

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 9927**

Roll No.

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**B. Tech.**

(SEM. II) THEORY EXAMINATION 2010-11

**PHYSICS**

*Time : 3 Hours*

*Total Marks : 100*

**Note :** (1) Attempt all questions.

(2) Marks of each question are shown against it.

1. Attempt any **four** parts of the following : (5×4=20)

(a) Derive the formula for the variation of mass of a particle with velocity.

(b) Show that if variation of mass with velocity is taken into consideration, the kinetic energy of a particle of rest mass  $m_0$  and velocity  $v$  is given by :

$$K = m_0 c^2 \left[ \left( 1 - \frac{v^2}{c^2} \right)^{-1/2} - 1 \right]$$

(c) The mass of a moving electron is 11 times its rest mass. Find its kinetic energy and momentum.

- (d) Prove the relation  $E^2 - p^2 c^2 = m_0^2 c^4$ , where symbols have their usual meaning.
- (e) Explain why a moving clock appears to go slow to a stationary observer.
- (f) Describe Einstein's mass-energy equivalence relation.

2. Attempt any **two** parts of the following : (10×2=20)

- (a) Describe the interference observed when a thin wedge shaped film is seen normally by reflected light. Find the expression for fringe width.
- (b) Give the construction and theory of plane transmission grating.
- (c) What is Rayleigh criterion of resolution ? Derive the expression for the resolving power of a microscope.

3. Attempt any **two** parts of the following : (10×2=20)

- (a) Draw a neat diagram of He-Ne Laser and describe its working principle. What are the characteristics of Laser beam ?
- (b) (i) Describe the principle of a half shade polarimeter and explain how will you use it to measure the specific rotation of glucose.

(ii) A 5% solution of cane sugar placed in a tube of length 40 cm causes the optical rotation of  $20^\circ$ . How much length of 100% solution of the same substance will cause  $35^\circ$  rotation ?

(c) What is meant by optical rotation ? Give Fresnel's theory of optical rotation and discuss its dependence on  $\lambda$ .

4. Attempt any **two** parts of the following : (10×2=20)

(a) Define Poynting vector. Derive an expression for it and explain its physical significance for EM wave in free space.

(b) Starting from Maxwell's equations obtain electromagnetic wave equation in free space.

(c) Discuss Larmor's theory of diamagnetism. Show that the diamagnetic susceptibility is negative and independent of temperature.

5. Attempt any **two** parts of the following : (10×2=20)

(a) State and prove Heisenberg's uncertainty principle and use it to show that electron can't reside in atomic nucleus.

(b) Explain Compton's effect. Show that Compton wavelength

shift is  $\Delta\lambda = \frac{h}{m_0c} (1 - \cos\theta)$ , where symbols have their usual meaning.

(c) (i) What is Bragg's law ? Describe Bragg's X-ray spectrometer.

(ii) Calculate the wavelength associated with a neutron having kinetic energy of 1 eV.

Physical constants :

$$\text{Plank's constant } h = 6.63 \times 10^{-34} \text{ J-s}$$

$$\text{Velocity of light } c = 3 \times 10^8 \text{ m/sec}$$

$$\text{Mass of electron } m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$\text{Mass of proton } m_p = 1.67 \times 10^{-27} \text{ kg}$$

$$\text{Mass of neutron } m_n = 1.67 \times 10^{-27} \text{ kg}$$