

NOVEMBER/DECEMBER 2018

**MPH32 — NUCLEAR AND PARTICLE
PHYSICS**

Time : Three hours

Maximum : 75 marks

SECTION A — (5 × 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.

