B.A./B.Sc. Semester—VI

PHYSICS

Paper–B (Radiation & Particle Physics)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— All parts of question **1** in section A are compulsory.
Attempt **ONE** question each from sections B, C,
D and E. All questions carry equal marks.

SECTION—A

1. (a) What are the main processes by which gamma
radiation interacts with matter ?

   (b) A proton and an alpha particle enter simultaneously
in a thick material with equal kinetic energy.
Which particle will stop earlier in the material
and why ?

   (c) What is the advantage of colliding beam
experiments over the fixed target experiments ?

   (d) What is the advantage of halogen quenching gas
over organic quenching gas in G. M. tubes ?

   (e) Why electrons cannot be accelerated in a
cyclotron ?

(f) What is charge conjugation ?

(g) List the names of fundamental forces and their mediating particles.   7×1=7

SECTION—B

2. Derive the mathematical expression for the loss of energy of a heavy charged particle passing through matter. What are the assumptions used in this derivation ? 7

3. What is Compton effect ? Derive an expression for Compton shift and kinetic energy of recoiled electron.   7

SECTION—C

4. Discuss the principle, construction and working of a semiconductor detector. Compare its advantages and disadvantages with scintillation detector.   7

5. Using suitable diagrams, explain the principle and applications of the following detectors :

    (i) Cherenkov detector   (ii) Bubble chamber   3+4

SECTION—D

6. Write a brief note on the following colliding machines :

    (i) Large Hadron Collider

    (ii) Fermilab Tevatron.   4+3

7. Discuss the principle, construction and working of a linear accelerator.   7

SECTION—E

8. (a) What are leptons, mesons and baryons ? 5

   (b) Determine the baryon number and strangeness of particle 'X' in the following strong interactions :

   (i) $p + p \rightarrow p + X + \Sigma^0$

   (ii) $K^- + p \rightarrow X + K^+ + K^0$ 2

9. What are quarks ? Give qualitative description of quark model. 7