**B. Tech. Second Semester (Artificial Intelligence and Data Science) /
B. Tech. – 21-22 – SOE – ADS - 203 Examination**

Course Code : AIDS 2152   Course Name : Applied Physics

Time : 3 Hours]   [Max. Marks : 40

Instructions to Candidates :—
- (1) Do not write anything on question paper except your exam seat number.
- (2) Write the answers along with accurate question number in answer book.
- (3) All questions are compulsory.
- (4) All questions carry marks as indicated.
- (5) Assume suitable data wherever necessary.
- (6) Illustrate your answers wherever necessary with the help of neat sketches.
- (7) Use of non – programmable calculator is permitted.
- (8) **List of Constants :**
  1. Planck's constant $h = 6.625 \times 10^{-34}$ J·s.
  2. Mass of electron $m_e = 9.1 \times 10^{-31}$ kg.
  3. Mass of Proton $m_p = 1.67 \times 10^{-27}$ kg.
  4. Charge of electron $e = 1.602 \times 10^{-19}$ C.
  5. Boltzmann constant $k = 1.38 \times 10^{-23}$ J/K.
  6. Velocity of light $c = 3 \times 10^8$ m/s.

1. (A) A electron is confined to move a one dimensional infinitely deep potential well of width $L = 100$ pm. Calculate :

   (a) The least energy of the electron.

   (b) Energy transferred to the electron if it is to make a quantum jump from its ground state to second excited state.

   (c) Wavelength of light, if the electron gains energy for the jump from energy level E_1 to E_3.   (CO 1)

   (B) Explain the concept of quantum mechanical tunneling.   5 + 2 (CO 1)

2. (A) In an intrinsic semiconductor $n \times p = n_i^2$ because $n = p$. Same is true for an extrinsic semiconductor even though $n \neq p$. Explain your answer.

(CO 2)

(B) In Hall coefficient experiment a current of 0·25 A is sent through a metal strip having thickness 0·2 mm and wide 5 mm. The Hall voltage is found to be 0·15 mV when a magnetic field f 2000 Gauss is used. Calculate carrier concentration and drift velocity of the carriers.   3 + 4 (CO 2)

3. (A) Explain the function of optical resonant cavity.

(CO 3)

(B) In He – Ne Laser system, the two energy levels of Ne involved in laser production have energies 20·66 and 18·7 eV. Population inversion occurs between these two levels. Determine the wavelength of Laser beam produced and population of upper level with lower level at 27°C.   4 + 3 (CO 3)

4. (A) Define graded index fiber and explain the transmission of signal through it.

(CO 3)

(B) The core has refractive index 1·5 and the cladding refractive index is 1·25. Estimate the value of critical angle and cone of acceptance ($2\theta_0$).

3 + 3 (CO 3)

5. (A) A proton and deuteron both move in a circular path in a magnetic field with the same tangential speeds. Compare the number of revolutions they make per second.

(CO 4)

(B) Discuss the motion of an electron projected into uniform electric field at an acute angle with the field direction. Obtain expressions for range, time of flight and maximum height attained by the particle.   2 + 5 (CO 4)

6. (A) Write a note on Graphene.

(CO 5)

(B) Discuss the classification of nanomaterials in brief.

2 + 4 (CO 5)

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