# SAPTARSHI

**Q.1 Choose the correct Alternative and rewrite the statement**                                    **[7]**

1.  In a uniform circular motion, the direction of linear velocity is along the
    a)  Tangent to the curve path                    b. Radius vector towards the center
    c.  Perpendicular to the plane of the circular motion          d. Radius vector

2.  Two satellite of masses m and 4m orbit the earth in circular orbit of redii 4r and r respectively. The ratio of their orbital speed is

    a) 1                  b) ½                  c) $\dfrac{1}{\sqrt{2}}$                  d) $\dfrac{1}{\sqrt{5}}$

3.  Ratio of KE. Required to escape from earth's surface to KE. Required to revolve close to earth is
    **a)**  1          b) 2          c)  1: 2          d) 4: 1

4.  Rotational KE of a body is E and its moment of inertia is I. Its angular momentum is :
    a)  EI.          b) $\sqrt{2EI}$          c) $2\sqrt{EI}$          d) E/ I

5.  How much amount of work is done by centripetal force in UCM during half a revolution?
    a)  Infinite          b) $\pi$ *Joule*          c) $\dfrac{\pi}{2}J$          d) 0

6.  Tuning fork P of frequency 260 Hz gives 8 beats per sec with a tuning fork R. prongs of R are filled a little. When P and R are again sounded 6 beats per sec are heard. Frequency of R before filling is
    a)  252 Hz          b)  268 Hz          c)  266 Hz          d)  254 Hz

7.  A man stands at the centre of a turn table and the turn table is rotating with certain angular velocity. If he walks towards rim of the turn table, then
    a)  Moment of inertia of the system decreases
    b)  Angular momentum of system increases
    c)  Angular velocity of the system increases
    d)  Kinetic energy of the system decreases

**Q.2 A) Attempt any six**                                                              **[12]**
1.  Explain the condition of weightlessness in orbiting satellite
2.  Give physical significance of moment of inertia.
3.  Obtain an expression for torque acting on rotating body with constant angular acceleration.
4.  Simple pendulum of length 1 m has mass 10 gram and oscilate freely with amplitude of 5 cm Find its potential energy at extreme position.

5. What would be duration of year if the distance between the sun and the earth becomes double the present distance?

6. Wavelength of two sound notes in air are $\dfrac{83}{170} m$ and $\dfrac{83}{172} m$, each of these notes produces 8 beats per second with each other in air. Find the velocity of sound in air.

7. Define Doppler Effect, state it's any two applications.

8. A light thin uniform rod of length 2 m has two particles stuck to its ends. The mass of each body is 100gram. Find the moment of inertia of the system about a transverse axis passing through the end of the rod .

**Q.3 Attempt any three**                                                                                            **[9]**

1. Define binding energy; obtain expression for binding energy of orbiting satellite.

2. Define conical pendulum; obtain expression for its period.

3. An energy of 500J is spent to increase the speed of wheel from 60 rpm to 240 rpm calculate the moment of inertia of the wheel.

4. A coin placed on a horizontal rotating disc, with centre at 10cm from the centre of the disc, is just about to slip of the disc when the disc performs 60 rpm. Find the coefficient of friction between disc and coin.

**Q.4**

Discuss analytically composition of two SHM s of the same period and parallel to each other along the same path. Find the resultant amplitude and initial phase.

The equation of simple harmonic progressive wave is given by $y = 0.05 \sin 2\pi \left( 10t - \dfrac{x}{12} \right)$ where all quantities are in SI units. Calculate the displacement of a particle at 5m from the origin, after 0.1 s.          **[7]**

**Or**

Obtain expression for linear simple harmonic progressive wave and express it in different forms.
A uniform horizontal disc is freely rotating about vertical axis passing through its centre at the rate of 180 rpm. . A blob of wax of mass 2g falls on it and sticks to it at distance of 25 cm from axis. If the frequency of rotation is reduced by 60 rpm, calculate the moment of inertia of disc.          [7]