Machines and mechanisms

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Basics and Kinematics Mechanism:

1. A rigid body possesses _____ degrees of freedom.

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

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

3. Which of the following is a higher pair?

a. Turning pair b. Screw pair

c**. Belt and pulley** d. None of the above

4. A higher pair has_____.

a. **Point contact** b. Surface contact

c. No contact d. None of the above

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

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

6 . 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

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

a. Coupling rod of a locomotive b**. Scotch yoke mechanism**

c. Hand pump d. Reciprocating engine

8. A ball and a socket forms a

a. Turning pair b. Rolling pair

c. Screw pair d. **Spherical pair**

9. 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

10. The lengths of the links of a 4- bar linkage with revolute pairs only are p,q,r and s units. Given that p < q < r < s and s+p < q+r which of these links should be the fixed one, for obtaining a 'double crank' mechanism?
a) **link of length p**
b) link of length q
c) link of length r
d) link of length s

11. For a four-bar linkage in toggle position, the value of mechanical advantage is
a) 0.0
b) 0.5
c) 1.0
d) ∞

12. In a slider-crank mechanism, the crank is rotating with an angular velocity of 20 rad/s in counterclockwise direction. At the instant when the crank is perpendicular to the direction of the piston movement, velocity of the piston is 2 m/s. Radius of the crank is
a) 100 cm
b) **10 cm**
c) 1 cm
d) 0.1 cm

13.In a single link robotic arm the end-effector slides upward along the link with a velocity of 0.5 m/s while the link rotates about revolute joint with an angular speed of 1 rad/sec. When the end-effector is at a distance of 1 m from the joint, the acceleration experienced by the end-effector will be
a) **1 m/s^2**
b) 1.41 m/s^2
c) 1.71 m/s^2
d) 2 m/s^2

14.. For the same crank length and uniform angular velocity of the crank in an offset slider crank mechanism, if the connecting rod length is increased by 1.5 times, the velocity of piston will
a) remain unchanged
b) increase 1.5 times
c) **decrease by 1.5 times**
d) increase by 1.5√2 times

15. It is planned to construct a four-bar mechanism ABCD with length AB= 60mm, BC = 100mm, CD = 70 mm and fixed link AD = 200 mm. If at least one link is required to have a complete rotation, this mechanism is

a) of crank-rocker type
b) of double-crank type
c) **of double rocker type**
d) impossible to construct

16. The number of links in a planer mechanism with revolute joints having 10 instantaneous centres is
a) 3
b) 4
c) 5
d) 6

17. When the nature of contact between the element of a pair is such that it can only slide relative to the other, the pair is known as a
a) screw pair
b) spherical pair
c) turning pair
d) **sliding pair**

18.. When the nature of contact between the element of a pair is such that one element can turn about the other by screw threads, the pair is known as a
a) **screw pair**
b) spherical pair
c) turning pair
d) sliding pair

19.Which of the following is an example of sliding pair?
a) **Piston and cylinder of a reciprocating steam engine**
b) Shaft with collars at both ends fitted into a circular hole
c) Lead screw of a lathe with nut
d) Ball and a socket joint

20.Which of the following is an open pair?
a) **Ball and socket joint**
b) Journal bearing
c) Lead screw and nut
d) Cam and follower

21.The lead screw of a lathe with nut forms a
a) rolling pair
b) sliding pair
c) **screw pair**
d) turning pair

22.Which of the following is a turning pair?
a) Piston and cylinder of a reciprocating steam engine

b) **Shaft with collars at both ends fitted into a circular hole**
c) Lead screw of a lathe with nut
d) Ball and a socket joint

23.When the two elements of a pair have a surface contact when relative motion takes place and the surface of one element slides over the surface of the other, the pair formed is known as a
a) **lower pair**
b) higher pair
c) self-closed pair
d) force-closed pair

24. When the two elements of a pair have _____ when in motion, it is said to a lower pair.
a) line or point contact
b) **surface contact**
c) permit relative motion
d) none of the mentioned

25. The two elements of a pair are said to form a higher pair, when they
a) have a surface contact when in motion
b) **have a line or point contact when in motion**
c) are kept in contact by the action of external forces, when in motion
d) permit relative motion

26. The two elements of a pair are said to form a _____ when they permit relative motion between them.
a) open pair
b) **kinematic pair**
c) higher pair
d) lower pair

27. In an open pair, the two elements of a pair
a) have a surface contact when in motion
b) have a line or point contact when in motion
c) are kept in contact by the action of external forces, when in motion
d) are not held mechanically
28.A combination of kinematic pairs, joined in such a way that the relative motion between the links is completely constrained, is called a
a) structure
b) mechanism
c) kinematic chain
d) inversion

28. The relation between number of pairs(p) forming a kinematic chain and the number of links(l) is
a) $l = 2p - 2$
b) $l = 2p - 3$
c) $l = 2p - 4$
d) $l = 2p - 5$

29. The relation between number of links(l) and number of joints(j) in a kinematic chain is
a) $l = 1/2\ (j+2)$
b) $l = 2/3\ (j+2)$
c) $l = 3/4\ (j+2)$
d) $l = j+4$

30. The relation $l = 2/3(j+2)$ apply to kinematic chains in which lower pairs are used. This may be used to kinematic chains in which higher pairs are used, but each higher pair may be taken as equivalent to
a) one lower pair and two additional links
b**) two lower pairs and one additional link**
c) two lower pairs and two additional links
d) all of the mentioned

31.The pair is known as a higher pair, when the relative motion between the elements of a pair is
a) turning only
b) sliding only
c) rolling only
d) partly turning and partly sliding

32. Which of the following is a higher pair?
a**) Belt and pulley**
b) Turning pair
c) Screw pair
d) Sliding pair

33. When the elements of a pair are kept in contact by the action of external forces, the pair is said to be a
a) lower pair
b) higher pair
c) self-closed pair
d) force-closed pair

34. The lower pairs are _____ pairs.
a) **self-closed pair**
b) force-closed pair
c) screw pair
d) none of the mentioned

35. The cam and follower is an example of
a) sliding pair
b) rolling pair
c) lower pair
d**) higher pair**

36. Which of the following is an example of higher pair?
a) Toothed gearing
b) Belt and rope drive
c) Ball and roller bearing
d) **All of the mentioned**

