

B.Sc. Semester - 5 (CBCS) Examination
Oct/Nov - 2024 (NEW COURSE)
Nuclear & Particle Physics (Core)

Time: 2:30 Hours**Marks: 70****Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate marks.

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- Que.1(A) Answer the following questions. (any two out of three) (10)
1. Discuss Semi-Empirical Mass Formula and significance of various terms.
 2. Describe Rutherford Scattering Experiment.
 3. Explain variation of binding energy with Mass Number.
- Que.1(B) Answer the following questions. (any one out of two) (04)
1. Discuss Nuclear Density.
 2. Calculate the binding energy per nucleon of ${}_{29}\text{Cu}^{64}$ using semi empirical mass formula. The constants of the formula are volume term (a_v) = 14.0, surface term (a_s) = 13.0, coulomb term (a_c) = 0.583, asymmetry term (a_{sym}) = 19.5 and pairing term (δ) = 33.5
- Que.2(A) Answer the following questions. (any two out of three) (10)
1. Explain the theory of Beta Decay and Neutrino Hypothesis.
 2. Explain Half Life and Mean Life.
 3. Discuss Continuous Beta Ray Spectrum.
- Que.2(B) Answer the following questions. (any one out of two) (04)
1. A radioactive substance has a decay constant $\lambda = 0.0231$ per day. Calculate the time t for $\frac{3}{4}$ of the original number of Atoms to Disintegrate.
 2. Write properties of Gamma Rays.
- Que.3(A) Answer the following questions. (any two out of three) (10)
1. Describe the interaction between Energetic Particle and Matter.
 2. Explain principle and construction of Scintillation Counter.
 3. Derive the Q Value Equation.
- Que.3(B) Answer the following questions. (any one out of two) (04)
1. Explain construction of Ionization Chamber.
 2. Explain Photomultiplier.
- Que.4(A) Answer the following questions. (any two out of three) (10)
1. Describe construction and working of Linear Accelerator.
 2. Discuss the main components of Nuclear Reactor.
 3. Discuss the Chain Reaction and Multiplication Factor.
- Que.4(B) Answer the following questions. (any one out of two) (04)
1. Write a note on Atom Bomb.
 2. A cyclotron has a magnetic field of 2 W/m², if the cyclotron is accelerating protons, the value of charge of proton (q_p) = 1.6×10^{-19} C, and, mass of proton (m_p) = 1.79×10^{-27} kg then at what frequency should cyclotron operate.
- Que.5(A) Answer the following questions. (any two out of three) (10)
1. Explain the Proton-Proton Cycle and Carbon-Nitrogen Cycle.
 2. Discuss Elementary Particle Quantum Numbers.
 3. Discuss the classification of Elementary Particles.
- Que.5(B) Answer the following questions. (any one out of two) (04)
1. Write a note on Antimatter.
 2. Explain magnetic bottle for Plasma Confinement.
