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**BTECH**  
**(SEM I) THEORY EXAMINATION 2021-22**  
**ENGINEERING PHYSICS**

Time: 3 Hours

Total Marks: 100

**Note:** Attempt all the sections. If require any missing data, then choose suitably.

**Section A**

1. Attempt all questions in brief: 2 x 10 = 20

Q.N.	Question	Marks	CO
a.	Differentiate between inertial and non- inertial frames.	2	1
b.	Show that the rest mass of a photon is zero.	2	1
c.	Write the similarities and dissimilarities between conduction and displacement current.	2	2
d.	Define the Poynting vector and write its unit.	2	2
e.	State the Wien's displacement law.	2	3
f.	Distinguish between modified and unmodified x-rays.	2	3
g.	The light rays from two independent bulbs do not show interference. Give the reason.	2	4
h.	State the Rayleigh criteria of resolution.	2	4
i.	What is an optical fibre? How does a light signal propagate through it?	2	5
j.	Write the essential requirements for the laser action.	2	5

**Section B**

2. Attempt any three of the following:

3 x 10 = 30

Q.N.	Question	Marks	CO
a.	Show that $E^2 = p^2c^2 + m_0^2c^4$	10	1
b.	Find the skin depth $\delta$ at a frequency of $3.0 \times 10^6$ Hz in aluminium where $\sigma = 38.0 \times 10^6$ S/m and $\mu_r = 1$ .	10	2
c.	An electron is bound in one dimensional potential box which has width $2.5 \times 10^{-10}$ m. Assuming the height of the box to be infinite, calculate the lowest permitted energy values of the electron.	10	3
d.	White light is incident on a soap film at an angle $\sin^{-1}(4/5)$ and the reflected light is observed with a spectroscope. It is found that two consecutive dark bands correspond to wavelengths $6.1 \times 10^{-5}$ cm and $6.0 \times 10^{-5}$ cm. If the refractive index of the film is $4/3$ , calculate the thickness.	10	4
e.	A communication system uses a 10 km fiber having a loss of 2.5 dB/km. Compute the output power if the input power is $500 \mu$ W.	10	5



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**Section C**

3. Attempt any one of the following:

1 x 10 = 10

Q.N.	Question	Marks	CO
a.	State the postulates of special theory of relativity and derive the Lorentz transformation equations. When Lorentz transformation equations get reduced to Galilean transformation equations?	10	1
b.	State and prove the velocity addition theorem. Show that the theorem is consistent with the Einstein's second postulate.	10	1

4. Attempt any one of the following:

1 x 10 = 10

Q.N.	Question	Marks	CO
a.	Establish the e-m waves' equations in free space and solve them to show that they travel with the speed of light in free space and are transverse in nature.	10	2
b.	State and prove the Poynting theorem. Show that $E/H = 377 \text{ Ohm}$ .	10	2

5. Attempt any one of the following:

1 x 10 = 10

Q.N.	Question	Marks	CO
a.	What is the Planck's theory of black body radiations? Obtain an expression for the average energy of the oscillators and derive the Planck's radiation law.	10	3
b.	Write the Schrodinger's wave equation for a particle in one-dimensional box and solve it to obtain the eigen values and eigen functions.	10	3

6. Attempt any one of the following:

1 x 10 = 10

Q.N.	Question	Marks	CO
a.	What do you mean by a wedge-shaped film? Discuss the interference due to it and obtain the expression for the fringe width.	10	4
b.	Discuss the formation of Newton's rings. Show that the diameters of the bright rings are proportional to the square root of odd natural numbers.	10	4

7. Attempt any one of the following:

1 x 10 = 10

Q.N.	Question	Marks	CO
a.	What do you mean by acceptance angle and numerical aperture? Derive the expressions for acceptance angle and numerical aperture.	10	5
b.	What do you understand by the stimulated emission? Discuss the He-Ne laser by giving its construction and working. How He-Ne laser is superior to the Ruby laser?	10	5

**Physical Constants:**Rest mass of electron  $m_0 = 9.1 \times 10^{-31} \text{ kg}$ , Speed of light  $c = 3 \times 10^8 \text{ m/s}$ Planck 's Constant  $h = 6.63 \times 10^{-34} \text{ J-s}$ , Charge on electron  $e = 1.6 \times 10^{-19} \text{ Coulomb}$