37. An automobile steering gear is an example of
a) sliding pair
b) rolling pair
c) lower pair
d) higher pair

38.The relation between the number of links(l) and the number of binary joints(j) for a kinematic chain having constrained motion is given by $j = 3/2 (l – 2)$. If the left hand side of this equation is greater than the right hand side, then the chain is
a) **locked chain**
b) completely constrained chain
c) successfully constrained chain
d) incompletely constrained chain

39. In a kinematic chain, a quaternary joint is equivalent to
a) one binary joint
b) two binary joints
c) **three binary joints**
d) four binary joints

40. In a steam engine, the link constitutes a
a) piston, piston rod and cross-head
b) connecting rod with big and small end brasses, caps and bolts
c) crank pin, crankshaft and flywheel

d) **all of the mentioned**

41. A mechanism is a assemblage of
a) two links
b) three links
c) **four or more than four links**
d) all of the mentioned

42. A mechanism consisting of four links is called a _____ mechanism.
a**) simple**
b) compound
c) inversion
d) none of the mentioned

43. A mechanism _____ for transmitting or transforming motion.
a**) can be used**
b) can not be used
c) both of the mentioned
d) none of the mentioned

44. When one of the links of a kinematic chain is fixed, the chain is known as a
a) structure
b) mechanism
c) inversion
d) machine
45. The method of obtaining different mechanisms by fixing in turn different links in a kinematic chain, is known as
a) structure
b) machine
c) **inversion**
d) compound mechanism

46. If the number of links in a mechanism are equal to l, then the number of possible inversions are equal to
a) l – 2
b) l – 1
c) l
d) l + 1

47. Which of the following statement is correct as regard to the difference between a machine and a structure?

a) The parts of a machine move relative to one another, whereas the members of a structure do not move relative to one another.
b) The links of a machine may transmit both power and motion, whereas the members of a structure transmit forces only.
c) A machine transforms the available energy into some useful work, whereas in a structure no energy is transformed into useful work.
d) all of the mentioned

48. A kinematic chain is known as a mechanism when
a) none of the links is fixed
b) one of the links is fixed
c) two of the links are fixed
d) none of the mentioned

49. The inversion of a mechanism is
a) changing of a higher pair to a lower pair
b) turning its upside down
c) obtained by fixing different links in a kinematic chain
d) obtained by reversing the input and output motion

50. The Grubler's criterion for determining the degrees of freedom (n) of a mechanism having plane motion is
a) $n = (l – 1) – j$
b) $n = 2(l – 1) – 2j$
c) $n = 3(l – 1) – 2j$
d) $n = 4(l – 1) – 3j$
View Answer

51. The mechanism forms a structure, when the number of degrees of freedom (n) is equal to
a) 0
b) 1
c) 2
d) -1
View Answer

52. In a four bar chain or quadric cycle chain
a) **each of the four pairs is a turning pair**
b) one is a turning pair and three are sliding pairs
c) two are turning pairs and two are sliding pairs
d) three are turning pairs and one is a sliding pair
View Answer

53. The mechanism in which two are turning pairs and two are sliding pairs, is called a
a) double slider crank chain

b) elliptical trammel
c) scotch yoke mechanism
d) all of the mentioned

54.In a coupling rod of a locomotive, each of the four pairs is a _____ pair.
a) sliding
b) turning
c) rolling
d) screw

55.In a single slider crank chain
a) each of the four pairs is a turning pair
b) one is a turning pair and three are sliding pairs
c) two are turning pairs and two are sliding pairs
d) three are turning pairs and one is a sliding pair

56. The mechanism consisting of three turning pairs and one sliding pair, is called a
a) single slider crank chain
b) whitworth quick return motion mechanism
c) crank and slotted lever quick return motion mechanism
d) all of the mentioned

57. Which of the following is an inversion of a single slider crank chain?
a) Pendulum pump
b) Oscillating cylinder engine
c) Rotary internal combustion engine
d) **All of the mentioned**

58. A point on a connecting link of a double slider crank mechanism traces a
a) straight line path
b) hyperbolic path
c) parabolic path
d) **elliptical path**

59. The whitworth quick return motion mechanism is formed in a slider crank chain when the
a) **coupler link is fixed**
b) longest link is a fixed link
c) slider is a fixed link
d) smallest link is a fixed link
View Answer

60. Scotch yoke mechanism is used to generate
a) **sine functions**
b) square roots
c) logarithms
d) inversions

61. Which of the following is an inversion of a double slider crank chain?
a) Oldham's coupling
b) Elliptical trammel
c) Scotch yoke mechanism
d) **All of the mentioned**

62. Whitworth quick return motion mechanism is an inversion of a double slider crank chain.
a) True
b) **False**

63. A rotary internal combustion engine has _____ cylinders.
a) four
b) five
c) six
d) **seven**

64. The total number of instantaneous centres for a mechanism consisting of n links are
a) n/2
b) n
c) n-1
d) **n(n-1)/2**

65. According to Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on
a) **straight line**
b) parabolic curve
c) triangle
d) rectangle

67. Which of the following property of the instantaneous center is correct?
a) A rigid link rotates instantaneously relative to another link at the instantaneous centre for the configuration of the mechanism considered.
b) The two rigid links have no linear velocity relative to each other at the instantaneous centre.
c) The velocity of the instantaneous centre relative to any third link is same whether the instantaneous centre is regarded as a point on the first link or on the second rigid link.
d) **all of the mentioned**

68. The magnitude of velocities of the points on a rigid link is
a) directly proportional to the distance from the points to the instantaneous centre and is parallel to the line joining the point to the instantaneous centre.
b) directly proportional to the distance from the points to the instantaneous centre and is perpendicular to the line joining the point to the instantaneous centre.
c) inversely proportional to the distance from the points to the instantaneous centre and is parallel to the line joining the point to the instantaneous centre.
d) **inversely proportional to the distance from the points to the instantaneous centre and**

is perpendicular to the line joining the point to the instantaneous centre.

