(180-PA-603311B) Roll No. .....

PAPER ID—10147

B.Sc. EXAMINATION, 2023

(Sixth Semester)

NUCLEAR PHYSICS

Code : PH-602

Time : 3 Hours *Maximum Marks : 45*

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. All questions carry equal marks. Use of Scientific (non-programmable) calculator is allowed.

Unit I

1. (a) What are the outcomes of Rutherford α-scattering experiment ? Discuss the estimation of radius of a nucleus using this experiment. 6

   (b) α-particles of energy 4 MeV are scattered back from a Gold foil (Z = 79). Calculate the maximum volume in which the positive charge of the atom is likely to be concentrated. 3

2. (a) What is Moseley's law ? Discuss, how charge of the nucleus is determined ? 6

   (b) In the Bain-Bridge mass spectroscope singly ionized atoms of Mg-24 pass in to deflection chamber with a velocity of 4×10^5 ms^{-1}. If they are deflected by a magnetic field of flux density 0.5 Tesla. Calculate the radius of path. 3

Unit II

3. (a) Discuss in detail the theory of α-disintegration with the help of quantum mechanical tunneling. 7

(b) Polonium 212 emit α-particle of 8.776 MeV energy. Calculate that disintegration energy that correspond to it. 2

4. (a) What is β-decay ? Discuss the neutron hypothesis for β-decay. 6

(b) A photon of energy 1.02 MeV is scattered through 90° by a free electron . Calculate the energy of photon and electron after interaction. 3

K.E = 1.02 MeV
θ = 90°

5. (a) Discuss in brief the three processes of interaction of Y-photon with matter by which radiation losses energy while passing through matter. 7

(b) The linear absorption coefficient of 1MeV gamma Rays is 0.70 cm^{-1}. Find the thickness of the lead required to reduce half the intensity of beam of such rays. 2

Unit III

6. (a) Discuss conservation Laws in nuclear reactions. Which quantities are not conserved 5

(b) Write short notes on following reactions : 4

(i) Transfer Reaction

(ii) Spallation Reaction.

7. (a) Write principle, construction and working of GM Counter. 7

(b) A GM counter collects 10 electron per discharge. When the counting rate is 500 counts per minute, what will be average current in the circuit. 1

(a) What is betatron ? Give betatron conditions, its principle, construction, working and uses. 7

(b) The uniform magnetic field of 2 Wb/m^2 is used in cyclotron to accelerate the proton. The radius of the cyclotron is 0.64 m. Calculate, how rapidly the electric firld between the does should reversed ? 2