

**Ph.D Course Work Examinations, July-2023****PHYSICS**  
**Course-III: Advanced Physics****Time: 3 Hours****Maximum Marks: 70****Instructions:**

- 1) Answer all the questions.
- 2) Part A: Questions 1-8 carries 15 marks each.
- 3) Part B: Questions 9-12 carries 5 marks each

**PART A**

1. a) Derive Lagrangian equation of motion using D'Alembert's principle. [10+05]  
b) Set up the equation of motion for simple pendulum using Lagrangian formulation.

**OR**

2. a) Develop the time-independent perturbation theory for non-degenerate cases and obtain first order correction for wave function and energy. [10+05]  
b) Write a note on Poisson brackets.
3. What are thermodynamic potentials? Obtain the Maxwell's thermodynamic relations using these potentials. [15]

**OR**

4. a) What is canonical ensemble? Obtain the expression for fluctuations in case of canonical ensemble. [10+05]  
b) Give an account on Johnson noise.
5. State and obtain the Gauss's law in differential and integral forms. [15]  
Give any one application of it.

**OR**

6. a) Deduce expressions for Maxwell's equations in linear isotropic media.

b) Brief on propagation of electromagnetic waves in free space. [10+05]

7. a) Explain the Newton-Raphson method for solving transcendental equation. [08+07]

b) Find the curve of the form  $y=ax^b$  that best fits the following data.

X	2	3	4	5	6
Y	6	8	10	12	14

**OR**

8. a) What is Raman effect? Explain the theory of Raman spectrometer with applications. [10+05]

b) Write a brief note on production of vacuum.

**PART B**

9. Explain the importance of symmetries and cyclic coordinates in equations of motion. 5M

**OR**

10. Give a brief account on Fermi-Dirac statistics. 5M

11. State and explain Biot-Savart's law. 5M

**OR**

12. Explain the working of Thermogravimetric analysis (TGA). 5M

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