Roll No. ..... Total Pages : 03

BT-2/M-18 **32027**

APPLIED PHYSICS-II

AS-102N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Name various types of bonds in solids and give one example of each. 10

   (b) Construct Wigner-Seitz primitive cell. 5

2. (a) Discuss in brief crystal structure of sodium chloride and cesium chloride. 8

   (b) What are Miller Indices ? For a simple cubic lattice, find the ratio of spacing of (110) and (111) planes. 7

Unit II

3. (a) What do you mean by phase velocity and group velocity ? Derive the relation between phase velocity and group velocity. 10

   (b) What is the physical significance of wave function φ ? 5

4. (a) State Uncertainty Principle and discuss its various applications. 7

   (b) Discuss the shortcomings of the classical physics and derive and Planck's radiation law. 8

Unit III

5. (a) What is Hall Effect ? Mention applications of Hall Effect. 7

   (b) What is meant by Fermi Energy ? Calculate its values for free electron gas at 0 K. 8

6. (a) What is Wiedemann-Franz Law. ? Explain the thermal conductivity of metals. 7

   (b) Prove that for a completely filled band, the number of effective electrons vanishes. 8

Unit IV

7. (a) What are Superconductors ? List the general features of superconducting materials and explain. 8

   (b) Discuss various applications of nanomaterials. 7

8. (a) Explain sol-gel method for synthesis of nanomaterials with its advantages and disadvantages. 7

   (b) Derive the London sequation with reference to superconductivity. 8

Roll No. ..... Total Pages : 03

BT-2/M-19 32023

APPLIED PHYSICS-II

AS-102N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Explain Diamond structure. Calculate its packing fraction. 7

   (b) What do you mean by point defects in solids ? Derive an expression for Concentration of Schottky defects in a crystal. 8

2. (a) Explain two and three dimensional bravais lattice. 8

   (b) Explain various lattice symmetry operations. 7

Unit II

3. (a) What are De-Broglie Waves ? Show that the De-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. 7

   (b) Derive Schrödinger time dependent equation for matter waves. 8

4. (a) What are the limitations of old quantum theory ? Explain wave particle duality by giving examples.

   (b) Explain the existence of neutrons, protons and alpha particles in the nucleus on the basis of Heisenberg Uncertainty Principle. 8

Unit III

5. (a) Discuss quantum free electron theory of metals. 8

   (b) Derive an expression for Density of states. 7

6. (a) Discuss the origin of energy bands in solids on the basis of Kronig-Penney Model. 7

   (b) Discuss briefly the following :

   (i) E-K diagram

   (ii) Fermi-Dirac distribution function. 4×2=8

Unit IV

7. (a) What is Meissner Effect ? Explain. 7

   (b) Discuss various properties of nanomaterials. 8

8. (a) Explain Bottom-up and Ball milling method for synthesis of non-material with its advantages and disadvantages. 8

   (b) Discuss various applications of superconductivity. 7

Roll No. ..... Total Pages : 2

CBTP/M-20 **16140**

PHYSICS-II

Paper–204

Time : Three Hours] [Maximum Marks : 60

Note : Attempt *five* question in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT–I

1. Explain various types of point defects in solid. Derive an expression for concentration of Schottky defects. 12

2. What are Miller Indices? How are they determined? Give their significant. 12

UNIT–II

3. Explain Drude's Theory of Conduction to derive an expression for electrical conductivity. 12

4. (a) What is Planck constant? Explain its importance. 6

(b) Give differences between quantum and classical Physics. 6

UNIT–III

5. Explain the concept of effective mass. How does it depend upon E-k curve. 12

6. What is an extrinsic semiconductor? Drive an expression for the variation of the fermi level with temperature for p-type semiconductor. 12

UNIT–IV

7. What is photoconductivity? Explain a simple model of photoconductors and calculate photoconductivity? How does it depend on the light intensity? 12

8. Give Classical theory of paramagnetism and clearly explain Curie law and also give the drawbacks of Classical theory. 12

Roll No. ..... Total Pages : 3

BT-1/D-18 **31046**

SEMICONDUCTOR PHYSICS

Paper-BS-115A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

1. (a) Explain various types of crystal system with example. (7)

   (b) What do you mean by point defects in soilds? Derive an expression for Concentration of Schottky in a crystal. (8)

