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**B. TECH.**  
**(SEM 1) THEORY EXAMINATION 2020-21**  
**ENGINEERING PHYSICS**

**Time: 3 Hours****Total Marks: 100****Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

| Qno. | Question   | Marks | CO |
|------|--|-------|----|
| a.   | State Einstein's postulates of Special Theory of Relativity.                         | 2     | 1  |
| b.   | Find the momentum of a photon having energy $1.00 \times 10^{-17}$ J.                | 2     | 1  |
| c.   | What is Displacement Current?  | 2     | 2  |
| d.   | Show that magnetic monopoles do not exist.   | 2     | 2  |
| e.   | State Wien's displacement law and Rayleigh-Jeans law.                                | 2     | 3  |
| f.   | Why are matter waves associated with a particle generated only when it is in motion? | 2     | 3  |
| g.   | Two independent sources of light cannot produce interference, why?                   | 2     | 4  |
| h.   | State Rayleigh criterion of Resolution. Also define resolving power.                 | 2     | 4  |
| i.   | Differentiate between spontaneous and stimulated emission.                           | 2     | 5  |
| j.   | With the help of a well-labelled diagram, name the components of an optical fibre.   | 2     | 5  |

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

| Qno. | Question   | Marks | CO |
|------|--|-------|----|
| a.   | Show that space-time interval between two events remains invariant under Lorentz transformations.  | 10    | 1  |
| b.   | Find the conduction current density and displacement current density for a solid with conductivity, $\sigma = 10^{-3}$ S/m and $\epsilon_r = 2.5$ . Electric field intensity, $E = 4.5 \times 10^{-6} \sin(10^9 t)$ .                  | 10    | 2  |
| c.   | Find the two lowest permissible energy states for an electron which is confined in a one dimensional infinite potential box of width $3.5 \times 10^{-9}$ m.   | 10    | 3  |
| d.   | Calculate the thickness of a soap bubble thin film that will result in constructive interference in reflected light. The film is illuminated with light of wavelength $5000 \text{ \AA}$ and the refractive index of the film is 1.45. | 10    | 4  |
| e.   | What do you understand by attenuation and dispersion in an optical fibre. A communication system uses a 25 km long fibre having a loss of 2.5 dB/km. The input power is 2500 $\mu$ W, compute the output power.                        | 10    | 5  |

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

| Qno. | Question   | Marks | CO |
|------|--|-------|----|
| a.   | What do you mean by time dilation? Explain with the help of a mathematical proof. Justify with an experimental evidence to show that time dilation is a real effect. | 10    | 1  |



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|----|---|----|---|
| b. | Derive Einstein's mass-energy relation and show that relativistic kinetic energy of a particle is given by:<br>$k = (m - m_0)c^2 = m_0c^2 \left[ \left( 1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}} - 1 \right]$ | 10 | 1 |
|----|---|----|---|

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

| Qno. | Question  | Marks | CO |
|------|---|-------|----|
| a.   | Write Maxwell's equations in free space. Also show that the electric and magnetic vectors are normal to the direction of propagation of the electromagnetic wave. | 10    | 2  |
| b.   | State and deduce Poynting theorem for the flow of energy in an electromagnetic field. Discuss the physical significance of Poynting theorem.                      | 10    | 2  |

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

| Qno. | Question  | Marks | CO |
|------|---|-------|----|
| a.   | What is wave function? Derive time independent Schrodinger wave equation. | 10    | 3  |
| b.   | What is Compton effect? Derive an expression for Compton shift.           | 10    | 3  |

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

| Qno. | Question  | Marks | CO |
|------|---|-------|----|
| 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. | 10    | 4  |
| b.   | What is a diffraction grating? Discuss the phenomenon of diffraction due to plane diffraction grating.  | 10    | 4  |

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

| Qno. | Question   | Marks | CO |
|------|--|-------|----|
| a.   | Illustrate the construction and working of He-Ne laser? Discuss important applications of laser. | 10    | 5  |
| b.   | Derive expressions for acceptance angle and numerical aperture.                                  | 10    | 5  |