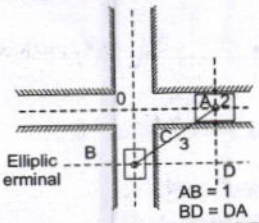
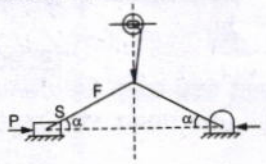
18. An elliptic trammel is shown in the given figure associated with the motion of the mechanism are fixed and moving centrodes. It can be established analytically or graphically that the moving centrode is a circle with radius and centre respectively of



(a) 1 and 0 (b) 1/2 and B
(c) 1/2 and C (d) 1/2 and D

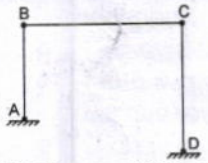
19. The Klein's method of construction for reciprocating engine mechanism
(a) is a simplified version of instantaneous centre method
(b) utilises a quadrilateral similar to the diagram of mechanism for reciprocating engine
(c) enables determination of Corioli's component
(d) is based on the acceleration diagram.

20. With reference to the mechanism shown in the figure, the relation between F and P is



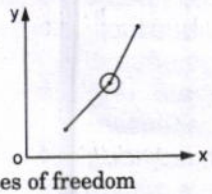
(a) $F = 0.5\ P\ .\ \tan\alpha$
(b) $F = P\ .\ \tan\alpha$
(c) $P = 2F\ .\ \tan\alpha$
(d) $F = 2P\ .\ \tan\alpha$

21. In the given figure, ABCD is a four-bar mecahnism. At the instant shown, AB and CD are vertical and BC is horizontal. AB is shorter than CD by 30 cm, AB is rotating at 5 rad/s and CD is rotating at 2 rad/s. The length of AB is



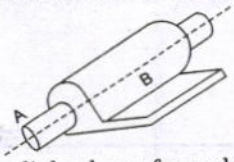
(a) 10 cm (b) 20 cm (c) 30 cm (d) 50 cm

22. The two-link system, shown in the figure, is constrained to move with planer motion. It possesses



(a) 2 degrees of freedom
(b) 3 degrees of freedom
(c) 4 degrees of freedom
(d) 6 degrees of freedom

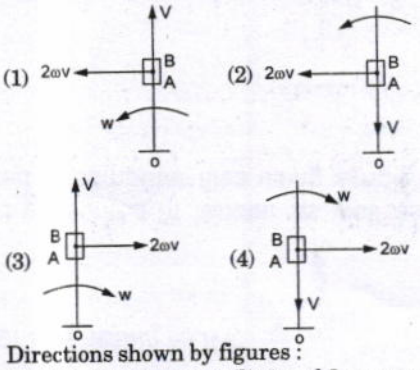
23. A round bar A passes through the cylindrical hole in B as shown in the given figure. Which one of the following statements is correct in this regard ?



(a) The two links shown form a kinematic pair
(b) The pair is completely constrained
(c) The pair has incomplete constraint
(d) The pair is successfully constrained

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

25. The directions of Coriolis component of acceleration, $2\omega V$, of the slider A with respect to the coincident point B is shown in figures 1, 2, 3 and 4



Directions shown by figures :
(a) 2 and 4 are wrong (b) 1 and 2 are wrong
(c) 1 and 3 are wrong (d) 2 and 3 are wrong

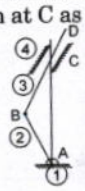
26. Match List-I with List-II and select the correct answer using the codes given below the lists :

List-I	List-II
(A) Crank shaft	1. Supports the revolving parts and transmits torque
(B) Wire shaft	2. Transmits motion between shafts where it is not possible to effect a rigid coupling between them
(C) Axle	3. Converts linear motion into rotary motion
(D) Plain shaft	4. Supports only the revolving parts

Codes :

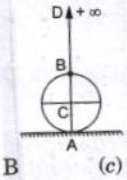
	A	B	C	D
(a)	3	2	1	4
(b)	4	2	3	1
(c)	3	2	4	1
(d)	1	4	2	3

