Question Bank

Subject: Classical Mechanics

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1. What is generalized coordinates ?
2. What are the respective symmetries associated with the conservation of linear momentum, angular momentum and energy ?
3. An oscillating pendulum tied to an oscillating support is the example of which constraint ?
4. How is Lagrange's equation of motion different from Newton's ?
5. Write Lagrange's equation of motion for an LC circuit.
6. What is virial theorem ?
7. What do you mean by central force ? Give two examples
8. What is principle of least action ?
9. Of Lagrange's and Hamilton's equation of motions, which does give the information about trajectory during motion of a particle ?
10. What is Coriolis force ?
11. For any arbitrary function φ, show that $L^1 = L + \frac{d\varphi}{dt}$ also satisfies Lagrange's equation.
12. Derive equation of motion for an one-dimensional harmonic oscillator using Hamiltonian dynamics
13. If for a rotational transformation of a vector is given by $\overrightarrow{X_1} = A\overrightarrow{X_0}$, then the value of A in matrix form is
14. If a planet of mass M, angular momentum J is rotating along on orbit under central force, then how can you decide the nature of the orbit ?
15. Express the equation of motion in terms of Poisson's bracket
16. Prove Jacobi's identity in Poisson's bracket
17. For a charge moving in an electromagnetic field, $L = T - q\varphi + q(\vec{v}.\vec{A})$. Then find its Hamiltonian.

18. Show that $q = \sqrt{2P}sinQ, p = \sqrt{2P}\,cosQ$ is canonical.
19. For a coupled oscillator consisting two equal masses and springs with equal spring constants, we have $\ddot{x}_1 + {\omega_0}^2 x_1 + {\omega_c}^2(x_1 - x_2) = 0$ and $\ddot{x}_2 + {\omega_0}^2 x_2 - {\omega_c}^2(x_1 - x_2) = 0$, then find the find the normal frequency of the motion.
20. Find the inertia tensor of the system of four point masses of 1gm, 1gm,2gm and 4gm located at the point (1,-1,0), (1,0,0), (1,1,1), (1,0,1)