LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **PHYSICS**

SIXTH SEMESTER – NOVEMBER 2012

# PH 6609/6605/6603/6600 - QUANTUM MECHANICS & RELATIVITY

Date : 05/11/2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**PART - A**

Answer **ALL** the questions: (10x2=20 Marks)

1. Define the term Work function.
2. What is Compton wavelength? What is its value for an electron?
3. Write down any two postulates of Quantum Mechanics.
4. Write down the Schrodinger time dependent equation.
5. An eigen function of the operator d2/dx2 is Ψ=e2x. Find the corresponding eigen value.
6. Mention the properties of Hermitian operators.
7. What are inertial and non inertial frames of reference?
8. A man has a mass of 100Kg on the ground. When he is in a rocket in flight his mass is 101 Kg as determined by an observer on the ground. What is the speed of the rocket?
9. What is Mach’s Principle?
10. Find the change in frequency of a photon of red light whose original frequency is 7.3x1014 Hz, when it falls through 22.5m.

**PART-B**

Answer any **FOUR** questions: (4 x7.5=30 Marks)

11 a) State and explain Heisenberg’s Uncertainity Principle. (5)

b) The photoelectric threshold for a metal is 3000 Å. Find the Kinetic energy

of an electron ejected from it by radiation of λ =1200 Å (2.5)

12 a) Determine the energy eigen values for a particle in a 1-dimesional potential well. (5.5)

b) Indicate graphically the first three wave functions for such a particle. (2)

13. Determine the expressions for the eigen values of L2  and LZ ? (7.5)

14) Explain the transformation of velocities and hence prove that the speed of

light is the maximum attainable speed. (5+2.5)

15)Discuss the path of the planet as predicted by the General theory of relativity.

(7.5)

**PART – C**

Answer any **FOUR** questions: (4 X12.5=50 Marks)

16. a) Explain the principle and working of an Electron microscope. (8)

b) An electron has a speed of 600m/s with an accuracy of 0.005%.Calculate the

uncertainty with which we can locate the position of the electron given

h=6.6x10-34Js and m=9.1x 10-31 Kg. (4.5)

17. Using Ehrenfest’s theorem, prove Newton’s second law of motion. (12.5)

18.a) Formulate the Schrodinger’s equation for a rigid rotator. (2.5)

b) Solve it to find the eigen values and eigen functions of the Rigid rotator. (10)

19. a) State the postulates of Special theory of relativity. (2.5)

b) Derive the Lorentz transformation equations. (10)

20.a) State the Principle of equivalence. (2.5)

b) Discuss Red shift of Spectral lines in a Gravitational field. (10)

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