CMR
INSTITUTE OF
TECHNOLOGY

Internal Assessment Test 1– September 2016

Roll No	

Sub:	Engineering Physics					Code:	15PHY12
Date:	8-9-2016	Duration:	90 mins	Max Marks:	50	Sem:	1st	Section:	All

Note: Value of Constants: $h = 6.625\times10^{-34}$ Js $k = 1.38\times10^{-23}$ J/K $m = 9.11\times10^{-31}$ kg. $\varepsilon_o = 8.85 \times 10^{-12}$ Fm^{-1}

Answer any five questions **(5×10=5)**

1. a) With a neat diagram explain the energy distribution in the spectrum of a blackbody. Show that Planck's law reduces to Wien's law and Rayleigh-Jeans law under certain conditions.
   b) In a Compton scattering experiment, the incident photons have a wavelength of 0.5 nm. Calculate the wavelength of scattered photons if they are viewed at an angle of 45° to the direction of incidence. [7+3]

2. a) Define the phase velocity and group velocity. Show that group velocity of a de Broglie wave is equal to particle velocity.
   b) Calculate the de Broglie wavelength associated with an electron having kinetic energy 100 eV. [6+4]

3. a) State Heisenberg's uncertainty principle. Using this principle, show that a free electron cannot exist within the nucleus of an atom.
   b) An electron is confined to a box of length 10^{-6} m. Calculate the minimum uncertainty involved in the measurement of its velocity. [7+3]

4. a) Derive the time independent Schrodinger wave equation for a free particle in one dimension.
   b) An electron is bound in one dimensional potential well of width 0.18 nm. Find its energy value in eV in the second excited state [6+4]

5. a) Solve the Schrödinger wave equation for the allowed energy levels in the case of particle in one dimensional potential well of infinite height
   b) What is wave function? Discuss its physical significance and properties. [6+4]

6. a) Explain the drawbacks of classical free electron theory.
   b) Calculate the probability of an electron occupying an energy level 0.02 eV below Fermi level at 200K. [6+4]

7. a) Obtain an expression for the conductivity of a metal from quantum mechanical considerations.
   b) Discuss the dependence of Fermi factor on temperature at temperatures T = 0K and T > 0K. [6+4]