69. In a mechanism, the fixed instantaneous centres are those centres which
a) **remain in the same place for all configurations of the mechani**sm
b) vary with the configuration of the mechanism
c) moves as the mechanism moves, but joints are of permanent nature
d) none of the mentioned

70. The instantaneous centres, which moves as the mechanism moves but joints are of permanent nature, are called permanent instantaneous centres.
a) **True**
b) False

71. The instantaneous centres which vary with the configuration of mechanism, are called
a) permanent instantaneous centres
b) fixed instantaneous centres
c) **neither fixed nor permanent instantaneous centres**
d) none of the mentioned

72. When two links are connected by a pin joint, their instantaneous centre lies
a) on their point of contact
b) at the centre of curvature
c) at the centre of circle
d) **at the pin joint**

73. The two links are said to have a pure rolling contact, when their instantaneous centre _____ on their point of contact.
a) **lies**
b) does not lie

74. When a slider moves on a fixed link having _____ their instantaneous center lies at infinity.
a) **straight surface**
b) curved surface
c) oval surface
d) none of the mentioned

75. When a slider moves on a fixed link having curved surface, their instantaneous centre lies
a) on their point of contact
b) **at the centre of curvature**
c) at the centre of circle
d) at the pin joint

76. A slider moving on a fixed link having constant radius of curvature will have its instantaneous centre at the center of the circle.
a) **True**
b) False

77. The instantaneous center of a rigid thin disc rolling on a plane rigid surface is located at
a) the centre of the disc
b) **the point of contact**
c) an infinite distance on the plane surface
d) the point on the circumference situated vertically opposite to the contact point

78. In its simplest form, a cam mechanism consists of following number of links
a) 1
b) 2
c) **3**
d) 4

79. Which of the following mechanisms produces mathematically an exact straight line motion?
a) Grasshopper mechanism
b) Watt mechanism
c) **Peaucellier's mechanism**
d) Tchabichiff mechanism

80. In a mechanism, usually one link is fixed. If the fixed link is changed in a kinematic chain, then relative motion of other links
a) **will remain same**
b) will change
c) will not occur
d) none of the mentioned

81. A Kinematic chain requires at least

a) 2 links and 3 turning pairs
b) 3 links and 4 turning pairs
c) **4 links and 4 turning pairs**
d) 5 links and 4 turning pairs

82. In a drag link quick return mechanism, the shortest link is always fixed. The sum of the shortest and longest link is
a) equal to sum of other two
b) greater than sum of other two
c) **less than sum of other two**
d) none of the mentioned

83. The following is the inversion of slider crank chain mechanism
a) whitworth quick return mechanism
b) hand pump
c) oscillating cylinder engine
d) all of the mentioned

84. Kinematic pairs are those which have
a) two elements held together mechanically
b) **two elements having relative motion**
c) two elements having Coroli's component
d) none of the mentioned

85. According to criterion of constraint by A.W. Klein
a) **J + 1/2 H = 3/2L – 2**
b) H + 1/2J = 2/3L – 2
c) J + 1/2H = 3/2L – 1
d) J + 3/2H = 1/2L – 2

86. A quarternary joint is equivalent to
a) one binary joint
b) two binary joints
c) **three binary joints**
d) four binary joints

87. A typewriter mechanism has 7 number of binary joints, six links and none of higher pairs. The mechanism is
a) **kinematically sound**
b) not sound
c) soundness would depend upon which link is kept fixed
d) none of the mentioned

88. The approximate straight line mechanism is a
a) **4 bar linkage**
b) 6 bar linkage
c) 8 bar linkage
d) 3 bar linkage

89. Open pairs are those which have
a) point or line contact between the two elements when in motion
b) surface contact between the two elements when in motion
c) **elements of pairs not held together mechanically**
d) two elements that permit relative motion

90. Peaucellier mechanism has
a) **8 links**
b) 6 links
c) 4 links
d) 5 links

91. Hart mechanism has
a) 8 links
b) **6 links**
c) 4 links
d) 5 links

92. A chain comprises of 5 links having 5 joints. Is it kinematic chain?
a) Yes
b) **No**
c) It is a marginal case
d) None of the mentioned

93. In the following equation [L = 2/3(J + 2)] to determine whether or not the given chain in kinematic, higher pair is treated equivalent to
a) **two lower pairs and an additional links**
b) two higher pairs and two additional links
c) one lower pairs and two additional links
d) none of the mentioned

94. The main disadvantage of the sliding pair is that it is
a) bulky
b) difficult to manufacture
c) wears rapidly
d) **both a and c**

95.For a kinematic chain to be considered as mechanism
a) two links should be fixed
b) **one link should be fixed**
c) none of the links should be fixed
d) there is no such criterion

96. An eccentric sheave pivoted at one point rotates and transmits oscillatory motion to a link whose one end is pivoted and other end is connected to it. This mechanism has
a) 2 links
b) 3 links
c) **4 links**
d) 5 links

97. Whitworth quick return mechanism is obtained by inversion of
a) **slider crank mechanism**
b) kinematic chain
c) five link mechanism
d) roller cam mechanism

98. The number of degrees of freedom of a planer linkage with 8 links and 9 simple revolute joints is
a) 1
b) 2
c) **3**
d) 4

99. A palnar mechanism has 8 links and 10 rotary joints. The number of degrees of freedom of the mechanism, using Grubler's criterion, is
a) 0
b) **1**
c) 2
d) 3

100. Match the approaches given below to perform stated kinematics/dynamics analysis of machine.
Analysis Approach
P. Continuous relative rotation 1. D'Alembert's principle
Q. Velocity and acceleration 2. Grubler's criterion
R. Mobility 3. Grashof's law
S. Dynamic-static analysis 4. Kennedy's theorem
a) P-1,Q-2,R-3,S-4
b) **P-3,Q-4,R-2,S-1**
c) P-2,Q-3,R-4,S-1
d) P-4,Q-2,R-1,S-3

Cam and Follower:

1. A cam is a_____element
   A) translating
   B) **Rotating**
   C) Reciprocating
   D) Oscillating
2. _____ is an output element
   A) Roller
   B) **Follower**
   C) Cam

