

B.Sc. T. Y. (CBCS Pattern) Semester-V
USDSEPHT09 - Physics Paper-I - Elements of Modern Physics

P. Pages : 2

Time : Three Hours



GUG/S/25/13093

Max. Marks : 50

- Notes : 1. All questions are compulsory and carry equal marks.
2. Draw neat and labelled diagrams wherever necessary.

Either:

1. A) i) Explain the concept of wave particle duality of light. 2
ii) Explain de Broglie concept of matter wave. 3
iii) Describe Davison and Germer's experiment for the study of electron diffraction. 3
iv) Compute de Broglie wavelength of a particle mass 1.67×10^{-27} kg and energy of 10 KeV. 2

OR

- B) a) State and explain Heisenberg uncertainty principle. 2½
b) Write failures of classical theories. 2½
c) Describe Heisenberg thought experiment on Gamma ray microscope to prove uncertainty principle. 2½
d) An electron is confined to a box of length 10^{-8} m. Calculate the minimum uncertainty in its velocity. Given : $m_e = 9 \times 10^{-31}$ kg. 2½

Either:

2. A) i) State Schrodinger wave equation. 1
ii) Derive the time independent Schrodinger equation for matter wave. 3
iii) Obtain time dependent Schrodinger equation for matter wave. 3
iv) Find the Eigen values of operator d^2/dx^2 for the function $\psi = \cos x$. 3

OR

- B) a) State fundamental postulates of quantum mechanics. 2½
b) What are Eigen values and Eigen function? Explain them with examples. 2½
c) State the boundary conditions for free particle in one dimensional box. 2½
d) Find the ground state energy of a particle of mass 9.1×10^{-31} kg. Confined to one dimensional potential box of size 10^{-10} m. 2½

Either:

3. A) i) What is alpha Decay? 1
ii) Explain the details of Gamow's theory of alpha Decay. 6
iii) Describe the range of Alpha particle? 3

OR

- B) a) Obtain the relation between mass number and radius of nucleus. 2½
 b) Discuss properties of nuclear forces. 2½
 c) Obtain an expression for half-life period of radioactive substance. 2½
 d) Find the binding energy of deuteron. 2½
 Given: $m_p = 1.007276 \text{ u}$
 $m_n = 1.008665 \text{ u}$
 $M_d = 2.013553 \text{ u}$

Either:

4. A) i) What is beta Decay? Explain three modes of Beta Decay. 4
 ii) Explain nuclear fission on the basis of Liquid Drop model and give its merits. 6

OR

- B) a) State and Explain Giger Nuttal law. Discuss its importance. 2½
 b) Describe Mossbauer effect. 2½
 c) Explain chain reaction with Uranium 235. 2½
 d) A nuclear reactor is developing a power of 3 MW. How many atoms of uranium – 235 undergo fission per second? Assume that energy of 200 MeV is released per fission. Given $1 \text{ MeV} = 1.6 \times 10^{-13} \text{ J}$. 2½

5. Solve **any ten** of the followings.

- a) Write the uncertainty relation for time energy. 1
 b) What is matter wave? 1
 c) What is black body radiation.? 1
 d) Write the physical significance of wave function ψ . 1
 e) Define operators in quantum mechanics. 1
 f) What is stationary States? 1
 g) Define the term radioactivity. 1
 h) Draw the graph packing fraction with mass number. 1
 i) Define Binding energy in nuclear reaction. 1
 j) What is nuclear isomerism? 1
 k) Define nuclear fusion. 1
 l) State any two properties of neutrino. 1
