Roll No:

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 1.00×10^{-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/mand $\varepsilon_r = 2.5$. Electric field intensity, $E = 4.5\times10^{-6}$ 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 3.5×10^{-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 Å 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 μW, compute the output power.	10	5

SECTION C

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

Qno.	Question	Marks	CO

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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

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