

NOVEMBER/DECEMBER 2018

**MPH32 — NUCLEAR AND PARTICLE
PHYSICS**

Time : Three hours

Maximum : 75 marks

SECTION A — ($5 \times 6 = 30$ marks)

Answer ALL questions.

All questions carry equal marks.

1. (a) Show that for nuclei with spin $I = 1$ or $1/2$, the quadrupole moment is zero in the state $M_I = 1$.

Or

- (b) Explain briefly the meson theory of nuclear forces.

2. (a) Explain Q-value of nuclear reaction. How is it related to threshold energy of a particle?

Or

- (b) Explain the differences between compound nucleus reaction and direct reaction mechanism.



3. (a) Explain the origin of Schmidt lines on the basis of single particle model.

Or

- (b) Discuss the main features of collective model of the nucleus.

4. (a) Explain non-conversion of parity in gamma decay.

Or

- (b) Discuss about the internal conversion of gamma rays.

5. (a) What do you know about symmetry properties of elementary particles? Describe in brief.

Or

- (b) Write a note on CP and CPT invariance.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

All questions carry equal marks.

6. Define scattering length. Give an account of effective range theory of n-p scattering at low energies.
7. Derive the Breit-Wigner formula for nuclear reactions.

8. On the basis of liquid drop model give a simple derivation of Weizacker's mass formula giving arguments for each term. What are the important conclusions drawn from this formula.

9. Explain the Fermi's theory of β decay.

10. Give a brief and logical description of all types of interactions among elementary particles.

