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 as $\frac{1}{\sqrt{\left(\frac{e+d}{n}\right)^2 - \lambda^2}}$ 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.

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B. Tech.

(SEM. I) ODD SEMESTER THEORY EXAMINATION 2010-11

ENGG. PHYSICS—I

Time : 2 Hours *Total Marks : 50*

SECTION—A

1. Attempt **all** parts. All parts carry **equal** marks. **(1×10=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 Å falls on the first minimum of some wavelength λ in single slit diffraction pattern, the wavelength λ is :

(i) 6900 Å (ii) 2300 Å

(iii) 4600 Å (iv) 4900 Å

(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 $\lambda = 5890$ Å of normal incidence, find the diameter of the wire.

(c) Find the angular separation of 5048 Å and 5016 Å 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 Å. 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 μm is propagated through the fiber of core diameter 50 μm, 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.