NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: II - THEORY EXAMINATION - (2023- 2024)
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.   Michelson and Morley experiment was designed to measure (CO1)   1

      (a)   The relativistic mass of an electron

      (b)   The relativistic energy of electron

      (c)   The velocity of earth relative to ether

      (d)   The acceleration of gravity on earth surface

1-b.   Two photons approach each other, their relative velocity will be (CO1)   1

      (a) $c/2$

      (b)   Zero

      (c) $c/8$

      (d) c

1-c.   Particle velocity is equal to (CO2)   1

      (a)   Phase velocity

      (b)   Group velocity

      (c)   Velocity of light

      (d)   None of these

1-d.   Among the following particles, which one will have the shortest wavelength associated with it for the same velocity (CO2)   1

      (a)   Proton

      (b)   Neutron

(c) α particle

(d) β particle

1-e. For constructive interference to take place between two monochromatic light waves of wavelength λ, the path difference should be (CO3) 1

(a) 2nλ/2

(b) (2n-1) λ/2

(c) (2n-1) λ/4

(d) (2n+1)λ/4

1-f. Which of the following are coherent sources? (CO3) 1

(a) A 60W and 40W bulbs

(b) Two halves of a 60W bulb

(c) Two virtual sources obtained by biprism

(d) Two bulbs each of 40W

1-g. Atomic packing factor for BCC is (CO4) 1

(a) 0.52

(b) 0.74

(c) 0.68

(d) None of these

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

(a) 12

(b) 6

(c) 2

(d) 8

1-i. When a material makes the transition from the normal to superconducting state, it actively excludes magnetic fields from its interior, this is known as (CO5) 1

(a) Magnetic levitation

(b) Meissner effect

(c) Josephson effect

(d) None of these

1-j. In Buckyball all carbon atoms arranged in (CO5) 1

(a) Trigonal shapes

(b) Tetragonal shapes

(c) Pentagonal shapes

(d) Hexagonal shapes

2. Attempt all parts:-

2.a. What is the difference between inertial or non inertial frame of reference? (CO1) 2

2.b. What do you understand by wave particle duality ? (CO2) 2

2.c.	What are optical filters? (CO3)	2
2.d.	Write the name of seven crystal systems. (CO4)	2
2.e.	Define critical temperature and critical magnetic field. (CO5)	2

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.	A clock keeps correct time. With what speed should it be moved relative to an observer so that it may be appear to lose 4 minutes in 24 hours. (CO 1)	6
3-b.	The mass of a moving electron is 11 times its rest mass. Calculate its kinetic energy and momentum. (CO1)	6
3-c.	Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^7 m/s. (CO2)	6
3-d.	Calculate the wavelength associated with 1MeV electron. (CO2)	6
3.e.	Newton's rings are observed by keeping a spherical surface of 100 cm radius on a plane glass plate. If the diameter of the 15th bright ring is 0.590 cm and the diameter of the 5th ring is 0.336 cm, what is the wavelength of light used? (CO3)	6
3.f.	Draw Plane (1,0,1) in cubic crystal. (CO 4)	6
3.g.	A superconducting tin has a critical temperature of 3.7 K at zero magnetic field and a critical field of 0.0306 Tesla at 0 K. Find the critical field at 2 K**.** (CO5)	6

SECTION-C   50

4. Answer any <u>one</u> of the following:-

4-a.	Show that velocity is variant and acceleration is invariant under Galilean transformations. (CO 1)	10
4-b.	Derive Einstein's mass energy relation. Give some evidence showing its validity. (CO1)	10

5. Answer any <u>one</u> of the following:-

5-a.	What do you understand by group velocity and phase velocity. Find the expression for Vp and Vg. (CO2)	10
5-b.	Define the wave function and give its physical significance. Also, Derive the time independent Schrodinger wave equations. (CO2)	10

6. Answer any <u>one</u> of the following:-

6-a.	Discuss the phenomenon of formation of interference fringes due to thin films and find the condition of maxima and minima. Show that the interference patterns of reflected and transmitted monochromatic light are complementary. (CO3)	10
6-b.	Explain the difference between Fresnel and Fraunhoffer diffraction. Obtain the intensities of diffraction pattern in Fraunhoffer diffraction due to single slit. (CO3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Calculate the atomic packing factor for simple cubic, body centered and face centered cubic lattice.(CO4)	10
7-b.	Describe the structure of NaCl crystal. (CO4)	10

8. Answer any <u>one</u> of the following:-

| 8-a. | Describe structure and properties of carbon nanotubes. (CO5) | 10 |
| 8-b. | Describe the structure, synthesis and properties of Fullerenes. (CO5) | 10 |