LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SIXTH SEMESTER – **APRIL 2012**

# PH 6609/PH 6605/6003/6600 - QUANTUM MECHANICS & RELATIVITY

Date : 16-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

**SECTION - A**

Answer **ALL** the questions: (10 × 2 = 20 Marks)

1. Mention the important properties of de Broglie waves.
2. What are the important applications of an electron microscope?
3. Give the physical significance of the wave function.
4. What do you mean by tunneling through a potential barrier?
5. What is Hermitian operator?
6. Show that [Lx, Ly] = i ħ Lz.
7. What will be the speed of a photon in one reference frame if it moves with a speed c in another frame of reference?
8. Calculate the rest mass energy of an electron in eV.
9. State Mach’s principle.
10. State the principle of equivalence.

**SECTION – B**

Answer any **FOUR** questions: (4 × 7.5 = 30 Marks)

11. (a) Distinguish between optical microscope and electron microscope. (5)

(b) Calculate de-Broglie wavelength associated with a proton moving with (1/30)c

(h= 6.62 × 10-34Js and m = 1.67×10-27kg). (2.5)

1. (a) Write down Schrödinger equation and eigen values for a linear harmonic

oscillator. (2+2)

(b) Discuss zero point energy. (3.5)

13. (a) What do you mean by eigen functions and eigen values? (1.5+1.5)

(b) Prove that every eigen value of Hermitian operator is real. (4.5)

14. On the basis of Lorentz transformations discuss (i) length contraction and (ii) time dilation. (4+3.5)

15. (a) What do you mean by inertial mass and gravitational mass? (1.5+1.5)

(b) Discuss the Red shift of spectral lines in a gravitation field. (4.5)

**SECTION – C**

Answer any **FOUR** questions: (4× 12.5 = 50 Marks)

16. (a) Describe, with neat diagrams, the experiment of Davisson and Germer on the

diffraction of electrons to establish the wave nature of matter. (10)

(b) If the uncertainty in the location of a particle is equal to its de Broglie wavelength,

What is the uncertainty in its velocity? (2.5)

17. Solve the Schrödinger equation for a particle moving in one dimensional potential well

of finite depth to find eigen functions and eigen values.

18. Solve the radial part of Schrödinger equation for the hydrogen atom to obtain eigen

values of energy.

19. Describe the Michelson-Morley experiment and discuss the various interpretations for

the negative result of the experiment. (10+2.5)

20. Discuss the motion of a planet in the gravitational field of the sun and explain the

advance of the perihelion of Mercury. (8+4.5)

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