(B) Inertia governor

(C) Spring loaded governor

(D) Hydraulic governor

Answer: A) Centrifugal governor

23. The minimum number of links required to form a simple kinematic chain is:

(A) 2

(B) 3

(C) 4

(D) 5

Answer: C) 4

24. A worm gear is used for:

(A) Large speed reduction

(B) Speed multiplication

(C) Power absorption

(D) Power addition

Answer: A) Large speed reduction

25. The primary unbalanced force in a reciprocating engine is due to:

(A) Reciprocating mass

(B) Rotating mass

(C) Piston friction

(D) Inertia force only

Answer: A) Reciprocating mass

26. A four bar chain with equal length opposite links is:

(A) Parallelogram mechanism

(B) Crank-rocker

(C) Double slider

(D) Quick return

Answer: A) Parallelogram mechanism

27. Pitch circle diameter of gear is:

(A) $D = m \times T$

(B) $D = \pi \times m$

(C) $D = T / m$

(D) $D = m/T$

Answer: A) $D = m \times T$

28. Law of gearing states:

(A) Common normal at the point of contact must always pass through pitch point

(B) Common tangent at the point of contact must pass through the pitch point

(C) Pitch circles must be tangent

(D) Tooth profiles must be involute

Answer: A) Common normal at the point of contact must always pass through pitch point

29. The quick return mechanism is used in:

(A) Shaper

(B) Drilling machine

(C) Lathe

(D) Milling machine

Answer: A) Shaper

30. Coriolis component of acceleration occurs in:

(A) Sliding and rotating motion

(B) Only sliding motion

(C) Pure rotation

(D) No motion

Answer: A) Sliding and rotating motion

31. Rolling contact bearings are:

(A) Lower pair

(B) Higher pair

(C) Neither

(D) Both

Answer: B) Higher pair

32. Instantaneous center is a point:

(A) Zero velocity

(B) Infinite velocity

(C) Maximum velocity

(D) Minimum acceleration

Answer: A) Zero velocity

33. The pitch of a chain is:

(A) Distance between centers of adjacent pins

(B) Diameter of pin

(C) Number of teeth

(D) Thickness of plate

Answer: A) Distance between centers of adjacent pins

34. The phenomenon of vibration with amplitude increasing continuously is called:

(A) Resonance

(B) Damping

(C) Critical speed

(D) Free vibration

Answer: A) Resonance

35. Balancing of rotating masses eliminates:

(A) Unbalanced force

(B) Unbalanced couple

(C) Both

(D) Neither

Answer: C) Both

36. The speed at which resonance occurs is called:

(A) Critical speed

(B) Synchronous speed

(C) Safe speed

(D) Natural frequency

Answer: A) Critical speed

37. Natural frequency depends on:

(A) Mass and stiffness

(B) Only mass

(C) Only stiffness

(D) Damping

Answer: A) Mass and stiffness

38. Damping can be:

(A) Viscous

(B) Coulomb

(C) Structural

(D) All of these

Answer: D) All of these

39. The minimum number of teeth on gear to avoid interference:

(A) 18 (for 20° pressure angle)

(B) 12

(C) 7

(D) 30

Answer: A) 18 (for 20° pressure angle)

