CBCS SCHEME

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BPHYS102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 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.

		Module – 1	**M**	**L**	**C**
Q.1	a.	Explain the construction and working of a semiconductor laser with the help of energy level diagram.	8	L2	CO1
	b.	What is refractive index profile? Discuss three different types of optical fibres based on modes of propagation and refractive index profile.	7	L2	CO1
	c.	The angle of acceptance of an optical fibre is 30° when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33.	5	L3	CO5
		OR			
Q.2	a.	Define acceptance angle and numerical aperture. Derive an expression for numerical aperture in terms of refractive indices of core, cladding and surrounding.	8	L2	CO1
	b.	Derive an expression for energy density for a system in thermal equilibrium in terms of Einstein's co-efficient.	7	L2	CO1
	c.	In a diffraction grating experiment the laser light undergoes second order diffraction for diffraction angle 1.48°. The grating constant is 5.08×10^{-5} m and the distance between the grating and the source is 80 cm, find the wave length of LASER light.	5	L3	CO5
		Module – 2			
Q.3	a.	Assuming the time independent Schrodinger's wave equation discuss the solution for a particle in one dimensional potential well of infinite height and hence obtain the normalized wave equation.	9	L2	CO2
	b.	State and explain Heisenberg uncertainty principle. Show that an electron doesn't exists inside the nucleus.	7	L2	CO2
	c.	Compute the deBroglie wavelength for a neutron moving with one tenth part of velocity of light. Given the mass of the neutron is 1.674×10^{-27} kg.	4	L3	CO2
		OR			
Q.4	a.	Setup Schrodinger time independent wave equation in one dimension.	9	L2	CO2
	b.	Define phase velocity and group velocity. Derive an expression for De Broglie wavelength of an electron.	7	L2	CO2
	c.	An electron has a speed of 100 m/s. The inherent uncertainity in its measurement is 0.005%. Calculate the corresponding uncertainity in the measurement of the position.	4	L3	CO2
		Module – 3			
Q.5	a.	Explain the Pauli matrices and apply Pauli matrices on the state $\lvert 0\rangle$ and $\lvert 1\rangle$.	9	L2	CO2
	b.	Differentiate between classical and quantum computing.	6	L2	CO2
	c.	Explain the Hadamard gate. Show that the Hadamard gate is unitary.	5	L2	CO2

OR					
Q.6	**a.**	A Linear operator 'X' operates such that $X\|0\rangle = \|1\rangle$ and $X\|1\rangle = \|0\rangle$. Find the matrix representation of 'X'.	5	L2	CO2
	b.	Describe the working of CNOT gate mentioning its matrix representation and truth table.	9	L2	CO2
	c.	Explain the representation of qubit using Bloch sphere.	6	L2	CO2
Module – 4					
Q.7	**a.**	Enumerate the failures of classical free electron theory and discuss the success of quantum free electron theory of metals.	8	L2	CO3
	b.	Explain DC and AC Josephson effects and mention any two applications of superconductivity in quantum computing.	7	L2	CO3
	c.	Find the temperature at which there is 1% probability that a state with an energy 0.5 eV above the Fermi energy is occupied.	5	L3	CO3
OR					
Q.8	**a.**	Explain Meissner's effect and the variation of critical field with temperature.	8	L2	CO3
	b.	Define Fermi factor. Discuss the variation of Fermi factor with temperature and energy.	7	L2	CO3
	c.	The critical temperature of Nb is 9.15 K. At zero Kelvin, the critical field is 0.196T. Calculate the critical field at 8 K.	5	L3	CO3
Module – 5					
Q.9	**a.**	Discuss timing in Linear motion, Uniform motion, Slow in and Slow out.	8	L2	CO4
	b.	Describe Jumping and parts of jumping in animation.	7	L2	CO4
	c.	A slowing-in object in an animation has a first frame distance 0.5 m and first slow in frame 0.35 m. Calculate the base distance and the number of frames in sequence.	5	L3	CO5
OR					
Q.10	**a.**	Illustrate the odd rule and odd rule multiplier with suitable example.	8	L2	CO4
	b.	Discuss modeling the probability for proton decay.	7	L2	CO4
	c.	In an optical fibre experiment the Laser light propagating through optical fibre cable of 1.5 m, made a spot diameter of 8 mm on the screen. The distance between the end of the optical fibre cable and the screen is 3.4 cm. Calculate the angle of contact and numerical aperture of given optical fibre.	5	L3	CO5

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