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**B. TECH**  
**(SEM I) THEORY EXAMINATION 2018-19**  
**ENGINEERING PHYSICS-I**

**Time: 3 Hours****Total Marks: 70****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION-A****1. Attempt all questions in brief.****2 x 7 = 14**

- a. Is earth an inertial frame of reference?
- b. Discuss the properties of matter waves.
- c. Write the characteristics of a wave function.
- d. Why the center of Newton's ring pattern is dark?
- e. Define optic axis of uniaxial crystal.
- f. What do you mean missing order in diffraction pattern?
- g. What do you understand by attenuation in optical fibre?

**SECTION-B****2. Attempt any three of the following:****7×3 = 21**

- a. Show that for non relativistic speed the relativistic kinetic energy formula reduce to classical formula. If the kinetic energy of a body is twice its rest mass energy, find its velocity.
- b. State and explain Heisenberg's uncertainty principle. An electron has a speed of  $1.05 \times 10^4$  m/s within the accuracy of 0.01%. Calculate the uncertainty in the position of the electron.
- c. Discuss the phenomenon of diffraction at a single slit and show that intensities of successive maxima are  $1: \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2}$
- d. Explain the phenomenon of double refraction in uniaxial crystals. Give the construction and theory of quarter wave plate. Find the thickness of quarter and half wave plate for the wave length of light  $5890 \text{ \AA}$  and  $\mu_o = 1.55\mu_E = 1.54$ .
- e. Define acceptance angle numerical aperture in optical fibre. Find an expression for acceptance angle.  
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  $50 \mu\text{m}$ , then find the normalized frequency and the number of mode supported by the fiber.

**SECTION- C****3. Attempt any one part of the following:****7 x 1 = 7**

- a) What was the objective of conducting the Michelson-Morley experiment? Describe the experiment.  
How is the negative result of the experiment interpreted?
- b) Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate.

**4. Attempt any one part of the following:****7 x 1 = 7**

- a) Derive Planck's radiation law. Show that Planck's formula for the energy distribution in a thermal spectrum is applicable for all wavelengths.
- b) What is Schrodinger wave function? Derive Schrodinger time dependent wave equation.

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

**7 x 1 = 7**

- a) Explain the formation of Newton's ring? In Newton's experiment the diameter of 4<sup>th</sup> and 12<sup>th</sup> dark rings are 0.400 cm and 0.700 cm respectively, deducing the diameter of 25<sup>th</sup> dark ring?
- b) What do you mean by resolving power of an optical instrument? What is Rayleigh's criterion of resolution? Find the minimum number of lines in plane diffraction grating required to just resolve the sodium doublet (5890 Å and 5896 Å) in second order.

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

**7 x 1 = 7**

- a) What do you mean by plane polarized, circularly polarized and elliptically polarized light? Show that plane and circularly polarized light is the special case of elliptically polarized light.
- b) What is Laser? Discuss the construction and working of a Ruby laser. Compare this with He-Ne Laser.

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

**7 x 1 = 7**

- a) What do you understand by modes of an optical fibre? Discuss propagation of light in single mode, multimode and graded index fibre.
- b) Explain the principle of holography. Describe the construction and reconstruction of image on hologram.

**Physical Constants**

Rest mass of electron	$m_o$	$= 9.1 \times 10^{-31} \text{ kg}$
Rest mass of Proton	$m_p$	$= 1.67 \times 10^{-27} \text{ kg}$
Speed of light	$c$	$= 3 \times 10^8 \text{ m/s}$
Planck Constant	$h$	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	$e$	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann Constant	$k$	$= 1.38 \times 10^{-23} \text{ J K}^{-1}$