Printed Page:- Subject Code:- AAS0101A

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

B.Tech

SEM: I - THEORY EXAMINATION (2021 - 2022)

Subject: Engineering Physics

Time: 03:00 Hours Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises three Sections A, B and C.

- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - I questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type - II questions carrying 10 marks each.
- 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 rest mass of photon of energy E is: (CO1) 1

1. zero
2. Ec^2
3. E/c^2
4. None of above

1-b. According to special theory of relativity (CO1) 1

1. Speed of light is relative
2. Speed of light is same in all inertial frames
3. Time is relative
4. Mass is relative

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

1. Phase velocity
2. Group velocity
3. Velocity of light
4. None of these

1-d. Which of the following can be a wave function? (CO2) 1

1. tan x
2. sin x
3. cot x
4. sec x

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

1. Greater for a narrow slit
2. Less for a narrow slit
3. Greater for a broad slit
4. Less for a broad slit

1-f. In Newton ring 's experiment ,fringes are circular because (CO3) 1

1. The air film is symmetrical
2. Of Plano convex lens
3. Sodium lamp is used
4. Glass plate is inclined at 450

1-g. Cassettes are based on (CO4) 1

1. Electricity
2. Magnetism
3. Electromagnetism
4. Semiconductors

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

1. Increases
2. Decreases
3. Remains Constant
4. None of above

1-i. What are the Active medium and pumping source to achieve population inversion in ruby laser (CO5) 1

1. Al^{+3} , Xenon Flash tube
2. Cl^{+3} , Xenon Flash tube
3. $Al^{+2}\ O^{+3}$, Xenon Flash tube
4. Cr+3 , Xenon Flash tube

1-j. Angle of acceptance is maximum for a fiber of: (CO5) 1

1. The critical angle is minimum
2. The critical angle is maximum
3. The critical angle is zero
4. The critical angle is negative

2. Attempt all parts:-

2-a. Define proper length and proper time. (CO1) 2

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

2-c. Why is the central spot in Newton's rings seen in reflected light dark? (CO3) 2

2-d. Name the three semiconductor memory devices. (CO4) 2

2-e. Write the Components of Laser devices. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Find the velocity of a particle if its kinetic energy is three times of its rest mass energy. (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. Derive an expression for the normalised wave function of a particle confined in one dimensional box. (CO2) 6

3-d. Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^{7}m/s. (C02) 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. Show that Fermi level in an intrinsic semiconductor lies half way between the top of 6

the valence band and bottom of the conduction band. (CO4)

3-g. What is Stimulated Emission of radiation.? (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. State the fundamental postulates of special theory of relativity and write the Lorentz transformation equations and discuss how these account for the phenomenon of length contraction. What is proper length? (CO1) 10

4-b. Show that $x^2+y^2+z^2-c^2t^2=0$ is invariant under Lorentz transformation equations. (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. Discus the phenomenon of Fraunhofer diffraction at single slit and find the relative intensities of successive maximas. (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. Discuss the position and variation of Fermi level with temperature in the p-type semiconductor. (CO4) 10

7-b. What do you understand by intrinsic and extrinsic semiconductors? Explain with the help of band theory. (CO4) 10

8. Answer any one of the following:-

8-a. Describe the construction and working of Ruby Laser. (CO5) 10

8-b. Describe various types of optical fibers on basics of modes and core refractive index? (CO5) 10