School of Engineering

Question Bank

I Year B. Tech – I Semester – 2023-24

APPLIED PHYSICS (MR23-1BS0121)

Q. No	Question	Course Outcome	Question Level	Marks	Section	Unit
1	Explain the processes of absorption, spontaneous and stimulated emission of light and derive the expression for relation between Einstein's coefficients	CO1	Easy	8	**Section-I**	1
2	Explain the construction of Ruby Laser and its working principle with the help of energy level diagram.	CO1	Easy	8	**Section-I**	1
3	Explain the construction of Helium-Neon Laser and its working principle with the help of energy level diagram.	CO1	Medium	8	**Section-I**	1
4	Define and deduce the expression for acceptance angle and numerical aperture of an optical fiber.	CO1	Easy	8	**Section-I**	1
5	Classify optical fibers, describe the structure and light propagation in step and graded index optical fibers.	CO1	Medium	8	**Section-I**	1
6	i.) What is pumping in LASER, explain its importance in the production of LASER ii.) What is population inversion and metastable state, explain their need in the production of LASER.	CO1	complex	8	**Section-I**	1
7	Explain the construction and working of Semiconductor diode laser using neat energy level diagram.	CO1	Medium	8	**Section-I**	1
8	i.)Explain the basic structure and working principle of an optical fiber. ii.)With neat block diagram explain the working of optical fiber communication system.	CO1	Easy	8	**Section-I**	1
9	i.) State de-Broglie hypothesis and derive the expression of de-Broglie wavelength in different forms. ii.) A proton is moving with a speed of 2.5×10^{10} *m/s*. Find the wavelength of Matter wave associated with it. (Mass of proton $m = 1.67 \times 10^{-27} kg$).	CO2	Easy	5 3	**Section-II**	2

10	Describe Davisson and Germer's experiment to verify the existence of matter waves.	CO2	Medium	8	**Section-II**	2
11	State Heisenberg's uncertainty principle, using Heisenberg's uncertainty principle prove the non-existence of electron inside the nucleus.	CO2	Easy	8	**Section-II**	2
12	Derive the Schrodinger time-independent wave equation for matter waves. What is the physical significance of wave function?	CO2	complex	8	**Section-II**	2
13	(i) What is meant by wave-particle duality, what led de-Broglie to suggest that matter has wave characteristics? (ii) What are matter waves, explain their characteristics and prove that matter waves can move faster than speed of light.	CO2	Medium	8	**Section-II**	2
14	State Heisenberg uncertainty principle, calculate the uncertainty with which we can locate the position of electron if the electron is moving with speed of 600 m/s with an accuracy of 0.005%.	CO2	complex	8	**Section-II**	2
15	(i) Obtain the expression for energy levels of a particle enclosed in a one-dimensional infinitely deep potential well. (ii) An electron is bound in one dimensional infinite well of width 1 Å, find the energy values of ground state and first two excited energy states.	CO2	Easy	8	**Section-II**	2
16	What is normalization of wave function? Derive the wave function expression for a particle enclosed in a one-dimensional infinitely deep potential well.	CO2	complex	8	**Section-II**	2
17	State Hall effect and derive Hall coefficient for an n-type semiconductor. Mention few applications of Hall effect.	CO3	Easy	8	**Section-III**	3
18	What is meant by p-n junction, explain its formation and discuss the biasing and V-I characteristics of p-n junction diode.	CO3	Medium	8	**Section-III**	3
19	Explain the processes of wafer cleaning, lithography and etching in the fabrication of semiconductor devices.	CO3	Medium	8	**Section-III**	3
20	What is LED? Explain the construction and working of LED with neat diagrams, mention few applications of it.	CO3	Medium	8	**Section-III**	3

21	What is Solar cell? Explain the construction and working of Solar cell with suitable diagrams.	CO3	Medium	8	**Section-III**	3
22	What is photodiode? Explain the construction and working of photodiode with suitable diagrams.	CO3	Easy	8	**Section-III**	3
23	(i) What is thin film, explain its role in semiconductor devices, and discuss different thin film deposition techniques. (ii) What is metallization, explain its role in semiconductor device fabrication.	CO3	complex	8	**Section-III**	3
24	(i) Distinguish between direct and indirect bandgap semiconductors (ii) Classify semiconductor based on its purity, discuss about the p-type and n-type semiconductors	CO3	Medium	8	**Section-III**	3
25	Explain classical and quantum computing, and distinguish between the classical bit and quantum bit (qubit).	CO4	Easy	8	**Section-IV**	4
26	Define complex vector space, explain its axioms using Dirac notation.	CO4	complex	8	**Section-IV**	4
27	Define linear combination, span, basis and dimension of a complex vector space.	CO4	Medium	8	**Section-IV**	4
28	Explain inner, outer and tensor products using dirac notation.	CO4	complex	8	**Section-IV**	4
29	Discuss the postulates of quantum mechanics.	CO4	Medium	8	**Section-IV**	4
30	What is Hilbert space and its importance in quantum computing, mention its key features and characteristics.	CO4	complex	8	**Section-IV**	4
31	Discuss quantum states and state vectors.	CO4	Medium	8	**Section-IV**	4
32	Explain the geometrical representation of a qubit with a neat diagram of the Bloch's sphere.	CO4	Medium	8	**Section-IV**	4
33	Discuss the representation of single and multiple qubits using Dirac notation.	CO5	Medium	8	**Sectionn-V**	5
34	Explain the superposition and entanglement of qubit states.	CO5	complex	8	**Sectionn-V**	5
35	Describe the process of quantum measurement.	CO5	complex	8	**Sectionn-V**	5

36	i) Write the differences between the classical and quantum logic gates ii) Explain XOR, NAND & NOR gates along with their truth tables.	CO5	complex	8	**Sectionn-V**	5
37	What is quantum logic gate? Explain the operation of quantum gate with matrix representation using Hadamard gate as example.	CO5	complex	8	**Sectionn-V**	5
38	What is single qubit gate? Discuss the operation of Pauli-X, Pauli-Y, Pauli-Z on qubits with truth tables.	CO5	Easy	8	**Sectionn-V**	5
39	What is multiple qubit gate? Discuss the operation of CNOT gate on two qubits with truth table.	CO5	Easy	8	**Sectionn-V**	5
40	What is multiple qubit gate? Discuss the operation of Toffoli (CCNOT) gate on three qubits with truth table.	CO5	complex	8	**Sectionn-V**	5