

M.Sc., DEGREE EXAMINATIONS – MARCH 2016  
IV SEMESTER

45071

Physics

PAPER I – Quantum Mechanics - II

Time : 3 Hours

Max. Marks: 75

(No additional sheet will be supplied)

**PART – A (5 x 3 = 15 marks)**

Answer any FIVE Questions

Each question carries 3 marks

Each answer should not exceed 1 page

1. Explain the indistinguishability of identical particles
2. State and Explain Pauli's exclusion principle
3. Discuss how two angular momenta can be combined
4. What is Spin angular momentum and write pauli's spin matrices
5. Obtain probability and current density using Dirac's Equation
6. Write the inadequacy of klen – Gordon equation
7. Discuss quantization of Schrodinger field
8. Define the creation and annihilation operators

**PART – B (4 x 15 = 60 marks)**

Answer ALL Questions

Each question carries 15 marks

Each answer should not exceed 6 pages

9. a) Discuss quantum dynamics of identical particles  
b) Explain how the state vector of a system of identical particles is obtained

(OR)

10. a) Construct symmetric and Anti-symmetric wave function for three particle system  
b) Explain Hydrogen molecule system

11. a) Find the Eigen values and Eigen function of  $\hat{L}^2$  and  $\hat{L}_z$   
b) Obtain matrices for  $J_+$  and  $J_-$  ?

(OR)

12. a) Explain what are Clebsh – Gordon co-efficients  
b) Obtain Clebsh – Gordon co-efficient for  $J_1 = 1$  and  $J_2 = \frac{1}{2}$

[P.T.O]

13. a) Write Klein – Gordon equation and discuss its significance  
b) Discuss plane wave solutions of the Dirac's equation and give their significance

(OR)

14. a) Obtain Dirac's equation for a free particle and explain its importance  
b) Discuss the covariance of Dirac's equation
15. a) Explain the concept of Second quantization  
b) Discuss how Hamiltonian formulation of classical field is obtained

(OR)

16. a) Discuss the quantisation of non-relativistic Schrodinger equation  
b) Obtain the commutation and Anti-commutation relations

