(T) Roll No. .....

PAPER ID—10708

Bachelor of Technology (Computer Science and Engineering), Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence), Bachelor of Technology in Computer Science and Engineering (Cyber Security), Bachelor of Technology (Computer Science) EXAMINATION, 2025

(Second Semester)

PHYSICS

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

(Compulsory Question)

1. (a) What do you understand by Fermi level ? Explain its significance in metals and semiconductors. **2**

(b) Distinguish between intrinsic and extrinsic semiconductor. **2**

(c) How are direct and indirect band gap semi-conductors different from each other ? **2**

(d) What is meant by potential barrier across a PN junction ? **2**

(e) What are Exciton ? 2

(f) Define the terms quantum dot and quantum wires. 2

(g) Draw energy level diagram for Hetrojunctions. 2

Unit I

2. (a) Explain the concept of density of states for a free electron gas. 5

(b) Write a short note on different types of bonding of atoms. 4

(c) Derive time dependent Schrödinger wave equation. 5

3. (a) On the basis of band theory of solid distinguish (in detail) between metal, insulator and semi-conductors. 8

(b) Calculate the density of electron at 422 K if band gap energy for semiconductor is 0.7 eV. 3

(c) Briefly give an idea about the structure of atom. 3

Unit II

4. (a) Explain the formation of *pn* junction and explain its working in forward and backward bias. 11

(b) Explain the term carrier generation and recombination in semiconductors. 3

5. (a) What is Hall effect ? Also write down the applications of Hall effect. 4

(b) Explain the dependence of Fermi level on carrier concentration and temperature. 10

Unit III

6. (a) Describe Fermi's Golden rule. 8

(b) Derive an expression for conductivity of metals on the basis of Drude model. 6

7. (a) Explain under what conditions stimulated emission of radiations can take place ? What are the characteristics of such radiations ? **6**

(b) Write short notes on the following : **8**

(i) Metal-semiconductor junction.

(ii) Use of semiconductors in optoelectronic devices.

Unit IV

8. (a) Discuss the Four probe method for the measurement of resistivity, carrier density and mobility of charge carriers in semiconducting materials. **10**

(b) Discuss which parameter can be extracted from I-V characteristics of diode. 4

9. (a) Discuss the fabrication and characteristization techniques for Quantum wire and Quantum dots. 9

(b) Write a short note on DLTS. 5

❖❖❖❖❖❖❖

(T) Roll No. .....

PAPER ID—16148

B. Tech. EXAMINATION, 2024

(First Semester)

COMPUTER SCIENCE AND ENGINEERING

(Internet of Things)

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) What is Heinsberg uncertainity principle ? 2

   (b) Write the probability distribution function of electrons ? 2

   (c) What will be the De-Broglie Wavelength of an electron having Kinetic energy of 500 eV ? 2

   (d) A n-type Ge crystal has a current density 100 A/m^2. The crystal has resistivity of 0.5 Ωm and electron mobility of 0.4 $m^2/V\text{-}S$. Calculate the drift velocity of electron in the crystal. Given $e = 1.6 \times 10^{-19}$ C. 2

   (e) What are excetons ? What are its types ? 2

   (f) What is the difference between metals, semiconductors and insulators ? 2

   (g) Find out the value of resistivity in Si chip having thickness $0.60 \pm 2\%$ cm and probe distance (S) 0.300 ± 2 cm. The mean value of V/I ratio is 38.22 experimentally. 2

Unit II

2. Explain the Kronig-Penney model for a linear lattice. How does it lead to the formation of energy bands in solids ? What happens to the width of allowed and forbidden bands with the change in the strength of the periodic potential ? 14

3. (a) What is an effective mass of an e^- in solids ? Derive an expression for the same. 7

   (b) Derive the expression of density of states in 3-dimensions using Quantum theory. 7

Unit III

4. (a) Distinguish between intrinsic and extrinsic semiconductors. Indicate in energy level diagrams, the conduction band, valence band, donor and acceptor states. What are the positions of Fermi levels for the intrinsic and extrinsic semiconductors. 7

(b) Discuss the variation of Fermi level with temperature for N-type semiconductor. 7

5. (a) What is diffusion and drift current ? Derive an expression for total current density in a semiconductor. 7

(b) Hall voltage of 0.1 mV is found to be developed when a sample carrying a current of 10.0 mA is placed in a transverse magnetic field of 3 KG. Calculate the charge carriers concentration of the sample. Given the thickness of the sample along the direction of magnetic field is 0.3 mm. 7

