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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM: II - THEORY EXAMINATION (2022-2023)

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. | Einstein Proposed_____. (CO1) | 1 |
| | (a) Special theory of relativity | |
| | (b) General theory of relativity | |
| | (c) Both | |
| | (d) None of above | |
| 1-b. | Either is_____ medium (CO1) | 1 |
| | (a) Isolated | |
| | (b) All pervading | |
| | (c) Both | |
| | (d) Air on earth | |
| 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. De-Broglie wavelength of particle is ? (CO2) 1
- (a) independent of the charge of particle
 - (b) dependent on the charge of particle
 - (c) independent of the velocity of particle
 - (d) None of these
- 1-e. The interference phenomenon can take place (CO3) 1
- (a) In transverse waves only
 - (b) In Longitudinal waves only
 - (c) In standing waves only
 - (d) All of above
- 1-f. Which of the following are coherent sources (CO3) 1
- (a) A 60W and 40W bulbs
 - (b) Two halves of a60W bulb
 - (c) Two virtual sources obtained by biprism
 - (d) Two bulbs each of 40W
- 1-g. The forbidden energy gap of carbon in diamond structure is (CO4) 1
- (a) 0.7 eV
 - (b) 1.1 eV
 - (c) 6 eV
 - (d) None of these
- 1-h. Cassettes are based on (CO4) 1
- (a) Electricity
 - (b) Magnetism
 - (c) Electromagnetism
 - (d) Semiconductors
- 1-i. The inner core of an optical fiber is _____ in composition. (CO5) 1
- (a) liquid
 - (b) Copper
 - (c) Bimetallic
 - (d) Glass or Plastic
- 1-j. Laser beam is made of (CO5) 1
- (a) Electrons

- (b) Highly coherent photons
- (c) Very light and elastic particles
- (d) None of above

2. Attempt all parts:-

- 2.a. Is earth an inertial or non – inertial frame of reference? Explain. (CO1) 2
- 2.b. Explain few important properties of matter waves (CO2) 2
- 2.c. What are optical filters? (CO3) 2
- 2.d. Write the types of semiconductors. (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. 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. 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) 6
- 3-d. Calculate the wavelength associated with 4 MeV proton and 4MeV Photon. (CO2) 6
- 3.e. Newton's rings are observed by keeping a spherical surface of 100 cm radius on a plane glass plate. If the diameter of the 15th bright ring is 0.590 cm and the diameter of the 5th ring is 0.336 cm, what is the wavelength of light used. (CO3) 6
- 3.f. What is semiconductor memory? (CO4) 6
- 3.g. The refractive indices of core and cladding materials of a step index fiber are 1.44 and 1.40, respectively. Calculate: (i) numerical aperture, (ii) fractional refractive indices change, and (iii) acceptance angle. (CO5) 6

SECTION C

50

4. Answer any one of the following:-

- 4-a. What was the objective of conducting the Michelson – Morley experiment? Describe the experiment. How is the negative result of the experiment interpreted? (CO1) 10
- 4-b. Derive the relation for variation in mass with velocity. (CO1) 10

5. Answer any one of the following:-

5-a. Derive an expression for the normalised wave function and energy of a particle confined in one dimensional box also define the eigen value and eigen function. (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. 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. Explain the difference between Fresnel and Fraunhofer diffraction. Obtain the intensities of diffraction pattern in Fraunhofer diffraction due to single slit. (CO3) 10

7. Answer any one of the following:-

7-a. What do you understand by intrinsic and extrinsic semiconductors? Explain with the help of band theory. (CO4) 10

7-b. Discuss the position and variation of Fermi level with temperature in the p-type semiconductor. (CO4) 10

8. Answer any one of the following:-

8-a. Describe various types of optical fibers on modes and core refractive index? (CO5) 10

8-b. Describe the construction and working of He-Ne Laser. Why He-Ne are superior to ruby laser. (CO5) 10