2. (a) Explain the characteristics of the following unit cells with examples: SC, BCC and FCC. (8)

   (b) What are Miller Indices? Draw the following planes (110) $(\bar{1}\,\bar{1}\,\bar{1})$ and $(\bar{1}\,\bar{1}\,0)$. (7)

UNIT–II

3. (a) What do you mean by wave packet? Show that the De-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. (8)

   (b) Derive Schrödinger time independent equation for matter waves. Give physical Significance of the wave function. (7)

4. (a) What is the need and origin of quantum mechanics? (7)

   (b) Explain group velocity and phase velocity. Derive the expression for group velocity with which a wave packet travels. (8)

UNIT–III

5. (a) Discuss Drude's electron gas model to explain electrical conduction in metals. (8)

   (b) What are Brillion Zones? Explain. (7)

6. (a) Based on band theory of solids, distinguish between conductors, semiconductors and insulators. (8)

   (b) What is Hall Effect? Mention applications of Hall Effect. (7)

UNIT–IV

7. (a) What do you mean by intrinsic semiconductor? Derive an expression for carrier Concentration in intrinsic semiconductor. (8)

   (b) Explain the working and characteristic of bipolar junction transistor. (7)

8. (a) Explain conductivity of charge carriers in n-type and p-type semiconductors. (8)

(b) Describe the formation of p-n junction. Discuss its current voltage characteristic. (7)

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BT-2/M-19 32002

PHYSICS-II

Phy-102E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Explain the terms : lattice translation vectors, symmetry operations, space lattice and basis. **12**
   (b) Draw diamond structure. **8**

2. (a) What do you understand by Frenkel defects ? Derive an expression for concentration of Frenkel defects as a function of temperature. **15**
   (b) Write note on Laue method. **5**

Unit II

3. (a) Distinguish between phase velocity and group velocity. Show that de-Broglie wave group associated with a moving particle travel with same velocity as that of particle. **15**
   (b) What are the difficulties with classical physics ? **5**

4. (a) Discuss quantum free electron theory. **10**
   (b) What do you understand by Fermi-Dirac distribution function ? **10**

Unit III

5. (a) Explain Kronig Penney Model for the origin of energy bands. **15**
   (b) Draw E *vs.* K diagram. **5**

6. What do you mean by Fermi Energy ? Derive an expression for Fermi energy as a function of temperature. **20**

Unit IV

7. (a) What are Traps ? Discuss a simple model to show effect of traps on the photoconductivity. **10**
   (b) Write a note on Photovoltaic Cell. **10**

8. (a) Derive an expression for magnetic susceptibility of a paramagnetic materials. **15**
   (b) What is Meissner Effect ? **5**

Roll No. ..... Total Pages : 2

BT-I/D-18 **31002**

PHYSICS-I

Paper : PHY-101 E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

1. (a) What do you mean by polarization of light? Describe the construction of the Nicol prism and show how it can be used as a polarizer and as an analyzer? 12

(b) Differentiate the phenomenon of interference and diffraction. 8

2. (a) Give the construction and theory of a plane diffraction grating and explain the formation of spectra by it. 12

(b) Newton's rings are observed in the reflected light of $\lambda = 5.9 \times 10^{-5}$ cm. the diameter of 10th dark ring is 0.50 cm. find the radius of curvature of the lens and thickness of the air film. 8

UNIT–II

3. (a) Discuss Einstein's coefficients. Derive relation between them. 12

(b) What is meant by population inversion? Discuss its importance in laser action. 8

4. (a) Discuss the propagation of light through an optical fiber. Describe single mode and multi-mode fibers. 12

(b) Calculate numerical aperture and acceptance angle of optical fiber with $\mu_{clad} = 1.52$ and $\mu_{core} = 1.62$. 8

UNIT–III

5. (a) Derive relation between vectors D, E and P. 10

(b) Derive an expression for the energy of electric field established in a dielectric medium. 10

6. (a) State and explain Ampere's law. 8

(b) Write down Maxwell's equations in differential form and explain their significance. 12

UNIT–IV

7. (a) State the fundamental postulates of the special theory of relativity and deduce from them the Lorentz transformation equation. 12

(b) Deduce the rest mass energy of an electron in Joules and in eV. 8

8. (a) Describe construction and working of G.M. Counter. 10

(b) Write note on Interaction of radiation with matter. 10

Roll No. .....

