TM143460A **Reg. No:.....**
Name:.....

M. Sc. DEGREE (CSS) EXAMINATION, FEBRUARY 2016
THIRD SEMESTER –PHYSICS
PHY3QM – QUANTUM MECHANICS –II
(Supplementary Examination- 2014 Admission)

Time: Three Hours **Maximum weight: 30**

PART A

I. Answer any *six* questions. Each question carries weightage 1

1. Distinguish between stimulated emission and spontaneous emission
2. What is dipole approximation?
3. Distinguish between sudden and adiabatic approximations
4. Explain scattering cross section and what is the dimension of it?
5. Explain Ramsauer - Townsend effect
6. Discuss the validity of Born approximation
7. Discuss the drawbacks of Klein-Gordon relativistic equation
8. Derive Dirac Hamiltonian
9. Why Lgrangian formulation is used for studying quantum field systems?
10. State and explain Noether's theorem

(6x1=6)

PART B

II. Answer any *Four* questions. Each question carries weight of 2

11. Calculate Einstein's B coefficient for the $n= 2, l = 1, m = 0 \rightarrow n = 1, l = 0, m = 0$ transition in the hydrogen atom
12. Derive Fermi's Golden rule equation
13. Obtain the relation connecting differential scattering cross section and scattering amplitude
14. Obtain the expansion of plane waves in terms of an infinite number of spherical waves
15. Express Dirac equation in covariant form
16. Starting from the action principle, obtain the Euler-Lagrangian equation for a classical field system

(4x2=8)

PART C

III. Answer ALL questions. Each question carries weight of 4

17. Derive expressions for Einstein's A and B coefficients. Obtain the selection rules for Hydrogen atom

OR

Obtain the Hamiltonian of a charged particle placed in an electromagnetic field. Using dipole approximation calculate the probability per unit time for absorption

18. Using partial wave analysis obtain the scattering cross section when the scattering is produced by an attractive square well potential. Deduce the result when the scattering potential is represented by a hard sphere.

OR

Explain Born approximation and apply it to the case of scattering by a Coulomb potential and then obtain Rutherford scattering formula

19. Obtain Dirac equation for a free particle. Find the energy eigen values of Dirac equation and discuss the significance of the eigen values

OR

Show that Dirac particle possesses spin angular momentum

20. Obtain the quantisation of neutral KG filed and show that the energy density of KG field is positive definite

OR

Quantize the Dirac field and then obtain the expression for the Hamiltonian of Dirac field

(4x4=16)