

Theory of machines
Multiple choice questions

Q:1 A rigid body possesses _____ degrees of freedom.

- a. One b. Two c. Four d. Six

(Ans:d)

2. Which of the following is an open pair?

- a. Journal bearing b. Ball and Socket joint
c. Leave screw and nut d. None of the above

(Ans:c)

3. Which of the following is a higher pair?

- a. Turning pair b. Screw pair
c. Belt and pulley d. None of the above

(Ans:c)

4. A higher pair has _____.

- a. Point contact b. Surface contact
c. No contact d. None of the above

(Ans:a)

5. In a ball bearing, ball and bearing forms a

- a. Turning pair b. Rolling pair c. Screw pair d. Spherical pair

(Ans:b)

6. Transmission angle is the angle between

- a. Input link and coupler b. Input link and fixed link
c. Output link and coupler d. Output link and fixed link

(Ans:c)

7. Which of the following is an inversion of Single slider crank chain?

- a. Beam engine b. Rotary engine
c. Oldham's coupling d. Elliptical trammel

(Ans:b)

8. _____ is an inversion of Double slider crank chain.

- a. Coupling rod of a locomotive b. Scotch yoke mechanism
c. Hand pump d. Reciprocating engine

(Ans:b)

9. A ball and a socket forms a

- a. Turning pair b. Rolling pair
c. Screw pair d. Spherical pair

(Ans:d)

10. The Kutzbach criterion for determining the number of degrees of freedom (n) is (where l = number of links, j = number of joints and h = number of higher pairs)

- a. $n = 3(l-1) - 2j - h$ b. $n = 2(l-1) - 2j - h$
c. $n = 3(l-1) - 3j - h$ d. $n = 2(l-1) - 3j - h$

(Ans:a)

11. A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is

- a. 2 b. 4 c. 3 d. None of the above

(Ans:b)

12. Which gear is used for connecting two coplanar and intersecting shafts?

- a. Spur gear b. Helical gear
c. Bevel gear d. None of the above

(Ans:c)

13. Module of a gear is

- a. D/T b. T/D c. $2D/T$ d. $2T/D$

(Ans:a)

14. Length of arc of contact is given by

- a. Arc of approach - Arc of recess b. Arc of approach + Arc of recess
c. Arc of approach / Arc of recess d. Arc of approach x Arc of recess

(Ans:b)

15. The type of gears used to connect two non parallel and non intersecting shafts is

- a. Spur gear b. Helical gear c. Bevel gear d. Spiral gear

(Ans:d)

16. To connect two parallel and coplanar shafts the following type of gearing is used

- a. Spur gear b. Bevel gear
c. Spiral gear d. None of the above

(Ans:a)

17. In which of the following type of gear train the first gear and the last gear are co-axial.

- a. Simple gear train b. Compound gear train
c. Reverted gear train d. None of the above

(Ans:c)

18. Which gear train is used for higher velocity ratios in a small space?

- a. Simple gear train b. Compound gear train
c. Reverted gear train d. Epicyclic gear train

(Ans:d)

19. Which type of gear train is used in clock mechanism to join hour hand and minute hand?

- a. Simple gear train b. Compound gear train
c. Reverted gear train d. Epicyclic gear train

(Ans:d)

20. Which type of gearing is used in steering system of an automobile?

- a. Rack and pinion b. Worm and wheel
c. Spiral gears d. None of the above

(Ans:a)

21. The couple will balance one another couple when they are in the same plane and

- a. Have unequal moments and their direction of rotation is opposite
b. Have equal moments and their direction of rotation is same
c. Have equal moments and their direction of rotation is opposite
d. None of the above

22. The frictional torque transmitted in a conical pivot bearing, considering uniform pressure is (Where R is the radius of shaft, α is semi angle of the cone, μ is coefficient of friction, and W is the load on bearing)

- a. $(\mu WR \operatorname{cosec}\alpha)/2$ b. $(3\mu WR \operatorname{cosec}\alpha)/4$
c. $(2\mu WR \operatorname{cosec}\alpha)/3$ d. None of the above

23. The friction circle is a circle drawn when a journal rotates in a bearing. Its radius depends upon the coefficient of friction and

