(Please write your Enrollment Number) Enrollment No. 04401032024

End-Term Examination
(CBCS)(SUBJECTIVE TYPE)(OffLine)
Course Name:<B Tech >, Semester:<I>, Batch <2024>
(December, 2024)

Subject Code: BAS 102	Subject: Applied Physics
Time :3 Hours	Maximum Marks :60

Constants: Planck's constant=6.626×10^{-34} m^2 kg / s, Mass of proton= 1.67×10^{-27} Kg, Mass of electron= 1.6×10^{-31} Kg

Note: Q1 is compulsory. Attempt one question each from the Units I, II, III & IV.

Q1		(2.5*8=20)	CO Mapping
a	For a plane transmission grating with 5000 lines/cm, find the absent order spectra if the width of the opacity is twice that of the transparency?		CO1
b	A parallel beam of monochromatic light is normally incident on a plane transmission grating having 12,000 lines per cm. The second order spectral line is observed at an angle 45°. Find the wavelength of light used?		CO1
c	Describe the properties and physical significance of Displacement current vector.		CO2
d	Visible light of frequency $\omega \approx 10^{15}\ s^{-1}$ is made to shine on a metal having conductivity $\sigma \approx 10^7\ S\ m^{-1}$. Assuming $\mu \approx \mu_0$ for the metal, find the depth at which the current density of incident light would drop down to 37% of its value at the metal surface.		CO2
e	Plot the first three quantum states, $\psi_n(x)$ and the corresponding probability density distribution functions $\lvert\psi_n(x)\rvert^2$ for a quantum particle trapped in a 1-D box for principal quantum numbers n=1and 2.		CO3
f	Calculate de Broglie wavelength (in Å) of a proton whose kinetic energy is 2.0 MeV.		CO3
g	A laser light with wavelength 770 nm has coherence length 10.2×10^{-4}m. Find the number of oscillations corresponding to the coherence length and the coherence time.		CO4
b	An optical signal at specific wavelength has a loss of 55% of its power after travelling 3.5 Km. Calculate the attenuation in db/km in this fiber.		CO4
	UNIT I		CO Mapping
Q2a	Derive Fresnel's Diffraction at a straight edge for a line source. Show the graphical representation of the diffraction pattern in the illuminated and the geometrical shadow regions.	(5)	CO1
b	Obtain the condition of bright fringes when interference of light occurs by reflected ray in a parallel thin film. Why the reflected and transmitted fringes are complementary to each other?	(5)	CO1
Q3a	Derive the intensity distribution for a single slit Fraunhoffer Diffraction. Show that the relative intensities of first two successive maximas are in the ratio 1: $4/9\pi^2$: $4/25\ \pi^2$ and so on. Show a plot of the diffraction pattern.	(7)	CO1

b	The sodium doublet lines have wavelengths 5890 Å and 5896 Å. Find the resolving power of the grating that can resolve the doublet in first order.	(3)	CO1
	UNIT II		**CO Mapping**
Q4 a	Write the four Maxwell's equations in integral form giving physical interpretation of each equation.	(6)	CO2
b	Two EM waves travel in opposite directions to form a standing wave. The electric and magnetic field vectors of the standing wave are given by $E_y(x, t) = 2E_o \cos(kx) \cos(\omega t)$ and $B_z(x, t) = 2B_o \sin(kx) \sin(\omega t)$. Calculate the time average of the Poynting vector of the resultant wave. What do we infer from the result?	(4)	CO2
Q5 a	Under what conditions does Ampere's circuital law fail? How did Maxwell modify Ampere's circuital law to account for these cases?	(5)	CO2
b	Derive the differential equations for propagation of electric and magnetic field vectors of an EM wave in an isotropic dielectric medium (ε,μ). Find the impedance offered by the dielectric medium and speed of light in the given medium.	(5)	CO2
	UNIT III		**CO Mapping**
Q6a	Describe the properties of wave function. Normalise the given Wave function : $\psi(x) = \begin{cases} A\sin(2x), -\pi \le x \le \pi \\ 0, \ elsewhere \end{cases}$	(5)	CO3
b	The position and momentum of a 1.0 keV electron are simultaneously measured. If the position is located within a 1 Å wave packet, what is the percentage of uncertainty in momentum?	(5)	CO3
Q7a	Derive the normalized wave function of an electron trapped in an infinite potential well and show that quantum mechanically such a particle acquires only discrete energy values.	(5)	CO3
b	An electron is constrained to move in a one dimensional box of Length(L) 0.1 nm. Find the first two energy Eigen values (in eV) and the corresponding de-Broglie wave lengths (in nm).	(5)	CO3
	UNIT IV		**CO Mapping**
Q8a	Establish a relationship between the Einstein's Coefficients for spontaneous and stimulated emissions in a LASER system.	(5)	CO4
b	Classify the multimode optical fibers on the basis of refractive index profile of the core, comparing the advantages/disadvantages of both.	(5)	CO4
Q9a	An optical fiber has the refractive index of the core and cladding as 1.545 and 1.495 respectively. Calculate its critical angle, numerical aperture and acceptance angle?	(5)	CO4
b	Explain the working of a He Ne Laser with its energy level diagram.	(5)	CO4