Code No: RR10201 **RR** **Set No. 2**

I B.Tech Examinations,December 2010
SOLID STATE PHYSICS
Common to BME, IT, ICE, ETM, E.CONT.E, EIE, CSE, ECE, CSSE, EEE
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain Hall effect.
   (b) Derive the expression for the Hall coefficient of an n-type semiconductor.
   (c) The R_H of a specimen is $3.66 \times 10^{-4} m^3 c^{-1}$. Its resistivity is 8.93×10^{-3} Ohm-m. Find [6+6+4]
      i. mobility of charge carriers and
      ii. carrier density.

2. (a) What is Piezo-electricity?
   (b) Obtain an expression for the internal field seen by an atom in an infinite array of atoms subjected to an external field.
   (c) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms per m^3. [4+8+4]

3. (a) Explain the terms drift velocity, relaxation time and mean free path for free electrons in a metal.
   (b) Derive an expression for electrical conductivity in metals using Drude-Lorenz theory.
   (c) Find the mobility of conduction electrons in copper.
   Given: Resistivity $= 1.7 \times 10^{-8}$ Ω-m.
   Atomic weight $= 63.54$.
   Density $= 8.96 \times 10^3$ kg/m^3
   Avagadro number $= 6.025 \times 10^{23}$ [6+6+4]

4. (a) Describe the hysteresis of a ferro-magnetic material.
   (b) Explain the properties and applications of ferrites.
   (c) Calculate the paramagnetic susceptibility at room temperature for iron oxide, when the material density is 5×10^{28} atoms / m^3. [6+6+4]

5. (a) Define co-ordination number and packing factor of a crystal.
   (b) Describe the FCC crystal structure.
   (c) Obtain an expression for the packing factor of FCC structure. [4+6+6]

6. (a) State the differences between ordinary light and laser light.
   (b) Explain the characteristics of laser light.

(c) Write about stimulated emission, spontaneous emission. [4+6+6]

7. (a) State and explain Bragg's law.

(b) Describe with suitable diagram, the powder method for determination of crystal structure.

(c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4+6+6]

8. (a) What is normalization of wave function? Give its significance.

(b) A particle of mass 'm' is confined in a field free region between impenetrable walls at x = 0 and x = a. Show that the energy levels of the particle are given by $E_n{=}n^2\ h^2/8\mathrm{m}a^2$.

(c) 10 kV electrons are passed through a thin film of metal for which the atomic spacing is 5.5×10^{-11} m. What is the angle of deviation for the first order diffraction maximum? [5+6+5]

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Code No: RR10201 **RR** **Set No. 4**

I B.Tech Examinations,December 2010
SOLID STATE PHYSICS
Common to BME, IT, ICE, ETM, E.CONT.E, EIE, CSE, ECE, CSSE, EEE
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is Piezo-electricity?
   (b) Obtain an expression for the internal field seen by an atom in an infinite array of atoms subjected to an external field.
   (c) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms per m^3. [4+8+4]

2. (a) Explain the terms drift velocity, relaxation time and mean free path for free electrons in a metal.
   (b) Derive an expression for electrical conductivity in metals using Drude-Lorenz theory.
   (c) Find the mobility of conduction electrons in copper.
   Given: Resistivity $= 1.7 \times 10^{-8}$ Ω-m.
   Atomic weight $= 63.54$.
   Density $= 8.96 \times 10^3$ kg/m^3
   Avagadro number $= 6.025 \times 10^{23}$ [6+6+4]

3. (a) State the differences between ordinary light and laser light.
   (b) Explain the characteristics of laser light.
   (c) Write about stimulated emission, spontaneous emission. [4+6+6]

4. (a) State and explain Bragg's law.
   (b) Describe with suitable diagram, the powder method for determination of crystal structure.
   (c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4+6+6]

5. (a) What is normalization of wave function? Give its significance.
   (b) A particle of mass 'm' is confined in a field free region between impenetrable walls at x = 0 and x = a. Show that the energy levels of the particle are given by E_n=n^2 $h^2/8ma^2$.
   (c) 10 kV electrons are passed through a thin film of metal for which the atomic spacing is 5.5×10^{-11} m. What is the angle of deviation for the first order diffraction maximum? [5+6+5]

6. (a) Define co-ordination number and packing factor of a crystal.
   (b) Describe the FCC crystal structure.
   (c) Obtain an expression for the packing factor of FCC structure. [4+6+6]

7. (a) Explain Hall effect.
   (b) Derive the expression for the Hall coefficient of an n-type semiconductor.
   (c) The R_H of a specimen is $3.66 \times 10^{-4} m^3 c^{-1}$. Its resistivity is 8.93×10^{-3} Ohm-m. Find [6+6+4]
      i. mobility of charge carriers and
      ii. carrier density.

