1E1023

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B.Tech. I - Sem.(Main/Back) Exam - Jan-Feb. 2012

103 - Physics - I

(Common to all Branches of Engg.)

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. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. **Scientific Calculator** 2. **Nil**

(Non Programmable)

Unit - I

1 A) (i) Describe the construction and working of Michelson's Interferometer. How would you use it to measure the wavelength of monochromatic light? (8)

(ii) What will be the effect on Newton's rings;

(a) If we use a plane mirror in place of glass plate.

(b) If the plano-convex lens is raised by a height of $\lambda/4$ from the surface of glass plate. (4)

(iii) In Michelson's interferometer, the readings of movable mirror for a pair of consecutive distinctness of fringes are 0.7 mm and 0.99 mm respectively. The source of light used has a doublet of wavelengths

whose mean value is taken as 5893Å. Find the difference between wavelength components. (4)

OR

1 B) (i) Explain how can Newton's rings be obtained in the laboratory? Show that the diameter of n^{th} dark ring is proportional to the square root of the natural number. (8)

(ii) Explain the working principle of Antireflection coating and derive an expression for the minimum thickness of the coating. (4)

(iii) Newton's rings are observed normally in reflected light of wavelength 5900Å. The diameter of 10^{th} dark ring is 0.5 cm. Find the thickness of air film and radius of curvature of plano-convex lens. (4)

Unit - II

2 A) (i) Using the concept of electric field vector of electromagnetic waves, explain plane, elliptically and circularly polarized light. (6)

(ii) State and prove Malus Law. (4)

(iii) Two crossed polaroids A and B are placed in the path of unpolarized light. A third polaroid C is placed in between A and B such that its transmission axis makes an angle of 30° with the transmission axis of polaroid A. If the intensity of unpolarized light incident on polaroid A is 32 w/m^2, what will be intensity of light emerging from polaroid B? (6)

OR

2 B) (i) Define specific rotation for solution. Describe the construction and working of Biquartz plate. How it can be used to measure specific rotation of sugar? (10)

(ii) How will you distinguish between?

(a) Elliptically polarized light and circularly polarized light

(b) Unpolarized and plane polarized light. (4)

(iii) Calculate the thickness of a half wave plate of quartz for a wave-

length of 5000Å. Here μ_e=1.553 and μ_o=1.544. (2)

Unit - III

3 A) (i) Derive an expression for the intensity of diffracted light in the Fraunhofer's diffraction due to single slit. Discuss the conditions for maxima and minima in diffraction pattern. (12)

(ii) A plane transmission grating has 5000 lines per cm and the total ruled width is 5 cm. Calculate

(a) The resolving power in second order.

(b) The smallest wavelength difference which can be resolved in second at 6000Å. (4)

OR

3 B) (i) What is diffraction grating? Give the theory of formation of spectra with a plane transmission grating. (6)

(ii) Explain Rayleigh's criterion of resolution. Deduce an expression for resolving power of a plane transmission grating. (6)

(iii) Diffraction pattern of a single slit of width 0.5 cm is formed by a lens of focal length 40 cm. Calculate the distance between the first dark and next bright fringe from the axis. (4)

Unit – IV

4 A) (i) What is Compton effect? Obtain an expression for shift in wavelength of scattered photon by Compton scattering. (6)

(ii) (a) Discuss the physical interpretation of wave function and its properties.

(b) Write down time dependent and time independent Schrodinger wave equations. (8)

(iii) An X-ray of wavelength 1.0Å is scattered at an angle of 90° by a free electron initially at rest. Compute the wavelength of scattered photon. (2)

OR

4 B) (i) Solve the Schrodinger wave equation for a particle trapped to one dimension box of side a and obtain its energy eigenvalues and eigenfunctions. (12)

(ii) Find the lowest energy of an electron confined to move in a one dimensional box of length 1Å. (4)

Unit – V

5 A) (i) What are the two postulates of Einstein's special theory of relativity? Derive Lorentz transformations for space and time coordinates. (8)

(ii) What is meant by length contraction and time dilation? (6)

(iii) At what speed should a rod move so that its length contracts by 60% along the direction of motion? (2)

OR

5 B) (i) Derive mass energy relation with examples. Show that $E^2 - P^2c^2 = m_0^2c^4$, where the symbols have their usual meanings. (10)

(ii) A spaceship moving away from the earth with velocity 0.5c fires a rocket whose velocity relative to spaceship is 0.8c (a) away from the earth and (b) towards the earth. What will be the velocity of the rocket as observed from the earth in the two cases? (6)