

## Topic :- SYSTEM OF PARTICLES AND ROTATIONAL MOTION

- As disc like reel with massless thread unrolls itself while falling vertically downwards the acceleration of its fall is
  - $g$
  - $\frac{g}{2}$
  - Zero
  - $\left(\frac{2}{3}\right)g$
- Two stars of mass  $m_1$  and  $m_2$  are part of a binary star system. The radii of their orbits are  $r_1$  and  $r_2$  respectively, measured from the C.M. of the system. The magnitude of acceleration of  $m_1$  is
  - $\frac{m_1 m_2 G}{(r_1 + r_2)^2}$
  - $\frac{m_1 G}{(r_1 + r_2)^2}$
  - $\frac{m_2 G}{(r_1 + r_2)^2}$
  - $\frac{(m_1 + m_2)}{(r_1 + r_2)^2}$
- Two thin uniform circular rings each of radius 10 cm and mass 0.1 kg are arranged such that they have a common centre and their planes are perpendicular to each other. The moment of inertia of this system about an axis passing through their common centre and perpendicular to the plane of one of the rings in  $\text{kgm}^{-2}$  is
  - $15 \times 10^{-3}$
  - $5 \times 10^{-3}$
  - $1.5 \times 10^{-3}$
  - $18 \times 10^{-4}$
- A solid sphere, disc and solid cylinder all of the same mass are made of the same material are allowed to roll down (from rest) on an inclined plane, then
  - Solid sphere reaches the bottom first
  - Solid sphere reaches the bottom last
  - Disc will reach the bottom first
  - All reach the bottom at the same time
- Two discs of the same material and thickness have radii 0.2 m and 0.6 m. Their moments of inertia about their axes will be in the ratio
  - 1 : 81
  - 1 : 27
  - 1 : 9
  - 1 : 3
- The centre of mass of a system of two particles divides the distance them
  - In inverse ratio of square of masses of particles
  - In direct ratio of square of masses of particles
  - In inverse ratio of masses of particles
  - In direct ratio of masses of particles

7. Angular momentum is conserved  
 a) Always  
 b) Never  
 c) When external force is absent  
 d) When external torque is absent
8. A straight rod of length  $L$  has one of its ends at the origin and the other at  $x = L$ . If the mass per unit length of the rod is given by  $Ax$  is constant, where is its mass centre?  
 a)  $L/3$                       b)  $L/2$                       c)  $2L/3$                       d)  $3L/4$
9. A bag of mass  $M$  hangs by a long thread and a bullet (mass  $m$ ) comes horizontally with velocity  $v$  and gets caught in the bag. For the combined system of bag and bullet, the correct option is  
 a) Momentum is  $\frac{mMv}{(m + M)}$                       b) Kinetic energy is  $\frac{1}{1}Mv^2$   
 c) Momentum is  $mv$                       d) Kinetic energy is  $\frac{1}{2} \frac{m^2v^2}{(M + m)}$
10. From a disc of radius  $R$ , a concentric circular portion of radius  $r$  is cut out so as to leave an annular disc of mass  $M$ . The moment of inertia of this annular disc about the axis perpendicular to its plane and passing through its centre of gravity is  
 a)  $\frac{1}{2} M (R^2 + r^2)$                       b)  $\frac{1}{2} M (R^2 - r^2)$                       c)  $\frac{1}{2} M (R^4 + r^4)$                       d)  $\frac{1}{2} M (R^4 - r^4)$
11. The moment of inertia of a rod about an axis through its centre and perpendicular to it is  $\frac{1}{2} ML^2$  (where  $M$  is the mass and  $L$  is the length of the rod). The rod is bent in the middle so that the two halves makes an angular of  $60^\circ$ . The same axis would be  
 a)  $\frac{1}{48} ML^2$                       b)  $\frac{1}{12} ML^2$                       c)  $\frac{1}{24} ML^2$                       d)  $\frac{ML^2}{8\sqrt{3}}$
12. If the angular momentum of a rotating body about a fixed axis is increased by 10%. Its kinetic energy will be increased by  
 a) 10%                      b) 20%                      c) 21%                      d) 5%
13. From an inclined plane a sphere, a disc, a ring and a spherical shell are rolled without slipping. The order of their reaching at the base will be  
 a) Ring, shell, disc, sphere                      b) Shell, sphere, disc, ring  
 c) Sphere, disc, shell, ring                      d) Ring, sphere, disc, shell
14. A cylinder rolls down an inclined plane of inclination  $30^\circ$ , the acceleration of cylinder is  
 a)  $g/3$                       b)  $g$                       c)  $g/2$                       d)  $2g/3$
15. A disc is rolling on the inclined plane, what is the ration of its rotational KE to the total KE?  
 a) 1:3                      b) 3:1                      c) 1:2                      d) 2:1

16. Angular momentum  $L$  of body with mass moment of inertia  $I$  and angular velocity  $\omega$  rad/sec is equal to
- a)  $\frac{I}{\omega}$                       b)  $I\omega^2$                       c)  $I\omega$                       d) None of these
17. If a force acts on a body at a point away from the centre of mass, then
- a) Linear acceleration changes                      b) Angular acceleration changes  
c) Both change                      d) None of these
18. The speed of a homogenous solid sphere after rolling down an inclined plane of vertical height  $h$  from rest without sliding is
- a)  $\sqrt{\frac{10}{7}gh}$                       b)  $\sqrt{\frac{4}{3}gh}$                       c)  $\sqrt{gh}$                       d)  $\sqrt{\frac{6gh}{5}}$
19. A solid cylinder is rolling down on an inclined plane of angle  $\theta$ . The coefficient of static friction between the plane and cylinder is  $\mu_s$ . Then condition for the cylinder not to slip is
- a)  $\tan \theta \geq 3\mu_s$                       b)  $\tan \theta > 3\mu_s$                       c)  $\tan \theta \geq 3\mu_s$                       d)  $\tan \theta < 3\mu_s$
20. Two blocks of masses  $m_1$  and  $m_2$  are connected by a massless spring and placed at smooth surface. The spring initially stretched and released. then
- a) The momentum of each particle remains constant separately  
b) The magnitude of momentum of both bodies are same to each other  
c) The mechanical energy of system remains constant  
d) Both (b) and (c) are correct.