8. (a) Describe the hysteresis of a ferro-magnetic material.
   (b) Explain the properties and applications of ferrites.
   (c) Calculate the paramagnetic susceptibility at room temperature for iron oxide, when the material density is 5×10^{28} atoms / m^3. [6+6+4]

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Code No: RR10201 **RR** **Set No. 1**

I B.Tech Examinations,December 2010
SOLID STATE PHYSICS
Common to BME, IT, ICE, ETM, E.CONT.E, EIE, CSE, ECE, CSSE, EEE
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define co-ordination number and packing factor of a crystal.
   (b) Describe the FCC crystal structure.
   (c) Obtain an expression for the packing factor of FCC structure. [4+6+6]
2. (a) What is Piezo-electricity?
   (b) Obtain an expression for the internal field seen by an atom in an infinite array of atoms subjected to an external field.
   (c) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms per m^3. [4+8+4]
3. (a) Explain the terms drift velocity, relaxation time and mean free path for free electrons in a metal.
   (b) Derive an expression for electrical conductivity in metals using Drude-Lorenz theory.
   (c) Find the mobility of conduction electrons in copper.
   Given: Resistivity $= 1.7 \times 10^{-8}$ Ω-m.
   Atomic weight $= 63.54$.
   Density $= 8.96 \times 10^3$ kg/m^3
   Avagadro number $= 6.025 \times 10^{23}$ [6+6+4]
4. (a) Describe the hysteresis of a ferro-magnetic material.
   (b) Explain the properties and applications of ferrites.
   (c) Calculate the paramagnetic susceptibility at room temperature for iron oxide, when the material density is 5×10^{28} atoms / m^3. [6+6+4]
5. (a) State and explain Bragg's law.
   (b) Describe with suitable diagram, the powder method for determination of crystal structure.
   (c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4+6+6]
6. (a) Explain Hall effect.
   (b) Derive the expression for the Hall coefficient of an n-type semiconductor.

(c) The R_H of a specimen is $3.66 \times 10^{-4} m^3 c^{-1}$. Its resistivity is 8.93×10^{-3} Ohm-m. Find [6+6+4]

i. mobility of charge carriers and

ii. carrier density.

7. (a) State the differences between ordinary light and laser light.

(b) Explain the characteristics of laser light.

(c) Write about stimulated emission, spontaneous emission. [4+6+6]

8. (a) What is normalization of wave function? Give its significance.

(b) A particle of mass 'm' is confined in a field free region between impenetrable walls at x = 0 and x = a. Show that the energy levels of the particle are given by E_n=n^2 $h^2/8ma^2$.

(c) 10 kV electrons are passed through a thin film of metal for which the atomic spacing is 5.5×10^{-11} m. What is the angle of deviation for the first order diffraction maximum? [5+6+5]

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Code No: RR10201 **RR** **Set No. 3**

I B.Tech Examinations,December 2010
SOLID STATE PHYSICS
Common to BME, IT, ICE, ETM, E.CONT.E, EIE, CSE, ECE, CSSE, EEE
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the terms drift velocity, relaxation time and mean free path for free electrons in a metal.
   (b) Derive an expression for electrical conductivity in metals using Drude-Lorenz theory.
   (c) Find the mobility of conduction electrons in copper.
   Given: Resistivity $= 1.7 \times 10^{-8}$ Ω-m.
   Atomic weight $= 63.54$.
   Density $= 8.96 \times 10^3$ kg/m^3
   Avagadro number $= 6.025 \times 10^{23}$ [6+6+4]

2. (a) Define co-ordination number and packing factor of a crystal.
   (b) Describe the FCC crystal structure.
   (c) Obtain an expression for the packing factor of FCC structure. [4+6+6]

3. (a) Describe the hysteresis of a ferro-magnetic material.
   (b) Explain the properties and applications of ferrites.
   (c) Calculate the paramagnetic susceptibility at room temperature for iron oxide, when the material density is 5×10^{28} atoms / m^3. [6+6+4]

4. (a) What is Piezo-electricity?
   (b) Obtain an expression for the internal field seen by an atom in an infinite array of atoms subjected to an external field.
   (c) The dielectric constant of He gas at NTP is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains 2.7×10^{25} atoms per m^3. [4+8+4]

5. (a) Explain Hall effect.
   (b) Derive the expression for the Hall coefficient of an n-type semiconductor.
   (c) The R_H of a specimen is $3.66 \times 10^{-4} m^3 c^{-1}$. Its resistivity is 8.93×10^{-3} Ohm-m. Find [6+6+4]
      i. mobility of charge carriers and
      ii. carrier density.

6. (a) State and explain Bragg's law.
   (b) Describe with suitable diagram, the powder method for determination of crystal structure.

(c) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. [4+6+6]

7. (a) What is normalization of wave function? Give its significance.

(b) A particle of mass 'm' is confined in a field free region between impenetrable walls at x = 0 and x = a. Show that the energy levels of the particle are given by E_n=n^2 $h^2/8ma^2$.

(c) 10 kV electrons are passed through a thin film of metal for which the atomic spacing is 5.5×10^{-11} m. What is the angle of deviation for the first order diffraction maximum? [5+6+5]

8. (a) State the differences between ordinary light and laser light.

(b) Explain the characteristics of laser light.

(c) Write about stimulated emission, spontaneous emission. [4+6+6]

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