2017

ROTATIONAL:

26. Which of the following statements are correct? (a) Centre of mass of a body always coincides with the centre of gravity of the body. (b) Centre of mass of a body is the point at which the total gravitational torque on the body is zero (c) A couple on a body produce both translational and rotational motion in a body. (d) Mechanical advantage greater than one means that small effort can be used to lift a large load.

(1) (b) and (d) (2) (a) and (b)

(3) (b) and (c) (4) (c) and (d)

39. Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2 . They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is

(1) $\frac{1}{2}I(\omega_1+\omega_2)^2$ (2) $\frac{1}{4}I(\omega_1-\omega_2)^2$ (3) $I(\omega_1-\omega_2)^2$ (4) $\frac{1}{8}I(\omega_1-\omega_2)^2$

41. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N?

(1) 25 m/s^2 (2) 0.25 rad/s^2 (3) 25 rad/s^2 (4) 5 m/s^2

2016 PH2

120. Two rotating bodies A and B of masses m and 2m with moments of inertia I_A and I_B ($I_B > I_A$) have equal kinetic energy of rotation. If L_A and L_B be their angular momentum respectively, then :-

(1) $L_B > L_A$ (2) $L_A > L_B$ (3) $2L_A = L_B$ (4) $2L_B = L_A$

121. A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation ($E_{sphere} / E_{cylinder}$) will be :-

(1) 1 : 4 (2) 3 : 1 (3) 2 : 3 (4) 1 : 5

122. A light rod of length L has two masses m_1 and m_2 attached to its two ends. The moment of inertia of the system about an axis perpendicular to the rod and passing through the centre of mass is :-

(1) $(m_1+m_2)L^2$ (2) $\sqrt{(m_1m_2)}L^2$ (3) $\frac{m_1m_2}{m_1+m_2}L^2$ (4) $\frac{m_1+m_2}{m_1.m_2}L^2$

2016 OLD

41 A car is negotiating a curved road of radius R. The road is banked at an angle θ the coefficient of friction between the tyres of the car and the road is μ. The maximum safe velocity on this road is : **[2016]**

(a) $\sqrt{gR^2\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

(b) $\sqrt{gR\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

(c) $\sqrt{\frac{g}{R}\frac{\mu_s+\tan\theta}{1-\mu_2\tan\theta}}$

(d) $\sqrt{\frac{g}{R^2}\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

40. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first ?
(1) Disk (2) Sphere (3) Both reach at the same time (4) Depends on their masses

39. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad/s^2. Its net acceleration in m/s^2 at the end of 2.0s is approximately : **[2016]**
(a) 8.0 (b) 7.0 (c) 6.0 (d) 3.0

38. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre ? **[2016]**
(a) 15 MR^2/32 (b) 13 MR^2/32 (c) 11 MR^2/32 (d) 9 MR^2/32

37. A force F = ai + 3j+ 6k is acting at a point r = 2i – 6j –12k. The value of a for which angular momentum about origin is conserved is : **[2015 RS]**
(a) 2 (b) zero (c) 1 (d) –1

36. Point masses m_1 and m_2 are placed at the opposite ends of a rigid rod of length L, and negligible mass. The rod is to be set rotating about an axis perpendicular to it. The position of point P on this rod through which the axis should pass so that the work required to set the rod rotating with angular velocity ω_0 is minimum, is given by :

(1) $x=\frac{m_1}{m_2}L$ (2) $x=\frac{m_2}{m_1}L$ (3) $x=\frac{m_2L}{m_1+m_2}$ (4) $x=\frac{m_1L}{m_1+m_2}$

35. An automobile moves on a road with a speed of 54 km/h. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kg m^2. If the vehicle is brought to rest in 15s, the magnitude of average torque transmitted by its brakes to the wheel is :
[2015 RS]
(a) 8.58 kg m^2 s^{-2} (b) 10.86 kg m^2 s^{-2} (c) 2.86 kg m^2 s^{-2} (d) 6.66 kg m^2 s^{-2}