Total Pages : 3

BT-I/D-19

31045

SEMICONDUCTOR PHYSICS

Paper–BS-115A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all. selecting at least *one* question from each unit.

UNIT–I

1. (a) Explain hcp structure and find its packing fraction. 7

(b) What is Frenkel Defect? Derive the relation to show that Frenkel defect in ionic crystal depend on temperature. 8

2. (a) Discuss the nature of bonds in the following: Na. Ice. Mg. 7

(b) What is bravais lattice? Explain different types of bravais lattice in three dimension. 8

UNIT–II

3. (a) Explain the basic postulates of Quantum mechanics. 7

(b) Derive the expression for Schrodinger time dependent wave equation for a free particle. 8

4. (a) State and explain Heisenberg uncertainty principle. Apply this principle to find the binding energy of an electron in an atom. 8

(b) Explain wave particle dualism with example. 7

UNIT–III

5. (a) Explain Kronig-Penney model for the motion of an electron in a periodic potential. 8

(b) Wtat is Fermi-Dirac Distribution Function ? What is the effect of temperature on Fermi function. 7

6. (a) What is Fermi energy. Derive an expressionfor carrier concentration in terms of Fermi energy. 8

(b) Calculate the expression for effective mass of an electron moving in a periodic potential. Explain its physical significance. 7

UNIT–IV

7. (a) What do you mean by extrinsic semiconductor? Derive an expression for carrier concentration in extrinsic semiconductor. 8

(b) Explain the working and characteristics of field effect transistor. 7

8. (a) Discuss in detail Schottky metal semiconductor junction. 7

(b) Describe the principle and working of semiconductor laser. 8

Roll No. ..... Total Pages : 4

BT-1/D-19 **31002**

PHYSICS–I

Paper–Phy-101E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least one question from each unit.

नोट : प्रत्येक इकाई से न्यूनतम **एक** प्रश्न का चयन करते हुए, कुल **पाँच** प्रश्नों के उत्तर दीजिए।

UNIT–I
(इकाई–I)

1. (i) How Fresnel's biprism is used to measure the thickness of thin sheet? (8)

   (ii) Explain the formation of Newton's rings in reflected light. (12)

   (i) पतली चादर की मोटाई के मापन हेतु फ्रेस्नेल के द्विप्रिज्म का प्रयोग किस प्रकार किया जाता है?

   (ii) परावर्तित प्रकाश में न्यूटन के वलय निर्माण की व्याख्या कीजिए।

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2. (i) Derive an expression for dispersive power of diffraction grating. (10)

   (ii) Describe the construction and working of Laurent's half shade polarimeter. (10)

   (i) विवर्तन ग्रेटिंग की प्रकीर्णन शक्ति के लिए व्यंजक व्युत्पन्न कीजिए।

   (ii) लॉरेन्ट हाफ शेड पोलरीमीटर की रचना तथा कार्यप्रणाली का वर्णन कीजिए।

UNIT–II
(इकाई–II)

3. (i) What do you understand by the terms : stimulated absorption, spontaneous emission and stimulated emission. (10)

   (ii) Explain the principle, construction and working of semiconductor LASER. (10)

   (i) अग्रलिखित पदों से आपका क्या अभिप्राय है : प्रेरित अवशोषण, तात्कालिक उत्सर्जन तथा प्रेरित उत्सर्जन।

   (ii) अर्द्धचालक लेजर (LASER) के सिद्धान्त, रचना तथा कार्यप्रणाली की व्याख्या कीजिए।

4. (i) Describe the propagation of light through an optical fiber. (14)

(ii) What are the applications of optical fiber? (6)

(i) प्रकाशिक तन्तु के माध्यम से प्रकाश के संचरण का वर्णन कीजिए।

(ii) प्रकाशिक तन्तु के कौन-कौन से अनुप्रयोग हैं?

UNIT–III

(इकाई–III)

5. (i) What do you understand by Poynting vector? (10)

(ii) State and prove Gauss's law. (10)

(i) पॉयन्टिंग वेक्टर से आपका क्या अभिप्राय है?