Unit IV

6. (a) What is P-N Junction ? How potential barrier is formed in P-N junction diode ? Explain what happens when P-N function is baised in forward and reverse direction. 9

(b) Discuss, how the process of Avalanche breakdown occurs via PN junction diode. How is it different from zener breakdown ? 5

7. (a) What is density of states ? Derive an expression for joint density of states of a semiconductor substance. 7

(b) On the account of optical transition, defined induced absorption, spontaneous emission and stimulated emission. Derive the relation between Eienstein coefficients. 7

Unit V

8. Discuss the following methods of measurements of semiconductor parameters :

(a) Hot Point Probe Measurements 7

(b) Band Gap measurements using UV vis spectroscopy. 7

9. (a) Discuss the band diagram and working of P-N hetrojunction of both forward and reverse bias in detail. 7

(b) What are 3D, 2D, 1D and 0D system in solids ? Give plots between density of state and energy of each system. 7

PAPER ID—10708

B. Tech. EXAMINATION, 2024

(Second Semester)

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Code : BPS-101

Physics

Time : 3 Hours *Maximum Marks : 70*

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all. Q. No. 1 (Unit I) is compulsory. Attempt any *four* questions from Unit II. All questions carry equal marks.

Unit I

1. (a) Differentiate elemental and compound semiconductors. 2

   (b) Write a short note on bonding of atoms.

   (c) Draw energy level diagram for Hetrojunctions. 2

   (d) What are quantum wells, quantum wires and quantum dots ? 2

   (e) Derive a relationship between diffusion coefficient and mobility of charge carrier in a semiconductor. 2

   (f) What is the significance of negative effective mass ? 2

   (g) How Optical loss and gain in Photovoltaic devices can be calculated ? 2

Unit II

2. (a) Stating the drawbacks of classical theory of free electron, derive (using quantum theory of free electron) the expression for eigen function and energy eigen values for a free electron confined to a potential well. 7

(b) Explain the formation of energy bands in solids. On the basis of energy bands distinguish between a metal, a semiconductor and an insulator. 7

3. (a) Discuss the variation of effective mass of electron with wave number k. 4

(b) Derive time independent Schrödinger wave equation. 5

(c) Discuss Hall effect in semiconductor assuming only one type of charge carriers. Discuss its applications. 5

4. (a) Distinguish between intrinsic and extrinsic semiconductors. Obtain an expression for the carrier concentration for an intrinsic semiconductor. 7

(b) Explain the concept of density of energy states. Derive expression for density of states in materials. 7

5. (a) Write short notes on the following : 7

(i) Metal semi-conductor junction

(ii) Use of semi-conductors in optoelectronic devices.

(b) Describe Fermi Golden rule. 7

6. (a) Compare the van der Pauw measurement method and four-point probe method to determine resistivity of materials. 6

(b) What is Photon ? Obtain the expression for density of states for photon. 5

(c) Write a short note on DLTS. 3

7. (a) Discuss, how UV spectroscopy can be used to determine optical band gap of a semiconductor. 5

(b) Show that as per Drude model the conductivity of the material is proportional to the relaxation time required to attain the equilibrium. 6

(c) List the various optical transitions that occur in bulk semiconductor when light of suitable wavelength incident on it. 3

(T) Roll No. .....

PAPER ID—16250

B.Tech. EXAMINATION, 2024

(First Semester)

ELECTRONICS AND COMMUNICATIONS ENGINEERING

Code : BSP-103

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question each from Unit II-V. Q. No. **1** (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) Define Electric Field. Give its units. 2

   (b) For permanent magnets, which type of magnetic material is preferred. Give examples 2

   (c) What do you mean by monochromaticity ? 2

   (d) The distance between two slits is 0.1 mm and the width of fringes formed on screen is 6 mm. If the distance between screen and slit is 1.2 m, calculate the wavelength of light used. 2

   (e) What is the difference between metals, semiconductors and insulators ? 2

   (f) Determine whether the potential field $V = x^2 - y^2 + z^2$ satisfy Laplace equation. 2

(g) A long solenoid has 200 turns per cm and carries a current of 2.5 Å. What is the magnetic field at its centre ? 2

Unit II

2. (a) Derive an expression for electric field and potential due to an electric dipole at an axial line 10

