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Department of Basic Sciences – Physics

Sl. No.	**Question Bank** **Module-1** **Lasers and optical fibers**	COs	RBT Levels
1	What is Laser? Mention important characteristics of Lasers.	CO1	L1
2	Discuss the possible ways through which radiation and matter interaction can take place.OR Define Induced, spontaneous and stimulated emission.	CO1	L2
3	Derive the expression for energy density in terms of Einstein's coefficients.	CO1	L3
4	Explain the Requisites of a Laser system.	CO1	L2
5	Explain the construction and working of a semiconductor laser.	CO1	L2
6	Explain the working of Bar code scanner.	CO1	L2
7	Explain the working of laser printer and laser cooling.	CO1	L2
8	With neat diagram derive an expression for numerical aperture and arrive at the condition for propagation of a signal in an optical fiber. OR Prove that NA =$\sqrt{{n_1}^2 - {n_2}^2}$	CO1	L3
9	What is refractive index profile? With neat diagrams, explain different types of optical fibers.	CO1	L2
10	What is attenuation? Discuss the various loss factors in optical fiber communication.	CO1	L2
11	With the help of block diagram, explain point to point communication using optical fiber.	CO1	L2

12	Define attenuation and mention the expression attenuation co efficient.	CO1	L2
13	Define optical fiber, refractive index profile and Numerical aperture and acceptance angle.	CO1	L2
14	Explain fiber optic networking.	CO1	L2
15	Explain conditions of a Laser system.	CO1	L2

Sl. No.	**Module-2** **QuantumMechaics**		
1	What are matter waves? Derive an expression for de Broglie wavelength. Mention different forms for de Broglie wavelength.	CO2	L2
2	State and explain Heisenberg's Uncertainty Principle and principle ofcomplementarity.	CO2	L2
3	Show that electron does not exit inside the nucleus using Heisenberg's Uncertaintyprinciple.	CO2	L2
4	Define Phase velocity and group velocity.	CO2	L1
5	Derive Time independent Schrodinger wave equation in one dimension. Mention the expression for 3D case.	CO2	L2
6	What is wave function? Give its physical significance and properties.	CO2	L2
7	Obtain the expression for Eigen value and Eigen function for particle in a box.	CO2	L3
8	Discuss the wave functions, probability densities and energy level for a particle in a box by considering the ground state and the first two excited state.	CO2	L3

Sl No	**Module-3** **Quantum Computing**		
1.	State and explain Moore's law.	CO2	L1
2.	Elucidate the differences between classical and quantum computing.	CO2	L2
3.	Explain the representation of qubit using Bloch Sphere.	CO2	L2
4	Define a qubit? Mention its properties.	CO2	L1
5	Define identity operator? Show that identity operator operates onthe states |0> and |1> leaves the same states.	CO2	L2
6	Mention the Pauli matrices. Discuss the Pauli matrices operationon |0> and |1> states.	CO2	L2
7	What is unitary operator? Show that $U^{+}U = UU^{+} = I$	CO2	L2
8	What are unitary row and column matrix? Explain how to find inner product of two ket vectors?	CO2	L2

9	Illustrate orthogonality and orthonormality with an example for each.	CO2	L3
10	Discuss CNOT gate and its operation on four different input states.	CO2	L3
	Discuss Swap gate and controlled Z gate mentioning its matrix representation and truth table.		
12	Discuss any two single qubit gates mentioning its matrix representation and truth table.	CO2	L2
13	Given $\|\psi\rangle = \begin{pmatrix}\alpha_1\\ \alpha_2\end{pmatrix}$ and $\|\phi\rangle = \begin{pmatrix}\beta_1\\ \beta_2\end{pmatrix}$ Prove that $\langle\psi\|\phi\rangle = \langle\phi\|\psi\rangle^*$	CO2	L3
14	Explain Hadamard gate. Show Hadamard is Unitary.	CO2	L2
15	Discuss the working of phase gate mentioning its matrix representation truth table.	CO2	L2
16	Explain T gate and mention the truth table.	CO2	L2
17	Explain the matrix and operation of Toffoli Gate.	CO2	L2

Sl. No	**Module-4** **Electrical Conductivity in Metals**		
1	List the assumptions of Quantum Free Electron Theory.	CO4	L1
2	Explain variation of Fermi factor with temperature and energy.	CO4	L2
3	Define Fermi Energy. Explain the Failures of CFET.	CO4	L2
4	Define Superconductivity. Explain Meissner effect.	CO4	L2
5	Define Fermi factor. Explain temperature dependence on resistivity in superconductors.	CO4	L2
6	Distinguish between Type-1 and Type-2 superconductors.	CO4	L2
7	Discuss qualitatively the BCS theory of superconductivity for negligible resistance of metal at temperatures close to absolute zero.	CO4	L2
8	What are High temperature Superconductors?	CO4	L2
9	What is Josephson effect and Explain DC and AC Josephson effects?	CO4	L3
10	What are SQUIDS .Give the qualitative explanation of DC and RF Squid with the help of a neat sketch?	CO4	L2
11	Define the term Critical field. Describe temperature dependence of critical field.	CO4	L2

12	Write a note on Density of states.	CO4	L2
Sl No.	**Module-5** **Applications of physics in Computing**		
1	Elucidate the importance of size & scale and weight and strength in Animations.	CO5	L2
2	Sketch and explain the motion graphs for linear, easy ease, easy ease in and easy ease out cases of animation.	CO5	L2
3	Discuss timing in Linear motion, Uniform motion, slow in and slow out.	CO5	L2
4	Illustrate the odd rule and odd rule multipliers with a suitable example.	CO5	L2
5	Describe Jumping and parts of jump.	CO5	L2
6	Define Animation, taxonomy of physics in Animation, Frames and Frames per second.	CO5	L2
7	Define Line of Action and Path of action.	CO5	L2
8	Explain Odd rule Scenarios.	CO5	L2
9	Define Strides, Steps and Gait in walking	CO5	L2
10	Discuss the salient features of Normal distribution using bell curves.	CO5	L2
11	Distinguish between descriptive and inferential statistics.	CO5	L2
12	Mention the general pattern of Monte Carlo method and hence determine the value of π.	CO5	L2
13	Discuss modeling the probability for proton decay.	CO5	L2