

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2024 - 2025)

Subject: Engineering Physics

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

1-a. A frame of reference has four coordinates, x, y, z, and t is referred to as the : 1
(CO1, K1)

- (a) Inertial frame of reference
- (b) Non-inertial frame of reference
- (c) Four-dimensional plane
- (d) Space-time reference

1-b. Which basic law is used for the derivation of mass variation with velocity? (CO1, 1
K1)

- (a) Law of conservation of Energy
- (b) Law of conservation of Kinetic Energy
- (c) Law of conservation of Momentum
- (d) Law of conservation of mass

1-c. Normalized Wave function must be (CO2,K1) 1

- (a) Single valued
- (b) Multi valued
- (c) Both single and multi valued
- (d) Complex

1-d. Relation Between group velocity and phase velocity is : (CO2,K1) 1

- (a) $v_p = c^2 v_g$

(b) $v_p v_g = c^2$

(c) $v_p = v_g$

(d) $v_g = c^2 v_p$

1-e. In the diffraction pattern due to single slit, the width of the central maximum will be (CO3, K1) 1

- (a) Greater for a narrow slit
- (b) Less for a narrow slit
- (c) Greater for a broad slit
- (d) Less for a broad slit

1-f. In Newtons Ring experiments , the diameter of dark rings is proportional to: (CO3,K1) 1

- (a) Odd Natural numbers
- (b) Natural Number
- (c) Even Natural Number
- (d) Square root of natural number

1-g. The group of points arranged in regular fashion in three dimensions is called: (CO4, K1) 1

- (a) Crystalline
- (b) Amorphous
- (c) Non-crystalline
- (d) None of these

1-h. Co-ordination number in case of Simple cubic structure is (CO4, K1) 1

- (a) 12
- (b) 6
- (c) 2
- (d) 8

1-i. Buckyball is a cluster of (CO5, K1) 1

- (a) 15 carbon atoms
- (b) 30 carbon atoms
- (c) 45 carbon atoms
- (d) 60 carbon atoms

1-j. The cooper pairs can maintain their coupled motion to a certain distance, which is known as: (CO5, K1) 1

- (a) Cooper length
- (b) Critical length
- (c) Coherence length
- (d) Penetration depth

2. Attempt all parts:-

- | | | |
|------|--|---|
| 2.a. | Is earth an inertial or non inertial frame of reference? Explain. (CO 1,K1) | 2 |
| 2.b. | Distinguish between phase velocity and group velocity. (CO2, K1) | 2 |
| 2.c. | Two independent sources could not produce interference, why?(CO3,K1) | 2 |
| 2.d. | What is a unit cell? Explain with example. (CO4, K2) | 2 |
| 2.e. | Draw the graph for temperature dependence of resistivity in case of superconductors. (CO5, K2) | 2 |

SECTION-B

30

3. Answer any five of the following:-

- | | | |
|------|---|---|
| 3-a. | Show that $x^2+y^2+z^2 = c^2t^2$ is invariant under Lorentz transformation equations. (CO1,K3) | 6 |
| 3-b. | At what speed the mass of a object will be double of its value at rest.(CO1,K3) | 6 |
| 3-c. | Calculate the energy difference between the ground state and first excited state for electron in one dimensional rigid box of length 10^{-8}cm . (CO2, K3) | 6 |
| 3-d. | Calculate the smallest possible uncertainty in the position of an electron moving with velocity $3 \times 10^7 \text{m/s}$. (CO2, K3) | 6 |
| 3.e. | Light of wavelength $5890\text{\AA}$ is reflected at nearly normal incidence from a soap film of refractive index is 1.40. What is the least thickness of the film that will appear (i) dark (ii) bright? (CO3,K3) | 6 |
| 3.f. | Copper has an FCC structure and its atomic radius is $1.278 \text{\AA}$. Calculate its density. (CO4, K3) | 6 |
| 3.g. | Transition temperature for lead is 7.26 K. The maximum critical field for the material is $8 \times 10^5 \text{ A/m}$. Lead has to be used as a superconductor subjected to a magnetic field of $4 \times 10^4 \text{ A/m}$. What precaution will have to be taken? (CO5, K3) | 6 |

SECTION-C

50

4. Answer any one of the following:-

- | | | |
|------|--|----|
| 4-a. | State the postulates of special theory of relativity. Deduce Lorentz transformation equations. (CO1, K2) | 10 |
| 4-b. | Why does mass of a body vary with velocity? Derive an expression to prove your statement. (CO1,K2) | 10 |

5. Answer any one of the following:-

- | | | |
|------|---|----|
| 5-a. | Derive an expression for the normalised wave function of a particle confined in one dimensional box. (CO2,K2) | 10 |
| 5-b. | What is uncertainty principle? Write any two applications of uncertainty principle. (CO2, K2) | 10 |

6. Answer any one of the following:-

- | | | |
|------|---|----|
| 6-a. | Describe and explain the formation of Newtons rings in reflected monochromatic light. Obtain the conditions for bright and dark fringe.(CO3,K2) | 10 |
| 6-b. | Explain the difference between Fresnel and Fraunhofer diffraction. Obtain the | 10 |

intensities of diffraction pattern in Fraunhofer diffraction due to single slit. (CO3, K3)

7. Answer any one of the following:-

7-a. Describe the crystal structure of NaCl crystal. Explain with diagram that the lattice is fcc but its coordination number is that of simple cubic lattice? (CO4, K4) 10

7-b. What are Miller indices? How are they determined? Give example. (CO4, K3) 10

8. Answer any one of the following:-

8-a. Describe structure and applications of Buckyballs. How they are synthesized. (CO5, K2) 10

8-b. Distinguish between type I and type II superconductors based on critical field. Explain the application of superconductivity in maglev vehicles. (CO5, K2) 10

REG:JAN_JUN-2025