- a. Angular velocity of journal b. Magnitude of the forces on journal
c. Radius of journal d. None of the above

24. When the addenda on pinion and wheel is such that the path of approach and path of recess are the half of their maximum possible value, then the length of path of contact is given by (where r is pitch circle radius of pinion, R is the pitch circle radius of wheel and Φ is the pressure angle)

- a. $\{(r^2+R^2)\cos\Phi\}/2$ b. $\{(r+R)\sin\Phi\}/2$
c. $\{(r+R)\cos\Phi\}/2$ d. None of the above

25. The ratio of height of porter governor (when length of arms and links are equal) to the height of watt governor is (Where m is the mass of the ball and M is the mass of sleeve)

- a. $(m+M)/m$ b. $M/(m+M)$

- c. $m/(m+M)$ d. None of the above

26. A governor is said to be isochronous when equilibrium speed of all radii of rotation of the balls within the working range

- a. Is constant b. Varies uniformly
c. Is not constant d. None of the above

27. The ratio of tension of two side of a flat belt is given by

- a. $e^{-\mu\theta}$ b. $e^{\mu\theta}$ c. $e \times \mu \times \theta$ d. None of the above

28. Crowning of a pulley is done to

- a. Prevent the slipping of a belt b. To increase the tension of a belt
c. To increase the angle of contact d. None of the above

29. The power transmitted by a belt drive is (T_1 =Tension on tight side, T_2 =Tension on slack side, where v = linear velocity, ω = angular velocity)

- a. $(T_1-T_2) \times v$ b. $(T_1-T_2) \times \omega$
c. $(T_1-T_2) / v$ d. $(T_1-T_2) / \omega$

30. The number of Instantaneous centres in a mechanism is (where n is the number of links)

- a. $n(n-1)/2$ b. $2n(n-1)/3$ c. $n(2n-1)/2$ d. $3n(n-1)/2$

31. For L number of links in a mechanism, the number of possible inversions is equal

- a. $L-2$ b. $L-1$ c. L d. $L+1$

32. Oldham's coupling is the inversion of

- a. four bar mechanism b. crank and lever mechanism
c. single slider crank mechanism d. double slider crank mechanism

33. The tooth profile most commonly used in gear drives for power transmission is

- a. A cycloid b. An involute c. An ellipse d. A parabola

34. The radius of gyration of a solid disc type flywheel of diameter 'D' is

- a. D b. $D/2$ c. $D/\sqrt{2}$ d. $(\sqrt{3}/2)D$

35. A Hartnell governor is a governor of the

- a. inertia type b. pendulum type
c. centrifugal type d. dead weight type

36. A governor is said to be isochronous when the equilibrium speed for all radii of rotation of the balls within the working range

- a. is not constant b. is constant
c. varies uniformly d. has uniform acceleration

37. In reciprocating engines primary forces

- a. are completely balanced b. are partially balanced
c. are balanced by secondary forces d. cannot be balanced

38. If a damping factor in a vibrating system is unity, then the system will

- a. have no vibrations b. be highly damped
c. be underdamped d. be critically damped

39. For steady state forced vibrations, the phase lag at resonance is

- a. 0° b. 45° c. 90° d. 180°

40. For spur with gear ratio greater than one, the interference is most likely to occur near the

- a. pitch point b. point of beginning of contact
c. point of end of contact d. root of the tooth

41. What is the number of instantaneous centres for an eight link mechanism?

- a. 15 b. 28 c. 30 d. 8

(Ans:b)

42. The method of direct and reverse cranks is used in engines for

- a. the control of speed fluctuations b. balancing of forces and couples
c. kinematic analysis d. vibration analysis

(Ans: b)

43. Oldham's coupling is an inversion of the kinematic chain used in

- a. Whitworth quick return mechanism b. Elliptical trammel
c. Rotary engine d. Universal joint

(Ans:b)

44. In balancing of 4-stroke in line engines, firing order helps to control the magnitude of

- a. Primary forces only b. Secondary forces only
c. Primary forces and primary couples only d. Primary and secondary couples only

45. Which one of the following statements in respect of involute profiles for gear teeth is not correct?

- a. Interference occurs in involute profiles
b. Involute tooth form is sensitive to change in centre distance between the base circles.
c. Basic rack for involute profile has straight line form
d. Pitch circle diameters of two mating involute gears are directly proportional to the base circle diameters.

