130 Rs → Pawdhi

ABV-Indian Institute of Information Technology & Management-Gwalior

Major Test, November 30, 2023, IMG/IMT-I[st] Semester
Engineering Physics
Subject Code: ITAS-1102

Time Duration: Three hour

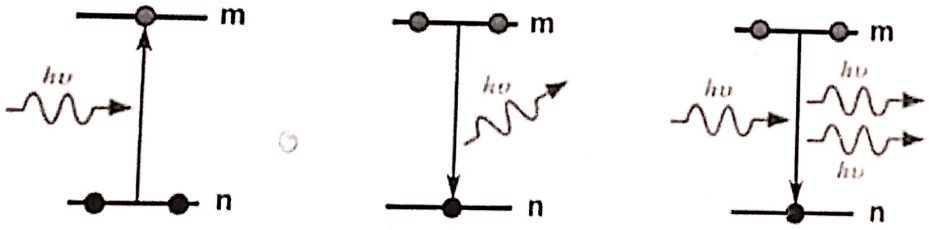
Maximum Marks: 50

Note: Q1, Q2, and Q3 are mandatory, and answer any 5 questions from Q4 to Q10.

Q1. Answer in True/False to any 10 of the following and write appropriate justification. 15

a) Miller Indices of a material in a plane are directly proportional to the square of the unit cell dimensions.
b) Dielectrics are metallic materials of high specific resistance ρ, negative temperature coefficient of resistance (-α) and large insulation resistance.
c) In the triclinic crystal structure, angles between the axes are, $\alpha=\beta=90^{\circ}$, $\gamma = 120^{0}$.
d) Brillouin Zones have a different shape, the same area/volume, and the same symmetry.
e) Notations P, I, F, and C represent the primitive, Body-centered, Base-Centered, and Face-Centered, respectively.
f) Quantum confinement is responsible for the increase of energy difference between energy states and band gap.
g) Nanowires of GaN and AlN can be used for Nano-LEDs.
h) Body-centered cubic has a maximum packing fraction.
i) The width of the depletion layer in an open-circuited diode is directly proportional to the square root of doping ($\sqrt{doping}$) if $N_A = N_B$.
j) The resistivity of the metal decreases with an increase in temperature.
k) De-Broglie's hypothesis and Davidson-Germer's experiment show that waves act like a particle.
l) Lattice + Basis = Crystal structure.

Q2. Differentiate ordinary light with LASER light. Identify the following figure and describe the concept properly. 5



Q3. Discuss the importance of Symmetry operations in Crystallography. Why the fivefold symmetry is not possible? Explain. 5

(Attempt any 5 from the following questions)

Q4 Write short notes on any two of the following: 5
a. Formation of Energy Bands
b. Fermi-Dirac distribution function,
c. Displacement Current,
d. Brillouin Zone

Q5. Consider an electron traveling at a velocity of 10^7 cm/sec and if the velocity increases by 1 cm/sec. Calculate the change in its kinetic energy. 5

Q6. Compute the Miller Indices for a plane intersecting at x = 1/4, y = 1 and z = 1/2. Write down the Planes of {100} family, shown in the figure of Hexagonal Cell. 5

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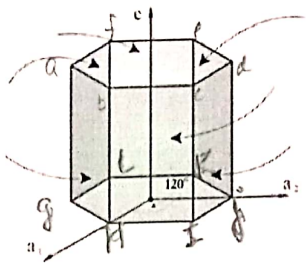
$\frac{1}{2}m(v_1^2 - v_2^2)$ $v_2 = 10^7 + \Delta v$



Q7. Write any three possibilities because of which point defect may occur in crystals. Explain the computation of Equilibrium Concentration of point defects: Following is the hint. $\left(\frac{N_V}{N} = e^{-\frac{E_A}{KT}}\right)$ 5

Q.8. Explain the laws associated with the folloing figures.. 5

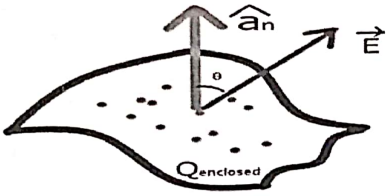


Fig. A

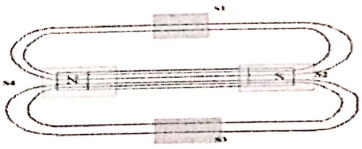


Fig. B

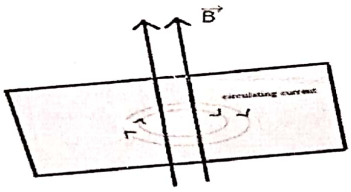


Fig. C

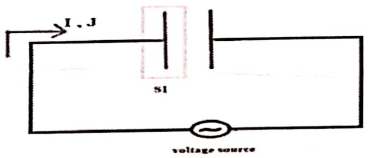


Fig. D

Q.9. A particle of mass ***m*** is confined to move inside an infinite potential well described by following function:

$$(x) = \begin{cases} -\infty & for\ x < 0 \\ 0 & for\ 0 \le x \le a \\ +\infty & for\ x > a \end{cases}$$

Calculate the wave function and energy of the particle. 5

Q.10. What are the different types of optical fibers? Explain the following terms of optical fiber: 5

a) Modes
b) Dispersion
c) Bending and splice loss

**********All the Best**********

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