Paper ID : 260768

Subject Code:BAS201

Roll No:													

BTECH
(SEM. II) THEORY EXAMINATION 2025-26
ENGINEERING PHYSICS

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. 02 x 7 = 14

Q no.	Question	CO	Level
a.	A 100 KeV X-ray photon strikes a heavy substance. Calculate the energy of photon, Compton scattered through an angle of 90°?	CO-1	K1
b.	Distinguish between conduction current and displacement current.	CO-2	K1
c.	Explain Rayleigh's criterion of resolution.	CO-3	K1
d.	In an optical fibre, the core material has refractive index 1.6 and refractive index of clad material is 1.3. What is the value of critical angle?	CO-4	K1
e.	Sketch the temperature dependence of resistivity for a superconducting material.	CO-5	K1
f.	Write physical interpretation of wave function.	CO-1	K1
g.	Find the unit vector normal to the given surface $xy^3z^2 = 10$ at a point (-1, -1, 2).	CO-2	K1

SECTION B

2. Attempt any *three* of the following: 07 x 3 = 21

Q no.	Question	CO	Level
a.	Consider a particle trapped in an infinite potential box of width a, $V(x) = \begin{cases} 0, & 0 < x < a \\ \infty, & otherwise \end{cases}$ Write the Schrodinger equation for this particle and hence get the expressions for the energy eigen values and energy eigen functions for the particle. Draw its first four energy eigen functions.	CO-1	K3
b.	Drive the wave equation for propagation of electric field $\vec{E}$ and magnetic field $\vec{B}$ in vacuum.	CO-2	K3
c.	Explain the resolving power of grating. Derive expression for resolving power of grating.	CO-3	K3
d.	What is optical fibre? Discuss the principle behind the transmission of light in an optical fibre. Also describe (i) step index fibre, (ii) graded index fibre.	CO-4	K3
e.	Differentiate between a quantum dot and quantum nanoparticles. How properties of nanomaterials are different from their bulk counterpart. Write any four fascinating applications of nanomaterials.	CO-5	K3

SECTION C

3. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	If $\Psi(x)$ represents wave function of a particle, discuss the physical reason why both, the wave function $\Psi(x)$ and its derivative $\frac{\partial \Psi}{\partial x}$, must have to be finite and continuous.	CO-1	K3
b.	A particle is trapped in one-dimensional box of width L. Calculate the expectation value $\langle p_x \rangle$. Discuss the significance of your result. Find the momentum eigenvalues and momentum eigenfunctions for the particle.	CO-1	K3

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4. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Starting from Maxwell's equations, derive equation of continuity $div\, \boldsymbol{J} + \frac{\partial \rho}{\partial t} = 0$. Discuss the physical significance of displacement current and its limitations.	CO-2	K3
b.	State and derive the Poynting theorem starting from Maxwell's equations. Explain the physical significance of each term in the theorem.	CO-2	K3

5. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	What are the coherent sources? Also explain the phenomenon of Newton's Rings. Calculate the thickness of a soap film (μ=1.33) that gives constructive second interference of reflected red colour (λ=700 nm) incident in the form of a parallel beam a 30° with the normal.	CO-3	K3
b.	What is diffraction? Explain types of diffraction bands produced in Fraunhofer diffraction at a single slit and show that the relative intensities of the successive maxima are $1:\frac{4}{9\pi^2}:\frac{4}{25\pi^2}:\frac{4}{49\pi^2}:\ldots\ldots$	CO-3	K3

6. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Explain the following: (i) Spontaneous and stimulated emission of radiation (ii) Population inversion (iii) He-Ne laser.	CO-4	K3
b.	Describe the different types of optical fibres on the basis of refractive index profile. Derive an expression for the numerical aperture of a step-index fibre in terms of the refractive index of the core and the refractive index difference between the core and cladding	CO-4	K3

7. Attempt any *one* part of the following: **07 x 1 = 07**

Q no.	Question	CO	Level
a.	Why does superconductivity disappear above the critical temperature despite the presence of charge carriers? A material shows a resistivity of 2μΩ·cm at 20 K and zero resistivity below 4 K. Identify the critical temperature and explain the phase transition.	CO-5	K3
b.	What are Quantum Wires and Quantum Wells? Explain their structure, properties, and applications. Also compare Top-Down and Bottom-Up approaches for fabrication of nanomaterials with suitable examples.	CO-5	K3