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| 1E1023 | Roll No. : _____ | Total Printed Pages : 4 |
| | 1E1023 | |
| 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 \AA and 4886 \AA . 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

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[Contd...

- (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 $(n+1)^{\text{th}}$ dark ring due to λ_2 , prove that the radius of the

$$n^{\text{th}} \text{ dark ring of } \lambda_1 \text{ is } \sqrt{\frac{\lambda_1 \lambda_2 R}{\lambda_1 - \lambda_2}}$$

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 $66 \text{ degree/dm / (gm/cc)}$, 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

$$I = I_0 \left(\frac{\sin \alpha}{\alpha} \right)^2 \left(\frac{\sin N\beta}{\sin \beta} \right)^2$$

Where symbols have their usual meaning. 8

- (ii) A diffraction grating just resolves lines 4547.27 \AA and 4547.98 \AA in third order. Will it resolve lines 6437.48 \AA and 6437.95 \AA 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 \AA . Calculate the wavelength of the incident x-rays. 4
- (iii) Give physical interpretation of wave function. 4

OR

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- 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 \AA . Calculate the probability of finding the particle within an interval of 5 \AA at the centres of the box when it is in its state of 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

