

(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2022 ONLY)

SUBJECT CODE **22PPS309**

REG.NO.

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER – 2023

M.Sc. – PHYSICS

MAXIMUM MARKS: 50

SEMESTER - III

TIME : 3 HOURS

ADVANCED QUANTUM MECHANICS – II

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS

(k1)

1. Born's approximation is applicable for _____.
 - (a) High energy, low atomic number for scatterer
 - (b) Low energy, low atomic number for scatterer
 - (c) High energy, high atomic number for scatterer
 - (d) Low energy, low atomic number for scatterer
2. The selection rules for hydrogenic atoms are
 - (a) $\Delta m = 0, \pm 1, \Delta l = \pm 1$
 - (b) $\Delta m = 0, \Delta l = 0$
 - (c) $\Delta m = 0, \Delta l = 0$
 - (d) $\Delta m = \pm 1, \Delta l = 0$
3. The Hamiltonian of an electron in a magnetic field H is
 - (a) $H = \mu B H$
 - (b) $H = \mu B \sigma H$
 - (c) $H = \mu B \sigma / H$
 - (d) $H = \mu B \sigma 2H$
4. a_k is ----- operator
 - (a) annihilation
 - (b) creation
 - (c) Hamilton
 - (d) none of the above
5. In the Hartree approximation _____ is neglected.
 - (a) Interactions between electron and nucleus
 - (b) attractive forces
 - (c) electron correlation
 - (d) repulsive forces

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

(K2)

6. What are partial waves?
7. What is allowed transition?
8. What type of particle obey Klein Gordon equation?
9. Define vacuum state.
10. Write the Hartree equation.

(CONTD 2)

SECTION – B**(5 X 3 = 15 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.****(K3)**

11. a) Discuss the method of partial wave analysis for the study of scattering problems.
(OR)
- b) Discuss the validity conditions for Born approximation.
12. a) Explain Laporte selection rule.
(OR)
- b) Obtain the Hamiltonian operator for a charged particle in an electromagnetic field.
13. a) Write short note on negative energy state of an electron.
(OR)
- b) Derive expressions for probability density and probability current density in the Dirac formalism.
14. a) Explain the quantization of field.
(OR)
- b) Discuss creation and annihilation operators.
15. a) Explain rigid rotator.
(OR)
- b) Discuss the wave functions that describe the bound states of Hydrogen atom.

SECTION – C**(5 X 5 = 25 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.****(K4 (Or) K5)**

16. a) Explain how the scattering amplitude provides the information about the scattering of particles.
(OR)
- b) Briefly discuss the integral equations in terms of Green's function.
17. a) Describe the phenomenon of Rayleigh scattering.
(OR)
- b) Deduce the relationship between Einstein's coefficients of spontaneous and induced emission.
18. a) Obtain Klein-Gordon equation for a charged particles moving in an electromagnetic field
(OR)
- b) Discuss the spin orbit interaction.
19. a) Explain the classical field equation in Hamiltonian form.
(OR)
- b) Discuss the Klein Gordon field equation.
20. a) Discuss the basic concepts of Hartree - Fock theorem and deduce the associated equations.
(OR)
- b) Explain the method of reduction of the two particles problem in many electron systems.