D) Rocker arm

3. Follower can _____
   A) Oscillate
   B) Translate
   C) Move along helical path
   D) Oscillate or translate
4. Cam and follower has _____ contact
   A) Point
   B) Area
   C) **Line**
   D) Curved surface
5. Cam and follower forms _____ pair
   A) Lower
   B) Medium
   C) **Higher**
   D) Very high
6. Cams usually _____
   A) Reciprocate
   B) **Rotate**
   C) Oscillate
   D) Move in spiral motion
7. Cams usually rotate at _____
   A) Variable speed
   B) Variable acceleration
   C) Constant speed
   D) Constant acceleration
8. The follower motion is determined by the _____ of the cam
   A) Base circle diameter
   B) Pitch circle diameter
   C) Follower end condition
   D) **profile**
9. Cam and follower are used to operate _____ in IC engines
   A) Pistons
   B) Lubrication
   C) Valves
   D) Connecting rod
10. Cam and follower are used to operate _____in automatic lathe.
    A) Feed mechanism
    B) Cross head travel
    C) Compound rest travel
    D) Hand wheel movement
11. Knife edge follower makes _____ contact
    A) Point
    B) Area
    C) Surface
    D) **line**
12. _____ follower reduces friction
    A) Flat face
    B) Spherical end
    C) Knife edge

D) **roller**

13. The cam profile and the pitch curve are one and the same for a _____ follower
    A) Flat face
    B) Spherical end
    C) Knife edge
    D) roller
14. Side thrust is more in _____ follower
    A) Flat face
    B) Spherical end
    C) Knife edge
    D) roller
15. Wear is minimum in _____ **follower**
    A) Flat face
    B) Spherical end
    C) Knife edge
    D) roller
16. When space is available _____ followers are preferred
    A) Flat face
    B) Spherical end
    C) Knife edge
    D) **roller**
17. Side thrust is much reduced in _____ follower
    A) Flat face
    B) Spherical end
    C) Knife edge
    D) roller
18. The side thrust in flat face follower is due to _____
    A) Wear
    B) **Friction**
    C) Pressure angle
    D) Base circle diameter
19. Wear of the flat face follower is reduced by _____
    A) **Offset**
    B) Setting high pressure angle
    C) Reducing base circle diameter
    D) Reducing prime circle diameter
20. flat face followers are used in _____ regions
    A) space constrained
    B) high speed cams
    C) low speed cams
    D) moderate speed cams
21. _____ faced followers have low contact stress.
    A) Flat
    B) Spherical
    C) Roller
    D) Knife edge
22. Reciprocating follower is otherwise called as _____ follower
    A) Rotating
    B) Oscillating

C) Spiral
D) **translating**

23. oscillating follower is otherwise called as _____ follower
A) **Rotating**
B) Oscillating
C) Spiral
D) translating

24. a radial _____ follower moves along the axis of the cam.
A) In-line
B) Offset
C) Oscillating
D) polynomial

25. an_____ follower has its axis set away from the axis of the cam.
E) In-line
F) **Offset**
G) Oscillating
H) polynomial

26. follower is NOT constrained to the cam by_____
A) spring
B) gravity
C) mechanical means
D) electrostatic means

27. **Cylindrical** cam has _____.
A) Reciprocating
B) Oscillating
C) Both reciprocating, and oscillating
D) helical

28. _____**cam** is otherwise called as disc cam
A) helical
B) spiral
C) **radial**
D) cylindrical

29. _____**cam** is otherwise called as plate cam
A) **Disc**
B) End
C) Cylindrical
D) conjugate

30. in radial cam the follower moves _____to the cam axis
A) parallel
B) **perpendicular**
C) spiral
D) helical

31. the smallest circle in a cam profile is called a _____
A) prime circle
B) base circle
C) pitch circle
D) pitch curve

32. the reference point on the follower that generates the pitch curve is called _____
A) pitch point

B) trace point
C) base point
D) reference point

33. for _____follower the pitch curve and the cam profile are same
A) roller
B) spherical end
C) knife edge
D) flat face

34. the angle between the direction of the follower motion and normal to the pitch curve is called the _____
A) included angle
B) excluded angle
C) pressure angle
D) Pitch angle

35. If pressure angle is to large the reciprocating follower gets _____
A) relieved
B) **jammed**
C) incremental motion
D) smooth motion

36. _____is the point on the pitch curve with maximum pressure angle
A) Pitch point
B) Prime point
C) Turning point
D) Trace point

37. _____is the circle through the pitch point.
A) Prime circle
B) Base circle
C) Pitch circle
D) Pitch curve

38. The curve generated by the trace point is _____
A) Prime curve
B) Base curve
C) Pitch circle
D) Pitch curve

39. Prime circle is the _____circle through the pitch curve
A) Biggest
B) Largest
C) **Smallest**
D) nearest

40. Prime circle and base circle are _____for flat face and knife edge followers
A) Different
B) **Same**
C) May be same or different it depends
D) unrelated

41. The maximum travel of the follower away from the cam is called _____
A) **Lift**
B) Displacement
C) Distance
D) Vetor sum

42. The lift of the follower is otherwise called as _____
    A) **stroke**
    B) Displacement
    C) Distance
    D) Vetor sum
43. The follower may NOT have _____
    A) uniform velocity
    B) uniform acceleration or retardation
    C) SHM
    D) Spiral motion
44. Cam profile can be described by a _____
    A) polynomial equation
    B) standard motion curves
    C) both A and B
    D) only experimentally
45. Regions of no displacement is called _____
    A) Zero displacement
    B) **Dwell**
    C) Reference
    D) Datum
46. Time of no displacement is called _____
    A) Inertial period
    B) Zero displacement period
    C) Null time period
    D) Dwell period
47. Uniform velocity motion is difficult because of _____at the start and finish.
    A) Finite acceleration
    B) Infinite acceleration
    C) Finite jerk
    D) Infinite jerk
48. _____displacement profile is added to mitigate the effect of acceleration during the start of a uniform velocity motion of a follower.
    A) **Parabolic**
    B) Cycloidal
    C) Involute
    D) evolute
49. Constant acceleration motion has infinite _____
    A) Velocity
    B) Displacement
    C) Coriolis acceleration
    D) jerk
50. Self-intersecting cam profile is called _____
    A) Interfering
    B) Intercepting
    C) Undercutting
    D) undermining

Governor:

1The height of a Watt's governor (in metres) in equal to _____, where N = Speed of the arm and ball about the spindle axis.

