Printed Page:- 04 **Subject Code:- BAS0201C**

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. A beam of light moves along right with speed c. If at that instant earth has speed v towards right then the speed of beam of light relative to earth must be: (CO1) 1

(a) c

(b) c+v

(c) c-v

(d) c^2-v^2

1-b. What will be the rest energy of an electron? (CO1) 1

(a) 0.41 MeV

(b) 0.51 MeV

(c) 0.61 MeV

(d) 0.71 MeV

1-c. Among the following particles, which one will have the shortest wavelength associated with it for the same velocity (CO2) 1

(a) Proton

(b) Neutron

(c) α particle

(d) β particle

1-d. Which of the following is not a characteristic of wave function? (CO2) 1

(a) Continuous

(b) Single valued

(c) Differentiable

(d) Physically Significant

1-e. If the separation between the two slits in Double Slit Fraunhofer Diffraction is changed, what change will be observed in the diffraction pattern? (CO3) 1

(a) The fringe length will increase

(b) The fringe length will decrease

(c) Fringes will be colored

(d) No change

1-f. Which of the following sources gives best monochromatic light (CO3) 1

(a) A candle

(b) A bulb

(c) Mercury Lamp

(d) laser Source

1-g. Which of the following is the expression for Lorentz force? (CO4) 1

(a) qE

(b) q (v × B)

(c) ma + qE

(d) qE + q (v × B)

1-h. The velocity of a charged particle to keep moving in the same direction, in a region where electric and magnetic fields are perpendicular to each other, is (CO4) 1

(a) E/B

(b) B/E

(c) E/B + qE/B

(d) B/E + qB/E

1-i. The Loss factor of a dielectric depends upon (CO5) 1

(a) Its Conductivity

(b) Real part of dielectric constant

(c) The thickness of dielectric

(d) The initial polarization of dielectric

1-j. The unit of D is (CO5) 1

(a) Volt/meter^2

(b) Coulomb/meter^2

(c) Volt/meter

(d) Coulomb/meter

2. Attempt all parts:-

2.a. Does the light or photons have mass? If no, then how photons have momentum? (CO1) 2

2.b. What do you mean by dispersive and non-dispersive medium? (CO2) 2

2.c. On which factors, the dispersive power of grating depends? (CO3) 2

2.d. Write the physical significance of skin depth? (CO4) 2

2.e. Write down the expression for Claussius – Mossotti Equation. (CO5) 2

SECTION B **30**

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

3-a. At what speed should a clock be moved so that it may appear to lose 1 minute in each hour? (CO1) 6

3-b. Calculate the work done to increase the speed of electron of rest energy 0.5 MeV from 0.8 c to 0.9 c. (CO1) 6

3-c. Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^7m/s. (CO2) 6

3-d. Calculate the wavelength associated with 1MeV electron and 1MeV Proton. (CO2) 6

3.e. Find the minimum number of lines in a plane diffraction grating required to just resolve the sodium doublet (5890 & 5896 Å) in the first order and second order. (CO3) 6

3.f. The power is being radiated by an 80 watt sodium lamp. At a distance of 12 meters from the lamp, determine the strength of the magnetic and electric fields. (CO4) 6

3.g. An ionic crystal is subjected to an electric field of 1250 V/m and the resulting polarization is 2.3×10^{-8} Cm^2, calculate the dielectric constant of the ionic crystal. ($\varepsilon o= 8.85\times10^{-12}$ F^{-1}). (CO5) 6

SECTION C 50

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

4-a. Derive the expression for relativistic velocity addition theorem. Show that the addition of velocity of light to the velocity of light merely reproduces the velocity of light. (CO1) 10

4-b. Deduce Einstein's mass – energy relation $E = mc^2$ and discuss it. Give some evidence showing its validity. (CO1) 10

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

5-a. What is Higgs Boson? Obtain time dependent and time independent Schrodinger wave equation for non-relativistic free particle. (CO2) 10

5-b. Discuss the importance of uncertainty principle. Using uncertainty principle calculate the radius of Bohr's first orbit. (CO2) 10

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

6-a. Explain the experimental arrangement of Newtons ring experiment. Why the center of newtons ring is dark? Find the refractive index of a liquid with the help of Newton's ring formation (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 <u>one</u> of the following:-

7-a. Write the differential and integral forms of Ampere's law. Explain in detail how Maxwell modified Ampere's law using displacement current. Also, explain the concept of displacement current and its consequences. (CO4) 10

7-b. Write and derive the expression for electromagnetic wave equation in free space. Using the expression, find the velocity of electromagnetic wave. (CO4) 10

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

8-a. With the help of diagram discuss the frequency dependence of Dielectric constant. Also discuss the dielectric loss. (CO5) 10

8-b. Define dielectric constant. Explain how the real and imaginary part of dielectric constant varies with frequency. Also define dielectric loss along with its expression. (CO5) 10