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MSH 452

II Semester M.Sc. Examination, September/October 2022
(CBCS)
MATERIALS SCIENCE
Classical Mechanics and Statistical Physics

Time : 3 Hours

Max. Marks : 70

Instructions : i) Scientific calculator may be **allowed**.
ii) Answer **all** questions.

1. a) Define D'Alembert's principle. Obtain Lagrange's equations of II kind.
b) Obtain the equation of motion of a simple pendulum using Lagrange's equation of the II kind and hence deduce the formula for its time period for small amplitude oscillation. **(12+8)**

OR

2. a) Prove the canonical invariance of Poisson brackets. Show that Poisson bracket of constants of motion with the Hamiltonian must be zero.
b) Obtain the time dependent Hamilton – Jacobi equation of motion. **(14+6)**
3. a) Derive Euler's equations of motion of a rigid body.
b) Solve the problem of a symmetric rigid body under force free conditions. **(12+8)**

OR

4. a) Show that there exists only two elastic constants in the case of an isotropic homogeneous elastic media.
b) Obtain expressions for longitudinal elastic wave velocities. **(14+6)**
5. Derive Maxwell – Boltzmann distribution function and determine the Lagrangian multipliers. **20**

OR

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6. a) Derive black body radiation formula through Planck's semi-classical approach.
- b) Discuss Bose condensation with relevant theory. **(8+12)**
7. Answer the following. **Each** question carries **two** marks. **(2×5=10)**
- a) Define virtual displacement and degrees of freedom.
- b) What is a cyclic coordinate ? What is its effect on the motion of the particle ?
- c) Connect the components of the torque to the angular momentum in body set of axes.
- d) Which statistics would you apply to helium gas at 6K ? Justify your answer.
- e) What would be the specific heat at constant volume for oxygen gas at RT ? Justify.
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