Printed Page:-04 **Subject Code:- AMIAS0201A**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

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 showed that (CO1) 1

(a) Newtonian mechanics is correct for all low and high velocities

(b) There is an absolute ether frame

(c) There is no absolute ether frame, but all frames are relative

(d) Velocity of light is relative in all cases

1-b. The postulates of special theory of relativity are applicable to: (CO1) 1

(a) Accelerated frame

(b) Inertial frame

(c) both

(d) None of above

1-c. If the momentum of a particle is increased to four times, then de-Broglie wavelength will be (CO2) 1

(a) Become twice

(b) Become half

(c) Become four times

(d) Become one fourth

1-d. Particle velocity is equal to ? (CO2) 1

(a) Phase velocity

(b) Group velocity

(c) Velocity of light

(d) None of these

1-e. Two coherent sources of light produced destructive interference when phase difference between them is (CO3) 1

(a) 0

(b) $\pi/2$

(c) $\pi/4$

(d) π

1-f. By observing the diffraction patter, the two images are said to be just resolved when _____ (CO3) 1

(a) The central maxima of one image coincide with central maxima of the other

(b) The central maxima of one do not coincide with central maxima of the other

(c) The central maxima of one image coincides with the first minimum of the other

(d) The central maxima of one image do not coincide with the first minimum of other

1-g. Permanent memory is (CO4) 1

(a) ROM

(b) RAM

(c) Program Tape

(d) Plain Disc

1-h. When a semiconductor is heated its resistance (C04) 1

(a) Increases

(b) Decreases

(c) Remains Constant

(d) None of above

1-i. In Optical fiber, the inner core is _____ the cladding. (CO 5) 1

(a) Denser than

(b) Less dense than

(c) The same density as

(d) None of above

1-j. The ratio of Einstein's coefficients pf spontaneous and stimulated emission varies with the frequency as: (CO5) 1

(a) ν

(b) $\nu^{1/2}$

(c) $\nu^{3/2}$

(d) ν^{3}

2. Attempt all parts:-

2.a. What is GPS? (CO1) 2

2.b. What are matter waves? (CO2) 2

2.c.	What is dispersive power? (CO3)	2
2.d.	How conductivity varies with temperature in semiconductors.(CO4)	2
2.e.	What is Spontaneous Emission of radiation? (CO 5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	At what speed will the mass of a body be 2.25 times its rest mass? (CO1)	6
3-b.	The proper life of a meson is 2×10^{-8}sec. calculate the mean life of a meson moving with a velocity of 0.8c. (CO1)	6
3-c.	Find the energy of an electron moving in one dimensional in an infinitely high potential box of width 1Å. (CO2)	6
3-d.	Calculate the de-Broglie wavelength associated with a proton moving with a velocity equal to (1/50) th of the velocity of light. (CO2)	6
3.e.	Find the minimum number of lines in a plane diffraction grating required to just resolve the sodium doublet (5890 & 5896 Angstrom) in the first order and second order. (CO3)	6
3.f.	In an N-type semiconductor, the fermi level is 0.2 eV below the conduction band at 300K. If the temperature 330K, find the new position of fermi level. (CO4)	6
3.g.	Calculate the numerical aperture, acceptance angle and the critical angle of the optical fibre from the following data: μ_1 (core refractive index) =1.50 and μ_2 (cladding refractive index) = 1.45. (CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	State Einstein's postulates of special theory of relativity. Derive the Lorentz transformation equations. (CO1)	10
4-b.	Derive the expression for relativistic velocity addition theorem. Show that the addition of velocity of light to the velocity of light merely reproduces the velocity of light. (CO1)	10

5. Answer any one of the following:-

5-a.	Derive time dependent and time independent Schrödinger equation? (CO2)	10
5-b.	What is uncertainty principle? How will you explain non existence of electrons in the nucleus? (CO2)	10

6. Answer any one of the following:-

6-a.	What is resolving power of a plan transmission grating? Derive the expression for it. (CO3)	10
6-b.	Why Newton's rings are circular? Prove that in reflected light: (i) diameters of bright rings are proportional to the square root of odd natural numbers. (ii) Diameters of dark rings are proportional to the square root of natural numbers. (CO3)	10

7. Answer any one of the following:-

7-a.	What is photovoltaic effect. Explain the construction and working of solar cell. (CO4)	10
7-b.	Differentiate between intrinsic and extrinsic semiconductors. Show that at 0K fermi level lies exactly mid of the valence and conduction band in intrinsic semiconductors? (CO4)	10

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

8-a.	Describe the construction and working of He-Ne Laser. Why He-Ne are superior to ruby laser. (CO5)	10
8-b.	Describe various types of optical fibers on basics of modes and core refractive index? (CO5)	10