1E1023

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B. Tech. (Sem. I) (Main/Back) Examination, January/February - 2011
Physics - I
(Common to all Branches of Engg.)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

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

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

1. Scientific Calculator (Non-Programmable) 2. Nil

UNIT - I

1 (i) Explain the working of Michelson's interferometer. How it is used to measure the difference in the wavelength between the D lines of sodium light? **8**

(ii) Michelson interferometer experiment is performed with a source which have two wavelengths 4882 $\mathring{A}$ and 4886 $\mathring{A}$. By what distance does the mirror have to be moved between positions of disappearance of fringes? **4**

(iii) Write short note on Interference filters. **4**

OR

1 (i) Explain the formation of Newton's rings in reflected light. Why Newton's rings are circular in shape, Explain. **6**

(ii) Light containing two wavelengths λ_1 and λ_2 falls normally on a plano convex lens of radius of curvature R resting on a glass plate. If the n^{th} dark ring due to λ_1, coincides with the $(n+1)^{th}$ dark ring due to λ_2, prove that the radius of the n^{th} dark ring of λ_1 is $\sqrt{\frac{\lambda_1\lambda_2 R}{\lambda_1 - \lambda_2}}$. **6**

(iii) Write short note on Anti-reflection coating. **4**

UNIT - II

2 (i) Show that plane polarised and circularly polarised light are the special cases of elliptically polarised light. **8**

(ii) Intensity of light through a polariser and analyser is maximum when their principal planes are parallel. Through what angle the analyzer must be rotated so that the intensity gets reduced to 1/4 of the maximum value. **4**

(iii) What is Malus Law? **4**

OR

2 (i) Describe the construction and working of Laurent's half shade polarimeter. **6**

(ii) What are quarter wave and half wave plates? - Explain. **6**

(iii) 80 gm of impure sugar when dissolved in a litre of water, gives an optical rotation of 9.9°, when placed in a tube of length 200 mm. If the specific rotation of sugar is 66 degree/dm / (gm/cc), find the percentage purity of sugar sample. **4**

UNIT - III

3 (i) Find out an expression for intensity at a point in the Fraunhofer diffraction due to a single slit. Draw the intensity distribution curve. 8

(ii) The width of a slit is 0.012 mm. Monochromatic light is incident on it. The angular position of first bright line is 5.2°. Calculate the wavelength of incident light. 4

(iii) What is difference in Fresnel's and Fraunhofer diffraction? 4

OR

3 (i) Show that the intensity of light diffracted from a plane transmission grating is given by

$$I = I_o \left(\frac{\sin\alpha}{\alpha}\right)^2 \left(\frac{\sin N\beta}{\sin\beta}\right)^2.$$

Where symbols have their usual meaning. 8

(ii) A diffraction grating just resolves lines 4547.27 $\mathring{A}$ and 4547.98 $\mathring{A}$ in third order. Will it resolve lines 6437.48 $\mathring{A}$ and 6437.95 $\mathring{A}$ in the first order? 4

(iii) Explain Rayleigh criterion of resolution. 4

UNIT - IV

4 (i) Obtain an expression for shift in wavelength of the scattered photon by Compton scattering. 8

(ii) In compton experiment the wavelength of x-ray radiation scattered at an angle of 45° is 0.022 $\mathring{A}$. Calculate the wavelength of the incident x-rays. 4

(iii) Give physical interpretation of wave function. 4

OR

4 (i) Write down Schrodinger's equation for a particle confined in a one dimensional box. Obtain the wave function for a particle confined in this box.

8

(ii) A particle is moving in one-dimensional potential box (of infinite height) of width 25 $\mathring{A}$. Calculate the probability of finding the particle within an interval of 5 $\mathring{A}$ at the centres of the box when it is in its state ot least energy.

4

(iii) Explain normalized and orthogonal wave functions.

4

UNIT - V

5 (i) State the postulates of special theory of relativity and deduce from them the Lorentz Transformations.

8

(ii) Rocket 'A' travels towards the right and rocket 'B' travels to the left, with velocities 0.8 c and 0.6 c, respectively relative to the earth. What is the velocity of rocket 'A' measured from rocket 'B'?

4

(iii) Describe experiment verification of time dilation.

4

OR

5 (i) Derive Einstein's mass energy relation and explain its importance.

6

(ii) Prove that particle having rest mass zero is always move with velocity of light.

6

(iii) If P and E represent the momentum and energy of a particle, then show that, under Lorentz Transformations, $\left(P^2 - \frac{E^2}{c^2}\right)$ is an invariant.

4
