KATWA COLLEGE

DEPARTMENT OF PHYSICS

INTERNAL ASSESSMENT EXAMINATION -2022

B.Sc. (H), SEMESTER: -I, PAPER: -CC-II (MECHANICS)

F.M: 10 **TIME: 1 HOUR**

❖ **Answer any five from the following questions: -** **5 x 2 = 10**

1. A car moves in a circular horizontal track of radius a with frequency of revolution ω. Find out its position vector, velocity, and acceleration at any instant of time t.
2. A particle of mass m moves along x axis under the influence of a conservative force field having potential $V(x)$. If the particle is located at positions x_1 and x_2 at respective times t_1 and t_2 , prove that if E is the total energy, then $t_2 - t_1 = \sqrt{\frac{m}{2}}\int_{x_1}^{x_2}\frac{dx}{\sqrt{E-V(x)}}$.
3. A particle of mass m lies in a potential given by $V(x) = ax^2 + b$, where x is the displacement from the stable position. Show that the motion of the particle is simple harmonic and find out its frequency of oscillation.
4. A particle of mass m moves in a straight line acted upon by a constant resisting force $\hat{x}F_o$. If it starts with a speed $\hat{x}v_o$, find out how much distance it will travel before coming to rest.
5. A particle is projected upward in a direction inclined 60^o to the horizontal. Show that its velocity at its greatest height is half of its initial velocity.(neglect air resistance).
6. A particle of mass 2 unit moves in a force field given by $\overrightarrow{F}(t) = 24t^2\hat{x} + (36t - 16)\hat{y} - 12t\,\hat{z}$, assuming at $t = 0$sec the particle is located at $\vec{r}_o = 3\hat{x} - \hat{y} + 4\hat{z}$and has velocity $\vec{v}_o = 6\hat{x} + 15\hat{y} - 8\hat{z}$. Find position and velocity of the particle after $t = 2$ sec.
7. A particle is projected vertically upwards and takes t_1 sec to rise to a height of H metre. If it takes t_2 sec more to reach the ground again, then prove that $H = \frac{1}{2}gt_1t_2$.
8. A particle of mass m unit moves in the force field given by $\vec{F} = -\frac{a}{r^3}\vec{r}$. Show that the field is conservative and find out the expression of potential.