



Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj
Nagpur University)

Hingna Road, Wanadongri, Nagpur.

MID SEMESTER EXAM – I

EVEN TERM—2021-22

Course Code : AIDS2152

Time :1½ Hours

Semester : B.Tech. AIDS SEM-II

Course Name : Applied Physics

Max. Marks: 30

Instructions to examinees:

- 1) All questions are compulsory.
- 2) Figures in bracket to the right indicate the marks for questions.
- 3) Assume suitable data wherever necessary.
- 4) Illustrate your answers wherever necessary with the help of neat sketches.
- 5) Use of non-programmable calculator is permitted.

List of constants :

Planck's constant $h = 6.625 \times 10^{-34} \text{ J.s}$, Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$,
Mass of proton $m_p = 1.67 \times 10^{-27} \text{ kg}$, Charge $e = 1.602 \times 10^{-19} \text{ C}$, Velocity of
light $c = 3 \times 10^8 \text{ m/s}$, $k = 1.3807 \times 10^{-23} \text{ J / K}$

Q.1	Solve the following	Marks	Level	CO-PO mapped
a)	Define matter waves and show that the de-Broglie wavelength for an electron accelerated by V volts is $\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$.	03	L2	CO1, PO2
b)	An eigen function of an operator d^2/dx^2 is - i) $\psi = \sin 4x$, ii) $\psi = (x^5 + 1)$ iii) $\psi = Ae^{-\frac{i}{\hbar}(Et - px)}$ Determine the eigen value of above eigen function.	03	L3	CO1, PO2

c)	An electron of mass 9.1×10^{-31} kg and a bullet of mass 50 grams both are traveling with the same velocity of 300 m/sec. Assume an accuracy of 0.01% in velocity measurement, calculate the uncertainty in location of their positions.	04	L3	CO1, PO2
Q.2	Solve the following	Mark s	Level	CO-PO mapped
a)	State and explain Hall effect ? Deduce the expression for Hall voltage and Carrier with suitable diagram in a given semiconductor.	05	L2	CO2, PO1
b)	Classify Conductors, Semiconductors and insulators on the basis of energy band structure.	03	L2	CO2, PO1
c)	Calculate the conductivity of intrinsic germanium at 300K. The electron and hole mobilities are $0.39 \text{ m}^2/\text{V.s}$ and $0.19 \text{ m}^2/\text{V.s}$ respectively. The intrinsic carrier density for germanium is $2.5 \times 10^{19} / \text{m}^3$.	02	L3	CO2, PO2
Q.3	Solve the following			
a)	Explain the process of spontaneous emission and stimulated emission with suitable diagrams. Mention the factors on which the number of transitions depend in these processes.	04	L2	CO3, PO1
b)	Define the terms: Population inversion, Pumping and Metastable states.	03	L1	CO3, PO1
c)	Estimate the relative populations of the two states in a Ruby laser that produces a light beam of wavelength 6943 Å at 300K and 500K.	03	L2	CO3, PO2

$$\begin{aligned}
 & 6.625 \times 10^{-34} \\
 & \sqrt{29 \cdot 1564 \times 10^{-50} \times 4} = 5.89 \sqrt{V} \\
 & = \frac{1229 \times 10^{-9}}{\sqrt{V}} = \frac{12.29 \times 10^1}{\sqrt{V}}
 \end{aligned}$$