40. A cam with a follower is an example of:

(A) Higher pair

(B) Lower pair

(C) Rolling pair

(D) Turning pair

Answer: A) Higher pair

41. Turnbuckle is used as a:

(A) Length adjusting device

(B) Power transmission device

(C) Speed control device

(D) Torque converter

Answer: A) Length adjusting device

42. The condition of reversibility in screw jack arises when efficiency is:

(A) More than 50%

(B) Less than 50%

(C) Equal to 100%

(D) Zero

Answer: B) Less than 50%

43. The ratio of maximum to minimum velocity in a Whitworth quick return mechanism is:

(A) >1

(B) <1

(C) =1

(D) 0

Answer: A) >1

44. Fluctuation of energy in a flywheel:

(A) Increases with load

(B) Decreases with load

(C) Independent of load

(D) Depends on radius only

Answer: A) Increases with load

45. A four bar link has:

(A) Four revolute pairs

(B) Two revolute and two prismatic pairs

(C) Three revolute and one prismatic pair

(D) Four prismatic pairs

Answer: A) Four revolute pairs

46. Pantograph is a:

(A) Four bar mechanism

(B) Three bar mechanism

(C) Cam-follower

(D) Gear train

Answer: A) Four bar mechanism

47. Dynamic balancing ensures:

(A) No vibration at any speed

(B) Less weight

(C) High speed

(D) Simplicity

Answer: A) No vibration at any speed

48. The addendum of gear is:

(A) Radial distance from pitch circle to top of tooth

(B) Bottom to pitch circle

(C) Total thickness

(D) Distance between teeth

Answer: A) Radial distance from pitch circle to top of tooth

49. The maximum fluctuation of energy in a flywheel is:

(A) Difference between maximum and minimum energies

(B) Twice the average energy

(C) Average energy

(D) Minimum energy

Answer: A) Difference between maximum and minimum energies

50. Cam profile most commonly used for quick return is:

(A) Tangent cam

(B) Circular cam

(C) Flat face cam

(D) Heart shaped cam

Answer: A) Tangent cam

51. The primary unbalanced force in rotating mass is proportional to:

(A) $m\omega^2 r$

(B) $mr\omega$

(C) $m\omega r^2$

(D) $m^2\omega^2 r$

Answer: A) $m\omega^2 r$

52. The “pitch circle” of a gear is:

(A) Imaginary circle that rolls without slipping

(B) Root circle

(C) Addendum circle

(D) Dedendum circle

Answer: A) Imaginary circle that rolls without slipping

53. A “kinematic pair” is defined by:

(A) Relative motion between links

(B) Material only

(C) Rigidity

(D) Flexibility

Answer: A) Relative motion between links

54. Differential gear in automobiles is:

(A) Epicyclic gear train

(B) Simple gear train

(C) Compound gear train

(D) None

Answer: A) Epicyclic gear train

55. The reversed slider-crank chain is used in:

(A) Whitworth quick return mechanism

(B) Coupling rod

(C) Differential

(D) Watt governor

Answer: A) Whitworth quick return mechanism

56. Kinematic inversion is:

(A) Changing fixed link of chain

(B) Changing length

(C) Changing number of links

(D) Changing shape

Answer: A) Changing fixed link of chain

57. Pitch cone is related to:

(A) Bevel gears

(B) Spur gears

(C) Helical gears

(D) Worm gears

Answer: A) Bevel gears

58. Scotch yoke mechanism converts:

(A) Rotary to reciprocating

(B) Reciprocating to rotary

(C) Linear to angular

(D) None

Answer: A) Rotary to reciprocating

59. In cycloidal motion of followers:

(A) Acceleration at beginning and end is zero

(B) Acceleration is maximum at midstroke

(C) Displacement is parabolic

(D) None

Answer: A) Acceleration at beginning and end is zero

60. The static friction in a pair is classified as:

(A) Dead

(B) Sliding

(C) Rolling

(D) None

Answer: B) Sliding

61. A machine is designed for:

(A) Performing useful work

(B) Increasing entropy

(C) Energy loss

(D) Reducing efficiency

Answer: A) Performing useful work

62. For a cam profile, “base circle” is:

(A) Smallest circle from cam center to profile

(B) Largest circle

(C) Addendum circle

(D) Pitch circle

Answer: A) Smallest circle from cam center to profile

63. Straight line motion mechanisms include:

(A) Peaucellier mechanism

(B) Pantograph

(C) Scotch-yoke

(D) Quick return

Answer: A) Peaucellier mechanism

64. Path of contact in gear teeth is:

(A) Involute

(B) Cycloidal

(C) Parabolic

(D) Both A and B

Answer: D) Both A and B

65. The relation for periodic time (T) of a simple pendulum is:

(A) $T = 2\pi\sqrt{(l/g)}$

(B) $T = 2p \times l/g$

(C) $T = (l/g)^2$

(D) $T = 2\pi \times g/l$

Answer: A) $T = 2\pi\sqrt{(l/g)}$

66. The rotating mass is balanced by placing:

(A) Opposite mass

(B) No mass

(C) Smaller mass

(D) Same side mass

Answer: A) Opposite mass

67. The gear train used for large speed reduction is:

(A) Compound

(B) Simple

(C) Epicyclic

(D) Reverted

Answer: C) Epicyclic

68. The function of universal joint is to:

(A) Transmit rotary motion at angle

(B) Transmit force only

(C) Couple shafts

(D) Change speed

Answer: A) Transmit rotary motion at angle

69. Seats provided on gear teeth for lubrication are called:

(A) Oil grooves

(B) Keys

(C) Holes

(D) Splines

Answer: A) Oil grooves