(b) Derive Laplace equation and Poisson's equation. 4

3. (a) Derive boundary condition for electric field. 10

(b) Define bound charges and electric displacement. 4

Unit III

4. (a) Derive an expression for equation of continuity. 7

(b) Explain Ferromagnetism on the basis of domain theory. 7

5. Establish Maxwell's equations for the electromagnetic fields and explain their significance in detail. 14

Unit IV

6. (a) Explain and differentiate between the interference due to division in wave front and division of amplitude. What is Fresnel's biprism ? 7

(b) What are Newton rings ? Explain the formation of bright and dark rings. Prove that the diameter of dark fringes are proportional to the square root of the natural numbers. 7

7. (a) What is Fraunhoffer diffraction ? Discuss analytically the Fraunhoffer diffraction at single slit. 7

(b) Explain the principle, construction and working of He-Ne Laser. What are its applications ? 7

Unit V

8. Discuss Kronig-Penney model. Using this model, show that the energy spectrum of electron consists of number of allowed energy bands separated by forbidden region. **14**

9. Discuss in detail the Bloch theorem for particles in a periodic potential. **14**

PAPER ID—10713

B. Tech. EXAMINATION, 2024

(Second Semester)

ELECTRICAL AND ELECTRONICS ENGINEERING

Code : BSP-103

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, Q. No. **1** is compulsory. Attempts *four* more questions by selecting *one* question from each Unit. All questions carry equal marks.

1. (a) Write Laplace's and Poission's equations.

(b) What do you mean by electromagnetic waves ?

(c) State Huygen's principle.

(d) How does laser light differ from 'normal' light ?

(e) Define population inversion.

(f) What do you mean by intrinsic and extrinsic semiconductors ?

(g) Explain the variation of conductivity of semiconductor with temperature. **7×2=14**

Unit I

2. (a) Show that divergence and curl both are zero for electric field. **10**

(b) Verify Laplace equation for a given potential :

$$V = 4x^2 - 6y^2 + 2z^2 .$$ **4**

3. Obtain boundary conditions on electric field and displacement vector. **14**

Unit II

4. State Biot-Savert law. Calculate the Magnetic field at center due to circular coil of radius R. 14

5. (a) Define displacement current density and derive equation of continuity. 5

   (b) Derive wave equation for E and B. 9

Unit III

6. What is Coherent Source ? Explain formation of Newton's rings in reflected systems and how are they changed in transmitted systems ? 14

7. (a) With the neat and clean diagram ,discuss the construction and working of Ruby laser. 10

   (b) Calculate the energy and momemtum of a photon of a laser beam of wavelength 6328 Å. 4

Unit IV

8. On the basis of classical free electron theory, obtain an expression of electrical conductivity of metals.

9. (a) Show that Fermi level lies in the middle of conduction band and valence band in case of intrinsic semiconductors.

   (b) Discuss carrier transport in semiconductors.

(T) Roll No. .....

PAPER ID—16148

B. Tech. EXAMINATION, 2024

(First Semester)

COMPUTER SCIENCE AND ENGINEERING

(Internet of Things)

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) What is Heinsberg uncertainity principle ? 2

   (b) Write the probability distribution function of electrons ? 2

   (c) What will be the De-Broglie Wavelength of an electron having Kinetic energy of 500 eV ? 2

   (d) A n-type Ge crystal has a current density 100 A/m^2. The crystal has resistivity of 0.5 Ωm and electron mobility of 0.4 $m^2/V\text{-}S$. Calculate the drift velocity of electron in the crystal. Given $e = 1.6 \times 10^{-19}$ C. 2

   (e) What are excetons ? What are its types ? 2

   (f) What is the difference between metals, semiconductors and insulators ? 2

   (g) Find out the value of resistivity in Si chip having thickness $0.60 \pm 2\%$ cm and probe distance (S) 0.300 ± 2 cm. The mean value of V/I ratio is 38.22 experimentally. 2

Unit II

2. Explain the Kronig-Penney model for a linear lattice. How does it lead to the formation of energy bands in solids ? What happens to the width of allowed and forbidden bands with the change in the strength of the periodic potential ? 14

3. (a) What is an effective mass of an e^- in solids ? Derive an expression for the same. 7

   (b) Derive the expression of density of states in 3-dimensions using Quantum theory. 7

