MALLA REDDY UNIVERSITY

Department of Physics

Applied Physics (AP)

February 2023

Question Bank

Unit-I : LASER

1. Explain the processes of absorption, spontaneous and stimulated emission of light and derive the expression for Einstein's coefficients. (8)
2. Describe the construction of Ruby laser and its working with the help of energy level diagram. (8)
3. Explain the construction and working of Helium-Neon laser with a neat energy level diagram. (8)
4. Explain the construction and working of Semiconductor diode laser with a neat energy level diagram. (8)
5. (a) Explain Population Inversion and Meta-stable states. (4)
   (b) Differentiate the three and four level laser schemes. (4)
6. (a) Explain the Electrical and Optical pumping schemes. (4)
   (b) Mention any five applications of Laser. (4)

Unit-II : Fiber Optics

1. Explain the construction and working principle of optical fiber. (8)
2. Define and deduce the expression for acceptance angle and numerical aperture of an optical fiber. (8)
3. Explain different types of optical fibers. (8)
4. Describe the different types of attenuation losses in the optical fibers. (8)
5. Discuss the optical fiber communication system with a neat block diagram. (8)
6. (a) Discuss the construction and working of temperature sensor. (4)
   (b) Discuss the construction and working of level sensor. (4)

Unit-III: Quantum Mechanics

1. (a) What are de-Broglie matter waves and arrive at the expression of de-Broglie wavelength in different forms. (6)
   (b) A proton is moving with a speed of $2.5 \times 10^{10}\ m/s$. Find the wavelength of matter wave associated with it. (Mass of proton $m = 1.67 \times 10^{-27} kg$). (2)
2. Describe Davisson and Germer's experiment to verify the existence of matter waves. (8)
3. (a) State Heisenberg's uncertainty principle. (3)

(b) Apply the Heisenberg's uncertainty principle to prove the non-existence of electron in the nucleus. (5)

4. Derive the Schrodinger time-independent wave equation of matter waves. What is physical significance of wave function ?. (8)

5. Obtain an expression for energy levels and wave functions of a particle enclosed in one-dimensional potential box of infinite well. (8)

Unit-IV: Band Theory of Solids

1. Illustrate the salient features of classical free electron theory and summarize the merits and demerits. (8)

2. Illustrate the salient features of quantum free electron theory and summarize the merits and demerits. (8)

3. (a) Explain the differences between classical and quantum free electron theory. (4)
   (b) What is Fermi energy? Discuss variation of Fermi level with energy and temperature. (4)

4. Derive the expression for density of states for an electron in a metal. (8)

5. Discuss the formation of bands in solids using Kronig–Penny model. (8)

6. Derive an expression for the effective mass of an electron moving in energy bands of a solid. (8)

7. (a) Classify the crystalline solids based on band theory of solids. (4)
   (b) Explain the following: 1) Bloch theorem and 2) E-K diagram. (4)

Unit-V: Semiconductor Physics

1. Derive an expression for the carrier concentration in an intrinsic semiconductor. (8)

2. What is an extrinsic semiconductor ? Derive an expression for carrier concentration in p-type semiconductor. (8)

3. What is an extrinsic semiconductor ? Derive an expression for carrier concentration in n-type semiconductor. (8)

4. (a) Explain variation of Fermi level with temperature in an intrinsic semiconductor. (4)
   (b) Explain variation of Fermi level with temperature in an extrinsic semiconductor. (4)

5. State Hall effect and derive the expression for Hall coefficient. Write application of Hall effect. (8)

6. Explain the formation of p-n junction and discuss V-I characteristics of p-n junction. (8)

7. What is LED ? Explain the construction and working of LED. (8)

8. What is Photo diode ? Explain the construction and working of Photo diode. (8)

9. What is Solar cell ? Explain the construction and working of Solar cell. (8)

Best wishes

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