## **Question Paper**

Exam Date & Time: 08-May-2024 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

## VI SEM B. Tech (BME) DEGREE END SEMESTER EXAMINATIONS, APRIL- MAY-2024

MATERIAL SCIENCE FOR BIOMEDICAL ENGINEERS [BME 4054]

Marks: 50

Answer all the questions.

## Duration: 180 mins.

MAIN

1)	Describe the primary interatomic bonds.	(2)
2)	Discuss the implications of Matthiessen's rule for the resistivity of metals.	(3)
3)	Apprise on the effects of impurities on the electrical conductivity of semiconductors, utilizing the Drude model for conductivity to justify your explanation. Provide insights into how impurities alter the carrier concentration and mobility in the semiconductor.	(5)
4)	Discuss the limitations of Paschen's law.	(2)
5)	Explain the possible polarizations in solids without permanent dipole moments.	(3)
6)	Discuss the role of impurities and defects in the breakdown of liquid and solid dielectric materials.	(5)
7)	Explain how nuclear spin contributes to the overall magnetic moment of an atom	(2)
8)	Compare and contrast the magnetic properties of ferrimagnetic and antiferromagnetic materials.	(3)
9)	A variable voltage source is connected to a copper anode and cathode. The space between the anode and the cathode is made of a vacuum. The cathode surface contains micro-projection. Predict the dielectric breakdown of the vacuum at higher voltages.	(5)
10)	Explain the term Bohr Magnetron.	(2)
11)	Compare and contrast the Curie temperature and the Neel temperature in the context of ferromagnetic and antiferromagnetic materials, respectively.	(3)
12)	Illustrate and explain the hysteresis loop and describe the changes in the magnetic domain of a ferromagnetic material as magnetization approaches saturation.	(5)
13)	What is Type I and Type II superconductors? Explain in detail.	(2)
14)	Explain the process of photoluminescence in a semiconductor material.	(3)
15)	A magnetic nanomaterial needs to be selected to develop an MRI contrast agent. The requirement is that the magnetization of the particles should be high, and there should not be any hysteresis. After the magnetic field is removed, the magnetic particles should not aggregate. Suggest the type of magnetic material for this application with detailed justification.	(5)

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