A 8.95/N2
B 89.5/N2
C 895/N2
D 8950/N2

Answer: c

2. The ratio of the height of a Porter governor (when the length of arms and links are equal) to the height of a Watt's governor is _____, where m = Mass of the ball, and M = Mass of the load on the sleeve.

A m/(m+M)
B M/(m+M)
C (m+M)/m
D (m+M)/M

Answer: c

3. A Hartnell governor is a

A pendulum type governor
B spring loaded governor
C dead weight governor
D inertia governor

Answer: b

4. Which of the following governor is used to drive a gramophone ?

A Watt governor
B Porter governor
C Pickering governor
D Hartnell governor

Answer: c

5. Which of the following is not a spring controlled governor?

A Hartnell
B Proell governor
C Hartung
D Pickering

Answer: b

6. For two governors A and B, the lift of sleeve of governor A is more than that of governor B, for a given fractional change in speed. It indicates that

A governor A is more sensitive than governor B
B governor B is more sensitive than governor A
C both governors A and B are equally sensitive
D both governors A and B are insensitive

Answer: a

7. The sensitiveness of a governor is given by _____, where ω1 and ω2 = Minimum and maximum angular speed, and ω = Mean angular speed.

A ω/(ω2-ω1)
B (ω2-ω1)/ω
C (ω2-ω1)/2ω
D 2ω/(ω2-ω1)

Answer: b

8. In a Hartnell governor, if a spring of greater stiffness is used, then the governor will be

A more sensitive
B less sensitive
C isochronous
D inactive

Answer: b

9. A hunting governor is

A more stable
B less sensitive
C more sensitive
D inactive

Answer: c

10. Isochronism in a governor is desirable when

A the engine operates at low speeds
B the engine operates at high speeds
C the engine operates at variable speeds
D one speed is desired under one load

Answer: d

11. The power of a governor is equal to ____, where c = Percentage increase in speed.

A c2(m+M)h / (1+2c)
B 2c2(m+M)h / (1+2c)
C 3c2(m+M)h / (1+2c)
D 4c2(m+M)h / (1+2c)

Answer: d

12. When the relation between the controlling force (F) and radius of rotation (r) for a spring controlled governor is F = a.r + b, then the governor will be

A stable
B unstable
C isochronous
D hunt

Answer: b

13. When the relation between the controlling force (F) and radius of rotation (r) for a spring controlled governor is F = a.r - b, then the governor will be

A stable

B unstable
C isochronous
D hunt

Answer: a

14. When the relation between the controlling force (F) and radius of rotation (r) for a spring controlled governor is F = a.r, then the governor will be

A stable
B unstable
C isochronous
D hunt

Answer: c

15. The vertical height of a Watt governor when it rotates at 60 r.p.m. is _____.
A 0.248 m
B 0.248 cm
C 0.248 mm
D 24.8 mm
Answer: a

16. In a spring loaded Hartnell type governor, the spring force varies between 562 to 930 N and the lift of the sleeve is 40 mm. The spring constant is ____.
A 0.92 N/mm
B 9.2 N/m
C 9.2 N/cm
D 9.2 N/mm
Answer: d

17. Watt's governor can work satisfactorily at speeds from
A 60 to 80 r.p.m
B 80 to 100 r.p.m
C 100 to 200 r.p.m
D 200 to 300 r.p.m
Answer: a

18. The height of a Watt's governor is
A directly proportional to speed
B directly proportional to square of its speed
C inversely proportional to speed
D inversely proportional to square of its speed
Answer: d

19. When the sleeve of a Porter governor moves downwards, the governor speed
A increases
B decreases
C remains unaffected
D first increases and then decreases
Answer: b

20. Which of the following is a pendulum type governor?
A Hartnell governor
B Watt governor
C Porter governor
D Proell governor
Answer: b

Gears and Gear Trains:

1. The gears are termed as medium velocity gears, if their peripheral velocity is
   a. 1-3 m/s
   b. 3-15 m/s
   c. 15-30 m/s
   d. 30-50 m/s
2. The gear train usually employed in clocks is a
   a. simple gear train
   b. reverted gear train
   c. sun and planet gear
   d. differential gear
3. In a gear having involute teeth, the normal to the involute is a tangent to the
   a. pitch circle
   b. base circle
   c. addendum circle
   d. dedendum circle
4. The working depth of a gear is the radial distance from the
   a. pitch circle to the bottom of a tooth
   b. pitch circle to the top of a tooth
   c. top of a tooth to the bottom of a tooth
   d. addendum circle to the clearance circle
5. When the axes of the first and last wheels are co-axial, then the train is known as
   a. simple train of wheels
   b. compound train of wheels
   c. reverted gear train
   d. epicyclic gear train
6. The size of a gear is usually specified by
   a. pressure angle
   b. circular pitch
   c. diametral pitch
   d. pitch circle diameter
7. The contact ratio is the ratio of
   a. length of pair of contact to the circular pitch
   b. length of arc of contact to the circular pitch
   c. length of arc of approach to the circular pitch
   d. length of arc of recess to the circular pitch
8. in involute gears, the pressure angle is
   a. dependent on the size of teeth
   b. dependent on the size of gears
   c. always constant
   d. always variable

