Printed Page:-04 **Subject Code:- AAS0101C**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: I - 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 postulates of special theory of relativity are applicable to: (CO1) 1

(a) Accelerated frame

(b) Inertial frame

(c) Both

(d) None of above

1-b. Michelson Morley experiment is based on the phenomenon (CO1) 1

(a) Interference

(b) Diffraction

(c) Polarization

(d) Dispersion

1-c. Matter wave are (CO2) 1

(a) EM wave

(b) Sound wave

(c) None of these

(d) Wave associate with moving particle

1-d. Wave packet comprises a group of waves (CO2) 1

(a) Of same velocity & wavelength

(b) Of slightly different in velocity & wavelength

(c) Both of above

(d) Equal to the velocity of light

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. According to Rayleigh criterion of resolution, the two spectral lines of equal intensity are just resolved when the central maximum of the diffraction pattern due to one falls: (CO3) 1

(a) On the central maximum of the diffraction pattern of the other
(b) On the secondary maximum of the diffraction pattern of the other
(c) On the first minimum of the diffraction pattern of the other
(d) None of the above

1-g. The displacement current arises due to (CO4) 1

(a) Positive charge only
(b) Negative charge only
(c) Both positive and negative charge
(d) Time varying electric field

1-h. Which of the following laws do not form a Maxwell equation? (CO4) 1

(a) Planck's law
(b) Gauss's Law
(c) Faraday's law
(d) Ampere's Law

1-i. The relation between electric field E, the displacement vector D and Polarization P is given by (CO5) 1

(a) $D = \varepsilon_o E + P$
(b) $P = D + E$
(c) $P = D + \varepsilon_o E$
(d) $E = D + P$

1-j. When the air in a capacitor is replaced by a medium of dielectric constant K, the capacity (CO5) 1

(a) Deceases K times
(b) Increases K times
(c) The K2 times
(d) Remains constant

2. Attempt all parts:-

2.a. Is earth an inertial or non – inertial frame of reference? Explain. (CO1) 2

2.b.	Explain wave particle duality and de-Broglie's hypothesis of matter waves. (CO2)	2
2.c.	What are the conditions of sustained interference? (CO3)	2
2.d.	Write equation of continuity. (CO4)	2
2.e.	What is ionic polarisation? (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	A particle of mass 'm' moves with speed $c/\sqrt{2}$. Calculate the mass, momentum, total energy and kinetic energy of the particle. (CO1)	6
3-b.	Find the velocity of a particle if its kinetic energy is three times of its rest mass energy. (CO1)	6
3-c.	Find the energy of an electron moving in one dimensional in an infinitely high potential box of width 1 Angstrom. (CO2)	6
3-d.	Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^{7}m/s. (CO2)	6
3.e.	Newton's rings are observed in the reflected light of wave length 5900 Å. The diameter of 10th dark ring is 0.6 cm. Find the radius of curvature of the lens used. (CO3)	6
3.f.	Calculate the value of poynting vector at the surface of sun if the power radiated by sun is 3.8×10^{26} W and radius is 7×10^{8} m. (CO4)	6
3.g.	The permittivity of diamond is 1.46×10^{-10} C^2/Nm^2. Determine its dielectric constant and electrical susceptibility. (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.	Derive time dependent and time independent Schrödinger equation (CO2)	10
5-b.	Define phase velocity and group velocity. Find the relation between group velocity and phase velocity for dispersive and non-dispersive medium. (CO2)	10

6. Answer any one of the following:-

6-a.	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
6-b.	Describe Fraunhoffer diffraction due to single slit and deduce the position of maxima and minima. Draw the representative graph of the intensity distribution. Indicate the position of maxima and minima in the figure. What are values of relative intensities of successive maxima? (CO3)	10

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

7-a.	State and explain Poynting theorem for the flow of energy in electromagnetic waves. (CO4)	10
7-b.	Find the expression for electromagnetic wave in free space and show that electromagnetic wave travels with the speed of light in free space. (CO4)	10

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

8-a.	What is dielectric polarization? Explain all the four types of polarization briefly. (CO5)	10
8-b.	Derive Claussius – Mossotti Equation. (CO5)	10