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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021-22 ONLY)

SUBJECT CODE 21 PPS 309

REG.NO. :

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

END-OF-SEMESTER EXAMINATIONS : DECEMBER – 2022

M.Sc. – PHYSICS **MAXIMUM MARKS: 70**

III SEMESTER **TIME : 3 HOURS**

QUANTUM MECHANICS – II

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. **(K1)**

1. The most common way of inducing transition between stationary states of quantum system is……
   a) supplying thermal energy b) by hitting electrons
   c) applying harmonic perturbation d) through adiabatic changes

2. In the time-dependent perturbation theory of Semiclassical theory of radiation, the electromagnetic field is represented by……
   a) Continuous potential **A**,Φ b) discrete A and continuous Φ
   c) Discrete potential A, Φ d) Volt

3. The relativistic Hamiltonian of a particle is……
   a) H = $\frac{p2}{2m} + V$ b) H = $\beta mc2 + V$
   c) H = $c\hat{\alpha}.\hat{p}.+ \beta mc^2$ d) b) H = $\frac{mv2}{2} + V$

4. The Canonical field equation in classical form is……
   a) $H = \Sigma P_i \dot{\psi}_\iota - L$ b) $\dot{\Psi} = \frac{\partial H}{\partial \pi}\ and\ \dot{\pi} = -\frac{\partial H}{\partial \varphi}$
   c) $\frac{dF}{dx} = \frac{\partial F}{\partial t} + \{F, H\}$ d) $ih\frac{\partial F}{\partial t} = -h^2\nabla^2\Psi + V\Psi$

5. Most common method to obtain central potential is…….
   a) Variation method b) WKB method
   c) Thomas-Fermi method d) perturbation method

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES **(K2)**

6. What are known as quantum dynamics?
7. Define “Rayleigh scattering”.
8. Which one is referred to as Schordinger relativistic equation?
9. What is Glein-Gordan field?
10. Expand the abbreviation “LCAO”.

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SECTION – B (5 X 4 = 20 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. a) Develop the time dependent perturbation theory and find the condition for a real transition.

(OR)

b) What is known as a sudden approximation? Give the theory

12. a) Obtain the expression for Einstein co-efficients through semi classical theory

(OR)

b) Define the term "Dipole approximation". Discuss its role in quantum mechanics

13. a) What are Dirac matrices? Deduce from relativistic Hamiltonian.

(OR)

b) Give a simple derivation of Klein-Gordan equation.

14. a) What is known as second quantization? Explain

(OR)

b) Write about creation and destruction operators.

15. a) Write about central field approximation

(OR)

b) Discuss the bound state of the hydrogen atom and its wave functions.

SECTION – C (4 X 10 = 40 MARKS)

ANSWER ANY FOUR OUT OF SIX QUESTIONS.
(16thQUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS.

(K4 (Or) K5)

16. Obtain the plane wave solution for the Dirac equation and discuss the energy levels of a free Dirac particle.

17. Obtain the equation for Fermi's Golden Rule from the theory of transition to continuum states.

18. Discuss the theory of first-order time-dependent perturbation, extend it to obtain transition probability expression in harmonic perturbation.

19. Write down the Dirac equation in an external electromagnetic field and deduce that a Dirac electron has magnetic moment eh/4$\pi mc\hat{o}$ and give the physical interpretation of the result.

20. Derive the classical field equations in Hamiltonian form.

21. Derive the expression for self-consistent potential using Hartee method

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