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 rest mass of photon of energy E is: (CO1,K1)　　　　　　1

　　(a)　zero

　　(b)　Ec^2

　　(c)　E/c^2

　　(d)　None of above

1-b.　　　According to special theory of relativity (CO1,K1)　　　　　　1

　　(a)　Speed of light is relative

　　(b)　Speed of light is same in all inertial frames

　　(c)　Time is relative

　　(d)　Mass is relative

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.　　　Matter wave are ?　(CO2,K1)　　　　　　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,K1)   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. The modification in the intensity of light resulting from the superposition of two waves of same frequency and having a constant phase difference, is called (CO3,K1)   1

(a) Interference

(b) Diffraction

(c) Polarization

(d) Dispersion

1-g. The smallest Unit in digit system is (CO4,K1)   1

(a) Bit

(b) Byte

(c) Kilobyte

(d) Megabyte

1-h. When a semiconductor is heated its resistance (C04,K1)   1

(a) Increases

(b) Decreases

(c) Remains Constant

(d) None of above

1-i. Laser beam is made of (CO 5)   1

(a) Electrons

(b) Highly coherent photons

(c) Very light and elastic particles

(d) None of above

1-j. It is the angle at which the propagating ray strikes the interface with respect to the normal. (CO5,K1)   1

(a) refracted angle

(b) Incident angle

(c) Reflected angle

(d) Critical angle

2. Attempt all parts:-

2.a. What is GPS? (CO1,K2)   2

2.b.	Define group velocity and phase velocity. (CO2,K2)	2
2.c.	What are missing orders? (CO3,K2)	2
2.d.	What are extrinsic semiconductors? (CO4,K2)	2
2.e.	What are the components of Laser devices? (CO5,K2)	2

SECTION-B   30

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

3-a.	An electron is moving with velocity 0.98 times the velocity of light in laboratory frame of reference. Find its kinetic energy. (CO1,K3)	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,K3)	6
3-c.	Calculate the smallest possible uncertainty in the position of an electron moving with velocity 3×10^7m/s. (C02,K3)	6
3-d.	Find the de-Broglie wavelength of a neutron of energy 12.8 MeV. (CO2,K3)	6
3.e.	A soap film of refractive index 1.45 is illuminated with light of different wavelengths at an angle 45°. There is complete destructive interference for $\lambda = 5890$ Å. Find the least thickness of the film. (CO3,K3)	6
3.f.	Find the value of f(E) for $E-E_f = 0.01eV$ at 400K. (CO4,K3)	6
3.g.	Calculate the energy and momentum of a photon of a laser beam of wavelength 6328 Å. (CO 5)	6

SECTION-C   50

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

4-a.	State Einstein's postulates of special theory of relativity. Derive the Lorentz transformation equations. (CO1,K3)	10
4-b.	Derive Einstein's mass energy relation. Give some evidence showing its validity. (CO1,K3)	10

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

5-a.	Define the wave function and give its physical significance. Also, Derive the time independent Schrodinger wave equations. (CO2)	10
5-b.	What is uncertainty principle? How will you explain non existence of electrons in the nucleus? (CO2,K2)	10

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

6-a.	Describe Newtons ring method to determine the wavelength of sodium light. What will happen in fringes if air film between planoconvex lens and glass plate is filled with a liquid of refractive index μFind the formula for μ(CO3,K2)	10
6-b.	Discus the phenomenon of Fraunhofer diffraction at single slit and find the relative intensities of successive maximas. (CO3,K2)	10

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

7-a.	Explain the working of solar cell. (CO4,K2)	10
7-b.	Show that Fermi level in an intrinsic semiconductor lies half way between the top	10

of the valence band and bottom of the conduction band. (CO4)

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

8-a.   Describe the Energy level diagram to explain the working of He-Ne Laser. (CO5)   10

8-b.   Describe various types of optical fibers on basics of modes and core refractive   10
          index? (CO5,K2)

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