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.   A cube ,when moved along one of its faces at a very high speed will look like   1
           a (CO1)

    (a)   rectangle

    (b)   rectangular parallelepiped

    (c)   sphere

    (d)   cube

1-b.   In Relativistic case, as the velocity of the particle approaches the speed of light,   1
           the Kinetic energy approaches _____ (CO1)

    (a)   Zero

    (b)   Kinetic Energy as in Non-Relativistic case

    (c)   Rest Energy

    (d)   Infinite

1-c.   Relation Between group velocity and phase velocity is (CO2)   1

    (a) $V_P = C^2 V_g$

    (b) $V_P V_g = C^2$

    (c) $V_P = V_g$

    (d) $V_g = C^2 V_p$

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.   Which of the following is the correct expression for the ratio of the intensity of principal maxima to the intensity of secondary maxima? (CO3)   1

(a) $1 + (N^2-1) \sin 2\beta$

(b) $1/1 + (N^2-1) \sin 2\beta$

(c) $(N^2-1) \sin 2\beta$

(d) $1/(N^2-1) \sin 2\beta$

1-f.   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-g.   Which of the following are not electromagnetic rays? (CO4)   1

(a)   Gamma rays

(b)   Beta rays

(c)   Light rays

(d)   X rays

1-h.   The divergence of which quantity will be zero? (CO4)   1

(a)   E

(b)   D

(c)   H

(d)   B

1-i.   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 K^2 times

(d)   Remains constant

1-j.   How can a dielectric be converted to a conductor? (CO5)   1

(a)   Compression

(b)   Heating

(c)   Expanding

(d)   Freezing

2. Attempt all parts:-

2.a.   How GPS is used? (CO1)   2

2.b.	Which phenomena shows wave nature of light? What is the significance of uncertainty principle? (CO2)	2
2.c.	What do you mean by grating and grating element? (CO3)	2
2.d.	What is electromagnetic signature. (CO4)	2
2.e.	Define electric flux density. What are its units. (CO5)	2

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.	Show that the circle $x^2 + y^2 = a^2$ in frame S appears to be an ellipse in frame S' which is moving with velocity 'v' relative to S. (CO1)	6
3-b.	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-c.	Calculate the uncertainty in the momentum of an electron if uncertainty in its position is 10 Å. (CO2)	6
3-d.	Find the energy of lowest energy level and momentum of electron in one dimensional potential box of width 1Å. (CO2)	6
3.e.	A diffraction grating used at normal incidence gives a green line (5400 Å) in a certain order n superimposed on the violet line (4050 Å) of the next higher order. If the angle of diffraction is 30^0. Calculate the value of n. Also find how many lines per cm are there in grating. (CO3)	6
3.f.	What is the skin depth in copper at 10 GHz? Assuming conductivity of copper $\sigma = 4.6$ x 10^7 S/m and permeability equal to that of free space ($\mu = 4\pi \times 10^{-7}$ H/m). Also find the propagation constant. (CO4)	6
3.g.	Calculate the electronic polarizability of a specimen with cubic symmetry and dielectric constant 3.8. It is given that atomic weight and density of the specimen are 32 and 1.99 gm$(cm)^{-3}$ respectively. (CO5)	6

SECTION-C   50

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

4-a.	State Einstein's postulates of special theory of relativity. Derive the Lorentz transformation equations. (CO1)	10
4-b.	Show that the relativistic form of Newton's second law when 'F' is parallel to 'v' is $F = m_o(dv/dt)(1-v^2/c^2)^{-(3/2)}$. (CO1)	10

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

5-a.	What is meant by normalized wave function? Show that energy of electron in 1-D potential well of length L and infinite depth is quantized. (CO2)	10
5-b.	Distinguish between phase velocity and group velocity. Prove that wave group associated with moving particle travels with same velocity as that of particle? (CO2)	10

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

6-a.	Discuss the phenomenon of interference in uniform thin films by reflected light and find the condition of maxima and minima. (CO3)	10

6-b. What do you mean by the resolving power of grating? Discuss rayleigh criteria for resolution and derive the necessary expression. (CO3)   10

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

7-a. Derive Maxwell equations in integral form. Also give physical significance of each equation. (CO4)   10

7-b. State and derive poynting theorem. Explain the concept of poynting vector. (CO4)   10

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

8-a. Write down the Claussius – Mossotti Equation. Derive it using Lorentz field in dielectric material. (CO5)   10

8-b. Explain dielectric losses? Obtain an expression for loss angle and loss tangent. (CO5)   10