R15

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

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Part- A (25 Marks)

1.a)	Define space lattice and primitive cell?	[2]
b)	What are Bravais lattices?	[3]
c)	Define phase space.	[2]
d)	Explain the concept of effective mass of an electron.	[3]
e)	What is space charge polarization?	[2]
f)	What are the characteristics of laser radiation?	[3]
g)	What is meant by Neel temperature?	[2]
h)	Write a short note on refractive index profiles of step index fiber.	[3]
i)	Explain Hall Effect.	[2]
j)	Explain surface to volume ratio in nanomaterials.	[3]

Part-B (50 Marks)

2.a) Derive an expression for the cohesive energy of an ionic crystal.
 b) Explain the powder method of crystal for structure analysis.   [5+5]
OR
3.a) Show that FCC crystals are closely packed than BCC and SC crystals.
 b) Mention the different kinds of crystal imperfections.   [5+5]

4.a) Explain the physical significance of wave function? A quantum particle confined to one-dimensional box of width 'a' is known to be in its first excited state. Determine the probability of the particle in the centre half.
 b) Explain and compare M.B, B.E and F.D statistical distribution functions.   [5+5]
OR
5.a) Show that the energies of a particle in a potential box are quantized.
 b) Discuss the Kronig-Penny model for the motion of an electron in a periodic potential.
                                                                                                                          [5+5]

6.a) Derive an expression for the internal electrical field in dielectrics exposed to a external electric field.
  b) Draw and explain B-H curve for a ferromagnetic material. [6+4]

OR

7.a) Distinguish between piezo and ferroelectric effects.
  b) Explain how ferrites are superior to ferromagnetic materials? Discuss hard and soft magnetic materials? [4+6]

8.a) How do you obtain circular rings in Newton's rings experiment? Derive an expression for radius of curvature of Newton's rings experiment.
  b) Derive the relation between the probabilities of spontaneous emission and stimulated emission of Einstein coefficients? [5+5]

OR

9.a) Distinguish between polarized and unpolarised light.
  b) What is population inversion in laser? How is it achieved? [5+5]

10.a) Derive an expression for the carrier concentration in p-type extrinsic semiconductor.
  b) What is the reverberation time? Derive Sabine's mathematical relation for reverberation time? [5+5]

OR

11.a) Draw and explain the energy band diagram of a p-n junction. Explain half-wave rectification using p-n diode?
  b) Why nanomaterials exhibit different properties. Explain the reason? [5+5]