Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	2	P	H	Y	S	1	2

First Semester B.E. Degree Examinations, April/May 2023

PHYSICS FOR COMPUTER SCIENCE AND ENGINEERING STREAM-I

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Missing data, if any, may be suitably assumed
3. Physical Constants:
Planck's constant (h) = 6.625 × 10^{-34} J s, charge of electron (e) = 1.6 × 10^{-19} C, mass of electron (m) = 9.1 × 10^{-31} kg, Avogadro constant (N_A) = 6.022 × 10^{23} /mol, Boltzmann constant (k) = 1.38 × 10^{-23} J/K, velocity of light (c) = 3 × 10^{8}m/s

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		MODULE – 1		
1.	**a.**	Define group velocity and hence derive an expression for group velocity.	**08**	(3 : 1: 1.1.1)
	b.	Explain de-Broglie's hypothesis, de-Broglie's wavelength and deduce the de-Broglie's wavelength by analogy.	**08**	(2 : 1 : 1.1.1)
	c.	In a measurement of position and momentum, the inherent uncertainty involved in the determination of position of an electron is 5.25×10^{-9} m, then, find the minimum uncertainty in the determination of its momentum.	**04**	(3 : 1 : 2.1.3)
		OR		
2.	**a.**	Show that non-existence of electrons in the nucleus on the basis of beta-decay observations using Heisenberg uncertainty principle.	**08**	(3 : 1: 1.1.1)
	b.	Derive one dimensional time-independent Schrödinger wave equation.	**08**	(2 : 1 : 1.1.1)
	c.	The ground state energy of an electron in an infinite well is MeV 5.6, if the width of the well is doubled, find the ground state energy.	**04**	(3 : 1 : 2.1.3)
		MODULE – 2		
3.	**a.**	Derive the expression for Einstein's coefficients using induced, spontaneous and stimulated absorption phenomena.	**08**	(3 : 2 : 1.1.1)
	b.	Explain the construction and working of semiconductor laser.	**08**	(2 : 2 : 1.1.1)
	c.	The ratio of population of two energy levels is 1.059×10^{-30}, determine the wavelength of laser light emitted by spontaneous emission at 330K.	**04**	(3 : 2 : 2.1.3)
		OR		
4.	**a.**	Define acceptance angle, numerical aperture and derive the expression for numerical aperture.	**08**	(3 : 2 : 1.1.1)
	b.	Define attenuation in an optical fiber and hence derive an expression for attenuation.	**08**	(2 : 2 : 1.1.1)
	c.	The attenuation of light in an optical fiber is 2.6 dB/km. what fraction of its initial intensity remains after 1 km and 3 km.	**04**	(3 : 2 : 2.1.3)
		MODULE – 3		
5.	**a.**	Explain classical free electron theory. Hence derive an expression for the electrical conductivity of a metal in terms of collision time.	**08**	(2 : 3 : 1.1.1)
	b.	Explain the three failures of classical free electron theory.	**08**	(2 : 3 : 1.1.1)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

	c.	Find the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} ohm-m, if the metal has 5.8×10^{28} conduction electrons per $m^{3.}$	**04**	(3 : 3 : 2.1.3)
		OR		
6.	**a.**	Explain with a neat diagram for type I and type II superconductors with the temperature dependence of critical field.	**08**	(2 : 3 : 1.1.1)
	b.	Write a note on applications of superconductors in Maglev vehicle or SQUIDs.	**08**	(2 : 3 : 1.2.1)
	c.	A super conducting tin has critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at 0 K, Compute the critical field at 2 K.	**04**	(3 : 3 : 2.1.3)
		MODULE – 4		
7.	**a.**	Explain the motion and timing in animation.	**05**	(2 : 4 : 1.1.1)
	b.	Explain the terms the odd rule, Motion graphs, weight and strength.	**05**	(2 : 4 : 1.1.1)
	c.	Define dielectric constant and describe an experiment to determine dielectric constant using charging and discharging of capacitor.	**10**	(2 : 5 : 1.1.1)
		OR		
8.	**a.**	Describe descriptive statistics and inferential statistics in animation.	**05**	(2 : 4 : 1.1.1)
	b.	Explain normal distribution and bell curve.	**05**	(2 : 4 : 1.1.1)
	c.	Define resonant frequency and describe an experiment to determine resonant frequency and quality factor using LCR series and parallel circuits.	**10**	(2 : 5 : 1.1.1)
		MODULE – 5		
9.	**a.**	Explain single-particle quantum interference with neat diagram.	**05**	(2 : 4 : 1.1.1)
	b.	Explain quantum superposition and the concept of qubit.	**05**	(2 : 4 : 1.1.1)
	c.	Define amplification factor and describe an experiment to determine amplification factor along with input and output characteristics.	**10**	(2 : 5 : 1.1.1)
		OR		
10.	**a.**	Explain the principle and working of Quantum Not Gate.	**05**	(2 : 4 : 1.1.1)
	b.	Explain the CNOT gate and its operation on four different input states.	**05**	(2 : 4 : 1.1.1)
	c.	Define Fermi energy and describe an experiment to determine the Fermi energy of copper.	**10**	(2 : 5 : 1.1.1)

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