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

Question Paper Code : 70185

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Computer Science and Engineering

PH 3256 — PHYSICS FOR INFORMATION SCIENCE

(Common to Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the electrical resistivity of sodium at 0°C. It has 2.533×10^{28} electrons per unit volume and has a mean free time of 3.1×10^{-14} S.

2. State Wiedemann-Franz law.

3. If the mobilities of electrons and holes in an intrinsic semiconductor at 300 K are 0.36 and 0.14 $m^2 V^{-1}s^{-1}$ respectively. Calculate the number of charge carriers (Given that the conductivity is 2.2 $\Omega^{-1} m^{-1}$).

4. What is the difference between PN junction diode and schottky diode?

5. Define the term magnetic relative permeability.

6. A magnetic field strength of 2×10^5 Am^{-1} is applied to a paramagnetic material with a relative permeability of 1.01. Calculate the value of B and M.

7. What are optical materials? Give its types.

8. Why the shape of LED is made hemispherical?

9. Define quantum well.

10. What is quantum mechanical tunneling?

PART B — (5 × 16 = 80 marks)

11. (a) Using the classical free electron theory, derive the mathematical expressions for the electrical conductivity and thermal conductivity of metals and hence deduce Wiedemann – Franz law.

Or

(b) What is density of states? Derive an expression for the density of states.

12. (a) What is Hall Effect? Derive an expression for the Hall voltage. Explain an experimental method used to measure the Hall coefficient of a specimen. What are the uses of Hall Effect?

Or

(b) Derive a mathematical expression for the carrier concentration of a P-type semiconductor and hence derive the expression for the Fermi level. Explain the variation of the Fermi level of a P-type semiconductor with temperature and concentration.

13. (a) What are domains? Discuss the domain concept and hence explain the hysteresis-curve. What are soft and hard magnetic materials? Mention the properties and applications of hard and soft magnetic materials.

Or

(b) Discuss in detail the classification of magnetic materials into dia, para, ferro, antiferro and ferromagnetism.

14. (a) Explain absorption and emission of light in metals, insulators and semiconductors.

Or

(b) (i) What is meant by OLED? Explain the principle, construction and working of OLED.

(ii) Distinguish between LED and OLED.

15. (a) Explain in detail what is quantum confinement and how quantum structures, in nano materials are classified.

Or

(b) Describe single electron phenomena and single electron transistors with necessary diagrams.

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

Question Paper Code : 60057

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

Computer Science and Engineering

PH 3256 — PHYSICS FOR INFORMATION SCIENCE

(Common to : B.E. Computer and Communication Engineering/ B.Tech. Artificial Intelligence and Data Science/B.Tech. Computer Science and Business Systems/B.Tech. Information Technology)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the postulates of classical free electron theory?

2. Define mobility of electrons.

3. What are direct and indirect bandgap semiconductors? Give examples.

4. The phosphorous doping in Si causes the Fermi level to lie 0.3 eV above the intrinsic Fermi level. Calculate the electron and hole concentration at 300 K. Assume intrinsic carrier concentration as 1.6×10^{16} atoms m^{-3}.

5. A paramagnetic material has a magnetic field intensity of $10^4 Am^{-1}$. If the susceptibility of the material at room temperature is 3.7×10^{-3}. Calculate the magnetization and flux density of the material.

6. Give examples of hard and soft magnetic materials.

7. What is the principle of solar cell?

8. How are optical materials classified?

9. How are qubits stored?

10. What does the Bloch sphere represent?

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for electrical conductivity of a material in terms of mobility of electrons and hence obtain Wiedemann-Franz law. (16)

Or

(b) Write short notes on the following :

(i) Fermi Dirac distribution (6)

(ii) Fermi energy at T = 0K and T > 0K (6)

(iii) Significance of Fermi energy (4)

12. (a) (i) Discuss with necessary theory the variation of fermi level with temperature in intrinsic semiconductor. (12)

(ii) Find the intrinsic carrier concentration and position of the intrinsic Fermi level in Si with respect to the VB edge. Assume $m_h^* = 0.92 m_0$, $m_e^* = 0.49 m_o$, $N_c = 2.21 \times 10^{25} m^{-3}$, $N_v = 8.60 \times 10^{24} m^{-3}$, $T = 300\text{K}$. (4)

