Printed Page:- 04 **Subject Code:- BAS0201A**

Roll. No:

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. The time of observation of a pulse of light in a frame of reference moving with velocity v is (CO1) 1

(a) $1/(1-v^2/c^2)$

(b) $1/\sqrt{(1-v^2/c^2)}$

(c) $(1-v^2/c^2)$

(d) $\sqrt{(1-v^2/c^2)}$

1-b. Which of the following is Einstein's mass energy relation? (CO1) 1

(a) $E_k = (m - m_0)c^2$

(b) $E = mc^2$

(c) $E^2 - p^2c^2 = m_0^2c^4$

(d) $E_k = mv^2/c^2$

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

(a) Become twice

(b) Become four times

(c) Becomes half

(d) Become one-fourth

1-d. A moving particle is associated with a wave packet or group of waves. The group velocity is equal to: (CO2) 1

(a) Velocity of light
(b) Velocity of sound
(c) velocity of the particle
(d) None of the above

1-e. The diffraction Phenomenon is (CO3) 1

(a) Bending of light around an obstacle
(b) Rectilinear propagation of light
(c) Oscillation of light wave in one direction
(d) None of above

1-f. In Newton' ring arrangement, the diameters of bright rings are (CO3) 1

(a) Directly proportional to the square roots of natural numbers
(b) Inversely proportional to the square roots of odd natural numbers
(c) Directly proportional to the square roots of odd natural numbers
(d) Directly proportional to the square roots of even natural numbers

1-g. Fermi level lies slightly above the top of valence band in (CO 4) 1

(a) N – type semiconductor
(b) P – type semiconductor
(c) Intrinsic semiconductor
(d) None of these

1-h. Acceptor-type impurities (CO4) 1

(a) Can be added to silicon but not to germanium
(b) Create excess electrons
(c) Must have three valence electrons
(d) Must have five valence electrons

1-i. Which of the following scheme does not produce lasing action? (CO 5) 1

(a) Two level scheme
(b) Three- level scheme
(c) Four-level scheme
(d) Five -level scheme

1-j. In Fiber optics, the signal is _____ waves. (CO 5) 1

(a) Light
(b) Radio
(c) Infrared
(d) Very low frequency

2. Attempt all parts:-

2.a. What was the main object of Michelson – Morley experiment? (CO 1) 2

2.b. What are the factors on which wavelength of matter wave depends? (CO 2) 2

2.c.	What do you mean by incoherent sources? (CO3)	2
2.d.	What is Fermi level? (CO4)	2
2.e.	What is the Necessary condition for Population inversion? (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Show that the momentum of a particle of rest mass m_o and kinetic energy K_E is given by the expression $p = \sqrt{(K_E^2/c^2 + 2m_oK_E)}$. (CO1)	6
3-b.	At what speed the mass of a object will be double of its value at rest.(CO 1)	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)	6
3-d.	An electron has deBroglie wavelength 2×10^{-12}m. Find its kinetic energy (CO1)	6
3.e.	A soap film of refractive index 1.43 is illuminated by white light incident at an angle of 30. The refracted light is examined by a spectroscope in which dark band corresponding to the wavelength 6000 Angstrom is observed. Calculate the thickness of the film. (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.	In a ruby laser, total number of cr^{+3} ions is $2.8 \times 1\ 0^{19}$. If a laser emits radiation of wavelength 7000 Å, calculate the energy of laser pulse. (CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	What is time dilation ? What is proper interval of time? Explain why a moving clock appears to go slow to a stationary observer. (CO1)	10
4-b.	Derive the relation for variation in mass with velocity. (CO1)	10

5. Answer any one of the following:-

5-a.	Define the wave function and give its physical significance. Also, Derive the time independent Schrodinger wave equations. (CO2)	10
5-b.	Derive an expression for phase and group velocity Also, Prove that phase velocity is greater than the velocity of light. (CO2)	10

6. Answer any one of the following:-

6-a.	Explain the difference between Fresnel and Fraunhoffer diffraction. Obtain the intensities of diffraction pattern in Fraunhoffer diffraction due to single slit. (CO3)	10
6-b.	Discuss the phenomenon of interference 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

7. Answer any one of the following:-

7-a.	What are semiconductor memory devices? How they are used for memory storage? (CO4)	10

7-b.	Show that Fermi level in an intrinsic semiconductor lies half way between the top of the valence band and bottom of the conduction band. (CO4)	10

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

8-a.	Describe the Energy level diagram to explain the working of He-Ne Laser. (CO5)	10
8-b.	Explain the phenomenon of light propagation through optical fiber. Derive the expression for acceptance angle and acceptance cone. (CO5)	10