9. In full depth $14\frac{1}{2}^{\circ}$ involute system, the smallest number of teeth in a pinion which meshes with rack without interference is
   a. 12
   b. 16
   c. 25
   d. 32
10. The ratio of the number of teeth to the pitch circle diameter in millimetres, is called
   a. circular pitch
   b. diametral pitch
   c. module
   d. none of these
11. An involute pinion and gear are in mesh. If both have the same size of addendum, then there will be an interference between the
   a. tip of the gear tooth and flank of pinion
   b. tip of the pinion and flank of gear
   c. flanks of both gear and pinion
   d. tip of both gear and pinion
12. The product of the diametral pitch and circular pitch is equal to
   a. 1
   b. $1/\pi$
   c. Π
   d. $2\ \pi$
13. An imaginary circle which by pure rolling action, gives the same motion as the actual gear, is called
   a. addendum circle
   b. dedendum circle
   c. pitch circle
   d. clearance circle
14. The two parallel and coplaner shafts are connected by gears having teeth parallel to the axis of the shaft. This arrangement is known as
   a. spur gearing
   b. helical gearing
   c. bevel gearing
   d. spiral gearing
15. The radial distance from the top of a tooth to the bottom of a tooth in a meshing gear, is called
   a. Dedendum
   b. Addendum
   c. Clearance
   d. working depth
16. The face of the tooth is the
   a. surface of the top of tooth
   b. surface of tooth above the pitch surface
   c. width of tooth below the pitch surface
   d. width of tooth measured along the pitch circle
17. The dedendum circle diameter is equal to (where φ = Pressure angle)
   a. pitch circle dia. x cos φ
   b. addendum circle dia. x cos φ
   c. clearance circle dia. x cos φ

d. pitch circle dia. x sin φ

18. In gears, interference takes place when
    a. the tip of a tooth of a mating gear digs into the portion between base and root circles
    b. gears do not move smoothly in the absence of lubrication
    c. pitch of the gears is not same
    d. gear teeth are undercut
19. Which of the following statement is correct for involute gears?
    a. The interference is inherently absent.
    b. The variation in centre distance of shafts increases radial force.
    c. A convex flank is always in contact with concave flank.
    d. The pressure angle is constant throughout the teeth engagement.
20. 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. 3
    c. 4
    d. 5
21. 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
22. 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
23. Which type of gearing is used in steering system of an automobile?
    a. Rack and pinion
    b. Worm and wheel
    c. Spiral gears
    d. Bevel gears
24. The number of degrees of freedom of an epicyclic gear train is
    a. 1
    b. 2
    c. 3
    d. 4
25. In the case of involute system of gears, if the centre distance is changed
    a. The velocity ratio changes
    b. The pressure angle changes
    c. The pitch circle remain unaffected
    d. The law of gearing fails to satisfied
26. Stub tooth is
    a. Provided on the rack only
    b. A tooth of standard profile
    c. Larger than standard tooth
    d. Shorter than standard tooth
27. A high pressure angle for spur gear leads to

a. Minimum axial thrust
b. Greater backlash
c. More interference
d. Wide base and stronger tooth

28. Gearing contact is which one of the following?
a. Sliding contact
b. Sliding contact,only rolling at pitch point
c. Rolling contact
d. Rolling and sliding at each point of contact

29. Which type of gears are used for shaft axes having an offset?
a. Mitre gears
b. Spiral bevel gears
c. Hypoid gears
d. Zerol gears

30. If the annular wheel of an epicyclic gear train has 100 teeth and the planet wheel has 20 teeth,the number of teeth on the sun wheel is
a. 80
b. 60
c. 40
d. 20

31. When two spur gears having involute profiles on their teeth engage the line of action is tangential to the
a. Pitch circle
b. Dedendum circle
c. Addendum circle
d. Base circle

32. What is the value of pressure angle generally used for involute gears
a. 35^0
b. 30^0
c. 25^0
d. 20^0

33. Pressure angle of involute gears does not exceed 25^0 since
a. This will lead to unwanted radial force
b. The number of teeth to avoid undercutting will be very high
c. No cutters available
d. Gears will become too small

34. The advantages of involute profile over cycloidal are given below.which of thes is **NOT** correct?
a. The interference is inherently absent in the involute system
b. In the involute system,the pressure angle is constant from commencement to end of engagement
c. The straight teeth of the basic rack for the involute profile admits of simple tools
d. The profile for the flank and face is a single curve in the involute system

35. A planetary gear train is a gear train having
a. A relative motion of the axes and the axis of at least one of the gears also moves relative to the frame
b. No relative motion of axes and no relative motion of axes with respect to the frame
c. No relative motion of axes and the axis of at least one of the gears also moves relative to the frame

d. A relative motion of axes and none of the axes of gears has relative motion with the frame

36. A gear of 28cm pitch circle diameter has 40 teeth.the circular pitch will nearly be
    a. 11mm/tooth
    b. 22mm/tooth
    c. 33mm/tooth
    d. 44mm/tooth
37. Consider the following profiles of mating gear teeth
    1. Involute profile
    2. Cycloidal profile
    3. Conjugate profile

    Which of these satisfy the law of gearing?

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

38. The arc of contact and path of contact are respectively 27mm and 25.4 mm in a pair of involute spur gears.the pressure angle would be
    a. 14.5^0
    b. 17.2^0
    c. 19.8^0
    d. 20.25^0
39. Helical gears may be designed in applications where gears are to be mounted on
    1. Non-parallel shafts
    2. Parallel shafts
    3. Intersecting shafts
    4. Non parallel and non intersecting shafts

    Which of these statements is/are correct?

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

40. Consider the following statement

    In case of involute gears in contact
    1. The motion is one of pure rolling
    2. Pressure angle does not change during contact
    3. Velocity ratio does not change
    4. Output torque of the driven gear changes

    Which of the above statements are correct

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

41. The problem of interference in involute profile gears can be overcome by which one of the following means?
    a. Decreasing the centre distance
    b. Using composite profile with cycloidal curve at the root of the tooth
    c. Using stub teeth of height more than the full depth teeth
    d. Proper lubrication

42. What shall be the centre distance between the axes of pinion and gear when a 20^0 full depth involute profile pinion with 20 teeth meshes with a gear that has 50 teeth for a module of 6mm?
    a. 70mm
    b. 140mm
    c. 210mm
    d. 280mm
43. Consider the following statement in respect of worm gears
    1. They are used for very high speed reduction
    2. The velocity ratio does not depend on the helix angle of the worm
    3. The axes of worm and gear are generally perpendicular and non intersecting

    Which of these statements are correct?
    a. 1and 2
    b. 1 and 3
    c. 2 and 3
    d. 1,2 and 3
44. Interference between the teeth of two meshing involute gears can be reduced or eliminated by
    1. Increasing the addendum of the gear teeth and corresponding reducing the addendum of the pinion
    2. Reducing the pressure angle of the teeth of the meshing gaers
    3. Increasing the centre distance

    Which of these statements is/are correct
    a. 1 and 2
    b. 2 and 3
    c. 1 only
    d. 3 only
45. Which one of the following statement is correct?
    a. The product of diametral pitch and circular pitch is equal to unity
    b. The pressure angle for involute gears depends upon the size of the teeth
    c. In a gear having involute teeth, the normal to the involute is a tangent to the base circle
    d. For commercially cut gears the limiting pitch line velocity is 60m/min

Gyroscope:

1.The gyroscopic acceleration is given by

A $\delta\omega/\delta t$

B $\omega\ \delta\theta/\delta t$

C $r\ \delta\theta/\delta t$

D $r\ \delta\omega/\delta t$

Answer: b

2. The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a tum to the left. The effect ofgyroscopic couple on the aeroplane.

