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

PAPER ID : 9602   Roll No.

B. Tech.

(Semester-I) Theory Examination, 2011-12

ENGINEERING PHYSICS –I

Time : 2 Hours]   *[Total Marks : 50*

Note :   This question paper contains three Sections-A, B and C. Section-A has one question having ten parts. Each part is to be answered in 50–75 words. Section-B has one question having five parts. Only three parts are to be answered, each in 100–200 words. Section-C has five questions with internal choice. All questions are to be answered, each in 300–500 words.

Section-A

1. Attempt *all* parts of this question. Each part carries 1 mark : 1×10=10

    (a) What was the objective of Michelson-Morley experiment ? What conclusions were drawn from this experiment ?

    (b) Write down the postulates of special theory of relativity.

    (c) Why do you need coherent sources for observing interference pattern ? How do you obtain such sources from one light source ?

    (d) Under what situations certain orders in optical gratings are missing ?

    (e) Describe Rayleigh's criterion of resolution. Write down the expression of resolution in case of a grating.

    (f) What is plane polarized light ? Describe one method to produce it.

(g) What do you mean by optical rotation ? On what parameters does it depend ?

(h) Distinguish between spontaneous emission and stimulated emission. Which one is required for laser action ?

(i) What are the components of a laser ? Also describe special characteristics of laser light.

(j) Describe the basic principle of an optical fibre.

Section-B

2. Attempt any *three* parts of this question. Each part carries 5 marks : 5×3=15

(a) What do you mean by time dilation ? Describe experimental evidence to show that time dilation is a real effect.

(b) Calculate the amount of work to be done to increase the speed of a electron from 0.8 c to 0.9 c. Given the rest energy of electron = 0.5 MeV. c is the velocity of light.

(c) Biprism fringes are produced using a source of wavelength 5893×10^{-8} cm. The biprism is of refractive index 1.5 and refracting angles 1.04 and 1.23 degrees. The distance of focal plane of the eyepiece from the biprism is 56.1cm and the distance from slit to biprism is 12.4 cm. Calculate (i) separation of the coherent images and (ii) the fringe width.

(d) A lens of focal length 100 cm forms Fraunhofer diffraction pattern of a single slit of width 0.04 cm in its focal plane. The incident light contains two wavelengths λ_1 and λ_2. It is found that the fourth minimum corresponding to λ_1 and the fifth minimum corresponding to λ_2 occur at the same point 0.5 cm from the central maximum. Compute λ_1 and λ_2.

(e) Calculate the numerical aperture, acceptance angle, and critical angle of the optical fibre if the refractive index of core is 1.50 and refractive index of cladding is 1.45.

$u = \dfrac{u + \nu^x}{1 - \nu^x c}$

Section-C

3. Attempt any *one* part of the following : 5×1=5

   (a) Derive Lorentz's transformations and use them to find out the expression for length contraction.

   (b) Derive an expression for the mass variation with velocity in the relativistic range.

4. Attempt any *one* part of the following : 5×1=5

   (a) Derive expressions for the dark and the bright fringes observed in Newton's ring experiment. How can this experiment be used to find out the wavelength of the unknown light ?

(b) Derive an expression for the intensity distribution of Fraunhofer type diffraction pattern in case of a single slit.

5. Attempt any *one* part of the following : 5×1=5

(a) Describe the method to produce and detect circularly and elliptically polarized light.

(b) Describe the working principle of Half shade polarimeter. How can one use this instrument to find out the specific rotation of sugar.

6. Attempt any *one* part of the following : 5×1=5

(a) What are Einstein's coefficients ? Obtain a relation between them. Also discuss the essential conditions for laser action.

(b) Describe the construction and working of He-Ne laser.

Attempt any *one* part of the following : 5×1=5

(a) Describe the propagation mechanism and communication in optical fibres. Also discuss about the signal loss in optical fibres.

(b) Describe the process of construction and reconstruction of image on hologram. Also describe the application of holography.