Unit III

4. (a) Distinguish between intrinsic and extrinsic semiconductors. Indicate in energy level diagrams, the conduction band, valence band, donor and acceptor states. What are the positions of Fermi levels for the intrinsic and extrinsic semiconductors. 7

(b) Discuss the variation of Fermi level with temperature for N-type semiconductor. 7

5. (a) What is diffusion and drift current ? Derive an expression for total current density in a semiconductor. 7

(b) Hall voltage of 0.1 mV is found to be developed when a sample carrying a current of 10.0 mA is placed in a transverse magnetic field of 3 KG. Calculate the charge carriers concentration of the sample. Given the thickness of the sample along the direction of magnetic field is 0.3 mm. 7

Unit IV

6. (a) What is P-N Junction ? How potential barrier is formed in P-N junction diode ? Explain what happens when P-N function is baised in forward and reverse direction. 9

(b) Discuss, how the process of Avalanche breakdown occurs via PN junction diode. How is it different from zener breakdown ? 5

7. (a) What is density of states ? Derive an expression for joint density of states of a semiconductor substance. 7

(b) On the account of optical transition, defined induced absorption, spontaneous emission and stimulated emission. Derive the relation between Eienstein coefficients. 7

Unit V

8. Discuss the following methods of measurements of semiconductor parameters :

(a) Hot Point Probe Measurements 7

(b) Band Gap measurements using UV vis spectroscopy. 7

9. (a) Discuss the band diagram and working of P-N hetrojunction of both forward and reverse bias in detail. 7

(b) What are 3D, 2D, 1D and 0D system in solids ? Give plots between density of state and energy of each system. 7

(220-CU-211632) Roll No. .....

PAPER ID—10708

B.Tech. (CSE/AI/IOT/CS all Computer)

EXAMINATION, 2023

(Second Semester)

PHYSICS

Time : 3 *Hours* *Maximum Marks* : 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting any *four* questions from Unit-II. Q. No. 1 (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) What do you mean by effective mass of an electron ? Give its physical significance. 2

   (b) Explain the term carrier generation and recombination in semiconductors. 2

   (c) Photovoltaic effect can be used to store energy. Justify. 2

   (d) Explain, how band gap of a material can be measured using UV-Vis spectroscopy. 2

   (e) How are p-n junction and metal semiconductor junction different from each other ? 2

   (f) Explain an experimental technique used to study the surface topography and crystallography of low dimension system. 2

(g) Using the expression of energy for electron in 1-D potential well determine the density of states associated with it. 2

Unit II

2. (a) Describe Kronig-Penney model for motion of electron in a periodic potential. Show from E-K graph that materials can be classified in to metals, insulators and semiconductors. 7

(b) Show how Fermi level depends on carrier concentration and temperature. 7

3. (a) Discuss the Schottky barrier in metal semiconductor junction for reverse bias condition. 5

(b) Derive time-dependent Schrödinger wave equation. 5

(c) What are Phonon ? Discuss, how do they contribute to scattering of a particle. 4

4. (a) Prove that the carrier concentration of electron in conduction band for n-type semiconductor depends upon the ionization energy of the donor atom. 6

(b) What do you mean by direct and indirect band gap ? 4

(c) The Hall coefficient of a silicon specimen was found to be -7.35×10^{-5} m^3C^{-1}. Determine the nature of the semiconductor. Given the electrical conductivity of Si is 200 $Omh^{-1}m^{-1}$. Calculate the density and mobility of charge carriers. 4

5. (a) What is pn junction ? Discuss the formation of pn junction and explain its working in forward and reverse bias. 7

(b) Explain the terms stimulated absorption, spontaneous emission and stimulated emission. A Laser source is operating at 632.8 nm. Calculate the ratio of stimulated emission to spontaneous emission coefficient. 7

6. (a) Describe the fabrication method and characterization techniques used to study the properties of quantum well, quantum wires and quantum dots. 8

(b) What is exciton ? Describe the classification of exciton on the basis of properties of material under study. 6

7. (a) Discuss the Four probe method for the measurement of resistivity, carrier density and mobility of charge carriers in semiconducting materials. 7

(b) Derive an expression for conductivity of metals on the basis of Drude model. 7

(T)(J-24) Roll No. 1111 5829.

PAPER ID—16250

B. Tech. (Electronics and Computer Engineering) EXAMINATION, 2024

(First Semester)

PHYSICS

Code : BSP-103

Basic Science

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Unit I has seven questions. All the questions are compulsory. All the questions carry 2 marks. Unit II has six questions. *Four* questions need to be attempted from this Section. All the questions have *two* parts of 7 marks each.

