LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SIXTH SEMESTER – **APRIL 2016**

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

Date: 15-04-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

PART-A

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

1) State Planck's hypothesis, to explain black body radiation.
2) State Heisenberg's uncertainty principle.
3) Is exp (–x) an admissible wave function? If so, for what range of x-values?
4) State the Born's interpretation of the wave function.
5) Why are the physical observables represented by Hermitian operator?
6) Write the operators L_x and L_y in Cartesian form.
7) State the postulates of special relativity.
8) If two particles are moving in opposite directions with speeds 0.5c, each, what is the relative speed of one with the other.
9) State Mach's principle.
10) State equivalence principle.

PART-B

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

11) Use uncertainty principle to account for the absence of electron inside the nucleus.
12) State and prove the Ehrenfest theorem $\frac{d\langle p\rangle}{dt} = -\langle \nabla V \rangle$, the symbols have their usual meaning.
13) Obtain the eigen values and eigen functions of L_Z operator.
14) Define proper time and obtain the expression for time dilation. Proper life of a mu meson is $2x10^{-6}$ sec. If it moves with a speed of $(\sqrt{3}/2)$ c, find its life time.
15) Explain gravitational red shift and obtain an expression for it.

PART-C

Answer any **FOUR** questions: **(4x12.5=50 marks)**

16) a) Obtain an expression for the change in the wave length of a scattered photon, in Compton effect.
b) What is the de-Broglie wave length of an electron, whose kinetic energy is 1eV?
17) Solve for the eigen values and eigen functions for a particle in a three dimensional box. Explain the concept of degeneracy.
18) Solve the radial wave equation for the hydrogen atom and obtain its eigen values.
19) Obtain the Lorentz transformation equations. Show that it reduces to Galilean transformation when v/c <<1.
20) Discuss the following:
a) Bending of light b) Gravitational lensing c) Precision of perihelion of Mercury.

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