

January 2015
M. Sc. IIIrd Semester Examination

PHYSICS
Second Paper : Nuclear and Particle Physics

Time 3 Hours]

[Max. Marks : Regular 85 / Private 100 / ATKT 35

Note : This question paper is meant for all Regular, Private and ATKT students. Answer all five questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.

1. Why are exchange nuclear forces considered ? Get and explain Bastlett and Heisenberg exchange interactions. Give the experimental evidence for them.

OR

Explain the compound nuclear reaction mechanism. How can one confirm this experimentally? Is there any other reaction mechanism ? Give a very short description of its mechanism.

2. (a) Why is phase stability necessary in cyclotron and how is it achieved ?
(b) Compare the performance of a cyclotron and a linear accelerator.

OR

Why betatron works on a different principle than other particle cyclotrons ? Describe and explain a GeV electron accelerator.

3. Give two examples each of nuclear behavior explained by shell model and by liquid drop model. Elaborate on the statement, "Liquid drop model is a strong interaction model and shell model is a weak interaction model." How can the two coexist in nuclei ?

OR

- (a) Calculate the spin, angular momentum and parity of the ground state of $^{17}_9\text{F}_8$.
(b) Define quadrupole moment, Q. Can $^{17}_9\text{F}_8$ have non-zero Q in ground state ?

4. Give Fermi theory of beta-decay. How is it verified ?

OR

Write short notes on :

- (a) Multipole radiation. Why is it so prominent in nuclei vis- a-vis in atoms.
(b) Internal conversion.

5. What are fundamental interactions ? Are these interactions independent of one another ? If gravitational interaction is the weakest, why it seems to be so prominent ?

OR

Write note on :

SU(3) Symmetry and Elementary Particles.

OR

Symmetry and Conservation Laws.

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