1. (i) Define gradient of a scalar field with the help of suitable example. 2

(ii) Why two independent sources can not produce observable interference pattern ? 2

(iii) What is Bohr magneton ? 2

(iv) Prove that divergence of curl of a vector field is always zero. 2

(v) Write equation of continuity and explain its physical significance. 2

(vi) Differentiate between diffusion and drift current in a semiconductor. 2

(vii) Explain the terms susceptibility and permeability in magnetism. 2

Unit II

2. (a) A vector field is given by $u = iy^2 + j2xy - kz^2$. Determine the divergence and curl of u at the point (1, 2, 1). Also determine if the vector filed is solenoidal or irrotational. 7

(b) Use Gauss law to find the electric field inside and outside of a uniformly charged sphere (charge density σ) of radius R. 7

3. (a) Derive all Maxwell's equations in differential form and discuss their physical significance. 7

(b) On the basis of Weiss theory of Ferromagnetism. Explain hysteresis and Curie point. Discuss the basic difference between paramagnetic and ferromagnetic substances. 7

4. (a) Discuss the working of Ruby laser with the help of suitable energy level diagram. 7

(b) What do you understand by resolving power of an optical instrument ? Find an expression for resolving power of a plane transmission grating. 7

5. (a) Explain Fraunhoffer diffraction through a single slit. Draw the intensity distribution curve. Mention the intensity of secondary maximas with respect to principal maxima. 7

(b) Light of wavelength 6000 Å is incident on a narrow slit of width 0.30 mm. The screen is placed 2 m away from the slit. Find : 7

(i) Position of the first dark fringe

(ii) Width of the central bright fringe.

6. (a) The conduction current density in a lossy dielectric is given by $J_c = 0.01 \sin(10^9 t)$ amp/m^2, Find the displacement current density if $\sigma = 10$ mho/m, $\epsilon_r = 6.5$, $\epsilon_0 = 8.854 \times 10^{-12}$. 7

(b) Find the resistance of intrinsic germanium rod 1 cm long, 1 mm wide and 1 mm thick at 300 K. For germanium $n_i = 2.5 \times 10^{19}$ /m^3 , $\mu_e = 0.39$ m^{2}V^{-1}s^{-1} and $\mu_p = 0.19$ m^{2}V^{-1}s^{-1} at 300 K. 7

7. (a) Explain the working of *p-n* junction. Discuss the forward and reverse biasing of *p-n* junction diode. 7

(b) Mark the Fermi level for : 7

(i) intrinsic semiconductor

(ii) *n* type semiconductor

(iii) *p* type semiconductor. Describe the behavior and properties of conductors, insulators and semiconductors on the basis of band theory.

(220-CU-211632) Roll No. .....

PAPER ID—10708

B.Tech. (CSE/AI/IOT/CS all Computer)

EXAMINATION, 2023

(Second Semester)

PHYSICS

Time : 3 *Hours* *Maximum Marks* : 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting any *four* questions from Unit-II. Q. No. 1 (Unit I) is compulsory. All questions carry equal marks.

Unit I

1. (a) What do you mean by effective mass of an electron ? Give its physical significance. 2

   (b) Explain the term carrier generation and recombination in semiconductors. 2

   (c) Photovoltaic effect can be used to store energy. Justify. 2

   (d) Explain, how band gap of a material can be measured using UV-Vis spectroscopy. 2

   (e) How are p-n junction and metal semiconductor junction different from each other ? 2

   (f) Explain an experimental technique used to study the surface topography and crystallography of low dimension system. 2

(g) Using the expression of energy for electron in 1-D potential well determine the density of states associated with it. 2

Unit II

2. (a) Describe Kronig-Penney model for motion of electron in a periodic potential. Show from E-K graph that materials can be classified in to metals, insulators and semiconductors. 7

(b) Show how Fermi level depends on carrier concentration and temperature. 7

3. (a) Discuss the Schottky barrier in metal semiconductor junction for reverse bias condition. 5

(b) Derive time-dependent Schrödinger wave equation. 5

(c) What are Phonon ? Discuss, how do they contribute to scattering of a particle. 4

4. (a) Prove that the carrier concentration of electron in conduction band for n-type semiconductor depends upon the ionization energy of the donor atom. 6

