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BTECH
(SEM I) THEORY EXAMINATION 2021-22
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.	Differentiate between inertial and non-inertial frames of reference.
b.	Why is a wave packet considered to be associated with a moving particle rather than a single wave train?
c.	Two independent sources of light cannot produce sustainable interference, why?
d.	Define Rayleigh's criterion of resolution.
e.	Define specific rotation.
f.	Differentiate between spontaneous and stimulated emission.
g.	Differentiate between laser light and ordinary light.

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

a.	Show that $x^2 + y^2 + z^2 - c^2t^2$ remains invariant under Lorentz transformations.
b.	Calculate the energy difference between the ground state and first excited state for an electron in a one dimensional rigid box of length 10^{-8} cm. (mass of electron $=9.1 \times 10^{-31}$ kg and $h= 6.626 \times 10^{-34}$ Joule-sec)
c.	White light is incident on a soap film at an angle $\sin^{-1} \frac{4}{5}$ and the reflected light is observed with a spectroscope. It is found that two consecutive dark bands correspond to wavelength 6.1×10^{-5} and 6.1×10^{-5} cm. If the refractive index of the film is $\frac{4}{3}$, calculate its thickness.
d.	Calculate the thickness of a calcite plate which would convert the plane polarized light into circularly polarized light. The principal refractive indices are $\mu_o=1.65$; $\mu_e=1.486$ and the wavelength of light is 5890\AA .
e.	A communication system uses a 10 km long fibre having a loss of 2.5 dB/km. Compute the output power if the input power is $500 \mu\text{W}$.

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

(a)	Derive the expression for time dilation? With the help of an experimental evidence show that time dilation is a real effect.
(b)	Derive Einstein's mass-energy relation and show that relativistic kinetic energy of a particle is given by: $k = (m - m_0)c^2 = m_0c^2 \left[\left(1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}} - 1 \right]$



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

(a)	Derive time dependent and time independent Schrodinger wave equation.
(b)	Using Heisenberg's uncertainty principle show that electron cannot exist inside the nucleus.

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

(a)	Describe the formation of Newton's rings in monochromatic light. Show that in reflected light, the diameters of bright rings are proportional to the square root of odd natural numbers.
(b)	Discuss intensity distribution due to Fraunhofer diffraction at a single slit and show that the relative intensities of successive maximum are nearly $1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} : \dots$

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

(a)	What are doubly refracting crystals? Explain the construction and working of a Nicol prism.
(b)	Explain the construction and working of He-Ne laser? Why is He-Ne laser better than Ruby laser?

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

(a)	Explain the terms acceptance angle, acceptance cone and numerical aperture. Derive expressions for acceptance angle and numerical aperture.
(b)	Describe construction and reconstruction of a Hologram? Mention two applications of Holography.