2023

Time - 3 hours

Full Marks - 60

*Answer **all groups** as per instructions.*

Figures in the right hand margin indicate marks.

GROUP – A

1. Fill in the blanks. (<u>all</u>)   [1 × 8

    (a) On reflection from a denser medium, path difference introduced is _____.

    (b) In Fresnel's biprism, the central fringe is _____.

    (c) In Fraunhofer diffraction from a slit, the light wavefront incident on the slit is _____.

    (d) For a known metal, the kinetic energy of the photo electron increases with the _____ of incident radiation.

    (e) Photoelectric emission is a _____ process.

    (f) Binding energy of the nucleus determines its _____.

    (g) In a beta decay, a neutron changes to a _____.

    (h) Reference frame moving at constant speed along a straight line is called a _____ reference frame.

GROUP – B

2. Answer any eight of the following questions within two to three sentences each. [1½ × 8

   (a) Define chromatic aberration.

   (b) What do you mean by coherent light sources ?

   (c) State Brewster's law.

   (d) State Malus law.

   (e) Explain de Broglie hypothesis.

   (f) Explain probability current density.

   (g) What is the physical significance of the expectation value of an observable ?

   (h) State equation of continuity in quantum mechanics.

   (i) Define average life of nuclear substance.

   (j) State postulates of special theory of relativity.

GROUP – C

3. Answer any eight of the following questions within 75 words each. [2 × 8

   (a) How can the chromatic aberration be minimized ?

   (b) Distinguish between ordinary and extraordinary rays in polarization.

   (c) What are the conditions of interference ?

   (d) Explain the concept of matter waves.

   (e) What are the limitations of Bohr's theory ?

   (f) Explain Heisenberg's uncertainty relation in quantum mechanics.

   (g) Explain the physical interpretation of wave function.

   (h) Explain mass defect and binding energy.

   (i) Explain packing fraction with example.

   (j) What are radioactive decay laws ?

GROUP – D

Answer all questions within 500 words each.

4. Differentiate between Fresnel and Fraunhoffer diffraction. [6

   OR

   Derive the expression for intensity distribution for diffraction due to a single slit.

5. Explain the experimental findings of photo electric effect using quantum theory of radiation. [6

   OR

   On the basis of Bohr's theory of hydrogen atom, explain the hydrogen spectra. Describe the correction for finite mass of nucleus.

6. State and prove Ehrenfest's theorem. [6

OR

Derive the expressions for energy eigenvalues and eigenfunctions for a particle in a one dimensional box.

7. Write notes on within 250 words each. [3 × 2

(a) Time dilation

(b) Length contraction

OR

Write notes on within 250 words each. [3 × 2

(a) Nuclear fusion

(b) Cyclotron