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B. Tech. Ist Semester (Main) Examination Feb.-2010

Physics - I

(Common to all Branches of Engineering)

1E1023

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **Five** questions selecting one question from each unit. All questions carry equal marks.*

Unit - I

1. a) Explain with the help of diagram and experiment arrangement to produce Newton's rings. **(2+4)**

   b) What are the differences between fringes obtained in Newton's ring experiment and those produced by a bi-prism. **(4)**

   c) In Newton's ring experiment an air film is formed between two convex surfaces each of radius of curvature 1m. Newton's rings are generated by using a light of wavelength 5000 $\mathring{A}$. Find the distance between 16^{th} and 9^{th} dark rings. **(6)**

OR

   a) Explain the working of Michelson's interferometer. How circular fringes be produced with it. **(3+3)**

   b) Show how Michelson's interferometer is used to find the wavelength of light. **(4)**

   c) Write short note on

      i) Antireflection coating and

      ii) Interference filters. **(3+3)**

Unit - II

2. a) What do you understand by the term 'polarization of light'. Distinguish between polarized and unpolarized light in details. **(3+5)**

   b) What is meant by plane polarized, circularly polarized and elliptically polarized light. State Malus Law. **(6+2)**

OR

   a) Discuss double reflection in calcite crystal. How can a phase retardation plate be obtained from it. **(4+4)**

   b) Describe a polarimeter and explain how it is used to measure the strength of sugar solution. **(3+5)**

Unit - III

3. a) Find out an expression for intensity at a point in a Fraunhufer diffraction due to single slit. Draw the intensity distribution curve. **(6+2)**

   b) The width of a slit is 0.012mm. Monochromatic light is incident on it. The angular position of first bright line is 5.2°. Calculate the wavelength of incident light. **(8)**

OR

   a) Deduce suitable formula to show the resolving power of a plane transmission grating depends on

      i) Number of ruled lines and

      ii) Width of ruled space **(8)**

   b) A sodium light consists of two lines of wavelength 5890 $\overset{0}{A}$ and 5896 $\overset{0}{A}$. Find the minimum number of lines that a grating must have in order to resolve their wavelength in first order. **(8)**

Unit - IV

4. a) i) What is the difference between compton effect and photoelectric effect. **(2)**

      ii) Explain how compton scattering confirms the quantum nature of radiation. **(2)**

      iii) Give reasons why the compton shift is detectable only in X-rays region and not in visible range of light. **(2)**

b) Calculate the percentage of the maximum shift in the wavelength of incident photons of wavelength $1\overset{0}{A}$ and $10\overset{0}{A}$ due to compton scattering. What conclusion do you draw from this calculation. **(8+2)**

OR

a) Derive Scrödinger's time dependent wave equation. What is the physical significance of wave function used in this equation. **(6+2)**

b) Determine the expectation value of position of a particle in one dimensional box. **(8)**

Unit - V

5. a) State the postulates of special theory of relativity and deduce from them the Lorentz transformations. **(2+6)**

b) Show that quantity $\left(x^2+y^2+z^2-c^2t^2\right)$ is invarient under Lorentz transformation. **(8)**

OR

a) Show that the relativistic kinetic energy is given by $(m-m_0)C^2$ and it approaches to non-relativistic kinetic energy for $v<<c$. (All symbols have their usual meanings). **(8)**

b) Calculate the velocity of a particle at which its mass becomes twice of its rest mass. **(8)**
