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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM:II CARRY OVER THEORY EXAMINATION - MAY 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. | The time of observation of a pulse of light in a frame of reference moving with velocity v is (CO1) | 1 |
| | (a) $1/(1-v^2/c^2)$ | |
| | (b) $1/\sqrt{(1-v^2/c^2)}$ | |
| | (c) $(1-v^2/c^2)$ | |
| | (d) $\sqrt{(1-v^2/c^2)}$ | |
| 1-b. | According to relativity, length of a rod in motion (CO1) | 1 |
| | (a) Is same as its rest length | |
| | (b) Is more than its rest length | |
| | (c) Is less than its rest length | |
| | (d) May be more or less than or equal to rest length depending on the speed of rod | |
| 1-c. | Wave function Ψ gives the idea for (CO2) | 1 |
| | (a) Energy of particle | |

- (b) Probability of finding particle
(c) Momentum of particle
(d) None of these
- 1-d. Matter wave are ? (CO2) 1
(a) EM wave
(b) Sound wave
(c) None of these
(d) Wave associate with moving particle
- 1-e. In the diffraction pattern due to single slit, the width of the central maximum will be (CO3) 1
(a) Greater for a narrow slit
(b) Less for a narrow slit
(c) Greater for a broad slit
(d) Less for a broad slit
- 1-f. Extended source is needed in (CO3) 1
(a) Young's double slit experiment
(b) Bi prism Experiment
(c) Newton's Ring Experiment
(d) None of them
- 1-g. The smallest Unit in digit system is (CO 4) 1
(a) Bit
(b) Byte
(c) Kilobyte
(d) Megabyte
- 1-h. The barrier potential depends on (CO 4) 1
(a) doping density
(b) temperature
(c) electronic charges
(d) all of these
- 1-i. Which of the following scheme does not produce lasing action? (CO 5) 1
(a) Two level scheme
(b) Three- level scheme
(c) Four-level scheme

(d) Five -level scheme

- 1-j. It is the angle at which the propagating ray strikes the interface with respect to the normal. (CO 5) 1
- (a) refracted angle
- (b) Incident angle
- (c) Reflected angle
- (d) Critical angle

2. Attempt all parts:-

- 2.a. Explain the negative results of Michelson – Morley experiments. (CO 1) 2
- 2.b. What are matter waves? (CO2) 2
- 2.c. What do you mean by grating and grating element? (CO3) 2
- 2.d. Name the three semiconductor memory devices. (CO4) 2
- 2.e. Write the Components of Laser devices. (CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. Find the velocity of a particle if its kinetic energy is three times of its rest mass energy. (CO1) 6
- 3-b. The proper life of a meson is 2×10^{-8} sec. calculate the mean life of a meson moving with a velocity of $0.8c$. (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 smallest possible uncertainty in the position of an electron moving with velocity 4×10^8 m/s. (CO2) 6
- 3.e. Find the minimum number of lines in a plane diffraction grating required to just resolve the sodium doublet (5890 & 5896 Angstrom) in the first order and second order. (CO3) 6
- 3.f. A 20-metre length of cable has a cross-sectional area of 1 mm^2 and a resistance of 5 ohms. Calculate the conductivity of the cable. (CO4) 6
- 3.g. Calculate a fractional difference between core and cladding surface refractive indices for a step index fiber having core and cladding refractive indices 1.65 and 1.45 respectively. (CO 5) 6

SECTION C

50

4. Answer any one of the following:-

- 4-a. What is time dilation ? What is proper interval of time? Explain why a moving 10

clock appears to go slow to a stationary observer. (CO1)

- 4-b. State Einstein's postulates of special theory of relativity. Derive the Lorentz transformation equations. (CO1) 10

5. Answer any one of the following:-

- 5-a. A particle of charge q and mass m is accelerated through a potential difference V . Write an expression for its de-Broglie wavelength. Find the expression for the energy state of a particle in one dimensional box. (CO2) 10
- 5-b. Derive the time independent and time dependent Schrodinger wave equations. (CO2) 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) 10
- 6-b. Discuss the formation of interference fringes due to a wedge shaped thin film seen by normally reflected sodium light and obtain an expression for the fringe width. (CO3) 10

7. Answer any one of the following:-

- 7-a. Obtain an expression for the electrical conductivity of an intrinsic and extrinsic semiconductors. (CO4) 10
- 7-b. What is Photovoltaic effect ? Discuss the construction and working of Photovoltaic cell with neat diagram. (CO4) 10

8. Answer any one of the following:-

- 8-a. What is fiber optics? Discuss the properties and applications of optical fiber. (CO5) 10
- 8-b. Describe the construction and working of Ruby Laser. (CO5) 10