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

Question Paper Code : 27472

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Second Semester

Civil Engineering

PH 6251 — ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw qualitatively Fermi-Dirac distribution function at $T = 0$ K and at a temperature $T > 0$ K.
2. Calculate the drift velocity of conduction electrons in a copper wire of cross-sectional area 5 mm^2 carrying a current of 5 A. Conduction electron density in copper is $8.5 \times 10^{28} / m^3$.
3. Calculate the electrical conductivity of silicon at room temperature doped with 5×10^{16} phosphorous atoms /cm^3. Assume that all the impurities are ionized at room temperature. (Mobility of electrons and holes in silicon are 1350 cm^3/Vs and 450 cm^3/ Vs respectively).
4. The Hall effect experiment is performed to determine the mobility of holes in a p-type silicon. The resistivity and thickness of the sample are $2.0 \times 10^5\ \Omega$cm and 2 mm respectively. For an applied magnetic field of 0.1 T and current of 5 μA, the measured Hall voltage is 30 mV. Find the mobility of holes.
5. What are magnetic domains? Are they present in all the materials?
6. What causes conduction electrons to pair together in conventional superconductor?
7. The relative permittivity of diamond and germanium are 5.8 and 16 respectively. Give reasons why relative permittivity of germanium is greater than diamond.
8. Why dielectrics are used in capacitors?
9. Why metallic glasses are used as transformer core materials?
10. What is Kerr effect?

PART B — (5 × 16 = 80 marks)

11. (a) Derive the expression for electrical and thermal conductivities of metals following the assumptions of classical free electron theory. Hence deduce Wiedemann-Franz law. (16)

Or

(b) (i) Derive an expression for density of energy states. (8)

(ii) Derive an expression for conduction electron density in metals. (8)

12. (a) Derive the expressions for intrinsic carrier concentration and electrical conductivity of an intrinsic semiconductor. Explain the variation of electrical conductivity with temperature and band gap of the semiconductor. (16)

Or

(b) Explain p- type semiconductor and derive an expression for the position of Fermi level. Explain the behaviour of this semiconductor at high temperature. (16)

13. (a) (i) Explain the classification of materials based on magnetic behaviour with examples. (12)

(ii) What type of magnetic materials are used in magnetic tapes and electromagnets for data storage? (4)

Or

(b) (i) Explain the terms critical temperature, critical magnetic field and critical current density and their significance for superconductors.(8)

(ii) Explain the interaction of type-I and type-II superconductors with external magnetic field. (8)

14. (a) (i) Explain the different mechanism by which a dielectric material loses its insulating property. (8)

(ii) Explain the behaviour of a dielectric material in an alternating electric field of different frequency range. (8)

Or

(b) (i) Define the term polarizability in dielectrics. Derive an expression for electronic polarizability. (8)

(ii) Explain ferroelectric materials. Give its applications. (8)

15. (a) (i) What are the properties exhibited by nanomaterials? Explain any one method of preparing nanomaterials. (8)

(ii) What are biomaterials? Give the applications of biomaterials in ophthalmology and dentistry. (8)

Or

(b) (i) What are shape memory alloys? Give their characteristic properties and applications. (8)

(ii) Explain different kinds of shape memory effect with schematic diagram. (8)

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

Question Paper Code : 57700

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Second Semester

Civil Engineering

PH 6251 – ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Distinguish between drift velocity and thermal velocity of an electron.

2. What are the essential features of quantum free electron theory ?

3. What is Hall voltage ? Hall voltage of an extrinsic semiconductor depends on what properties of the material ?

4. The electrical resistivity of certain intrinsic semiconductor is 0.40 Ω m. The electron and hole motilities are 0.64 $m^2 V^{-1} s^{-1}$ and 0.36 $m^2 V^{-1} s^{-1}$ respectively. Calculate the electron and hole densities.

5. What are the properties required for a material to be suitable for making electromagnet ? Give examples.

6. What is London penetration depth ?

7. How does a dielectric material find its application in gas lighters ?

8. Calculate the electronic polarizability for argon atom. Given $\varepsilon_r = 1.0024$ at NTP and $N = 2.7 \times 10^{25} m^{-3}$.

