

Question Bank for PG Course

অঙ্ক (Mathematics)

পঞ্চম (ক) পত্র (Paper - VA)

Principles of Mechanics : PGM-T-VA

- Identify which of the following is not a feature of conservative forces:
 - A potential energy function V exists having a definite value at every point.
 - $T+V=\text{constant}$, where T is the kinetic energy and V is the potential energy.
 - The work done by the force is path dependent.
 - Around any closed path the work done is zero.
- Write the expression for kinetic energy(T) of a particle of mass m in spherical polar coordinate system (r, θ, ϕ)
- Consider the following constraint :
$$(y + yz - 1)\dot{x} + (x + xz - 1)\dot{y} + xy\dot{z}$$
Classify it.
- Which of the following statement is false about D'Alembert's principle :
 - It depends upon Newton's second law of motion.
 - It has the ability to get rid of the constraint forces.
 - It asserts that the work done by applied forces and inertial forces in an actual displacement is zero.
 - None of the above.
- For a conservative N -particle system having n degrees of freedom, write down the Lagrange's equations of motion with usual notations
- In which system the quantity $\sum_{j=0}^n \dot{q}_j \frac{\partial L}{\partial \dot{q}_j} - L$ (with usual notations) is a constant ?
- Which of the following is correct about Coriolis force?
 - It can change the speed of a particle.
 - It does not contribute to the energy equation.
 - It bends the path of a particle to the left in the Northern Hemisphere.
 - None of the above.
- Using standard notations, the relation between the Hamiltonian and Lagrangian of a system of particles with n degrees of freedom is given by
- Write the Hamilton's canonical equations of motion for a n -particle system ($i = 1, 2, \dots, n$) in terms of Poisson Brackets(with usual notations) –
- With usual notations, which of the following is not a property of Poisson bracket?
 - $\{u_1 + u_2, v\} = \{u_1, v\} + \{u_2, v\}$
 - $\{u, v\} = \{v, u\}$

3. $\{u, vw\} = \{u, v\}w + v\{u, w\}$
4. $\{u, \{v, w\}\} + \{v, \{w, u\}\} + \{w, \{u, v\}\} = 0$
11. The Lagrangian of a plane pendulum is $L = \frac{1}{2}ml^2\dot{\theta}^2 + mgl \cos \theta$, the notations having usual meaning. Write its Hamiltonian .
12. What is the Hamilton's principle of least action (notations having usual meaning)?
13. From which equation the Brachistochrone is a path obtainable (notations having usual meanings)?
14. Consider the canonical transformation $Q = -p$, $P = q + \lambda p^2$, where λ is a constant and (q,p) , (Q,P) are old and new set of canonical variables respectively. What is the Type 2 generating function for this transformation?
15. If $S(q, E, t)$ is the type 2 generating function of canonical transformation and other notations have usual meaning, then write the Hamilton-Jacobi equation for a free particle .