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PHY-502

Statistical Mechanics and Quantum Mechanics

M.Sc. PHYSICS (MSCPHY-12/13/16/17)
First Year, Examination-2019

Time: 3 Hours **Max. Marks: 80**

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Note:- This paper is of Eighty (80) marks divided into two (02) Section A and B. Attempt the question contained in these sections according to the detailed instructions given therein.

Section-A

(Long Answer Type Question)

Note:- Section - A contains five (05) long answer-type questions of fifteen (15) marks each. Learners are required to answer any three (03) questions only. (3×15=45)

1. What is a partition function? Derive the rotational partition function for a diatomic gas molecule and obtain different thermodynamic parameters.

2. What are quantum distributions? Using grand canonical ensemble, arrive at Fermi Dirac distribution function for indistinguishable particle

3. Solve the Schrodinger equation for Eigen values and Eigen functions of a linear harmonic oscillator.

4. Discuss the time-dependent perturbation theory of the first order and hence deduce the Fermi Golden rule.

5. Obtain the solution of the free particle Dirac equation.

Section-B

(Short Answer Type Question)

Note:- Section-B contains eight (08) short answer type questions of seven (07) marks each. Learners are required to answer any five (05) questions only. (5×7=35)

1. Distinguish between micro canonical, canonical and grand canonical ensembles.

2. State and prove equipartion theorem for an ideal gas.

3. Give the general theory of addition of any two angular momentums.

4. What is an operator? Explain about different types of operators used mechanics.

5. Obtain the Eigen value of a rigid rotator.

6. Why hydrogen atom in the ground state does not shown first order stork effect? Explain

7. Explain Variational principle and hence obtain the upper bound for the ground state energy of the system.

8. What is Pauli Spin operator? Explain Pauli spin function in the form of 2X2 matrices.

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