9. Define the term birefringence.

10. What are metallic glasses ? Give two important characteristic properties of these materials.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Derive the expressions for electrical and thermal conductivities of metals based on classical free electron theory. Discuss how far they were successful in explaining the experimental results. **(12)**

(ii) A 5.8 m length and 2.0 mm diameter wire carries a current of 750 mA current, when the applied potential across its ends is 22 mV. If the drift speed of the electrons is 7.2×10^5 m/s, calculate the electrical resistivity of the wire and the conduction electron density of the material of the wire. **(4)**

OR

(b) (i) Explain Fermi-Dirac distribution function and discuss its behaviour with respect to temperature. Also represent it graphically. **(6)**

(ii) Assuming the expression for density of energy states, find the expression for conduction electron density in metals. How does it change with temperature ? **(6)**

(iii) The electrical conductivity of Cu at room temperature is 5.9×10^7 $\Omega^{-1}m^{-1}$. The Fermi energy for Cu is 7.0 eV and the conduction electron density is 8.4×10^{28} electrons m^{-3}. Calculate the Fermi velocity and mean free path of the electrons. **(4)**

12. (a) Explain the electrical properties of an intrinsic semiconductor based on band theory. Derive an expression for electron density in the conduction band and explain how it changes with temperature. **(16)**

OR

(b) Derive an expression for Fermi energy level in a n-type semiconductor. Discuss the variation the Fermi level with temperature along with graphical representation and show that n-type semiconductor behaves as an intrinsic semiconductor at high temperature. **(16)**

13. (a) (i) Distinguish between hard and soft magnetic materials with their applications. **(8)**

(ii) Write a note on ferrites. Give reasons why ferrites are preferred over ferromagnetic materials as core materials for high frequency applications. **(8)**

OR

(b) (i) Distinguish between type I and type II superconductors. **(8)**

(ii) Explain BCS theory of superconductivity. **(4)**

(iii) Explain SQUID. **(4)**

14. (a) (i) Derive an expression for the Lorentz field developed inside a dielectric material when it is placed in a electric field. **(12)**

(ii) Explain any two important dielectric breakdown mechanism. **(4)**

OR

(b) (i) Explain the phenomenon of ferroelectricity. Explain the ferroelectric properties exhibited by $BaTiO_3$ crystal. **(12)**

(ii) How does a dielectric material behave when it is placed in a A.C field ? **(4)**

15. (a) (i) Explain the characteristic properties exhibited by NiTi shape memory alloy. **(8)**

(ii) Write a note on NLO materials. **(8)**

OR

(b) (i) Explain pulsed laser deposition method of preparing nano materials. What are the advantages of this method compared to other methods ? **(8)**

(ii) Explain the application of biomaterials in the fields of orthopedics. **(8)**

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

Question Paper Code : 77276

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Second Semester

Civil Engineering

PH 6251 — ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define mobility of electrons. Write its unit.

2. Fermi temperature of a metal is 24600 K. Calculate the Fermi velocity of electrons.

   Given : $k = 1.38 \times 10^{-23}$ J K^{-1}, $m = 9.1 \times 10^{-31}$ kg.

3. What are elemental semiconductors and compound semiconductors?

4. With increase of temperature, the conductivity of a semiconductor increases. Why?

5. What are the applications of ferrites?

6. What is the principle of SQUID?

7. What are the uses of dielectric material?

8. Define dielectric loss.

9. What do you understand by the term quenching?

10. What are nanomaterials?

PART B — (5 × 16 = 80 marks)

11. (a) (i) On the basis of free electron theory, derive an expression for electrical conductivity of metals. (12)

(ii) What are the drawbacks of classical free electron theory of metals? (4)

Or

(b) (i) Explain the concept of density of energy states. Derive an expression of density of energy states. (12)

(ii) Find the expression for carrier concentration in metals. (4)

12. (a) Obtain an expression for density of holes in the valence band of p-type semiconductor. (16)

Or

(b) What is Hall effect? Derive an expression of hall co-efficient. Describe an experimental setup for the measurement of hall co-efficient. (2+8+6)

13. (a) (i) Briefly explain different types of magnetic materials and their properties. (12)

(ii) Distinguish between soft and hard magnetic materials. (4)

Or

(b) (i) Explain Meissner effect, type I and type II superconductors. (4+4+4)

(ii) Calculate the critical current for a wire of lead having a diameter of 1 mm at 4.2 K. Critical temperature of lead is 7.18 K and H_c at 0K is 6.5×10^4 A/m. (4)

14. (a) Derive the expression for electronic and ionic polarisabilities. (8+8)

Or

(b) Discuss in detail the various dielectric breakdown mechanisms. (16)

15. (a) What are metallic glasses? Explain how they are prepared by melt spinning method. Also mention their application. (2+7+7)

Or

(b) Explain with necessary diagrams the synthesis of nanomaterials using the following methods.