27. In the mechanism ABCD shown in the given figure, the fixed link is denoted as (1), Crank AB as (2), rocker BD as (3), Swivel trunnion at C as (4). The instantaneous centre C is



(*a*) centre of swivel trunnion
(*b*) intersection of line AB and a perpendicular to BD at C
(*c*) infinity along AC
(*d*) infinity perpendicular to BD

28. The instantaneous centre of motion of a rigid-thin-disc-wheel rolling on a plane rigid surface shown in the figure, is located at the point



(*a*) A (*b*) B (*c*) C (*d*) D

29. In a cam drive with uniform velocity follower, the slope of the displace-ment curve must be as shown in Fig. I. But in an actual practice it is shown in Fig. II (i.e. rounded at the corners) This is because of

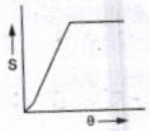


Fig. I

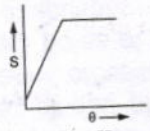
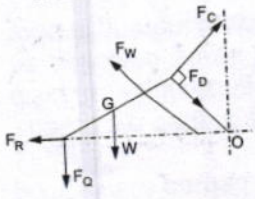


Fig. II

(*a*) the difficulty in manufacturing cam profile
(*b*) loose contact of follower with cam surface
(*c*) the acceleration in the beginning and retardation at the end of stroke would require to be infinitely high
(*d*) uniform velocity motion is a partial parabolic motion

30. With reference to the engine mechanism shown in the given figure, match List-I with List-II and select the correct answer using the codes given below the lists :

List-I	List-II
(A) F_Q	1. Inertia force of reciprocating mass
(B) F_R	2. Inertia force of connecting rod
(C) F_W	3. Crank effort
(D) F_C	4. Piston side thrust



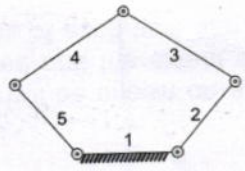
Codes :

	A	B	C	D
(*a*)	1	2	4	3
(*b*)	1	2	3	4
(*c*)	4	1	2	3
(*d*)	4	1	3	2

31. The centre of gravity of the coupler link in a 4-bar mechanism would experience
(*a*) no acceleration
(*b*) only linear acceleration
(*c*) only angular acceleration
(*d*) both inear and angular accelerations

32. Instantaneous centre of a body rolling with sliding on a stationary curved surface lies
(*a*) at the point of contact
(*b*) on the common normal at the point of contact
(*c*) on the common tangent at the point of contact
(*d*) at the centre of curvature of the stationary surface

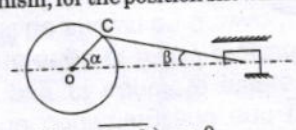
33. The number of degrees of freedom of a five link plane mechanism with five revolute pairs as shown in the figure is



(*a*) 3 (*b*) 4 (*c*) 2 (*d*) 1

34. In a cam mechanism with reciprocating roller follower, the follower has a constant acceleration in the case of
(*a*) cycloidal motion
(*b*) simple harmonic motion
(*c*) parabolic motion
(*d*) 3 - 4 - 5 polynomial motion

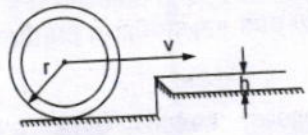
35. The cross head velocity in the slider crank mechanism, for the position shown in the figure is



(*a*) $V_c \cos(90 - \overline{\alpha + \beta}) \cos\beta$
(*b*) $V_c \cos(90 - \overline{\alpha + \beta}) \sec\beta$
(*c*) $V_c \cos(90 - \overline{\alpha - \beta}) \cos\beta$
(*d*) $V_c \cos(90 - \overline{\alpha - \beta}) \sec\beta$

where V_c is the linear velocity of the crank pin.

