

Roll No.

42021

**M. Sc. (Physics) 4th Semester
Examination – May, 2019
NUCLEAR & PARTICLE PHYSICS**

Paper : PHY(H)-401/4247
[Maximum Marks : 80

*Time : Three Hours]
Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

Note : All questions carry equal marks. Question 1 is compulsory and attempt *one* question from each unit.

1. (i) Write a short note on Wigner, Majorana, Bartlett, $4 \times 4 = 16$ and Heisenberg Potential.
- (ii) Using Single particle shell model predict the ground state spin, parity, and magnetic moment of :
(a) ${}^{17}_8\text{O}$ (b) ${}^{47}_{22}\text{Ti}$
- (iii) What are expected types of multipole / gamma ray transitions between following states of odd A nuclei (a) $f_{5/2}$ to $d_{3/2}$ and (b) $h_{9/2}$ to $s_{1/2}$.
- (iv) Are the following interactions allowed ? If allowed then write the type of interactions.
(a) $\pi^- + p \rightarrow A^0 + K^0$
(b) $p + p \rightarrow p + \pi^+ + K^0 + A^0$

P. T. O.

UNIT - I

- 2. Discuss experimentally measured physical properties of the ground state of deuteron and compare its binding energy obtained by considering square well potential of this two nucleon system. 16

- 3. Prove that scattering cross-section for low energy nucleon-nucleon scattering is independent of nuclear potential. 16

UNIT - II

- 4. Write the assumptions and merits of liquid drop model. Explain nuclear fission on the basis of liquid drop model. 16

- 5. What are magic numbers ? Write the experimental evidences for magic numbers. Write assumptions of the single particle shell model and ordering of energy states according to shell model. 16

UNIT - III

- 6. Prove the existence of neutrino in β -decay and describe the Fermi theory of β -decay. 16

- 7. If the outgoing part of a partial spherical wave with angular momentum l is changed by η_l and $\eta_l = -1$, then prove that scattering cross-section attains its maximum value. 16

UNIT - IV

- 8. (a) Explain the elementary ideas of CP and invariance.
- (b) Explain the types of interactions occurring in particle physics with examples.

- 9. (a) Describe Quark Model and write baryon and mesons in terms of quarks.
- (b) Write a short note on SU(2) and SU(3) symmetries.
