

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

PAPER ID : 9602

Roll No.

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## B. Tech.

(Semester-I) Theory Examination, 2012-13

### ENGINEERING PHYSICS-I

Time : 2 Hours]

[Total Marks : 50

Note : Attempt questions from each Section as per instructions.

#### Section-A

Attempt all Parts of this question. Each part carries 1 mark.  $1 \times 10 = 10$

1. (a) What do you understand by inertial and non-inertial frame?
- (b) Show that the rest mass of photon is zero
- (c) Describe Rayleigh criterion of resolution.
- (d) Show that the relativistic K.E. will convert classical K.E. if  $v \ll c$ .
- (e) What are coherent sources?
- (f) Define dispersive power.

- (g) Derive the condition of missing spectra.  
(h) What is numerical aperture?  
(i) Write the difference between spontaneous and stimulated emission.  
(j) What are the necessary conditions of laser?

**Section-B**

Attempt any *three* parts of this question. Each part carry 5 marks.  $5 \times 3 = 15$

2. (a) Show that time dilation is real effect.  
(b) Calculate the percentage contraction of a rod moving with velocity of  $0.8c$  in the direction inclined at  $60^\circ$  to its own length.  
(c) A thin film of a soap solution is illuminated by white light at an angle  $i = \sin^{-1}(4/5)$ . In reflected light, two dark consecutive overlapping fringes are observed corresponding to wavelength  $6.1 \times 10^{-7}$  m. The refractive index for soap solution is  $4/3$ . Calculate the thickness of the film.  
(d) The indices of refraction of quartz for right handed and left handed circularly polarized light of wavelength  $6500 \text{ \AA}$  travelling in the direction of optical axis have the following values :

$$\mu_R = 1.53914 \text{ and } \mu_L = 1.53910.$$

Calculate the rotation of plane of polarization of light in degrees produced by a plate 0.2 mm thick.

- (e) If the fractional difference between core and cladding refractive indices of a fiber is 0.0135 and NA is 0.2425, calculate the refractive indices of core and cladding materials.

### Section-C

Attempt *all* questions of this Section. Each question carries 5 marks.  $5 \times 5 = 25$

3. Attempt any one part :  $5 \times 1 = 5$
- (a) Derive the expression of time dilation. Show that time dilation is real effect.
- (b) Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate.
4. Attempt any one part :  $5 \times 1 = 5$
- (a) What is the effect of thin mica sheet, when it is introduced in the path of one interfering ray?
- (b) What do you understand by missing order spectrum? What particular spectra would be absent if the width of the transparencies and opacities of the grating are equal.

Show that only first order is possible if the width of grating element is more than wavelength of light and less than twice the wavelength of light.

5. Attempt any one part :  $5 \times 1 = 5$

(a) Find the expression of diameter of Newton's ring due curved surfaces in case of reflected light.

(b) Discuss Fraunhofer diffraction pattern due to a single slit. Find the expressions for the width of central maxima.

6. Attempt any one part :  $5 \times 1 = 5$

(a) What is polarized light? How will you produce and detect plane, elliptically and circularly polarized lights.

(b) What are Einstein's coefficients A and B? Establish a relation between them.

7. Attempt any one part :  $5 \times 1 = 5$

(a) Derive the expression of acceptance angle, acceptance cone and numerical aperture.

(b) Discuss the construction and reconstruction of image of a hologram.

**Physical Constants :**

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

Velocity of light in free space .