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Question Paper Code: 52005

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Second Semester

Computer Science Engineering

15UPH205 - SEMICONDUCTOR PHYSICS AND OPTO ELECTRONICS

(Common to ECE and IT)

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The resistance of the most of the conducting materials __ with increase in temperature CO1-R
(a) Increases (b) Decreases
(c) Remain same (d) first decreases and then increases
2. The value of $F(E)$ lies between __ CO1-R
(a) 0 and 1 (b) 1 and 2 (c) -1 and 1 (d) 0 and -1
3. Silicon doped with phosphorous is a __ CO2-R
(a) intrinsic semiconductor (b) extrinsic semiconductor
(c) p-type semiconductor (d) n-type semiconductor
4. Cobalt is the example for __ material CO2-R
(a) ferromagnetic (b) ferroelectric (c) dielectric (d) paramagnetic
5. Dielectric materials have __ CO3-R
(a) free charges (b) no free charge (c) free electrons (d) none of these
6. A superconductor repels magnetic flux lines, this phenomenon is called CO3-R
(a) Isotope effect (b) Hall effect (c) Josephson effect (d) Meissner effect

7. Demodulation is done in__ CO4-R
 (a) Receiving antenna (b) Transmitter
 (c) Radio receiver (d) Transmitting antenna
8. Optical switching can be classified into _____ categories. CO4-R
 (a) Two (b) Three (c) Four (d) One
9. For long distance communication __ are more suitable CO5-R
 (a) graded index fibers (b) single mode step index fibers
 (c) step index fibers (d) silica fibers
10. Which of the following loss occurs inside the fibre? CO5-R
 (a) Radiative loss (b) Scattering (c) Absorption (d) Attenuation

PART – B (5 x 2= 10Marks)

11. Define drift velocity. CO1-R
12. List types of semiconductors with example. CO2-R
13. Mention any two properties of superconductors. CO3-R
14. What is meant by modulation and demodulation in optical communication system? CO4-R
15. Name the types of optical fibers based on number of modes. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) (i) Apply the classical free electron theory to derive the expression for electrical conductivity and thermal conductivity of metals. CO1-App (12)
- (ii) Calculate the probability function $F(E)$ of an electron for following cases. CO1-App (4)
- (a) Probability of occupation of electron for $E < E_F$ at $T=0K$
- (b) Probability of occupation of electron for $E > E_F$ at $T=0K$
- Or
- (b) (i) Calculate the number of available electron states per unit volume in an energy interval dE using quantum free electron theory. CO1-App (12)
- (ii) Calculate carrier concentration in metals using above expression. CO1-App (4)

17. (a) (i) Demonstrate Hall effect experiment to determine the type of semiconductor. CO2-U (12)
(ii) Classify magnetic materials based on their properties and spin. CO2-U (4)
- Or
- (b) (i) Explain the formation of domain structure and various energies involved in the process of domain growth with diagram. CO2-U (10)
(ii) Differentiate soft magnetic materials from hard magnetic materials. CO2-U (6)
18. (a) (i) Obtain Clausius-Mossotti equation which gives the relation between the macroscopic dielectric constant and the microscopic polarizability of a substance. CO3-Ana (12)
(ii) Compare and contrast the different types of polarization mechanisms involved in a dielectric material. CO3-Ana (4)
- Or
- (b) (i) Explain the characteristics of type-I and type-II superconductors with examples. CO3-Ana (10)
(ii) Select and explain the device which is used to measure earth quakes and magnetic signal from the brain, heart etc. CO3-Ana (6)
19. (a) (i) Express the concepts of the stark effect and the Franz Keldysh effect. CO4-U (10)
(ii) Give short notes on pulse code modulation. CO4-U (6)
- Or
- (b) (i) What is meant by optical switching? Explain the working of self electro optic effect device (SEED). CO4-U (12)
(ii) List the applications of bipolar controller. CO4-U (4)
20. (a) (i) Derive the expression for critical angle, acceptance angle and numerical aperture of an optical fiber. CO5-U (12)
(ii) Discuss the types of optical fiber based on the number of modes of propagation of light signal. CO5-U (4)
- Or
- (b) (i) Discuss the optical fibre communication system with neat block diagram. CO5-U (10)
(ii) Describe principle, construction and working of temperature sensor. CO5-U (6)

