

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

PAPER ID : 9602

Roll No.

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B. Tech.

(SEM. I) ODD SEMESTER THEORY

EXAMINATION 2010-11

ENGG. PHYSICS—I

Time : 2 Hours

Total Marks : 50

SECTION—A1. Attempt **all** parts. All parts carry **equal** marks. $(1 \times 10 = 10)$

(a) Two photons approach each other, their relative velocity is :

(i) zero

(ii) c (iii) $2c$ (iv) $c/2$

(b) Which of the following is invariant under Galilean transformation ?

(i) velocity

(ii) acceleration

(iii) speed

(iv) none of these

(c) A path difference of $3\lambda/2$ between the two waves corresponds to the phase difference :(i) $3\pi/2$ (ii) $\pi/3$ (iii) 3π (iv) $2\pi/3$

(d) In a biprism experiment 5 mm wide fringes are obtained on a screen 1.0 m away from the coherent sources by using light of wavelength 5000 Å. The separation between two coherent sources is :

(i) 1.0 mm

(ii) 0.1 mm

(iii) 0.01 mm

(iv) 0.05 mm

- (e) Which of the following does not change on the refraction of light ?
- (i) wavelength
 - (ii) frequency
 - (iii) velocity
 - (iv) intensity
- (f) If first secondary maximum of wavelength $4600 \text{ \AA}$ falls on the first minimum of some wavelength λ in single slit diffraction pattern, the wavelength λ is :
- (i) $6900 \text{ \AA}$
 - (ii) $2300 \text{ \AA}$
 - (iii) $4600 \text{ \AA}$
 - (iv) $4900 \text{ \AA}$
- (g) Wave that cannot be polarized is :
- (i) electromagnetic wave
 - (ii) matter waves
 - (iii) longitudinal wave
 - (iv) transverse wave
- (h) If N_1 and N_2 are the numbers of atoms in ground state and excited state respectively, then in population inversion :
- (i) $N_1 < N_2$
 - (ii) $N_1 > N_2$
 - (iii) $N_1 = N_2$
 - (iv) None of these
- (i) Light get attenuated in an optical fiber due to :
- (i) scattering
 - (ii) micro bending
 - (iii) absorption
 - (iv) all the above
- (j) If the hologram is broken into pieces, then :
- (i) there is irreparable loss of information
 - (ii) entire image of the object is lost
 - (iii) each piece is capable of reconstructing the entire image
 - (iv) none of these

SECTION—B

2. Attempt any **three** parts. All parts carry **equal** marks.

(5×3=15)

- (a) Calculate the length and orientation of a rod of length 5 m in a frame of reference moving with a velocity of $0.6c$ in the direction making an angle 30° with the rod.
- (b) Two plane glass surfaces in contact along one edge are separated at the opposite edge by a thin wire. If 20 interference fringes are observed between these edges, in sodium light of wavelength $\lambda = 5890 \text{ \AA}$ of normal incidence, find the diameter of the wire.
- (c) Find the angular separation of $5048 \text{ \AA}$ and $5016 \text{ \AA}$ wavelengths in second order spectrum obtained by a plane diffraction grating having 15000 lines per inch.
- (d) Find the thickness of a quarter wave plate for the wavelength of light of $5890 \text{ \AA}$. The refractive indices for ordinary and extraordinary rays are 1.55 and 1.54 respectively.
- (e) A step index fiber has core and cladding refractive indices 1.466 and 1.460 respectively. If the wavelength of light $0.85 \mu\text{m}$ is propagated through the fiber of core diameter $50 \mu\text{m}$, find the normalized frequency and the number of mode supported by the fiber.

SECTION—C

Note :—Attempt **all** questions of this section. All questions carry **equal** marks.

3. Attempt any **one** part of the following :

(1×5=5)

- (a) Show that no signal can travel faster than the velocity of light.
- (b) Show that the relativistic invariance of the law of conservation of momentum leads to the concept of variation of mass with velocity.

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

- (a) What are coherent sources ? State the essential conditions for observing the phenomenon of interference of light.
- (b) Explain briefly how the Fraunhofer diffraction pattern is modified when single slit is replaced by a double slit arrangement. (Derivation is not required)

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

- (a) Explain the formation of interference fringes by means of a Fresnel's biprism and derive the expression for the wavelength.
- (b) What do you understand by dispersive power of grating ? Show that the dispersive power of grating can be expressed

$$\text{as } \frac{1}{\sqrt{\left(\frac{e+d}{n}\right)^2 - \lambda^2}} \text{ where all terms have their usual meanings.}$$

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

- (a) Describe the construction and working of a biquartz polarimeter.
- (b) Explain the spontaneous and stimulated emission of radiation. Why is spontaneous radiation incoherent ?

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

- (a) What do you understand by attenuation in optical fiber ? Discuss the important factors responsible for the loss of power in optical fiber.
- (b) Explain the principle of holography using construction and reconstruction of images.