



SOMAIYA
VIDYAVIHAR UNIVERSITY

Semester: August 2022 – December 2022		
Maximum Marks: 100	Examination: ESE Examination	Duration: 3 Hrs.
Programme code: Q6	Class: F. Y. B. Tech	Semester: I (SVU 2020)
Programme: B. Tech.		
Name of the Constituent College: K. J. Somaiya College of Engineering		Name of the department: EXTC/IT/MECH/COMP/EXCP.
Course Code: 116U06C102	Name of the Course: Engineering Physics	
Instructions: 1) Draw neat diagrams 2) All questions are compulsory		
3) Assume suitable data wherever necessary.		
4) Values of the constants are given at the end of the Q. papers.		

Que. No.	Question	Max. Marks
Q1	Solve any Four	20
i)	Write Maxwell's equations in differential form and mention their physical significance.	5
ii)	State the scalar magnetometer. Explain how the Hall effect can be used for measurement of magnetic field.	5
iii)	Describe Davission -Germer experiment to verify De Broglie hypothesis	5
iv)	Obtain the expression for path difference between two reflected rays in thin transparent film.	5
v)	Show that for an intrinsic semiconductor, $E_F = (E_C + E_V)/2$ where symbols have their usual meaning.	5
vi)	Show that energy levels of a particle in one dimensional infinite potential well are quantized	5

Que. No.	Question	Max. Marks
Q 2 A	Solve the following	10
i)	A drop of oil of volume 0.2 cc is dropped on the surface of a tank water of area 1 sq. m. The film spreads uniformly over the whole surface. White light which is incident normally on the surface is observed through spectroscope. The spectrum is seen to contain one dark band whose centre has wavelength 5500 Å in air. Find the refractive index of the given oil.	5
ii)	Define – absorption, spontaneous emission, stimulated emission, metastable state, population inversion.	5
	OR	
Q 2 A	What is polarization. State and explain Malus Law. Calculate the Brewster angle for i) ethyl alcohol for which $\mu = 1.361$ and carbon tetra chloride for which $\mu = 1.461$.	10
Q 2 B	Solve any One	10
i)	Using Heisenberg's Uncertainty Principle, show that electron cannot exist within the nucleus. A position and momentum of 1 keV electron are simultaneously measured. If position is located within 10 nm then what is the percentage uncertainty in its momentum?	10
ii)	Derive one dimensional Time Dependent Schrodinger equation for matter waves. An electron is trapped in a one dimensional box of length 0.1 nm. Calculate the energy required to excite the electron from its ground state to the	10

	4 th excited state.	
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Que. No.	Question	Max. Marks
Q3	Solve any Two	20
i)	Derive the expression for numerical aperture for a step index optical fibre. Find the core radius necessary for single mode operation at 850 nm in step index fibre with $n_1 = 1.480$ and $n_2 = 1.47$. What is the numerical aperture and maximum acceptance angle of this fibre.	10
ii)	Define drift current, diffusion current and mobility of charge carriers. The resistivity of intrinsic InSb at room temperature is 2×10^{-4} ohm-cm. If the mobility of electron is $6 \text{ m}^2/\text{V-sec}$ and mobility of hole is $0.2 \text{ m}^2/\text{V-sec}$, calculate its intrinsic carrier density.	10
iii)	Explain the statement – “Magnetic monopoles does not exist” using Maxwell’s equation. State Gauss law for electric field and derive first Maxwell’s equation.	10

Que. No.	Question	Max. Marks
Q4	Solve any Two	20
i)	State magnetostriction, piezoelectric and inverse piezoelectric effect. Explain various cuts of the quartz crystal which can be used in piezoelectric oscillators.	10
ii)	What are types of radiations? Define "sievert". How it is related with SAR value of radiation. Describe construction and working of a Geiger-Muller counter	10
iii)	What is gradient of a scalar field? What is its significance?. Find the curl and divergence of the vector function $F = (x+y)\mathbf{i} + (x+z)\mathbf{j} + (y-z)\mathbf{k}$ and show that the vector field is conservative. (i, j and k are the unit vectors along X, Y and Z axis)	10

Que. No.	Question	Max. Marks
Q5	(Write notes / Short question type) on any four	20
i)	i) Why do we see different colours from a thin oil film spread on the water surface? ii) Why excessively thin films appear black?	5
ii)	State and explain Clausius-Mossotti equation.	5
iii)	Explain de Broglie hypothesis of matter waves and deduce the expression for wavelength. State any two properties of matter wave.	5
iv)	State Gauss law for electric field. Derive first Maxwell’s equation.	5
v)	Define and explain Seebeck and Peltier effect.	5
vi)	List five types tropisms, explain any one in brief. What is differential growth in the plants?	5

constants:

- i) Speed of light $c = 3 \times 10^8 \text{ m/sec}$.
 ii) Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$.
 iii) Elementary charge $= 1.6 \times 10^{-19} \text{ C}$.
 iv) Planck's constant $= 6.63 \times 10^{-34} \text{ Js}$.
 v) Avogadro's No $= 6.024 \times 10^{26} / \text{mole}$.
 vi) Boltzmann's constant $= 1.38 \times 10^{-23} \text{ J/K}$.
 vii) Mass of proton $= 1.67 \times 10^{-27} \text{ kg}$.