(ii) गौस का नियम बताइए एवं सिद्ध कीजिए।

6. (i) Deduce an expression for energy stored in dielectric in an electrostatic field. (10)

(ii) What are three vectors in dielectrics? Name and find the relationship between them. (10)

(i) किसी स्थिर विद्युत क्षेत्र में डाइइलेक्ट्रिक में भण्डारित ऊर्जा के लिए व्यंजक व्युत्पन्न कीजिए।

(ii) डाइइलेक्ट्रिक में तीन वेक्टर कौन-कौन से हैं? उनके नाम लिखिए तथा उनके मध्य सम्बन्ध ज्ञात कीजिए।

UNIT–IV

(इकाई–IV)

7. What was the objective of conducting the Michelson-Morley experiment? Describe the experiment. How do you interpret the results? (20)

मिचेलसन-मॉर्ले प्रयोग के संचालन का क्या उद्देश्य था? इस प्रयोग का वर्णन कीजिए। आप परिणामों की व्याख्या किस प्रकार करते हैं?

8. (i) Write a note on Nuclear Reactor. (10)

(ii) Describe the principle, construction and working of Ionization chamber. (10)

(i) नाभिकीय रिएक्टर पर टिप्पणी लिखिए।

(ii) आयनीकरण चैम्बर के सिद्धान्त, रचना तथा कार्यप्रणाली का वर्णन कीजिए।

Roll No. ..... Total Pages : 2

BT-I/D-17 **31014**

APPLIED PHYSICS-I
Paper : AS-101 N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

1. (a) Explain with theory the construction and working of Michelson's interferometer. 10

   (b) If red light source is replaced by violet light then what will be the change in width of principal maxima of Plane Transmission Diffraction grating. 5

2. (a) What is the difference between Fresnel and Fraunhoffer diffraction ? 8

   (b) Explain the effect of placing a thin film in the path of one of the interfering beams of Fresnel's bi-prism. 7

UNIT–II

3. (a) Explain the construction and working of Nicol prism. What are its limitation as a polarizer. 10

   (b) Describe various applications of laser. 5

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4. (a) Define Specific rotation. Describe the construction and working of Laurents half shade polarimeter. 8

   (b) Explain the construction and working of semiconductor laser. 7

UNIT–III

5. (a) Explain step index single mode optical fiber with its applications. 7

   (b) What are ultrasonic waves? How can you determine the velocity of ultrasonic waves? 8

6. (a) Explain with the help of a block diagram how optical fiber communication system works. 7

   (b) Discuss the magnetostrictive effect method of production of ultrasonic waves. 8

UNIT–IV

7. (a) State the postulates of special theory of relativity and prove the energy momentum relation $E^2 = p^2c^2 + m_0^2 c^4$ where p is the relativistic mass. 7

   (b) Describe the Michelson-Morley experiment and discuss its results. 8

8. (a) Explain how nuclear radiations interact with matter. 5

   (b) Describe the construction and working of Geiger Muller counter and explain how quenching is achieved. 10

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Roll No. ..... Total Pages : 3

BT-I/D-18 **31014**

APPLIED PHYSICS–I

Paper : AS101N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

1. (a) Explain with theory the formation of Newton's rings in reflected light and how it can be used to determine the wavelength of monochromatic light. 10

   (b) Define resolving power of plane transmission grating. 5

2. (a) Explain briefly the theory of Plane Transmission Diffraction grating. How do you explain absent order spectra? 10

   (b) A plano convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of 8th bright ring in the reflected system is 0.72×10^{-2} m. Calculate the wavelength of light used. 5

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UNIT–II

3. (a) Explain the construction and working of Biquartz polarimeter. 7

   (b) What do you mean by double refraction? How this phenomenon can be used for obtaining polarized light? 8

4. (a) Discuss the Einstein's coefficients. Derive relation between them. 7

   (b) Explain with the help of neat diagram the principle and working of He-Ne laser. 8

UNIT–III

5. (a) What is the principle of propagation of light on an optical fiber? Define the terms numerical aperture and acceptance angle of optical fibre. 10

   (b) Discuss various applications of ultrasonics. 5

6. (a) What do you mean by step index and graded index multimode optical fiber? Explain clearly. 8

   (b) Discuss the piezoelectric method of production of ultrasonic waves. 7

UNIT–IV

7. (a) State and prove the law of equivalence of mass and energy. 7

   (b) Derive Lorentz transformation equation. Using them prove that "moving clock appear to go slow." 8

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8. (a) Describe the principle and working of scintillation counter. 7

(b) What is the basic principle of gas filled nuclear radiation detectors? Describe the construction and working of proportional counter. 8