Or

(b) Explain the working characteristics, applications and limitations of Schottky diodes. (16)

13. (a) What is an antiferromagnetic material? Explain the antiparallel alignment of dipoles in antiferromagnetic material with suitable sketch and hence derive an expression for the susceptibility of an antiferromagnetic material. (16)

Or

(b) Explain in detail the process of data storage in magnetic hard discs. (16)

14. (a) Explain with neat sketch the principle working and applications of organic LEDs. (16)

Or

(b) Discuss the construction and working of a laser diode. (16)

15. (a) (i) What are the conditions for quantum confinement to occur? (8)

(ii) Discuss in detail the different types of quantum structures. (8)

Or

(b) (i) How does a CNOT gate work? (6)

(ii) What is coulomb blockade effect in nanomaterials? (6)

(iii) What is the difference between tunnel diode and normal diode? (4)

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

Question Paper Code : X 10948

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
AND APRIL/MAY 2021
Second Semester
Computer Science and Engineering
PH 8252 : PHYSICS FOR INFORMATION SCIENCE
(Common to Information Technology)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What are the main drawbacks of classical free electron theory ?
2. Define Mean free path of an electron.
3. What is an intrinsic semicondutor ? Give two examples.
4. What is the difference between direct and indirect bandgap semiconductors ?
5. Define Magnetic dipole moment.
6. What is Bohr Magnetron ?
7. Explain the terms population inversion, meta stable state in laser materials.
8. Give six examples of insulating materials.
9. Explain the term Fermi energy.
10. What is nanomaterials ?

PART – B **(5×16=80 Marks)**

11. a) Derive the energy levels of particle in a one dimensional box and also plot the probability of identifying a particles in various excited states.

(OR)

b) Derive the Fermi-Dirac statistics distribution.

12. a) Draw energy level diagram for i) intrinsic semiconductor, ii) n type semiconductor iii) p type semiconductor.

(OR)

b) What is Hall effect ? Explain physical origin of Hall effect, show that p type semiconductor has Hall co-efficient $R_H = 1/pe$.

13. a) Write about Domain theory of magnetic materials also explain a hysteresis curve.

(OR)

b) Discuss in detail about magnetic materials classifications with its behavior.

14. a) Explain with neat band structure of Laser diode also distinguish between LED and Laser diode.

(OR)

b) Write a note on i) Scattering of light and its types ii) PN diode and its function.

15. a) How size affects Fermi energy in nanomaterials ? Also explain how it connects with quantum confinement.

(OR)

b) Write two ways of preparation of carbon nanotubes. Discuss three of its applications.

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

Question Paper Code : 41114

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Second Semester

Computer Science and Engineering

PH 8252 — PHYSICS FOR INFORMATION SCIENCE

(Common to Information Technology)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define drift velocity.

2. What is called thermal conduction?

3. Distinguish between intrinsic and extrinsic semiconductors.

4. Define Hall effect and Hall voltage.

5. Define Magnetic susceptibility.

6. What is the Curie Temperature?

7. What are the properties LASER light?

8. Define optical data storage.

9. State the expression for Fermi energy of non-interacting ensemble of identical spin ½ particles.

10. Define nanomaterials and give example for carbon based nanomaterials.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the wavefunction and probability of particle in a one dimensional box and also show the possibility of energy levels in three dimensional case. (16)

Or

(b) Explain Wiedezman - Franz law, also explain electrical conductivity of metals based on free electron theory of gases. (16)

12. (a) (i) What is Hall effect? Explain with theory also give two of its applications. (4)

(ii) Derive the Hall coefficient for n-type and p-type semi conductor. (12)

Or

(b) Obtain the expression for carrier concentration of the intrinsic semiconductor, Distinguish p and n type semiconductors. (16)

13. (a) With neat diagram explain properties of para, dia, ferri, ferro and anti ferro magnetism. (16)

Or

(b) Discuss domain theory of ferromagnetic materials and explain energy associated with it.

14. (a) Define LASER, also explain with neat band structure of homo junction laser diode.

Or

(b) What is P-N junction diode? Explain the characteristics of p-n-junction under reverse and forward bias with suitable graph and also explain LED.