(b) What do you mean by direct and indirect band gap ? 4

(c) The Hall coefficient of a silicon specimen was found to be -7.35×10^{-5} m^3C^{-1}. Determine the nature of the semiconductor. Given the electrical conductivity of Si is 200 $Omh^{-1}m^{-1}$. Calculate the density and mobility of charge carriers. 4

5. (a) What is pn junction ? Discuss the formation of pn junction and explain its working in forward and reverse bias. 7

(b) Explain the terms stimulated absorption, spontaneous emission and stimulated emission. A Laser source is operating at 632.8 nm. Calculate the ratio of stimulated emission to spontaneous emission coefficient. 7

6. (a) Describe the fabrication method and characterization techniques used to study the properties of quantum well, quantum wires and quantum dots. 8

(b) What is exciton ? Describe the classification of exciton on the basis of properties of material under study. 6

7. (a) Discuss the Four probe method for the measurement of resistivity, carrier density and mobility of charge carriers in semiconducting materials. 7

(b) Derive an expression for conductivity of metals on the basis of Drude model. 7

(220-EL-211732) Roll No. .....

PAPER ID—10713

B.Tech. (VLSI/ECE/EEE all Elect)

EXAMINATION, 2023

(Second Semester)

PHYSICS

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all. Q. No. **1** is compulsory. Attempt *four* more questions selecting exactly *one* question from each Unit. All questions carry equal marks.

1. (a) Define curl and divergence of electrostatic field.

   (b) What is the difference between polar and non-polar dielectrics ?

   (c) Write the characteristics of electromagnetic waves.

   (d) What is role played by He in the He-Ne laser ?

   (e) Define drift and diffusion current.

   (f) What do you mean by Fermi level and Fermi energy ?

   (g) What are the coherent sources ? Can two independent light sources produce stable interference effects ? **2×7=14**

Unit I

2. Define electric dipole and obtain an expression for electric field and potential due to it. **14**

3. (a) Discuss energy of charge distribution and find its expression in terms of electric field.

(b) Find the constants a, b, c such that the vector field :

$$F = (x + 2y + az)i + (bx - 3y - 2)j + (4x + cy + 2z)k$$

where i, j and k are the unit vectors along x, y and z axis respectively. **14**

Unit II

4. (a) Derive Maxwell equations for non-conducting medium. **10**

(b) Obtain an expression for equation of continuity. **4**

5. (a) Define magnetic susceptibility and permeability. Obtain the relation between them. **10**

(b) What is the importance of Hysteresis loop ? What information can be had from such loops ? **4**

Unit III

6. (a) What are Newton's rings ? Explain formation of Newton's rings in reflected light. **10**

   (b) A diffraction grating having 4000 lines/ cm is illuminated normally by a light of wavelength 5000 Å. Calculate its dispersive power in third order spectrum. **4**

7. (a) Discuss construction and working of He-Ne Laser. **10**

   (b) Write the properties of laser light. **4**

Unit IV

8. (a) Discuss Kronig-Penny Model of motion of electron in a periodic potential. **10**

   (b) Obtain Wiedemann-Franz law. **4**

9. (a) What is Fermi level ? How does it change with temperature and concentration of electrons ? **10**

(b) Discuss metals, semiconductors and insulators on the basis of energy level diagram. **4**

(T-1299) Roll No. .....

ID—220-EL-111721

B. Tech. EXAMINATION, 2023

(First Semester)

ELECTRONICS ENGINEERING (VLSI DESIGN TECHNOLOGY)

Code : BSP-103

Physics

Time : 3 Hours *Maximum Marks : 70*

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Unit I has seven questions. All the questions are compulsory. All the questions carry 2 marks. Unit II has six questions. *Four*

questions need to be attempted from this Unit. All the questions has two parts of 7 marks each.

Unit I

1. Write *four* main characteristics of a laser light. 2

2. What kinds of fringes are formed in Newton's ring experiment ? Why the center of the ring system is dark. 2

3. Define magnetic susceptibility. 2

4. What do you understand by mass-action law ? 2

5. Write Gauss law of electrostatics. 2

6. What is the difference between diffusion and drift current ? 2

7. What are Brillouin zones ? 2

Unit II

1. (a) What do you understand by divergence of a vector field ? Compute the divergence of vector :

$$V = ix^2 + j3xz^2 + k2xz\,.$$ 7

(b) Calculate the potential and field due to a dipole of dipole moment 3.5×10^{-11} C/m at a distance 0.5 m from it : 7

(i) on its axis

(ii) on its perpendicular bisector.

