SECTION 'C'

Q.N.3. Attempt any one part of the following]

		Course Objective	Marks
a)	Derive time dependent and time independent Schrodinger wave equation.	CO2	10
b)	A particle of rest mass m_0 has kinetic energy K. Show that its de-Broglie wavelength is given by $$\lambda = \frac{hc}{\sqrt{K(K+2m_0c^2)}}.$$ What will happen if $K << m_0c^2$	CO1	10
c)	Distinguish between group velocity and phase velocity and deduce a relation between them. What happens if the phase velocity is independent of frequency?	CO1	10

Table 1: Mapping between COs and questions
(Number of COs may vary from course to course)

COs	Questions Numbers	Total Marks
CO1	1c,1d,1e,2a,2b, 3b,3c	45.5
CO2	1a,1b,2c,3a	19.5

Name:
Student University Roll No.:

School of Engineering
First Sessional Examination, Even Semester (AS: 2022-23)
B. Tech: CSE, CSE-CCML1, CSE-IOTBC1, CSE-AI
Year: 1   Semester: 2

Course Title: Physics II (Set A)   M.M.: 30
Course Code: BAS 3202   Time: 1 hr

Instructions if any: Read the question Carefully.

		Course objective	Marks
Q.N.1. Attempt all parts of the following:			
	SECTION 'A'		
a)	What do you mean by a wave packet?	CO2	1
b)	What do you mean by wave function? Give its significance.	CO2	1
c)	Give the physical significance of Heisenberg's uncertainty principle.	CO1	1
d)	What is the difference between an electromagnetic wave and matter wave?	CO1	1
e)	Can a photon and electron of the same momentum have the same wavelength?	CO1	1
Q.N.2. Attempt any two parts of the following:		Course objective	Marks
	SECTION 'B'		
a)	Calculate the de-Broglie wavelength associated with a proton moving with velocity $(1/20)^{th}$ of the velocity of light.	CO1	7.5
b)	An electron has speed of 600 m/s with an accuracy of 0.005%. Calculate the uncertainty with which we can locate the position of the electron.	CO1	7.5
c)	A particle is moving in one dimensional potential box (of infinite height) of width 25 Å. Calculate the probability of finding the particle within an interval of 5 Å at the centre of the box when it is in its state of least energy.	CO2	7.5
d)	What will be the kinetic energy of an electron if its de-Broglie wavelength equals the wavelength of sodium light?	CO1	7.5

5. (a) Describe bucky balls. Discuss their properties and uses.

(b) What are super-conductors? Describe Meissner effect in super-conductors.

(c) What are type I and type II super conductors?

6. (a) Prove that the velocity of plane electro-magnetic wave in free space is given by :

$$C = \frac{1}{\sqrt{\mu_0 \in_0}}$$

(b) What is Heisenberg uncertainty princple? Apply this to prove the non-existence of electron inside the nucleus.

(c) What do you mean by inter planar distance? Show that in a cubic lattice the distance between successive planes having Miller indices (h k ℓ) is given by :

$$d_{hk\ell} = \frac{a}{\sqrt{h^2 + k^2 + \ell^2}}$$

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SECTION – C

Note :– Attempt all questions. Attempt any two parts from each question. $5 \times 8 = 40$

3. (a) What are matter waves? Show that De-Broglie wavelength associated with a particle of mass 'm' and kinetic energy 'E' is given by :

$$\lambda = \frac{h}{\sqrt{2mE}}$$

(b) What do you mean by group velocity and phase velocity of a wave packet? Show that :

$$v_p \times v_g = c^2$$

(c) Derive time independent Schrodinger wave equation.

4. (a) Describe the diamond crystal structure and calculate the packing factor of diamond.

(b) Describe Laue's experiment for diffraction of X-rays. What are the outcomes of Laue's experiment.

(c) What is poynting vector? Discuss the poynting theorem for the flow of energy in electro-magnetic field.

[P. T. O.

(d) Write down Maxwell's equations in differential form.

(e) What are Cooper pairs?

(f) What do you mean by face-centred cubic lattice?

(g) What do you mean by SEM?

(h) Define skin depth.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

(a) Calculate the velocity and kinetic energy of a neutron having De-Broglie wavelength 1 Å.

(b) The lattice constant for a unit cell of aluminium is 4.049 Å. Calculate the spacing of (220).

(c) If earth receives 2 cal min^{-1} cm^{-2} solar energy, what are the amplitudes of electric and magnetic fields of radiation?

(d) A super conducting lead has critical temperature of 6.2 K and critical magnetic field of 0.0306 T at 0K. Determine the critical magnetic field at 3.1 K.

B. Tech. Examination 2022–23

(Even Semester)

PHYSICS - II

Time : Three Hours]   *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : $8 \times 1 = 8$

(a) What do you mean by wave function?

(b) Describe Bragg's law.

(c) Show that De-Broglie wavelength of an electron accelerated through a potential difference of V volts is given by :

$$\frac{12.28}{\sqrt{V}} \text{ Å}$$

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