

Tribhuvan University
Institute of Science and Technology
2081
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Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (PHY118)
(Physics)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The questions are of equal value.

Section A

Long Answer Questions:

Attempt any TWO questions

[2×10=20]

1. What do you mean by the contact potential? Give band scheme of a p-n Junction by illustrating:
(a) Potential difference V_c resulting from the positive donor ions in the n-side of the depletion layer and the negative acceptor ions in the p-side of the depletion layer. (b) Potential energy barrier faced by the majority charge carriers (electrons) in the n-side of the diode as they attempt to cross the junction. (c) Potential energy barrier faced by the majority side of the diode as they attempt to cross the junction. [10]
2. Discuss single crystal growth by discussing following techniques: (a) Czochralski Method, (b) Bridgman-Stockbarger Method, (c) Floating Zone Method and (d) Vapor-Phase Epitaxy. [10]
3. Describe torque on a current-carrying rectangular loop of wire on a pivot rod when placed in a magnetic field. Give alternative way of increasing the torque on the coil. [10]

Short Answer Questions:

[8×5=40]

Attempt any EIGHT questions:

4. Explain group velocity. [5]
5. Discuss effective mass of electrons and holes. [5]
6. Set up Schrodinger equation and discuss the wavefunction. [5]
7. An oscillating block of mass 250 g takes 0.15 sec to move between the endpoints of the motion, which are 40 cm apart. (a) What is the frequency of the motion? (b) What is the amplitude of the motion? (c) What is the force constant of the spring? [5]
8. A proton is accelerated through a potential difference of 200 V. It then enters a region where there is a magnetic field $B = 0.5$ T. The magnetic field is perpendicular to the direction of motion of the proton. Find the force experienced by the proton. [5]
9. A small particle of mass 10^{-6} g moves along the x axis; its speed is uncertain by 10^{-6} m/sec. (a) What is the uncertainty in the x coordinate of the particle? (b) Repeat the calculation for an electron assuming that the uncertainty in its velocity is also 10^{-6} m/sec. [5]

10. A beam of hydrogen atoms is used in a Stern-Gerlach type experiment. The atoms emerge from the oven with a velocity $v = 10^4$ m/sec. They enter a region 20 cm long where there is a magnetic field gradient $dB/dz = 3 \times 10^4$ T/m. The field gradient is perpendicular to the incident velocity of the atoms. The mass of the hydrogen atom is 1.67×10^{-27} kg. What is the separation of the two components of the beam as they emerge from the magnet? [5]

11. The energy gaps of some alkali halides are KCl = 7.6 eV, KBr = 6.3 eV, KI = 5.6 eV. Which of these are transparent to visible light? At what wavelength does each become opaque? [5]

12. The output of a digital circuit (y) is given by this expression:

$$y = (AB + \overline{CBA})(\overline{B + C})$$

Where A, B and C represent inputs. Draw a circuit of above equation using OR, AND and NOT gate and hence find its truth table. [5]