CBCS SCHEME

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BPHYS102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2025
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.	Discuss the three processes of interaction of radiation with matter along with relevant mathematical expressions and diagrams.	09	L2	CO1
	b.	Define attenuation and give expression for attenuation coefficient in an optical fiber. Explain the three major causes of attenuation.	07	L2	CO1
	c.	In a diffraction grating experiment, the laser light undergoes third order diffraction with diffraction angle 2.2°. The grating constant is $d = 5.05\times10^{-5}$ m. The distance between the grating and source is 0.8 m. Find the wavelength of laser.	04	L3	CO5
		OR			
Q.2	a.	Define acceptance angle and numerical aperture. Hence, derive an expression for NA in terms of RIs of core, cladding and surrounding.	08	L2	CO1
	b.	Discuss the application of laser in bar-code scanner and laser printer with the help of relevant diagrams.	08	L2	CO1
	c.	Given the Numerical aperture 0.30 and RI of core 1.52, calculate the R.I of clad.	04	L3	CO1
		Module – 2			
Q.3	a.	Derive the expression for deBroglie wavelength by analogy and explain Heisenberg uncertainty principle with relevant mathematical expressions.	08	L2	CO2
	b.	Discuss eigen wavefunction, probability function for a particle in an infinite potential well for the ground state and 1st excited state with neat relevant diagram.	08	L2	CO2
	c.	Calculate the energy of first three states for an electron in a one dimensional potential well of width 0.2 nm.	04	L3	CO2
		OR			
Q.4	a.	Set up Schrodinger's time-independent differential wave equation. Mention the expression for 3 dimensional version of the same.	08	L2	CO2
	b.	Write note on : i) Wave function ii) Max Born interpretation iii) Principle of complementarity	08	L2	CO2
	c.	The speed of an electron is measured to within an uncertainty of 3×10^{4} ms^{-1} in one dimension. What is the minimum width required by the electron to be confined in an atom?	04	L3	CO2
		Module – 3			
Q.5	a.	Discuss (i) Quantum NOT gate (ii) CNOT gate with matrix representation and their operation on the basis states.	08	L2	CO2

Q.5	b.	Define qubit and mention three properties. Explain the representation of qubit using Bloch sphere.	08	L2	CO2
	c.	Given $\lvert\psi\rangle = \begin{bmatrix}\alpha_1 \\ \alpha_2\end{bmatrix}$ and $\lvert\phi\rangle = \begin{bmatrix}\beta_1 \\ \beta_2\end{bmatrix}$, prove that $\langle\psi\lvert\phi\rangle = \langle\phi\lvert\psi\rangle^*$	04	L3	CO2
		OR			
Q.6	a.	Explain the operation of (i) Hadamard gate and (ii) Toffoli gate with matrix representation and truth table.	08	L2	CO2
	b.	Explain orthogonality and orthonormality with an example for each.	08	L2	CO2
	c.	Show that the matrix $A = \begin{bmatrix} i & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & i \end{bmatrix}$ is unitary.	04	L3	CO2
		Module – 4			
Q.7	a.	Mention 3 failures of CFET and the assumptions of QFET.	07	L2	CO3
	b.	Write short notes on (i) quantum tunnelling (ii) squid (iii) charge qubit (iv) Josephson junction.	08	L2	CO3
	c.	Calculate the probability of occupation of an energy level 0.02 eV above Fermi level at 300 K.	05	L3	CO3
		OR			
Q.8	a.	Define Fermi factor. Discuss the variation of Fermi factor with temperature and energy. Represent the same using graph.	08	L2	CO3
	b.	With relevant diagrams, explain Type-1 (Soft) and type-2(Hard) superconductors with two examples for each.	08	L2	CO3
	c.	Superconducting aluminium has critical temperature of 1.2 K at zero magnetic field. If the critical field is 0.01 Tesla at 0 K, find its critical field at 0.5 K.	04	L3	CO3
		Module – 5			
Q.9	a.	Illustrate odd rule and odd rule multipliers with suitable example for slow-in and slow-out.	08	L2	CO4
	b.	Mention the general pattern of Monte Carlo method and hence determine the value of π .	08	L2	CO4
	c.	Given the base distance 0.5 cm for the slow-in and given the last frame is 6^{th} , calculate the distance between the frames #3 and #4 .	04	L3	CO4
		OR			
Q.10	a.	Distinguish between descriptive and inferential statistics.	08	L2	CO4
	b.	In the context of animation, describe the action of jump with measurable physical quantities and relations between them.	08	L2	CO4
	c.	The average number of internet failures in a household per week is 3. What is the probability of 4 internet failures happening next week assuming Poisson model?	04	L3	CO4

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