

University of Mumbai
Examination 2021 under cluster No.3 (Lead College:FCRIT)

Examinations Commencing from 7 th March 2022

Program: First Year Engineering

Curriculum Scheme: Rev2019

Examination: FE Semester I

Course Code: **FEC102** and Course Name: **Engineering Physics-I**

Time: 2 hours

Max. Marks: 60

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Schrodinger's equation is _____ order differential equation
Option A:	Zero
Option B:	First
Option C:	Second
Option D:	Third
2.	Calculate the maximum order of diffraction if X rays of Wavelength 0.987\AA are incident on a crystal of lattice spacing 0.282nm .
Option A:	9
Option B:	5
Option C:	6
Option D:	8
3.	Which of the following is not the significance of Hall effect
Option A:	Magnetic field measurement
Option B:	Charge carrier concentration measurement
Option C:	Voltage measurement
Option D:	Mobility measurement
4.	When a ray of light is traveling from a denser medium to rarer medium the refracted ray _____
Option A:	Changes phase by $\pi/2$
Option B:	Changes phase by $\pi/4$

Option C:	Changes phase by $3\pi/2$
Option D:	Does not change phase
5.	The de Broglie wavelength of an electron which has been accelerated from rest through a potential of 100V is
Option A:	3.258 A.U.
Option B:	2.228A.U.
Option C:	1.543 A.U.
Option D:	1.228 A.U.
6.	Mobility of electron and holes in a sample of intrinsic Ge at room temperature are $3600\text{cm}^2/\text{V-sec}$ and $1700\text{cm}^2/\text{V-sec}$ respectively if the electron and hole densities are each equal to $2.5 \times 10^{13}/\text{cm}^3$. Calculate the conductivity.
Option A:	2.12mho/meter
Option B:	2.12 ohm/meter
Option C:	4.12mho/meter
Option D:	4.12 ohm/meter
7.	In a Newton's rings experiment, the diameter of 10 th dark ring changes from 1.40cm to 1.27cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid.
Option A:	1.215
Option B:	2.153
Option C:	1.561
Option D:	1.832
8.	In which band the Fermi level of p-type semiconductor overlaps if the impurity concentration is increased?
Option A:	Intrinsic fermi level
Option B:	Conduction band
Option C:	Valence band
Option D:	Acceptor level

9.	Which of the following statement is true?
Option A:	Wavelength of De-Broglie waves is directly proportional to mass.
Option B:	De-Broglie waves are electromagnetic waves.
Option C:	The velocity of matter waves is greater than the velocity of light.
Option D:	Phase velocity is equal to particle velocity.
10.	The speed of electron is measured with an uncertainty $2 \times 10^4 \text{ m/s}$. What is the minimum space required by the electron to be confined in an atom?
Option A:	$0.058 \times 10^{-10} \text{ m}$
Option B:	$0.579 \times 10^{-8} \text{ m}$
Option C:	$5.79 \times 10^{-10} \text{ m}$
Option D:	$5.79 \times 10^{-10} \text{ cm}$
11.	A crystal lattice plane (3 2 6) makes an intercept 1.5 \AA along X-axis in a crystal having lattice constants 1.5 \AA , 2 \AA , 4 \AA on X,Y and Z respectively. Find the length of Y and Z intercepts along Y and Z axes.
Option A:	2 \AA , 3 \AA
Option B:	1.5 \AA , 2 \AA
Option C:	3 \AA , 1.5 \AA
Option D:	3 \AA , 2 \AA
12.	Which of the following is true for Bragg's spectrometer?
Option A:	The ionisation current decreases with glancing angle.
Option B:	The ionisation current peaks are obtained for certain values of glancing angles.
Option C:	The ionisation current peaks are obtained for all the glancing angles.
Option D:	The ionisation current Vs glancing angle graph is a straight line.

