Reg. No. | | | | | | | | | | | | | |

**B.E / B.TECH. DEGREE EXAMINATION, MAY 2023**

Second Semester

**PH18252 - PHYSICS OF MATERIALS**

(Common to BIO, ECE &EEE)

***(Regulation 2018 & 2018A)***

**TIME: 3 HOURS** **MAX. MARKS: 100**

**CO 1** Comprehend the behavior of electrons in solids.

**CO 2** Demonstrate an understanding of various properties of Semiconducting materials and their internal structure.

**CO 3** Students will get the exposure of the dielectric properties and material and its applications materials in various fields.

**CO 4** Summarize basics of magnetism and superconductivity. Explore a few of their technological applications.

**CO 5** Develop an understanding the applications of Nano materials and new engineering materials in various fields.

**PART- A (10 x 2 = 20 Marks)**

(Answer all Questions)

| | | CO | RBT LEVEL |
|---|---|---|---|
| **1** | What are the merits of classical free electron theory? | **1** | **2** |
| **2** | Evaluate the average energy of a free electron at 0K while the fermi energy of a free electron at 0K. | **1** | **4** |
| **3** | Compared with Germanium, silicon is widely used to manufacture the elemental device? | **2** | **3** |
| **4** | Given an extrinsic semiconductor, how will you find whether it is n-type or p-type? | **2** | **3** |
| **5** | Distinguish between Lorentz force and Coulomb force in dielectrics. | **3** | **3** |
| **6** | Calculate the electronic polarizability of neon. The radius of neon atom is 0.158 nm. | **3** | **3** |
| **7** | Every superconducting material has diamagnetism. Justify | **4** | **4** |
| **8** | What is meant by energy product? What do you infer from it?. | **4** | **3** |
| **9** | List out the various forms of carbon nanotubes. | **5** | **2** |
| **10** | Elucidate why cryotron is referred as a switching device? | **5** | **4** |



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**PART- B (5 x 14 = 70 Marks)**

| | | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|---|
| **11(a)** | **(i)** | Obtain Wiedemann Franz Law by deriving the expressions of electrical and thermal conductivity and find the expression for Lorentz number. | **(12)** | **1** | **3** |
| | **(ii)** | The electrical resistivity of copper at 27°C is $1.72 \times 10^{-8} \Omega m$. Compute its thermal conductivity if the Lorentz number is $2.26 \times 10^{-8}$ $W\Omega K^{-2}$ | **(2)** | **1** | **3** |
| | | **(OR)** | | | |
| **11(b)** | **(i)** | Explain with suitable diagram how does Fermi energy distribution function varies with temperature. | **(4)** | **1** | **3** |
| | **(ii)** | Derive an expression for the Density of states and based on that calculate the carrier concentration in metals. | **(10)** | **1** | **3** |
| **12(a)** | | Explain the terms conduction band and valence band of an intrinsic semiconductor with a diagram. Deduce an expression for the carrier concentration of an electron in intrinsic semiconductor. | **(14)** | **2** | **4** |
| | | **(OR)** | | | |
| **12(b)** | | Obtain an expression for Hall coefficient for n-type and p-type semiconductors. Mention the applications of Hall Effect. | **(14)** | **2** | **4** |
| **13(a)** | | Mention the different mechanisms of polarization in different dielectric materials, with necessary polarizability expressions. | **(14)** | **3** | **3** |
| | | **(OR)** | | | |
| **13(b)** | | Derive an expression for the Local field in a dielectric for a cubic structure. Deduce Clausius-Mosotti equation. | **(14)** | **3** | **3** |
| **14(a)** | **(i)** | Distinguish between Type-I and Type-II superconductors. | **(7)** | **4** | **2** |
| | **(ii)** | A train runs without wheel-Interpret its principle and working. | **(7)** | **4** | **2** |
| | | **(OR)** | | | |
| **14(b)** | **(i)** | Give the classification of magnetic materials on the basis of magnetic susceptibility. | **(7)** | **4** | **2** |
| | **(ii)** | Distinguish between soft and hard magnetic materials. | **(7)** | **4** | **2** |

| | | | | | |
|---|---|---|---|---|---|
| **15(a)** | **(i)** | Discuss in detail the production and properties of Bucky balls. | **(7)** | **5** | **3** |
| | **(ii)** | Explain any one method for preparation of carbon nanotubes and give their important properties | **(7)** | **5** | **3** |
| | | **(OR)** | | | |
| **15(b)** | **(i)** | What are intelligent materials why they are called so? | **(4)** | **5** | **2** |
| | **(ii)** | Describe the characteristics of intelligent materials. List out any four Applications. | **(10)** | **5** | **2** |

**PART- C (1 x 10 = 10 Marks)**

(Q.No.16 is compulsory)

| | | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|---|
| **16** | **(i)** | Explain how band gap of a semiconducting material can be determined experimentally? | **(6)** | **2** | **3** |
| | **(ii)** | Sketch hysteresis curve and mark ‘retentivity’ and ‘coercivity’. | **(4)** | **4** | **3** |

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