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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 (2024 - 2025)

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. Choose the incorrect statement concerning the theory of relativity: (CO1, K1)

1

- (a) It proves the existence of ether
- (b) Velocity of light is independent of the motion of observer
- (c) Time is relative
- (d) There is variation of mass with velocity

1-b. Michelson and Morley experiment showed that (CO1, K1)

1

- (a) Newtonian mechanics is correct for all low and high velocities
- (b) There is an absolute ether frame
- (c) There is no absolute ether frame, but all frames are relative
- (d) Velocity of light is relative in all cases

1-c. Among the following particles, which one will have the shortest wavelength associated with it for the same velocity (CO2, K1)

1

- (a) Proton
- (b) Neutron
- (c) α particle
- (d) β particle

1-d. Uncertainty principle states that the error in measurement is due to: (CO2, K1)

1

- (a) Dual nature of particles
- (b) Due to small size of particles

- (c) due to large size of particles
- (d) due to error in measuring instrument
- 1-e. In Double Slit Fraunhofer Diffraction, some orders of interference pattern are missing. It is called _____. (CO3, K1) 1
- (a) Absent Spectra
- (b) Missing Spectra
- (c) End Spectra
- (d) Emission Spectra
- 1-f. By observing the diffraction pattern, the two images are said to be just resolved when _____. (CO3, K1) 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. The displacement current arises due to (CO4, K1) 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 is false about electromagnetic waves? (CO4, K1) 1
- (a) The energy in an electromagnetic wave is divided equally between electric and magnetic vectors.
- (b) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of the wave.
- (c) These waves do not require any material medium for propagation
- (d) Both electric and magnetic field vectors attain the maxima and minima at the same place and the same time
- 1-i. Which of the following is a non-polar molecule? (CO5, K1) 1
- (a) H_2
- (b) NH_3
- (c) H_2O
- (d) NO
- 1-j. Which of the following is not equal to dielectric constant? (CO5, K1) 1
- (a) V_o/V
- (b) C_o/V
- (c) E_o/E
- (d) ϵ_o/ϵ

2. Attempt all parts:-

2.a.	Define massless particle with examples.(CO1, K2)	2
2.b.	What do you mean by dispersive and non-dispersive medium? (CO2, K2)	2
2.c.	What is dispersive power?(CO3,K2)	2
2.d.	Define Ampere's circuital law. (CO4,K2)	2
2.e.	Write down the relation between electric field E, the displacement vector D and Polarization P in a dielectric material. (CO5,K2)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Calculate the percentage contraction of a rod moving with a velocity of $0.8c$ in a direction inclined at 60° to its own length. (CO1, K3)	6
3-b.	A clock keeps correct time. With what speed should it be moved relative to an observer so that it may be appear to lose 4 minutes in 24 hours? (CO1, K3)	6
3-c.	Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^7 m/s. (CO2, K2)	6
3-d.	Find the probabilities of finding a particle trapped in a box of length L in the region from $0.45L$ to $0.55L$ for the ground and first excited state. (CO2, K3)	6
3.e.	How many orders will be visible if the wavelength of incident radiation is $5000 \text{ \AA}$ and numbers of lines on the gratin is 2620 to an inch?(CO3,K3)	6
3.f.	What is the skin depth in silver at 3 MHz? Assuming conductivity of silver $\sigma = 2 \times 10^7$ S/m and permeability equal to that of free space ($\mu = 4\pi \times 10^{-7}$ H/m). (CO4,K3)	6
3.g.	A cubic dielectric crystal is placed in an external field $E = 2 \times 10^6$ V/m. Its polarization is $P = 1.2 \times 10^{-5}$ C/m ² . Find the internal electric field.(CO5, K3)	6

SECTION-C 50

4. Answer any one 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, K3)	10
4-b.	Show that the apparent length of a rigid body in the direction of its motion with uniform velocity v is reduced by the factor $\sqrt{1-v^2/c^2}$. (CO1, K2)	10

5. Answer any one of the following:-

5-a.	Why wave functions are to be normalized? Obtain time independent Schrodinger equations. Give physical significance of the equation. (CO2, K2)	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, K2)	10

6. Answer any one of the following:-

6-a.	Explain the difference between Fresnel and Fraunhofer diffraction. Obtain the intensities of diffraction pattern in Fraunhofer diffraction due to single slit.(CO3,K2)	10
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- 6-b. 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,K2) 10
7. Answer any one of the following:-
- 7-a. Derive Maxwell equations in integral form. Also give physical significance of each equation. (CO4,K2) 10
- 7-b. Write down Maxwell's equations in free space. State and prove equation of continuity. (CO4,K2) 10
8. Answer any one of the following:-
- 8-a. What do you mean by internal field? Derive an expression for internal field in liquids and solids. (CO5,K3) 10
- 8-b. What is electronic polarizability? Show that electronic Polarizability is directly proportional to cube of the radius of the atom. (CO5, K3) 10

REG:JAN_JUN-2025