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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. An inertial frame is (CO1, K1)

1

- (a) Accelerated
- (b) Decelerated
- (c) Moving with uniform velocity or at rest
- (d) May be accelerated, decelerated or moving with constant 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. Wave function ψ gives the idea for (CO2, K1)

1

- (a) Energy of particle
- (b) Probability of finding particle
- (c) Momentum of particle
- (d) None of these

1-d. Which of the following is the correct relation between the group velocity and the phase velocity? (CO2, K1)

1

- (a) $v_g = v_p + \lambda dv_p/d\lambda$
- (b) $v_p = v_g + \lambda dv_p/d\lambda$

(c) $v_p = v_g - \lambda \frac{dv_p}{d\lambda}$

(d) $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$

- 1-e. 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-f. In Newton rings experiment, fringes are circular because the air space between plane glass plate and plano convex lens is (CO3 , KL2) 1
- (a) Circularly non-symmetric
 - (b) Circularly Symmetric
 - (c) Hyperbolic
 - (d) Cylindrical
- 1-g. Consider the energy level diagram of an intrinsic semiconductor. The Fermi level lies in the: (CO4, K1) 1
- (a) Valence band
 - (b) Forbidden band
 - (c) Conduction band
 - (d) It can be at any of the above locations depending upon the doping concentration and temperature
- 1-h. Fermi-Dirac statistics is applied for: (CO4,K1) 1
- (a) Distinguishable particle
 - (b) Symmetrical Particles
 - (c) Particles with half integral spin
 - (d) Particles with integral spin
- 1-i. If N_1 are the number of atoms in ground state and N_2 are in excited state then the condition for population inversion is: (CO5, K1) 1
- (a) $N_1 = N_2$
 - (b) $N_1 < N_2$
 - (c) $N_1 > N_2$
 - (d) None of the above
- 1-j. How does the refractive index vary in Graded Index Fibre (CO5, K1) 1
- (a) Tangentially
 - (b) Radially
 - (c) Longitudinally
 - (d) Transversely

2. Attempt all parts:-

2.a.	What is GPS?(CO1, K2)	2
2.b.	What are essential conditions for a wave function to be well behaved? (CO2, K2)	2
2.c.	What is the difference between Fresnel and Fraunhofer diffraction? (CO3, K1)	2
2.d.	Explain the principal of photovoltaic effect. (CO4,K2)	2
2.e.	Define acceptance angle and acceptance cone in optical fiber. (CO5, K1)	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, K3)	6
3-b.	A particle has a velocity, $u' = 3i + 4j + 12k$ m/sec. in a coordinate system moving with velocity $0.8c$ relative to laboratory along +ve direction of x-axis. Find u in laboratory frame. (CO1, K3)	6
3-c.	Find the energy of an electron moving in one dimensional in an infinitely high potential box of width 1 Angstrom. (CO2, K3)	6
3-d.	Calculate the de-Broglie wavelength of an α accelerated through a potential difference of 200 volts. (CO2, K3)	6
3.e.	A grating has 15 cm of the surface ruled with 6000 lines per cm. What is the resolving power of grating in the first order? (CO3, K3)	6
3.f.	Find the value of $f(E)$ for $E-E_f = 0.02eV$ at 100K. (CO4, K3)	6
3.g.	Calculate the energy and momentum of a photon of a laser beam of wavelength 6546 Å. (CO5, K3)	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 clock appears to go slow to a stationary observer. (CO1, K2)	10
4-b.	What was the objective of conducting the Michelson-Morley experiment? Describe the experiment. How is the negative result of the experiment interpreted? (CO1, K3)	10

5. Answer any one of the following:-

5-a.	Define particle velocity and group velocity. Prove that group velocity is equal to particle velocity. (CO2, K2)	10
5-b.	What is Heisenberg uncertainty principle? Apply it to find the radius of first orbit. (CO2, K3)	10

6. Answer any one of the following:-

6-a.	Discuss the phenomenon of interference in wedge shaped thin film by reflected light and find the condition of maxima and minima. (CO3, K2)	10
6-b.	What is the Rayleigh criterion of resolution. What is transmission grating? Show that resolving power of a transmission grating is the product of number of rulings on the grating and order of fringe. (CO3, K2)	10

7. Answer any one of the following:-

- 7-a. What are intrinsic and extrinsic semiconductors? How Does the Fermi level vary with temperature in Extrinsic semiconductors? (CO4, K2) 10
- 7-b. Derive an expression for the position of fermi level in intrinsic semiconductors and explain it with the help of band diagram.(CO4, K2) 10

8. Answer any one of the following:-

- 8-a. What is the working principle of laser? Discuss the construction and working of a Ruby laser. (CO5, K3) 10
- 8-b. Explain the phenomenon of light propagation through optical fiber. Derive the expression for acceptance angle and acceptance cone. (CO5, K2) 10

REG:JAN_JUN-2025