KATWA COLLEGE

DEPARTMENT OF PHYSICS

INTERNAL ASSESSMENT EXAMINATION -2022

B.Sc. (H), SEMESTER: - V, PAPER:- DSE-2 (CLASSICAL DYNAMICS)

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

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

1. What do you mean by generalised force and find out its expression?If the generalised coordinates q is an angle θ, what is the dimension of corresponding generalised force?
2. The Lagrangian for a coupled harmonic oscillator is given by, $L = \frac{1}{2}[\dot{q}_1^2 + \dot{q}_2^2] - \frac{1}{2}(\omega_1^2 q_1^2 + \omega_2^2 q_2^2) + \alpha q_1 q_2$,where $\alpha, \omega_1, \omega_2$are constants and q_1, q_2 are suitable coordinates.
   a) Find out the Hamiltonian of the system.
   b) Write down the Lagrange's equations of motion.
3. What is the modified Hamilton's Principle? And how it leads to the Hamilton's equations of motion.
4. What do you mean by homogeneity of time? Show, from Lagrange's equation of motion, that the total mechanical energy of an isolated system is conserved due to homogeneity of time.
5. What do you mean by Cyclic coordinates? If all the coordinates of a dynamical system are cyclic, show that the coordinates are obtained completely by integration.
6. A commonly used potential energy function to describe the interaction between two atoms is the Lenard-Jones 6-12 potential given by
$$U(r) = U_0\left[\left(\frac{r_0}{r}\right)^{12} - 2\left(\frac{r_0}{r}\right)^{6}\right]; r > 0$$
Where r is the distance between the atoms. Let m be the effective mass of the two atoms. Find the angular frequency of small oscillations about the stable equilibrium position for two identical atoms bound to each other by this potential.
7. A charged particle is moving in a circular path in a uniform magnetic field. Show that its period is independent of the radius of the path and speed is proportional to the radius of the path.
8. Find the normal frequencies of oscillation of the system with two degrees of freedom whose Lagrangian is $L = \frac{1}{2}m[\dot{x}_1^2 + \dot{x}_2^2] - \frac{3}{2}k(x_1^2 + x_2^2) + kx_1x_2$.