

M.Sc.(Phy.) Semester - 3 (CBCS) Examination
Oct/Nov-2021 (NEW COURSE)
Nuclear and Particle Physics (Core (New))

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

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

Que.1 Answer in brief any seven (14)

1. Discuss in brief the basic nuclear properties (i) spin and (ii) Magnetic moment.
2. What is average binding energy? Write its equation.
3. Write any two experimental evidences in favor of Shell Model.
4. Mention any two failures of Shell Model.
5. Mention various modes of beta decay.
6. Write down the properties of neutrino.
7. Differentiate: Nuclear reaction and nuclear scattering.
8. What is transfer reaction? Give one example.
9. What are nucleons and hyperons?
10. What are hadrons? How will you categorize them?

Que.2 Answer the following questions: Any TWO out of THREE (14)

1. Explain the term binding energy of the nucleus. Sketch graphically the variation of binding energy per nucleon as a function of mass number.
2. With special reference to volume, coulomb and surface terms of Liquid drop model, derive the equation of total binding energy of a nucleus.
3. Discuss: Neutrino theory of beta decay.

Que.3 Answer the following questions: (14)

- a) Explain the Shell Model of the nucleus.
- b) Explain the processes namely: beta decay, positron emission and electron capture (use $m_p = 1.00728 \text{ amu}$, $m_n = 1.00867 \text{ amu}$, $m_e = 0.00055 \text{ amu}$).

OR

Que.3 Answer the following questions:

- (a) Discuss the mechanism of Compton Effect when γ radiation interacts with matter.
- (b) Discuss the interaction of charged particles with matter.

Que.4 Answer the following questions: Any TWO out of THREE (14)

1. With necessary figure, discuss a case of nuclear reaction in a lab system.
2. List out various quantum numbers associated with elementary particles. Discuss Isospin quantum number I.
3. With necessary examples of interaction and decay processes, show that baryon number is conserved in all three types of interactions.

Que.5 Write any TWO short notes (14)

1. Dynamic properties of nuclei.
2. Internal conversion process.
3. Nuclear reaction cross section.
4. Classification of nuclear reactions.
