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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2021 - 2022)

Subject: Engineering Physics

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 marks each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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. A frame of reference has four coordinates x, y, z, and t is referred to as the_____ (CO1) 1

(a) Inertial frame of reference

(b) Non-inertial frame of reference

(c) Four-dimensional plane

(d) Space-time reference

1-c. De-Broglie wavelength for an electron (CO2) 1

(a) $\lambda = 12.28/\sqrt{V}$ Å

(b) $\lambda = 1.28/\sqrt{V}$ Å

(c) $\lambda = 1.228/\sqrt{V}$ Å

(d) $\lambda = 122.8/\sqrt{V}$ Å

1-d. Wave function Ψ gives the idea for (CO2) 1

(a) Energy of particle

(b) Probability of finding particle

(c) Momentum of particle

(d) None of these

1-e. When a drop of oil is spread on a water surface, it display beautiful colours in daylight because of (CO3) 1

(a) Interference of light

(b) Diffraction of light

(c) Refraction of light

(d) None of above

1-f. By observing the diffraction pattern, 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. Consider the energy level diagram of an intrinsic semiconductor. The Fermi level lies in the (CO4) 1

(a) Valence band

(b) Forbidden band

(c) Conduction band

(d) It can be at any of the above locations depending upon the doping concentration and temperature

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

(a) The critical angle is minimum

(b) The critical angle is maximum

(c) The critical angle is zero

(d) The critical angle is negative

1-j. Ruby LASER produces the Laser beam of Wavelength (CO5) 1

(a) 6943Å

(b) 6328 Å

(c) 6320 Å

(d) 6940Å

2. Attempt all parts:-

2.a. Write down the postulates of special theory of relativity. (CO1) 2

2.b. Write down the normalization condition for an acceptable wave function (CO2) 2

2.c. What are optical filters? (CO3) 2

2.d. What is Fermi level? (CO4) 2

2.e. What is Meta-stable state? (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. How fast would a rocket have to go relative to an observer for its length to contracted to 99% of its length at rest? (CO1) 6

3-b. At what speed should a clock be moved so that it may appear to lose 1 minute in each hour? (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 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.e. A non reflecting film is to be deposited. What would be the necessary thickness for zero reflection at 5500 Angstrom? The refractive index of layer is 1.334. (CO3) 6

3.f. 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) 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.	Deduce an expression for time dilation on the basis of Lorentz transformation equations. Give an example to show that time dilation is real effect. (CO1)	10
4-b.	Deduce the relativistic velocity addition theorem. Show that it is consistent with Einstein's second postulate of special theory of relativity. (CO1)	10

5. Answer any one of the following:-

5-a.	A particle of charge q and mass m is accelerated through a potential difference V. Write an expression for its de-Broglie wavelength. Find the expression for the energy state of a particle in one dimensional box. (CO2)	10
5-b.	What is Heisenberg uncertainty principle? Apply it to find the radius of first orbit. (CO2)	10

6. Answer any one of the following:-

6-a.	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
6-b.	Discus the phenomenon of Fraunhofer diffraction at single slit and find the relative intensities of successive maximas. (CO3)	10

7. Answer any one of the following:-

7-a.	Discuss the position and variation of Fermi level with temperature in the n-type semiconductor. (CO4)	10
7-b.	What are semiconductor memory devices? How they are used for memory storage? (CO4)	10

8. Answer any one of the following:-

8-a.	What are Einstein's coefficients? Obtain a relation between them. (CO5)	10
8-b.	Describe various types of optical fibers on modes and core refractive index? (CO5)	10