Unit IV

7. (a) Define canonical transformations and obtained the equations for the transformation between the variable (q, p) and (Q, P) with F (q, Q, t). **12+8**

(b) If transformation equations are $P = q \cot p$ and $Q = \ln((\sin p)/q)$, show that transformation are is canonical and obtained generating function.

(c) Prove the invariance of Poisson bracket under canonical transformations.

8. (a) Prove the invariance of Poisson bracket under canonical transformations and show $Q = aq + bp$, $P = cq + dp$ transformation is canonical only if $ad - bc = 1$.

(b) Define infinitesimal canonical transformation and discuss Hamilton Jacobi Equation. **12+8**

AA-282

M. Sc. EXAMINATION, Dec. 2017

(First Semester)

(Main & Re-appear)

PHYSICS

PHY-503-B

Classical Mechanics

Time : 3 *Hours*] [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Define close n particle system and show that the total angular momentum about a point is the sum of angular momentum at centre of mass and angular momentum about center of mass. **12+8**

   (b) Define contraits and find the type of constraint associated with a frictionless rolling cylinder rolling down a rough inclined plane.

2. (a) Define Lagrangian function and obtained the Lagrange's equation from D'Alembert's Principle and extends it for dissipative system. **12+8**

   (b) If $F = q[E + (v \times B)]$ then show that :

   $L = \frac{1}{2}mv^2 - q\varphi + qA.v$, symbols have their usual meaning.

Unit II

3. (a) Define central force and discuss Kepler problem.

   (b) Discuss stability of the circular orbits. If a central force 'F' varies r^n, then show that orbit is stable when $n > 3$. **12+8**

4. (a) Discuss effective potential energy and explain the classification of orbits.

   (b) Define Euler angles involved in the transformation from one set of coordinate system to another having the same origin and obtain the transformation matrix. Express angular velocity of a rotating body in term of Euler's angles. **8+12**

Unit III

5. (a) Drive Eigen value equation and obtain the orthogonality of the Eigen vectors.

   (b) Discuss force free motion of a symmetrical rigid body. **12+8**

6. (a) Discuss legendre transformation and obtained Hamiltonian equation of motion.

   (b) If $T = \frac{1}{2}m\left(\dot{x}^2 + \dot{y}^2\right)$ and $V = \frac{1}{2}\left(\omega_0^2\left(x^2 + y^2\right)\right) - \alpha xy$, find Eigen frequencies and Eigen vectors. **8+12**