



**BTECH**  
**(SEM I) THEORY EXAMINATION 2023-24**  
**PHYSICS**

**TIME: 3HRS****M.MARKS: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.**

Qno.	Question	Marks
a.	Write down the postulates of special theory of relativity.	2
b.	How mass of a body varies with velocity?	2
c.	Write Maxwell's Equation in differential form.	2
d.	State equation of continuity.	2
e.	What is de-Broglie hypothesis?	2
f.	What is Blackbody radiation?	2
g.	Why two independent sources cannot be coherent?	2
h.	What do you understand by the resolving power of an optical instrument?	2
i.	Describe the basic principle of an optical fiber communication.	2
j.	Define population inversion.	2

**SECTION B****2. Attempt any three of the following:**

a.	Derive Lorentz transformation equations for space and time.	10
b.	Explain the concept of displacement current and show that how it led to the modification of Ampere's law.	10
c.	Find the energy of an electron moving in one dimension in an infinitely high potential box of width 1Å (mass of electron is $9.11 \times 10^{-31}$ Kg and $h = 6.63 \times 10^{-34}$ J-s).	10
d.	Explain the phenomenon of interference in thin films due to reflected light.	10
e.	Calculate the numerical aperture, acceptance angle of the fiber from the following data: Refractive index of core ( $n_1$ ) = 1.50 and refractive index of cladding ( $n_2$ ) = 1.45.	10

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

a.	Derive Einstein's mass-energy relation. If the total energy of a particle is exactly thrice its rest energy, what is the velocity of the particle?	10
b.	Deduce necessary expression for time-dilation. Show that time-dilation is a real effect.	10

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

a.	Derive the wave equations for electric and magnetic field for free space and show that the electromagnetic waves travel in free space with velocity of light.	10
b.	State and deduce Poynting theorem for the flow of energy in an electromagnetic field. If the magnitude of H in a plane wave is 1 amp/meter, find the magnitude of E for plane wave in free space.	10

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

a.	What is the physical significance of a wave function? Derive time dependent Schrodinger wave equation	10
b.	What is Compton effect? Derive an expression for Compton shift.	10

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

a.	Derive an expression for the dark and the bright rings diameter observed in Newton's ring experiment. How can this experiment be used to find out the wavelength of unknown light?	10
b.	Derive an expression for intensity distribution due to Fraunhofer's diffraction at a single slit. Show that the intensity of first subsidiary maximum is about 4.5 % of that of the principal maximum.	10

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

a.	Explain acceptance angle and acceptance cone of an optical fiber. What do you mean by Numerical aperture? Derive expressions for them.	10
b.	Describe the principle and working of Ruby laser system with the help of neat diagram.	10