36. A wheel of centroidal radius of gyration 'k' is rolling on a horizontal surface with constant velocity. It comes across an obstruction of height 'h'. Because of its rolling speed, it just overcomes the obstruction. To determine v, one should use the principle(s) of conservation of



(a) energy
(b) linear momentum
(c) energy and linear momentum
(d) energy and angular momentum.

37. A cord is wrapped around a cylinder of radius 'r' and mass 'm' as shown in the given figure. If the cylinder is released from rest, velocity of the cylinder, after it has moved through a distance 'h' will be

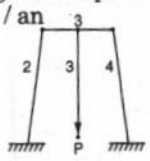
(a) $\sqrt{2gh}$
(b) $\sqrt{gh}$
(c) $\sqrt{\frac{4gh}{3}}$
(d) $\sqrt{\frac{gh}{3}}$

38. Consider the following statements
1. A round bar in a round hole form a turning pair
2. A square bar in a square hole forms a sliding pair
3. A vertical shaft in a footstep bearing forms a successful constraint

Of these statements
(a) 1 and 2 are correct (b) 2 and 3 are correct
(c) 1 and 3 are correct (d) 1, 2 and 3 are correct

39. A bicycle remains stable in running through a bend because of
(a) Gyroscopic action (b) Corioliss' acceleration
(c) Centrifugal action (d) Radius of curved path

40. In the four-bar mechanism shown in the given figure, links 2 and 4 have equal lengths. The point P on the coupler 3 will generate a / an



(a) ellipse
(b) parabola
(c) approximately straight line
(d) circle

GEARS TRAIN & FLYWHEEL

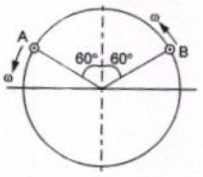
41. In gears, interference takes place when
(a) tip of a tooth of a mating gear digs into the portion between base and root circles
(b) gears do not move smoothly in the absence of lubrication
(c) pitch of the gear is not same
(d) gear teeth are undercut

42. If the rotating mass of a rim type flywheel is distributed on another rim type flywheel whose mean radius is half the mean radius of the former, then energy stored in the later at the same speed will be
(a) four times the first one
(b) same as the first one
(c) one fourth of the first one
(d) one and a half times the first one

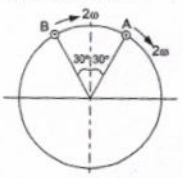
43. A flywheel is fitted to the crankshaft of an engine having 'E' amount of indicated work per revolution and permissible limits of coefficient of fluctuation of energy and speed as K_e and K_s respectively. The kinetic energy of the flywheel is given by

(a) $\frac{2K_e E}{K_s}$ (b) $\frac{K_e E}{2K_s}$ (c) $\frac{K_e E}{K_s}$ (d) $\frac{K_s E}{2K_e}$

44. For a twin cylinder V-engine, the crank position for Primary reverse cranks and Secondary direct cranks are given in the following diagrams :



Primary reverse cranks



Secondary direct cranks

The engine is a
(a) 60° V – engine (b) 120° V – engine
(c) 30° V – engine (d) 150° V – engine

45. In an automobile service station, an automobile is in a lifted up position by means of a hydraulic jack. A person working in the service station gives a tap to one rear wheel and make it rotate by one revolution. The rotation of another rear wheel is
(a) zero
(b) also one revolution in the same direction
(c) also one revolution but in the opposite direction
(d) unpredictable

46. Match List-I with List-II and select the correct answer using the codes given below the lists

List-I (*Standard tooth forms*)	**List-II** (*Advantages or disadvantages*)
(A) 20 and 25 systems	1. Results in lower loads on bearing
(B) 14½ stub-tooth	2. Broadest at the base and strongest in bending
(C) 25 Full-depth system	3. Obsolete
(D) 20 Full-depth system	4. Standards for new applications

Codes :

	A	B	C	D
(a)	4	3	2	1
(b)	3	1	2	4
(c)	3	2	1	4
(d)	4	2	3	1

47. 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