70. If a mechanism has n links, the number of pairs is:

(A) n(n-1)/2

(B) (n+1)/2

(C) n(n+2)/2

(D) (n-1)/2

Answer: A) n(n-1)/2

71. Which component affects natural frequency?

(A) Mass

(B) Stiffness

(C) Both

(D) None

Answer: C) Both

72. In a simple gear train, if the number of gears is odd, the direction…

(A) Opposite to driver

(B) Same as driver

(C) No relation

(D) Varies with size

Answer: A) Opposite to driver

73. An Ackermann steering gear is used in:

(A) Automobiles

(B) Tractors

(C) Airplanes

(D) Bicycles

Answer: A) Automobiles

74. Toggle mechanism is used for:

(A) Amplifying force

(B) Reducing speed

(C) Coupling

(D) Decoupling

Answer: A) Amplifying force

75. The minimum number of teeth on pinion for involute gear (20° pressure angle) is:

(A) 18

(B) 20

(C) 12

(D) 36

Answer: A) 18

76. Double helical gears are known as:

(A) Herringbone gears

(B) Worm gears

(C) Spur gears

(D) Bevel gears

Answer: A) Herringbone gears

77. Balancing of multi-cylinder engines is done to:

(A) Reduce vibrations

(B) Increase power

(C) Increase speed

(D) Increase load

Answer: A) Reduce vibrations

78. The condition for the Grashof's law is:

(A) Sum of shortest and longest ≤ sum of other two links

(B) All links equal

(C) Only shortest is fixed

(D) All are variable

Answer: A) Sum of shortest and longest ≤ sum of other two links

79. Swaying couple is associated with:

(A) Locomotives

(B) Automobiles

(C) Pumps

(D) Compressors

Answer: A) Locomotives

80. Velocity ratio in an epicyclic gear train is found by:

(A) Tabular method

(B) Analytical method

(C) Graphical method

(D) All of these

Answer: D) All of these

81. The transmission angle in mechanisms refers to:

(A) Efficiency of force transfer

(B) Angle between coupler and output link

(C) Angle between driver and follower

(D) None

Answer: B) Angle between coupler and output link

82. Scotch Yoke is used in:

(A) Reciprocating engines

(B) Compressors

(C) Both

(D) None

Answer: C) Both

83. Lobe cams are used when:

(A) Multiple high-speed rises required

(B) Slow movement only

(C) Constant velocity needed

(D) No dwell desired

Answer: A) Multiple high-speed rises required

84. Primary force balancing is necessary in:

(A) High speed engines

(B) Low speed engines

(C) All engines

(D) None

Answer: A) High speed engines

85. Addendum teeth are:

(A) Above pitch circle

(B) Below pitch circle

(C) On root circle

(D) On base circle

Answer: A) Above pitch circle

86. Epicyclic gear trains allow:

(A) Output shaft to rotate and revolve

(B) Only rotate

(C) Only revolve

(D) Not move

Answer: A) Output shaft to rotate and revolve

87. For minimum wear, velocity ratio of mating gears should be:

(A) Constant

(B) Variable

(C) Decreasing

(D) Increasing

Answer: A) Constant

88. Stepped pulley is used for:

(A) Changing speed in belt drive

(B) Changing torque

(C) Changing diameter

(D) Reducing friction

Answer: A) Changing speed in belt drive

89. The speed at which centrifugal force balances the restoring force is:

(A) Critical speed

(B) Resonance speed

(C) Synchronous speed

(D) Idle speed

Answer: A) Critical speed

90. In kinematic pairs with sliding, the pair is called:

(A) Prismatic

(B) Turning

(C) Rolling

(D) Revolute

Answer: A) Prismatic

91. The ratio of angular velocity of driving wheel to driven wheel is called:

(A) Velocity ratio

(B) Force ratio

(C) Power ratio

(D) Speed difference

Answer: A) Velocity ratio

92. Free vibration occurs with:

(A) No damping or forcing

(B) Forced oscillations

(C) Damped oscillations

(D) None

Answer: A) No damping or forcing

93. Klein’s construction is used for:

(A) Velocity and acceleration in mechanisms

(B) Stress analysis

(C) Gear train analysis

(D) Flywheel design

Answer: A) Velocity and acceleration in mechanisms

94. The mechanical advantage of a machine is:

(A) Load/Effort

(B) Effort/Load

(C) Load × effort

(D) None

Answer: A) Load/Effort

95. The number of degrees of freedom in typical planar mechanism is given by:

(A) 3(n–1)–2j–h

(B) 2(n+1)–3j–h

(C) n–2j+h

(D) (n+2)–2j

Answer: A) 3(n–1)–2j–h (n = links, j = lower pairs, h = higher pairs)

96. Hartnell governor is a type of:

(A) Spring loaded governor

(B) Hydraulic governor

(C) Inertia governor

(D) None

Answer: A) Spring loaded governor

97. Differential mechanism is used in:

(A) Automobiles

(B) Railway engines

(C) Bicycles

(D) Aircrafts

Answer: A) Automobiles

98. The term “hunting” in governors is:

(A) Oscillation of speed above and below mean

(B) Sustained speed

(C) Constant speed

(D) Reduced speed

Answer: A) Oscillation of speed above and below mean

99. Quick return ratio is the ratio of:

(A) Time of return stroke to cutting stroke

(B) Cutting stroke to return stroke

(C) Both

(D) None

Answer: B) Cutting stroke to return stroke

100. Pantograph is used to:

(A) Duplicate motion to different scale

(B) Increase speed

(C) Change direction

(D) Reduce motion

Answer: A) Duplicate motion to different scale

***