

Roll No.

(12/24)

15421

M.Sc. EXAMINATION

(For Batch 2021 & Onwards)

(Third Semester)

PHYSICS

Msc/Phy/3/CC12

Nuclear and Particle Physics

Time : Three Hours

Maximum Marks : 70

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory.

1. Explain the following in brief : $5 \times 2 = 10$

- (i) Why is binding energy low for light mass nuclei ?

- (ii) What is isospin ?
- (iii) What is spin-orbit coupling ?
- (iv) Why is colour quantum number introduced in particle physics ?
- (v) What is alpha decay paradox ?

Unit I

- 2. (a) Discuss meson theory of nuclear forces.
What are mesons ? 8
- (b) Discuss charge independence and charge symmetry of nuclear forces. 7
- 3. (a) Write about fundamental forces of nature along with their comparative properties. 10
- (b) What are central and non-central forces ? Explain. 5

Unit II

- 4. (a) Give evidences in the support of nuclear shell model. 7
- (b) Predict stability against beta-decay by mass parabola for members of an isobaric family. 8
- 5. (a) Derive semi-empirical mass formula with liquid drop model of nucleus. 8
- (b) Describe single particle shell model for square well potential. 7

Unit III

- 6. (a) Discuss Fermi's theory of beta-decay and explain Fermi-Kurie plot. 10
- (b) Write basics of nuclear fission 5.

7. Write short notes on the following : $5 \times 3 = 15$

- (a) Parity non-conservation in beta-decay.
- (b) Selection rules for beta-decay.
- (c) Compound nuclear reaction.

Unit IV

8. (a) What are Leptons ? Discuss classification of Leptons with examples. 7

(b) Briefly explain about quarks and gluons.

(c) What is charge conjugation operator ? 4

9. (a) Describe Gell-Mann-Nishijima formula and verify it for some particles. 8

(b) Explain C and P non-conserving property of neutrino. 7