B. TECH
(SEM-I) THEORY EXAMINATION 2019-20
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.   Why cannot two independent sources of light produce interference?
   d.   Define resolving power of an optical instrument.
   e.   Define specific rotation.
   f.   Differentiate between spontaneous and stimulated emission.
   g.   State the characteristics of laser 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 $=9.1\times10^{-31}$ kg and h= 6.626×10^{-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 6.0×10^{-5}cm. If the refractive index of the film be 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 5890Å.
   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 µW.

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: $k=(m-m_0)c^2 =m_0c^2\left[\left(1-\dfrac{v^2}{c^2}\right)^{-\frac{1}{2}}-1\right]$

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 dark rings are proportional to the square roots of natural numbers.

   (b)   Discuss the phenomenon of Fraunhoffer diffraction at a single slit.

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 Ruby laser? Discuss two important applications of 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? Write two applications of Holography.

Physical Constants:

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