

**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  $4882 \text{ \AA}$  and  $4886 \text{ \AA}$ . 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



- (ii) Light containing two wavelengths  $\lambda_1$  and  $\lambda_2$  falls normally on a plano convex lens of radius of curvature  $R$  resting on a glass plate. If the  $n^{\text{th}}$  dark ring due to  $\lambda_1$ , coincides with the  $(n+1)^{\text{th}}$  dark ring due to  $\lambda_2$ , 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  $9.9^\circ$ , 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  $5.2^\circ$ . 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 rtuonline.com

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

Where symbols have their usual meaning.

- (ii) A diffraction grating just resolves lines  $4547.27 \text{ \AA}$  and  $4547.98 \text{ \AA}$  in third order. Will it resolve lines  $6437.48 \text{ \AA}$  and  $6437.95 \text{ \AA}$  in the first order? 8
- (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  $45^\circ$  is  $0.022 \text{ \AA}$ . 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  $25 \text{ \AA}$ . Calculate the probability of finding the particle within an interval of  $5 \text{ \AA}$  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

