Code No: 132AA **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year II Semester Examinations, January/February - 2024
ENGINEERING PHYSICS - II
(Common to EEE, ECE, CSE, IT)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) A photon has a wavelength of 500 nm. Calculate its energy. [2]
b) Calculate the energy levels of an electron in a one-dimensional box of length 2 nm. [3]
c) What are applications of indirect band gas semiconductor? [2]
d) Why direct bandgap semiconductors are preferred in LEDs? [3]
e) Calculate the electric field at a point P located at a distance of 10 cm along the perpendicular bisector of an electric dipole with a length of 5 cm and a charge of ±10μC. [2]
f) Explain nature of $BaTiO_3$. [3]
g) A coil with a core of material X has a relative permeability of 500. If the coil without the core has an inductance of 2 mH, what is the inductance when the core is inserted? [2]
h) What is magnetic susceptibility? [3]
i) Calculate the surface-to-volume ratio for a nanocube with a side length of 50 nm? [2]
j) What is a potential drawback of using the sol-gel process in nanomaterial synthesis? [3]

PART - B

(50 Marks)

2.a) What is the de-Broglie hypothesis, and how does it relate to the dual nature of matter?
b) What is an E-K curve, and how does it describe the relationship between energy and momentum for electrons in solids? [5+5]

OR

3.a) Describe the energy levels of a particle in a one-dimensional potential box.
b) Discuss the qualitative aspects of the Kronig-Penny model in explaining electron behavior in a crystalline solid. [5+5]

4.a) How does doping affect the Fermi level in extrinsic semiconductors?
b) Draw and explain the energy band diagram of a PN junction diode in equilibrium. [5+5]

OR

5.a) Describe five applications of solar cells.
b) Explain the I-V characteristics of a solar cell and how they are influenced by light intensity. [5+5]

6.a) Compare electronic, ionic, and orientation polarizations.
b) What is pyroelectricity and how is it different from piezoelectricity? [5+5]

OR

7.a) What is electronic polarization and how does it occur in materials?
b) Explain the phenomenon of ferroelectricity and its significance. [5+5]

8.a) Describe the properties of antiferromagnetic materials.
b) How does temperature affect superconductivity? [5+5]

OR

9.a) How do ferrimagnetic materials differ from other magnetic materials?
b) Classify materials into dia, para, and ferromagnetic types based on their magnetic moments. [5+5]

10.a) Describe the sol-gel process in bottom-up nanofabrication. What are its advantages and applications?
b) Discuss the principles of SEM and its applications. [5+5]

OR

11.a) How do the electrical, mechanical, and thermal properties of materials change at the nanoscale?
b) Explain how XRD is used in the characterization of nanomaterials and what information it provides? [5+5]

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