15. (a) (i) Define Quantum confinement effect. (2)

(ii) Explain the properties and significance of quantum structures

(1) Quantum well

(2) Quantum wire

(3) Quantum dots. (12)

(iii) Write a note on size dependence of Fermi Energy. (2)

Or

(b) What are the allotropes of carbon nanostructures? Write two ways of preparation of carbon nanotubes?

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05/06/18 FN

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

Question Paper Code : 40065

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Second Semester
Computer Science and Engineering
PH 8252 – PHYSICS FOR INFORMATION SCIENCE
(Common to Information Technology)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. How does the classical free electron theory lead to Ohm's law ?
2. Explain the concept of hole in semiconductors.
3. Distinguish between direct and indirect band in semiconductor.
4. You are given a piece of extrinsic semiconductor. How will you find to which type it belongs ?
5. Derive the relation between magnetic susceptibility and relative permeability.
6. Which material would you use for the hard drive and for a power generator ?
7. Discuss absorption of light by semiconductors.
8. What are the optical properties ?
9. What do you understand by quantum confinement ?
10. What are the Nanodevices ?

PART – B (5×16=80 Marks)

11. a) Deduce a mathematical expression for electrical conductivity of a conducting material and hence obtain Wiedemann-Franz Law. (10+6)

(OR)

b) What is density states ? Derive an expression for the density of states. (2+14)

12. a) Derive an expression for the carrier concentration in N-type and P-type semiconductors. (8+8)

(OR)

b) Explain with a sketch the variation of Fermi level with temperature and concentration impurities in P and N type semiconductors. (8+8)

13. a) Compare and contrast the different types of magnetic materials and mention their properties and applications. (16)

(OR)

b) Explain the domain theory of ferromagnetism. Using that how will you explain the properties of ferromagnetic materials. (16)

14. a) Explain the theory and working of LED. What are the advantages of using LED in electronic display ? (16)

(OR)

b) What is a solar cell ? Discuss in detail the construction and working of solar cell. Mention the applications of solar cell. (16)

15. a) Explain an experimental method used to measure the Hall coefficient of a specimen. Discuss in the principle and working of magnetic hard disk. (8+8)

(OR)

b) Draw energy band diagram for the p-n junction diode. Discuss in detail the operation and applications of single electron transistor. (6+10)

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

Question Paper Code : 80285

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Second Semester

Computer Science and Engineering

PH 8252 — PHYSICS FOR INFORMATION SCIENCE

(Common to Information Technology)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Wiedemann-Franz law.
2. Distinguish between electron rest mass and effective mass.
3. How does the carrier concentrations in semiconductors vary with temperature?
4. Outline the features of Schottky diode.
5. Show the magnetic dipole alignment in ferro, anti-ferro and ferrimagentism.
6. What are magnetic domains?
7. Comment on the blue color of the sky.
8. Why organic LED is called so?
9. Define the term quantum confinement.
10. List the various low dimensional systems.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the Classical free electron model of materials and deduce an expression for the electrical conductivity. Also discuss the success and failures of this model.

Or

(b) (i) Contrast the terms degenerate and non- degenerate states. (6)

(ii) Derive the energy value of a particle in a three dimensional box. (10)

12. (a) (i) Discuss the direct and indirect band gap semiconductors. (10)

(ii) Silicon crystal is doped with atoms 5×10^{20} per m^3. The donor level is 0.05 eV from the edge of the conduction band. Taking the band gap to be 1.12 eV, calculate the position of the Fermi level at 200 K. (6)

Or

(b) (i) Describe Hall effect. Mention its significances. (10)

(ii) A semiconducting crystal, 12 mm long, 5 mm wide and 1 mm thick, has a magnetic flux density of 0.5 Weber/m^2 applied from front to back perpendicular to the largest faces. When current of 20 mA flows lengthwise through the specimen, the voltage measured across its width is found to be 37 μV. What is the Hall coefficient of this semiconductor? (6)

13. (a) (i) Categorize magnetic materials and tabulate its properties and applications. (12)

(ii) The magnetic susceptibility of silicon is -0.4×10^{-5}. Calculate the flux density and magnetic moment per unit volume when field of intensity 5×10^5 A/m is applied. (4)

Or

(b) (i) Draw the Hysteresis curve of typical ferromagnetic materials and explain it through domain concept. (10)

(ii) Identify the relevant magnetic properties used for memory storage. (6)

14. (a) (i) Explain the terms associated with optical materials (12)

(1) Luminescence

(2) Kerr effect

(3) Recombination.

