PSCPHYT07 - Paper-VII (Core-VII): Classical Mechanics

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1. Either:

a) What are constraints? Give detailed classification with suitable examples. **8**

b) Derive Lagrange's equation of motion for the system for which the forces are derivable from potential function V. **8**

OR

e) Discuss D'Alemberts Principle. **8**

f) Discuss variational principle. **8**

2. Either:

a) Discuss Routh's procedure for cyclic co-ordinates. **8**

b) Explain Hamilton - Jacobi theory. **8**

OR

e) Using Hamilton's equation of motion show that the Hamiltonian **8**

$$H = \frac{P^2}{2m}e^{-rt} + \frac{1}{2}mW^2 x^2 e^{rt}$$

Leads to the equation of motion of a damped harmonic oscillator.

f) Define Poisson bracket and state the different properties of Poisson-bracket. Further show that $[x, y+z] = [x, y]+[x, z]$. **8**

3. Either:

a) Establish a relation between scattering angles in laboratory system and C.M. System. **6**

b) Show that the total energy of a particle under the action of central force is constant. Also find expressions of r (t) and θ (t). **10**

OR

e) Assuming the motion of a particle under the action of central force show that **8**

$$\frac{1}{2}m\dot{r}^2 + \frac{\ell^2}{2mr^2} + v(r) = \text{Constant.}$$

f) Discuss classification of orbits for inverse square central forces. **8**

4. Either:

    a) State and prove Euler's Theorem. **8**

    b) Explain moment of inertia tensor. **8**

<div align="center">OR</div>

    e) Discuss eigen values and principal axis transformation. **8**

    f) Explain non-inertial frames and Pseudo forces. **8**

5. Answer all the followings -

    a) Explain phase space dynamics. **4**

    b) Explain in brief canonical transformations. **4**

    c) Write a short note on Rutherford Scattering. **4**

    d) Explain Rigid body dynamics. **4**

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