A To raise the nose and dip the tail

B To dip the nose and raise the tail

C To raise the nose and tail

D To dip the nose and tail

Answer: a

3. The axis of spin, axis of precession and axis of gyroscopic torque are in

A two parallel planes
B three perpendicular planes
C three parallel planes
D two perpendicular planes

Answer: c

4. A motor car moving at a certain speed takes a left turn in a curved path. If the engine rotates in the same direction as that of wheels, then due to the centrifugal forces

A the reaction on the inner wheels increases and on the outer wheels decreases
B the reaction on the outer wheels increases and on the inner wheels decreases
C the reaction on the front wheels increases and on the rear wheels decreases
D the reaction on the rear wheels increases and on the front wheels decreases

Answer: b

5. The rotor of a ship rotates in clockwise direction when viewed from the stern and the ship takes a left turn. The effect of the gyroscopic couple acting on it will be

A to raise the bow and stern
B to lower the bow and stern
C to raise the bow and lower the stern
D to lower the bow and raise the stern

Answer: c

6. A disc spinning on its axis at 20 rad/s will undergo precession when a torque 100 N-m is applied about an axis normal to it at an angular speed, if mass moment of inertia of the disc is the 1 kg-m²

A 2 rad/s
B 5 rad/s
C 10 rad/s
D 20 rad/s

Answer: b

Inertia Force Analysis:

1. Inertia force acts
(a) Perpendicular to the acceleration force
(b) Along the direction of acceleration force
(c) Opposite to the direction of acceleration force
(d) None of the above
Ans: (c)

2. State whether true or false

a) The inertia force is equal in magnitude and opposite in direction to accelerating force.
b) The magnitude of inertia force is given by the expression
c) The resultant force acting on a body together with the reversed effective force are in equilibrium.
d) All true statement

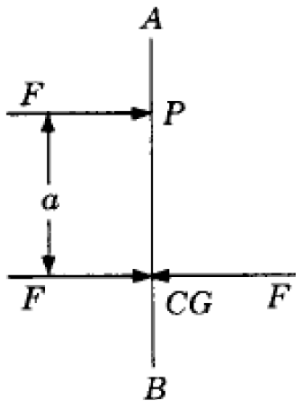
Ans: d

3. In an engine, the work done by inertia force in a cycle is

a) Positive
b) Zero
c) Negative
d) None of these

Ans: d

4. A link is subjected to a force F (→) at a point P perpendicular to the link at a distance 'a' from the CG as shown in fig. This will result in



(a) an inertia force F (→) through the CG and no inertia torque

(b) all inertia torque F.a (clockwise) and no inertia force

(c) both inertia force F (→) trough the CG and inertia torque F.a (clockwise)

(d) both inertia force F(→) through the CG and inertia torque F.a (CCW)

Ans: (c)

5. According to D' Alembert's principle, the body is in equilibrium position if
(a) inertia force is applied in the direction opposite to the resultant force
(b) inertia force is applied in the same direction of the resultant force
(c) both a. and b
(d) none of the above

Ans: (a)

6. When the crank is at the inner dead centre, in a horizontal reciprocating steam engine, then the velocity of the piston will be

(a) zero (b) minimum (c) maximum (d) one

Ans:(a)

7. (ω cos θ) / n is the formula used to calculate
(a) angular velocity of connecting rod
(b) velocity of piston
(c) angular acceleration of connecting rod
(d) All of the above
Ans: (a)

8. In IC engine mechanism, which formula is used to calculate acceleration of the piston?
(a) ω^2 r (cos θ + cos θ / n)

(b) ω^2 r (cos θ + cos 2θ / n)
(c) ω^2 r (cos θ - cos θ / n)
(d) ω^2 r (cos θ - cos 2θ / n)
Ans: ~~(b)~~

9. The velocity of piston in a reciprocating steam engine is given by (where ω = Angular velocity of crank, r = Radius of crank pin circle, θ = Angle turned by crank from inner dead center, and n = Ratio of length of connecting rod to the radius of crank)
(a) ωr [sin θ + (sin 2θ/n)]
(b) ωr [cos θ + (cos 2θ/n)]
(c) ω²r [sin θ + (sin 2θ/n)]
(d) ω²r [cos θ + (cos 2θ/n)]
Ans: (a)

10. When the crank is at the outer dead centre, in a reciprocating steam engine, then the acceleration of the piston will be
(a) ω² r {(n + 1)/n}
(b) ω² r {(n - 1)/n}
(c) ω² r {n/(n + 1)}
(d) ω² r {n/(n - 1)}
Ans: (b)

11. In a reciprocating steam engine, when the crank has turned from inner dead centre through an angle θ, the angular velocity of the connecting rod is given by

(a) $\omega \sin\theta/(n^2 - \sin^2\theta)^{1/2}$

(b) $\omega \cos\theta/(n^2 - \cos^2\theta)^{1/2}$

(c) $\omega \sin\theta/(n^2 - \cos^2\theta)^{1/2}$

(d) $\omega \cos\theta/(n^2 - \sin^2\theta)^{1/2}$

Ans: Option D

12. Displacement of the piston in a reciprocating steam engine is given by

a) $\omega.r\left(\sin\theta + \frac{\cos 2\theta}{n}\right)$
b) $r(1-\cos\theta) + l(1-\cos\phi)$
c) $\omega^2.r\left(\sin\theta + \frac{\cos 2\theta}{n}\right)$
d) None of the above