(ii) Compare the absorption, emission and scattering of light in metals and semiconductors. (4)

Or

(b) Illustrate the working and I-V characteristics of (i) Solar cell and (ii) Organic LEDs and (iii) laser diodes.

15. (a) (i) Define Fermi energy and explain how it depends on the size of the materials? (4)

(ii) Demonstrate the effect of quantum confinement in low dimensional systems and Obtain the expression for DOS. (12)

Or

(b) Describe the construction and working of (i) nano diodes (ii) SET (iii) Quantum dot lasers.

05/06/18 FN

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

Question Paper Code : 40065

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Second Semester
Computer Science and Engineering
PH 8252 – PHYSICS FOR INFORMATION SCIENCE
(Common to Information Technology)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. How does the classical free electron theory lead to Ohm's law ?
2. Explain the concept of hole in semiconductors.
3. Distinguish between direct and indirect band in semiconductor.
4. You are given a piece of extrinsic semiconductor. How will you find to which type it belongs ?
5. Derive the relation between magnetic susceptibility and relative permeability.
6. Which material would you use for the hard drive and for a power generator ?
7. Discuss absorption of light by semiconductors.
8. What are the optical properties ?
9. What do you understand by quantum confinement ?
10. What are the Nanodevices ?

PART – B (5×16=80 Marks)

11. a) Deduce a mathematical expression for electrical conductivity of a conducting material and hence obtain Wiedemann-Franz Law. (10+6)

(OR)

b) What is density states ? Derive an expression for the density of states. (2+14)

12. a) Derive an expression for the carrier concentration in N-type and P-type semiconductors. (8+8)

(OR)

b) Explain with a sketch the variation of Fermi level with temperature and concentration impurities in P and N type semiconductors. (8+8)

13. a) Compare and contrast the different types of magnetic materials and mention their properties and applications. (16)

(OR)

b) Explain the domain theory of ferromagnetism. Using that how will you explain the properties of ferromagnetic materials. (16)

14. a) Explain the theory and working of LED. What are the advantages of using LED in electronic display ? (16)

(OR)

b) What is a solar cell ? Discuss in detail the construction and working of solar cell. Mention the applications of solar cell. (16)

15. a) Explain an experimental method used to measure the Hall coefficient of a specimen. Discuss in the principle and working of magnetic hard disk. (8+8)

(OR)

b) Draw energy band diagram for the p-n junction diode. Discuss in detail the operation and applications of single electron transistor. (6+10)

Reg. No. :

Question Paper Code : 90499

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Second Semester
Computer Science and Engineering
PH8252 – PHYSICS FOR INFORMATION SCIENCE
(Common to Information Technology)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Write down the expression for electrical conductivity of a metallic conductor.
2. Which statistics can be used for explaining energy distribution in conductors? Write down the expression.
3. Draw the energy band diagram for an intrinsic semiconductor with necessary parameters.
4. Differentiate between direct and indirect band gap materials.
5. Define magnetic permeability and susceptibility.
6. What are hard and soft magnetic materials ? Give examples for both.
7. Discuss the absorption, emission and scattering of light in metals.
8. How LASER is different from LED ?
9. What is quantum confinement ?
10. What is a single electron transistor ? How does it work ?

PART – B **(5×16=80 Marks)**

11. a) Discuss the classical free electron theory in detail. What are the success and failures of this theory ?

(OR)

b) Derive an expression for the density of single-particle states as a function of energy for a free electron gas in three dimension.

12. a) Derive an expression for carrier concentration in intrinsic semiconductors.

(OR)

b) Discuss the variation of Fermi level with temperature and impurity concentration with the help of neat diagrams.

13. a) How materials can be classified according to their magnetic properties ? Describe them with examples.

(OR)

b) What are GMR sensors ? Explain their applications in digital storage media with necessary diagrams.

14. a) Discuss the carrier generation and recombination processes in semiconductor devices with neat diagram.

(OR)

b) What is photo-current ? How photo-current is generated in a P-N junction diode ?

15. a) How nanomaterials are different from bulk materials? Discuss the basic properties of nanomaterials.

(OR)

b) What are carbon nanotubes ? Explain their properties and applications in detail.