2. (a) Draw the B-H curve for ferromagnetic material. Identify the retentivity and the coercive field on the curve. What is energy loss per cycle ? 7

(b) Distinguish between ferrimagnetic, ferromagnetic and antiferromagnetic materials. Give an example of each class of material and their applications. 7

3. (a) Discuss the working of Ruby laser with the help of suitable energy level diagram. 7

(b) A Newton ring arrangement is used with a light sources of wavelength $\lambda_1 = 6000$ Å and $\lambda_2 = 5000$ Å and it is found that the nth dark ring due to λ_1 coincide with $(n + 1)$th dark ring due to λ_2. If the radius of curvature of curved surface of the lens is 90 cm, then find the diameter for the nth dark ring for λ_1. 7

4. (a) Draw the intensity distribution curve for Fraunhoffer diffraction due to single slit. Show that the intensity of secondary maximas w.r.t. principal maxima are in the ratio $1 : 4/9\pi^2 : 4/25\pi^2 : 4/49\pi^2$..... 7

(b) Define resolving power of an instrument. Deduce the resolving power of a Grating. 7

5. (a) Describe the modified Ampere's law. Discuss the significance of displacement current. 7

(b) Discuss the origin of bands with the help of Kronig-Penney model. 7

6. (a) What are *n*-type and *p*-type semiconductors ? Show that the concentration of electrons in an *n*-type semiconductor is proportional to the square root of donor concentration. 7

(b) Define Fermi energy and Fermi level. Draw the Fermi level for intrinsic and extrinsic semiconductors. Also discuss the dependence of Fermi level on carrier concentration and temperature. 7

(T-1297) Roll No. .....

ID—220-EL-111621

B. Tech. EXAMINATION, 2023

(First Semester)

COMPUTER SCIENCE AND ENGINEERING
(CYBER SECURITY)

Code : BSP-101

Physics

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Unit I has seven questions. All the questions are compulsory. All the questions carry 2 marks. Unit II has six questions, *four* questions need to be attempted from this Unit. All the questions have two parts of 7 marks each.

Unit I

1. Which types of semiconductors are used for optoelectronic applications ? 2

2. What do you mean by direct and indirect bandgap ? 2

3. Draw IV characteristics of a p-n junction diode. 2

4. Explain the difference between diffusion and drift current. 2

5. Explain Fermi's golden rule. 2

6. What is the meaning of DLTS ? 2

7. What are Brilluoin zones ? 2

Unit II

1. (a) Discuss the Kronig-Penney model for the motion of an electron in a periodic potential. Explain the formation of band using E-K diagram. 7

(b) Derive one-dimensional Schrödinger wave equation. Explain the physical significance of wave function. 7

2. (a) Explain how the conductivity of intrinsic semiconductor varies with temperature. The intrinsic carrier density of a semiconductor is $1.5 \times 10^{16}\ m^{-3}$. If the mobility of electron and hole are 0.13 and 0.05 $m^2\ V^{-1}\ s^{-1}$, calculate the conductivity of the semiconductor. 7

(b) Define Fermi energy and Fermi level. In a *p*-type semiconductor, Fermi level lies 0.4 eV above the valance band. If the concentration of acceptor atom is tripled, find the new position of the Fermi level. 7

3. (a) What is Hall effect ? The Hall coefficient of certain silicon specimen was found to be $-7.35 \times 10^{-5}\ m^3\ C^{-1}$ from 100 to 400 K. Determine the nature of the

semiconductor. If the conductivity was found to be 200 Ω^{-1} m^{-1}, calculate the density and mobility of the charge carrier. 7

(b) What is Schottky diode ? Describe the working principle and applications of Schottky diode. 7

4. (a) What are Quantum dots ? Describe one technique to fabricate and characterize the quantum dots. 7

(b) Explain Four point Probe method for measurement of resistivity of a semiconductor. 7

5. (a) Explain the method of determination of band-gap using UV-V is absorption spectra. 7

(b) Discuss the operation of P-N junction diode. Explain how a semiconductor diode can be used as a rectifier. 7

6. (a) Explain Photovoltaic effect. Discuss the working principle of photovoltaic cell with the help of suitable diagram. 7

(b) What do you understand by the term density of states ? Derive the expression for density of states of quantum wire. 7