

[This question paper contains 3 printed pages.]

4609

Your Roll No.

B.Sc. Prog./III

AS

PH-302 – PHYSICS-MODERN PHYSICS

(Admissions of 2008 and onwards)

Time : 3 Hours

Maximum Marks : 75

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

Attempt five questions in all.

Question No. 1 is compulsory.

1. Attempt any five of the following :

- (i) Determine the wavelength associated with an electron having Kinetic Energy equal to 1 MeV.
- (ii) What is Larmor's theorem? Obtain the Larmor's frequency.
- (iii) What is wave function? Explain the Normalization condition.
- (iv) State Pauli's Exclusion Principle. What are Symmetric and Antisymmetric wave functions?
- (v) Give some useful applications of LASERs.
- (vi) Explain Radio-Carbon Dating.

P.T.O.

- (vii) Give a brief description of the earth's atmosphere. (3×5=15)
2. A rectangular potential barrier has a height V_0 and width 'a', write the Schrödinger's equation in all the regions for a particle having Energy $E < V_0$. Obtain the transmission probability. (15)
3. (a) Explain in detail the Normal Zeeman Effect. Obtain an expression for the "Zeeman Shift". (8)
- (b) Discuss the Stern-Gerlach experiment. Explain the importance of the results obtained. (7)
4. (a) State and prove Heisenberg's Uncertainty Principle. Discuss one of its applications. (10)
- (b) What is the minimum uncertainty in the energy of an excited state of a system if on the average it remains in that state for 10^{-11} s? (5)
5. (a) Explain the Basic Principle of Lasers. What are the various components in a general Laser System? Give the important properties of Lasers. (9)
- (b) Obtain Einstein's A and B coefficients. (6)
6. (a) What is β -decay? Explain in detail its energy spectra. Describe neutrino hypothesis in case of β -decay. (9)

- (b) What are the various applications of Nuclear Science in Medicine, Crime detection and Mining? (6)
7. (a) What is Ozone Layer? How it is formed? What are the causes of its depletion? (8)
- (b) What is Compton's Effect? Obtain the expression for the change in wavelength in Compton's scattering. (7)
8. (a) Describe the three main types of elementary particles. Classify the following particles into one of the above: e^- , p , π^- . (6)
- (b) State two conservation laws in elementary particles. (2)
- (c) What are the six types of quarks? Give an idea of standard model. (7)

Constants

$$C = 3 \times 10^8 \text{ m/s}$$

$$e = 1.6 \times 10^{-19} \text{ Coulomb}$$

$$h = 6.6 \times 10^{-34} \text{ J.S.}$$

$$M_e = 9.1 \times 10^{-31} \text{ Kg}$$

$$M_n = 939.55 \text{ MeV} = 1.00866u$$

$$M_p = 938.26 \text{ MeV} = 1.00728u$$