DESCRIPTIVE QUESTIONS

1.	Calculate the lowest three energy states of an electron confined in potential well of width 1 \AA
2.	Derive expression for interplanar spacing for a cubic crystal system in terms of Miller

	indices.
3.	A hall probe made with copper strip 2 cm wide and 0.1 cm thick consist of 8.5×10^{22} electrons per cubic meter and is carrying a current of 5A. What is the magnetic field that the probe has sensed if Hall voltage is measured to be $4\mu V$.
4.	White light falls normally on film of soapy water of thickness $5.3 \times 10^{-5} \text{ cm}$ and refractive index 1.3. Which wavelength in the visible region will be reflected most strongly
5.	Derive the Schrodinger's time independent differential equation.
6.	What is Meissner's effect ? Show that a superconductor is a perfect diamagnet.
7.	Derive Braggs equation for x ray diffraction in crystals. Calculate the glancing angle on a plane (100) having lattice constant 2.814 \AA corresponding to first order Bragg's diffraction maximum for Xray of wavelength 1.541 \AA .
8.	Define group velocity and phase velocity. State relationship between them.
9.	The Fermi level is at 2.1eV. What is the energy for which the probability of occupancy at 300°K is 0.99.
10.	Show that for a Newton's Rings setup, diameter of a dark ring is proportional to square root of ring number.
11.	Show that the intrinsic fermi level lies in the middle of the band gap.
12.	An electron has a momentum $3 \times 10^{-26} \text{ kgm/sec}$ with an accuracy of 0.01%. Find the minimum uncertainty in the location of the electron.
13.	State De-Broglie's hypothesis. Derive expression for De Broglie's wavelength.
14.	What is antireflection coating? State the conditions for antireflection coating.
15.	Explain terms energy density and power density. Compare capacitor , supercapacitor and batteries with respect to their energy density and power density.
16.	A wedge-shaped air film with a wedge angle of $40''$ is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between consecutive bright fringes is 0.11 cm. Calculate the wavelength of light used.
17.	Draw the energy level diagram for a zero bias and forward biased PN junction diode.
18.	Plot the planes for the given Miller Indices (0 0 2), (0 $\bar{1}$ 1), (1 2 2) , ($\bar{2}$ 1 2).
19.	The energy corresponding to second excited state of an electron confined in a one dimensional potential well is 342eV. Find out the width of the well.
20.	Show that the interplanar distance in a cubic structure depends on lattice constant and miller indices.
21.	Fermi Energy for silver is 5.5eV. Find out the energy for which the probability of occupancy at 300K is 0.9.
22.	A glass plate having parallel sides has thickness $4 \times 10^{-4} \text{ mm}$ and refractive index 1.5. If it is illuminated normally by white light What wavelength will be intensified in reflected beam in visible spectrum?
23.	Using Uncertainty principle, show that electrons cannot exist within the nucleus.
24.	Describe Type I and Type II superconductors and prove that superconductors are

	perfect diamagnetic.
25.	Find the miller indices of a set of planes with intercepts a , $2a$ and $3a$ on x , y and z axes respectively for a cubic crystal. Find the values of intercepts if the lattice constant is 5.76\AA .
26.	What is quantum computing? What makes a quantum computer different from a regular computer?
27.	A copper strip of 2.5 cm wide and 0.2 mm thick is placed in a magnetic field with $B = 1.8\text{ wb/m}^2$. If a current of 150 A is set up in the strip, calculate Hall voltage that appears across the strip. Assume $R_H = 8 \times 10^{-7} \text{ m}^3/\text{c}$.
28.	Discuss the conditions required for a thin film to act as antireflection coating.
29.	Draw the diagram [fully labelled and self-explanatory] to show the variation of Fermi level with temperature for an n-type semiconductor.
30.	Find the de-Broglie wavelength of 12 keV electrons.
31.	'The phase velocity of matter wave is greater than the velocity of light'. Prove this statement.
32.	How can Newton's rings be obtained? Why do we get circular rings?
33.	Compare supercapacitor with battery. (Four comparisons)
34.	Newton's rings are obtained with reflected light of wavelength 6000\AA . If the diameter of the 10^{th} dark ring is 5 mm , calculate the radius of curvature of the lens.
35.	Explain the principle and construction of a LED.
36.	What are crystal planes? Draw the following in a cubic unit cell. i) $(2\ 1\ 3)$ ii) $(0\ \bar{1}\ \bar{2})$ iii) $(0\ 0\ \bar{3})$