



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

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

**SIXTH SEMESTER – NOVEMBER 2016**

**PH 6609/6605/6603/6600 – QUANTUM MECHANICS & RELATIVITY**

Date: 14-11-2016

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**PART A (10x 2 = 20)**

**Answer ALL questions**

1. Determine the de Broglie wavelength of an electron of energy MeV.
2. State Heisenberg's uncertainty principle.
3. Write the time dependent Schrodinger's equation.
4. What is degeneracy?
5. What are Eigen functions and Eigen values?
6. Evaluate  $[L_x, L_y]$ .
7. Define inertial and non –inertial frames of reference.
8. A rod 1m long is moving along its length with a velocity  $0.9c$ . Calculate its length as it appears to an observer on the earth.
9. State equivalence principle in general relativity.
10. State Mach's principle.

**PART B (4 x7.5 = 30 )**

**Answer any FOUR questions.**

11. Describe G.P.Thomson experiment.
12. Establish Schrodinger's equation for a linear harmonic oscillator and solve it to obtain its Eigen values.
13. Obtain the commutation relation between (i) position and momentum and (ii) Hamiltonian and momentum.
14. Derive expression for length contraction and time dilation.
15. Explain the postulates of the general theory of relativity.

**PART C (4 x 12.5 = 50)**

**Answer any FOUR questions**

16. (i) Explain the principle and working of an electron microscope. (ii) Outline an idealised experiment to bring out the significance of Heisenberg's uncertainty principle.
17. State and prove Ehernfest's theorem
18. Solve for the eigen values and the eigen functions of  $L^2$  and  $L_z$  operator.
19. Deduce the formula for relativistic variation of mass with velocity. Briefly explain its significance.
20. Give the theory of any two experimental confirmation of general theory of relativity.

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