

## Mid Term Examination

B. TECH PROGRAMMES (UNDER THE AEGIS OF USICT)

Second Semester, May, 2023

Paper Code: BS 106

Physics-II

Time: 1.5 Hours

Paper: Applied

Max. Marks: 30

Note: Attempt Question no. 1 which is compulsory and any two more questions from remaining.

	Question 1	Marks	COs
1(a)	Distribute three particles in three energy states in accordance of MB, BE and FD statistics.	2.5	CO2
1(b)	What do you understand by normalisation of a wave function? Give the essential features of acceptable wave function.	2.5	CO1
1(c)	Determine the uncertainty in position of an electron whose speed is measured to be $5.0 \times 10^3$ m/sec to an accuracy of 0.003%.	2.5	CO1
1(d)	Compute the root mean square speed of oxygen molecules at $0^\circ\text{C}$ . Given mass of $\text{O}_2 = 5.31 \times 10^{-26}$ kg	2.5	CO2

	Question 2	Marks	Cos
2(a)	Evaluate the expectation value of the position and the momentum of a particle trapped in a box of width L.	5	CO1
2(b)	Determine the energy required to jump from ground state to second excited state by an electron trapped in a box of length 1 Å.	2	CO1
2(c)	Brief the conditions required for the quantum tunnelling. Calculate the transmission probability for an electron of energy 2eV when incident upon a rectangular potential barrier of height 6eV and width 0.50 nm.	3	CO1

	Question 3	Marks	Cos
3(a)	Find the expression of the average molecular energy of an ideal gas molecule.	4	CO2
3(b)	How does Fermions differ from Bosons? Give examples.	3	CO2
3(c)	Calculate the average energy and speed of a free electron at 0K for a given substance? Given fermi energy of substance is 7.9 eV	3	CO2

	Question 4	Marks	Cos
4(a)	Using Schrodinger's equation, find wave function for a particle of mass m in an infinite potential well of width L. Also find its eigen energy values.	6	CO1
4(b)	An electron gas obeys the Maxwell-Boltzmann statistics. Calculate the average thermal energy (in eV) for an electron in the system at 300K.	2	CO2
4(c)	States the Plancks' radiation law and give its expression for energy density.	2	CO2



## CLASS TEST

II Semester (B.Tech)

Paper Code: BS106

Time: 1.5 hour

June 2023

Subject: Applied Physics-II

Max. Marks: 30

Note: Q. No. 1 is compulsory. Attempt any two Question from the rest.

	Questions	Marks	CO
1a	Distinguish between crystalline and amorphous solids.	2.5	3
b	Discuss diamond structure and calculate its atomic packing factor.	2.5	3
c	X-ray of wavelength $2 \times 10^{-11} \text{m}$ suffers first order reflection from (111) crystal plane at an angle of $45^\circ$ . Calculate the interatomic spacing of the crystal.	2.5	3
d	Explain why a semiconductor acts as an insulator at 0 Kelvin.	2.5	4
2.a	Discuss the seven crystal systems pointing out their characteristic features and giving examples.	4	3
b	What is the utilization of miller Indices in crystal structure? Making use of intercepts in the ratio 3a:4b on the x and y-axis and parallel to z-axis. Find the miller Indices of planes.	3	3
c	Explain Laue's method of X-rays diffraction.	3	3
3.a	Discuss the point defects in solids. Derive an expression for the concentration of Erenkel defect.	5	3
b	Draw sketches illustrating (110), (111) and (002) planes in cubic unit cell.	3	3
c	Ca has FCC structure and its atomic radius is $1.278 \text{\AA}$ . Calculate its density.	2	3
4.	Distinguish between intrinsic and extrinsic semiconductor and draw their Fermi energy level diagram. Derive an expression for the electron carrier concentration in an intrinsic semiconductor. OR Explain the Kronig-Penney model for the motion of an electron in the periodic potential. Derive effective mass of an electron and explain its physical significance.	10	4