MAKE-UP EXAM

USN | | | | | | | | | |

BPHYS102/202

First/Second Semester B.E./B.Tech. Degree Examination, Nov./Dec. 2023
Applied Physics for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***VTU Formula Hand Book is permitted.***
3. ***M : Marks , L: Bloom's level , C: Course outcomes.***
4. ***Physical constants: Plank's constant, $h = 6.625 \times 10^{-34}$ J-S; Speed of light, $c = 3 \times 10^{8}\ ms^{-1}$; Mass of electron, $m = 9.1 \times 10^{-31}$ kg; Charge of electron, $e = 1.6 \times 10^{-19}$ C; Boltzmann constant, $k = 1.38 \times 10^{-23}\ JK^{-1}$; Acceleration due to gravity, $g = 9.8\ ms^{-2}$.***

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Obtain the expression for energy density of radiation under thermal equilibrium condition interms of Einstein's co-efficient.	**09**	**L2**	**CO1**
	b.	Explain the different types of optical fibers with suitable diagrams.	**06**	**L2**	**CO1**
	c.	An optical fiber of length 2 km has input power of 200 mW, which emerges out with power of 160 mW. Calculate the attenuation co-efficient of the fiber.	**05**	**L3**	**CO1**
		OR			
Q.2	**a.**	Describe the construction, principle and working of a semiconductor LASER with neat diagrams.	**07**	**L2**	**CO1**
	b.	Define numerical aperture and acceptance angle. Obtain an expression for numerical aperture interms of refractive indices of core, cladding and surrounding medium.	**08**	**L2**	**CO1**
	c.	In diffraction grating experiment the LASER light undergoes first order diffraction with diffracting angle 23.86°. The grating constant is $1.66 \times 10^{-6}\ m^{-1}$. Calculate the wavelength of LASER source.	**05**	**L3**	**CO5**
		Module – 2			
Q.3	**a.**	State Heisenberg's uncertainty principle. Using this principle, prove that the electron does not exists inside the nucleus.	**08**	**L2**	**CO2**
	b.	Set up one dimensional time-independent Schrodinger wave equation.	**08**	**L2**	**CO2**
	c.	An electron is bound in one dimensional infinite potential well of width 0.12 nm. Find the energy value and de-Broglie wavelength in first excited level.	**04**	**L3**	**CO2**
		OR			
Q.4	**a.**	State and explain de-Broglie's hypothesis and derive the expression for de-Broglie wavelength by analogy.	**06**	**L2**	**CO2**
	b.	Derive the expression for energy eigen functions and eigen values for a particle in one dimensional infinite potential well.	**10**	**L2**	**CO2**
	c.	Estimate the potential difference through which an electron is needed to be accelerated so that its de-Broglie wavelength becomes equal to 20 $\mathring{A}$.	**04**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Define single and two qubits. Explain the block sphere representation of qubit.	**08**	**L2**	**CO2**
	b.	Explain the controlled NOT gate (CNOT gate) with four different input states with the truth table.	**08**	**L2**	**CO2**
	c.	Show that S - gate can be formed by connecting two T – gates in series.	**04**	**L3**	**CO2**
		OR			

Q.6	a.	Mention the Pauli's matrices. Discuss the operations of Pauli's matrices on $\| 0 >$ and $\| 1 >$ states.	10	L2	CO2
	b.	Explain the operations of phase gate [S – gate] with $\| 0 >$ and $\| 1 >$ states with truth table. Mention its matrix representation.	06	L2	CO2
	c.	A linear operator X operates such that $X \| 0 > = \| 1 >$ and $X \|1 > = \| 0 >$. Find the matrix representation of the operator X.	04	L3	CO2
Module – 4					
Q.7	a.	What is Meissner effect? Explain Type I [Soft] and Type II [Hard] super conductors.	08	L2	CO3
	b.	What is Fermi factor? Discuss the variation of Fermi factor with temperature and energy.	08	L2	CO3
	c.	Superconducting tin has a critical magnetic field of 0.0217 T at 2K. If the critical temperature for superconducting transition for tin is 3.7K, find the critical magnetic field at 3K.	04	L3	CO3
OR					
Q.8	a.	Define critical temperature and critical magnetic field. Explain briefly BCS theory of superconductivity.	08	L2	CO3
	b.	Enumerate the failures of classical free electron theory and mention the assumptions of quantum free electron theory.	08	L2	CO3
	c.	The Fermi level in potassium is 2.1 eV. What is the energy of the energy level for which the probability of occupation at 300 K is 0.98?	04	L3	CO3
Module – 5					
Q.9	a.	Explain the odd rule with odd rule multipliers with suitable examples.	08	L2	CO4
	b.	Explain Poisson distribution and probability mass function with example.	07	L2	CO4
	c.	In case of animating a jump, the push height is 0.5m and jump magnification is 5. Calculate the jump height and push acceleration.	05	L3	CO4
OR					
Q.10	a.	Discuss slow in and slow out with neat diagrams.	08	L2	CO4
	b.	Write a note on Monte-Carlo method and discuss the determination of the value of π using Monte-Carlo method.	07	L2	CO4
	c.	In an optical fiber experiment the LASER light propagating through optical made a spot diameter of 21 mm on the screen. When the distance between the end of the fiber and the screen is 31 mm, calculate the acceptance angle and numerical aperture.	05	L3	CO5

* * * * *