[This question paper contains 4 printed pages.]

1008   *Your Roll No. ....*

B.Sc. (Hons.) / II   C

ELECTRONIC SCIENCE – Paper – 2.1 (VIII)

(Modern Physics and Quantum Mechanics)

Time : 3 Hours   *Maximum Marks : 38*

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt **five** *questions in all.*
Question No. 1 *is compulsory.*
Attempt at least **two** *questions from each Section.*

1.   (a) Calculate deBroglie wavelength of an electron having Kinectic energy 100 MeV.

(b) Explain the terms Phase velocity and Group velocity.

(c) Using the Uncertainty Principle, find the minimum value in (MeV) of the Kinectic energy of a nucleon confined within a nucleus of radius $R = 5 \times 10^{15}$ mts.

P.T.O.

(d) Explain nuclear fission and fusion processes. Give one example for each.

(e) State neutrino hypothesis of β-decay. (2×5=10)

SECTION A

2. (a) What are Cathode rays ? Give their properties.

(b) Discuss Thomson's experiment in detail for the determination of $\dfrac{e}{m}$ for electrons. (2.5)

3. (a) What is photoelectric effect ? Discuss how classical theory failed. but quantum theory succeeded in explaining the experimentally observed results of photoelectric effect.

(b) A Sodium Surface with work function 2.28 eV is illuminated by light of wavelength 400 nm. Find the maximum kinectic energy and speed of photoelectrons emitted. (4.3)

4. (a) Explain the anomalous Zeeman effect on the basis of quantum theory.

(b) If X-rays of wavelength 0.5 A are detected at an angle of 5° in the first order. What is the spacing between the adjacent planes of the crystal. (5,2)

SECTION B

5. (a) Give the physical significance of wave function.

    (b) A particle of Kinectic energy E, moving from left to right, approaches a one-dimensional potential step defined by :

    $$V(x) = 0 \text{ for } x < 0$$

    $$\& \ V(x) = V \text{ for } x \geq 0$$

    Write the Schrödinger equation for the particle in the two regions. Solve the Schrödinger equation for $E > V_0$ and hence find the expressions for reflectivity & transmissivity of the particle. Also solve the Schrödinger equation for $E < V_0$.   (1.6)

6. (a) What is Moss bauer Effect ? Explain by giving one example.

    (b) With the help of Davisson-Germer experiment explain how deBroglie wave hypothesis was established.   (3.4)

7.   (a) Obtain time-dependent & time Independent
         Schrödinger equation.

     (b) A quantum-mechanical system having mass of m
         is described by the wave function $\psi(x) = \exp(ikx)/x$.
         Calculate the probability current density.   (5,2)