(i) Chemical vapour deposition (8)

(ii) Pulsed laser deposition. (8)

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

Question Paper Code : 80840

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Second Semester

Civil Engineering

PH 6251 — ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the properties of metals described inadequately by Drude's – model?
2. Define the mobility of electrons.
3. Define fermilevel and write its expression.
4. Sketch a graph between electrical conductivity and temperature of an intrinsic semiconductor.
5. Compare Para and ferromagnetic materials.
6. What is SQUID and mention its uses?
7. Define dielectric loss.
8. Write the applications of ferroelectric materials?
9. What are shape memory alloys?
10. Mention any four methods to produce nano materials.

PART B — (5 × 16 = 80 marks)

11. (a) Derive the expression for electrical and thermal conductivities of a metal, hence obtain the expression for Wiedemann-Franz law. (6 + 6 + 4)

Or

(b) Define density of energy states? Derive the expression for the density of energy states in metals. (2 + 14)

12. (a) Derive the expression for the carrier concentration in an intrinsic semiconductor and show the variation of fermilevel with temperature with a neat diagram.

Or

(b) Obtain an expression for the carrier concentration of electrons in the conduction band of an n-type semiconductor.

13. (a) What are the different types of magnetic materials? Explain each magnetic material in detail with diagrams.

Or

(b) Write an essay on different types of superconducting materials, their properties and their applications.

14. (a) Explain the different types of polarization mechanisms in dielectrics and sketch their dependence on the frequency of applied electric field.

Or

(b) What is meant by local field in a dielectric and how it is calculated for a cubic structure? Deduce Clausius-Mosotti relation.

15. (a) What are metallic glasses? How are they prepared? Explain their use as transformer core material.

Or

(b) Explain biomaterial and its applications in the field of medicine.

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

Question Paper Code : 97253

B.E./B.Tech. DEGREE EXAMINATION, DECEMBER 2015/JANUARY 2016.

Second Semester

Civil Engineering

PH 6251 — ENGINEERING PHYSICS – II

(Common to all branches except Biotechnology and Pharmaceutical Technology)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. The Fermi energy of copper is 7.0 *eV*. Find the Fermi velocity of the electrons.

2. The conduction electron density in aluminum is 18.1×10^{28} *electrons*/m^3. Calculate the Fermi energy of aluminum.

3. How many pentavalent atoms per cm^3 has to be added to an intrinsic silicon semiconductor to produce a n-type semiconductor with electrical conductivity of $5\Omega^{-1}cm^{-1}$ at room temperature. (Assume that all the donor atoms are ionized at room temperature).

4. What is a Hall probe? How it is used to measure magnetic flux density?

5. What is hysteresis?

6. Give the differences between conventional superconductors and high temperature superconductors.

7. What are ferroelectric materials?

8. Define dielectric loss.

9. Define the term birefringence.

10. What is shape-memory effect?

PART B — (5 × 16 = 80 marks)

11. (a) Discuss Drude-Lorentz theory of metals. Derive an expression for electrical and thermal conductivity of metals and hence prove Wiedemann-Franz law. (2 + 12 + 2)

Or

(b) Derive an expression for density of energy states, hence deduce an expression for conduction electron density in metals. (12 + 4)

12. (a) Derive an expression for Fermi energy level for an intrinsic semiconductor and show that it lies in the middle of the band gap at T = 0 K. Discuss how the Fermi level changes with temperature. (12 + 4)

Or

(b) Derive an expression for concentration of holes in a p-type semiconductor. Discuss how a p-type semiconductor behaves at various temperature with a graph. (12 + 4)

13. (a) Explain the origin of magnetism in materials and the classification of dia, para, ferro, antiferro and ferri magnetic materials with suitable examples. (16)

Or

(b) (i) Explain Transition temperature, Meissner effect, critical magnetic field and Isotope effect in superconductors. (12)

(ii) Explain any two applications of superconductors (4)

14. (a) (i) Derive an expression for electronic and ionic polarization. (12)

(ii) Explain the use of dielectric material in transformers and capacitors. (4)

Or

(b) (i) What is dielectric breakdown? Explain the different mechanism by which a dielectric material losses its insulating property. (12)

(ii) How does a dielectric material behaves in a A.C field of different frequency. (4)

15. (a) What are metallic glasses? Discuss the method of preparing metallic glasses, the characteristic properties exhibited by them and their applications. (16)

Or

(b) What are biomaterials? Discuss the classification of biomaterials and their uses in the field of medicine with suitable examples. (16)

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