

KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E.

Course : EEG 207

Year : II

Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date

27 NOV 2023

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option. Symbols have their usual meaning.

- The co-ordination number of FCC crystal is _____
a. 1 b. 4 c. 8 d. 12
- Which material is used as a conducting material in electrical machines?
a. Iron b. Aluminum c. Nickel d. Copper
- A material with unequal anti-parallel atomic magnetic moments is _____
a. Ferrimagnet b. An antiferromagnet
c. A ferrite d. Non-magnetic
- What is the level that acts as a reference which separates the vacant and filled states at 0 Kelvin?
a. Excited level b. Ground level c. Valance orbit d. Fermi energy level
- The drift velocity of free electrons with mobility of $3.5 \times 10^{-3} \text{ m}^2/\text{Vs}$ in copper for an electric field strength of 0.5 V/m is _____
a. 3.5 m/s b. $1.75 \times 10^3 \text{ m/s}$ c. 11.5 m/s d. $1.75 \times 10^3 \text{ m/s}$
- When a pure semiconductor is heated, its resistance _____
a. Goes up b. Goes down c. Can't say d. Remains same
- Fermi energy level for p-type extrinsic semiconductors lies _____
a. At the middle of band gap b. Close to the conduction band
c. Can't be predicted d. Close to the valance band
- The SiO_2 layer in an IC acts as _____
a. Resister b. Capacitor c. Inductor d. Insulating layer
- Packing efficiency of face centered cubic unit cell is _____
a. 52% b. 68% c. 74% d. 82%
- The responsivity of a photodiode having quantum efficiency of 1% at $0.8 \mu\text{m}$ is _____
a. 6.4mA/w b. 4.5 mA/w c. 2.4mA/w d. 0.4mA/w

11. What is the process of producing electric dipoles inside the dielectric by an external electric field?
 a. Polarisation b. Dipole moment c. Deploration d. Magnetisation
12. If χ represents the susceptibility, C represents the Curie constant, θ represents the Curie temperature and T is absolute temperature which of the following represents Curie-Weiss law?
 a. $\chi = C/(T - \theta)$ b. $\chi = C/(T + \theta)$ c. $\chi = (T - \theta)/C$ d. $\chi = (T + \theta)/C$
13. In IC fabrication process, metallization is done for _____
 a. Protection b. Packaging c. Cleaning d. Interconnection
14. The density of states in the conduction in the conduction band for energy level E is proportional to _____
 a. E b. \sqrt{E} c. $E^{1.5}$ d. E^2
15. In which of these is reverse recovery time nearly zero?
 a. Zener diode b. Tunnel diode c. Schottky diode d. PiN diode
16. A uniform silver wire has a resistivity of 1.54×10^{-18} ohm/m at room temperature. For an electric field along the wire of 1 volt/cm, the mobility, assuming that there are 5.8×10^{28} conduction electrons/m³ is _____ m²/Vs.
 a. 1.54 b. 6.9973 c. 6.9973×10^{-3} d. 0.69973
17. The dielectric strength of ferroelectric materials depends to a large extent on _____
 a. Area of hysteresis loop for the material
 b. Presence of magnetic materials in the vicinity
 c. Intensity of electric field
 d. Frequency of applied voltage
18. A paramagnetic material has a magnetic field intensity of 10^4 Am⁻¹. If the susceptibility of the material at room temperature is 3.7×10^{-5} , the magnetization in the material is _____
 a. 7 Am⁻¹ b. 17 Am⁻¹ c. 27 Am⁻¹ d. 37 Am⁻¹
19. In a phototransistor, base current is _____
 a. not a factor b. set by bias voltage
 c. directly proportional to light d. inversely proportional to light
20. A current of 16 A is passed through a conductor with an electron density of 4×10^{28} m⁻³ and area of cross-section 10^{-5} m². The average drift velocity of free electrons in the conductor is _____
 a. 2.5×10^{-4} m/s b. 5×10^{-3} m/s c. 2×10^{-10} m/s d. 3.5×10^{-2} m/s

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Semester : I
F. M. : 40

SECTION "B"
[4 Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions. Symbols have their usual meaning.

1.
 - a. Explain the working of the fast breeder reactor nuclear plant with the help of suitable diagram. [5]
 - b. Write the significance of the Fermi -Dirac distribution function. [2]
 - c. Calculate the Curie constant for a paramagnetic material that was inserted at room temperature (300K) in a magnetic field of 1.2×10^4 A/m and whose magnetic induction was measured to be 0.05T. Assume that Curie temperature is zero. [3]
2.
 - a. Obtain an expression that locates the Fermi energy in n type semiconductor. Find the expression in terms of energy gap of the material. [5]
 - b. Differentiate between the direct band gap material and indirect band gap material with the help of suitable diagrams. [5]
3.
 - a. Derive an expression for Hall voltage and explain the application areas of Hall effect. [5]
 - b. Derive the time dependent form of Schrodinger wave equation and explain the significance of Schrodinger equations. [5]
4.
 - a. Classify the cubic unit cell of a crystal and obtain the packing efficiency of body centered cubic unit cell. [5]
 - b. Describe the working mechanism of tunnel diode with the help of IV characteristics. [5]
5.
 - a. Explain the general procedure for PNP transistor IC fabrication. [5]
 - b. Write short notes on: [2 × 2.5 = 5]
 - (i) Phototransistor
 - (ii) Wave-particle duality

