KIIT UNIVERSITY

MID SEMESTER EXAMINATION-2014

PHYSICS -II (PH-201)

(SCHEME-II)

Full Marks-25 **Time: 2 Hrs**

Answer any five questions including question No.1 which is compulsory.

The figures in the right hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. (i) Mention any four phenomena in nature which violate the wave nature of electromagnetic radiation. [1X5

   (ii) Write down Rayleigh–Jeans' Law of black body radiation.

   (iii) If radiation of wavelength 8000 Å is able to emit photoelectrons of zero velocity from a certain metal surface, then calculate the threshold frequency and work function of the metal.

   (iv) Prove that $v_p v_g = c^2$ where symbols have their usual meanings.

   (v) An electron is accelerated from rest through a potential difference of 1.6 kV. Calculate its de Broglie wavelength.

2. Mention Planck's hypothesis of quantum theory. Hence derive Planck's radiation formula for black body radiation. [5

3. (i) Write down Einstein's photoelectric equation. Mention the laws of photoelectric effect. Explain graphically the variation of stopping potential with frequency of incident light. [3

(ii) X-rays of wavelength 1.2 Å undergo Compton scattering due to electrons. What is the maximum possible value of Compton shift if the Compton wavelength of electron is 0.02426 Å? [2

4. What is Compton Effect? Derive an expression for Compton shift. [5

5. What are matter waves? Derive an expression for their wavelength. Prove that phase velocity of matter waves is more than speed of light. [5
6. Two sinusoidal waves of same amplitude but slightly different frequencies and wavelengths superpose. Derive phase velocity and group velocity and find out the relationship between them. [5

7. (i) State Heisenberg's uncertainty principle. Show that there cannot be any existence of free electrons inside the nucleus of an atom. [3
   (ii) Calculate the smallest possible uncertainty in the momentum of an electron for which the uncertainty in its position is 4 Å. [2

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