Ans: b

13. Velocity of the piston in a reciprocating steam engine is given by

a) $\omega.r\left(\sin\theta + \frac{\sin 2\theta}{2n}\right)$
b) $\omega^2.r\left(\cos\theta + \frac{\cos 2\theta}{n}\right)$
c) $\omega^2.r\left(\sin\theta + \frac{\sin 2\theta}{2n}\right)$
d) None of the above

Ans: a

14. The acceleration of the piston in a reciprocating steam engine is given by

a) $\omega.r\left(\sin\theta+\frac{\sin 2\theta}{n}\right)$

b) $\omega^2.r\left(\cos\theta+\frac{\cos 2\theta}{n}\right)$

c) $\omega^2.r\left(\sin\theta+\frac{\sin 2\theta}{2n}\right)$

d) None of the above

Ans: b

15. In a slider crank mechanism, if θ and β are the angles made by the crank and the connecting rod respectively with the line of stroke and v is the linear velocity of the crank pin, the velocity of slider is given by.

a) $V\cos[90^o-(\theta-\beta)]\cos\beta$

b) $V\cos[90^o+(\theta-\beta)]\cos\beta$

c) $V\cos[90^o-(\theta+\beta)]\sin\beta$

d) $V\cos[90^o-(\theta+\beta)]\cos\beta$

Ans: d

16. In a slider crank mechanism, the connecting rod has zero angular velocity when the crank angle is

a) 0^o
b) 45^o
c) 90^o
d) 180^o

Ans: c

17. When the crank is at the inner dead centre, in a horizontal reciprocating steam engine, then the velocity of the piston will be

a) Zero
b) Minimum
c) Maximum
d) Twice the initial one

Ans: a

18. In a slider crank mechanism, the piston becomes maximum when

(a) crank and connecting rod are in line with each other

(b) crank is perpendicular to the line of stroke of the piston

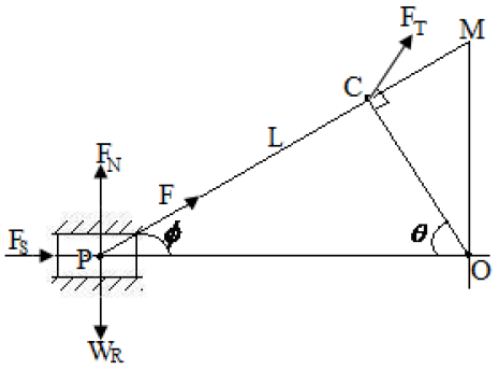
(c) crank and connecting rod are mutually perpendicular

(d) crank is 120° with the line of stroke

Ans: (b)

19. A slider crank mechanism is show in fig.

(1) $F_Q \sin(\theta + \phi)$ (2) $F_s \sin\theta + \left(\frac{\sin 2\theta}{n}\right)$ (3) $F_S.OM$ (4) $F_T.r$



Which of the following expressions stand for crank effort? Select the correct answer using the codes given below:

(a) 1 and 3 (b) 1, 2 and 4 (c) 1, 2 and 3 (d) 2, 3 and 4

Ans: (d)

20. When the crank is in outer dead centre, in a single cylinder double acting engine, the turning moment is _____.

a. Zero
b. Maximum
c. Minimum
d. Mean

Ans: (a)

21. Crank effort is the net force applied at the crack pin _____to the crank which gives the required turning moment on the crankshaft.

a) Parallel
b) Perpendicular
c) At 45^o
d) 135^o

Ans: (b)

22. In an engine, the work done by inertia forces in cycle is

(a) zero (b) positive (c) Negative (d) One

Ans: (b)

23. The essential condition of placing two masses, so that the system becomes dynamically equivalent is

(a) $l_1 l_2 = K_G^2$

(b) $l_1 l_2 = K_G$

(c) $l_1 = K_G$

(d) $l_2 = K_G$

where K_G = Radius of gyration, $l_1 \& l_2$ are distance of two masses from C.G. of the body.

Ans: (a)

24. A rigid body under the action of external forces can be replaced by two masses placed at a fixed distance apart. The two masses form an equivalent dynamical system, if
(a) The sum of mass movement of inertia of masses about their centre of gravity is equal to the mass moment of inertia of the body
(b) The sum of two masses is equal to the total mass of the body
(c) The centre of gravity of the two masses coincides with that of the body.
(d) All of these.
Ans: (d)

25. Two systems shall be dynamically equivalent when
(a) The mass of two are same
(b) C.G. of two coincides
(c) M.I. of two about an axis through e.g. is equal
(d) All of the above
Ans: (d)

26. Which one of the following condition is satisfied for a system to be dynamically equivalent?

a) $a^1.a^2 = k^2$
b) $a^1 + a^2 = k^2$
c) $a^1 - a^2 = k^2$
d) $a_2.a_2 = k$

Ans: a

27. In a dynamically equivalent system, a uniformly distributed mass is divided in to _____ point masses.

a) Two
b) Three
c) Four
d) Five

Ans: (a)

28. Any distributed mass can be replaced by two point masses to have the same dynamical properties if

a) The sum of the two masses are equal to the total mass
b) The combined centre of mass coincides with that of the rod
c) The moment of inertia of two point masses about perpendicular axis through their combined centre of mass is equal to that of the rod
d) All of above

Ans: (d)

29. Which of the following is not required condition for replacing a rigid body by a dynamically equivalent system of two masses?

a) Sum of the two masses is equal to the total mass

b) Sum of the square of the two masses is equal to the square of total mass
c) The combined centre of mass coincides with that of the rod
d) The moment of inertia of two point masses about perpendicular axis through their combined centre of mass is equal to that of the rod

Ans: (b)

30. The difference between which two factors denotes the correction couple?

a) Difference between force required to accelerate non dynamically equivalent system and dynamically equivalent system
b) Difference between torque required to accelerate non dynamically equivalent system and dynamically equivalent system
c) Difference between torque required to decelerate dynamically equivalent system and non dynamically equivalent system
d) none of the above

Ans: (b)