46. Which one of the following is an exact straight line mechanism using lower pairs?

- a. Watt's mechanism b. Grasshopper mechanism
c. Robert's mechanism d. Paucellier's mechanism

(Ans:d)

47. In a system subjected to damped forced vibrations, the ratio of maximum displacement to the static deflection is known as

- a. Critical damping ratio b. Damping factor
c. Logarithmic decrement d. Magnification factor

(Ans:d)

48. Consider the following statements:

Coriolis acceleration component appears in the acceleration analysis of the following planar mechanisms:

- a. Whitworth quick return mechanism
b. Slider crank mechanism
c. Scotch Yoke mechanism

Which of these statements is/are correct?

- a. 1, 2 and 3 b. 1 and 2 c. 2 and 3 d. 1 only

49. Consider the following mechanisms:

1. Oscillating cylinder engine mechanism
2. Toggle mechanism
3. Radial cylinder engine mechanism
4. Quick return mechanism

Which of the above are inversions of slider crank mechanism?

- a. 1, 2 and 4
b. 2, 3 and 4
c. 1, 2 and 3
d. 1, 3 and 4

(Ans: d)

50. With usual notations for different parameters involved, the maximum fluctuations of energy for a flywheel is given by

- a. $2EC_s$ b. $EC_s/2$ c. $2EC_s^2$ d. $2E^2C_s$

(Ans:a)

51. Whirling speed of the shaft is the speed at which

- a. Shaft tends to vibrate in longitudinal direction b. torsional vibrations occur
c. shaft tends to vibrate vigorously in transverse direction
d. combination of transverse and longitudinal vibration occurs

(Ans:c)

52. The frictional torque transmitted in a flat pivot bearing, assuming uniform wear, is

- a. μWR b. $\frac{3}{4}\mu WR$ c. $(\frac{2}{3})\mu WR$ d. $\frac{1}{2}\mu WR$

(Where μ = Coefficient of friction, W =Load over the bearing, R =Radius of bearing)

(Ans:d)

53. The velocity of sliding of meshing gear teeth is

- a. $(\omega_1 + \omega_2)y$ b. $(\omega_1/\omega_2)y$ c. $(\omega_1 \times \omega_2)y$ d. $(\omega_1 + \omega_2)/y$

(Where ω_1 and ω_2 are angular velocities of meshing gears and 'y' is distance between point of contact and the pitch point)

(Ans:c)

54. A speed reducer unit consists of a double threaded worm of pitch = 11mm and a worm wheel of pitch diameter = 84 mm. The ratio of output torque to the input torque is

- a. 7.6 b. 12 c. 24 d. 42

55. Hammer blow

a. is the maximum horizontal unbalanced force caused by the mass provided to balance the reciprocating masses.

b. is the maximum vertical unbalanced force caused by the mass added to balance the reciprocating masses

c. varies as the square root of the speed

d. varies inversely with the square of the speed

(Ans:b)

56. A pulley and belt in a belt drive form a

a. cylindrical pair b. turning pair

c. rolling pair d. sliding pair

(Ans:b)

57. In a hydrodynamic journal bearing, there is

a. a very thin film of lubricant between the journal and the bearing such that there is contact between the journal and the bearing

b. a thick film of lubricant between the journal and the bearing

c. no lubricant between the journal and the bearing

d. a forced lubricant between the journal and the bearing

(Ans:b)

58. The balancing weights are introduced in planes parallel to the plane of rotation of the disturbing mass. To obtain complete dynamic balance, the minimum number of balancing weights to be introduced in different planes is

- a. 1 b. 2 c. 3 d. 4

(Ans:b)

59. The unbalanced force in a single cylinder reciprocating engine is

1. equal to inertia force of the reciprocating masses 2. equal to gas force

3. Always fully balanced

Which of the statement(s) is/are correct?

- a. 1 alone b. 2 alone c. 1 and 3 d. 2 and 3

60. Minimum number of teeth for involute rack and pinion arrangement for pressure angle of 20° is

- a. 18 b. 20 c. 30 d. 34

(Ans:a)