

**B. TECH.**  
**(SEM I) THEORY EXAMINATION 2022-23**  
**PHYSICS**

**Time: 3 Hours****Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

- (a) What are the negative results of the Michelson-Morley experiment?
- (b) What are the massless particles?
- (c) What do you understand by displacement current?
- (d) Define the Poynting vector.
- (e) What do you understand by a black body?
- (f) State Wein's displacement law.
- (g) What are the coherent sources?
- (h) What is Rayleigh's criterion of resolution?
- (i) Define population inversion.
- (j) What is the dispersion in optical fibers?

**SECTION B****2. Attempt any three of the following: 10x3=30**

- (a) Show that momentum of a particle (p) of rest mass ( $m_0$ ) and energy (E) is given by  $E^2 = m_0^2 c^4 + p^2 c^2$ .
- (b) If the magnitude of H in a plane wave is 1 amp/meter, find the magnitude of E for a plane wave in free space. (Where  $\mu_0 = 4\pi \times 10^{-7}$  Weber/amp-m and  $\epsilon_0 = 8.85 \times 10^{-12}$  C/N-m<sup>2</sup>).
- (c) Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to 1/20<sup>th</sup> of the velocity of light.
- (d) Calculate the wavelength of light whose first diffraction maximum in the diffraction pattern due to a single slit falls at 30° and coincides with the first minimum of red light of wavelength 6500Å.
- (e) Calculate the numerical aperture, acceptance angle, and critical angle of the fiber from the following data:  $\mu_1$  (core refractive index) = 1.50 and  $\mu_2$  (cladding refractive index) = 1.45.

**SECTION C****3. Attempt any one part of the following: 10x1=10**

- (a) Derive the Lorentz Transformation equations and show that Lorentz Transformation approaches to Galilean Transformation when the velocity (v)  $\ll$  c.
- (b) Derive a suitable expression for time dilation and show that time dilation is a real effect.

**4. Attempt any *one* part of the following: 10x1=10**

- (a) Derive the expression for the Poynting theorem in electromagnetic waves.
- (b) Show that electromagnetic waves are transverse in nature.

**5. Attempt any *one* part of the following: 10x1=10**

- (a) Derive the time-independent Schrodinger equation, for matter waves.
- (b) Derive a suitable expression for Planck's radiation law.

**6. Attempt any *one* part of the following: 10x1=10**

- (a) What are Newton's rings? How they are formed? Derive the expressions for the diameter of bright and dark rings in reflected monochromatic light.
- (b) Derive the conditions of principal maxima and minima for the diffraction due to a grating.

**7. Attempt any *one* part of the following: 10x1=10**

- (a) What is an optical fiber? Derive the expression for the numerical aperture, acceptance angle, and critical angle of an optical fiber.
- (b) Discuss the construction and working of the He-Ne laser and give its advantages over the Ruby laser.

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