

## NUCLEAR AND PARTICLES PHYSICS - III

**Time Allowed : Three Hours**

**Maximum Marks : 40**

**Note :-** The candidates are required to attempt two questions each from Section A and B carrying 8 marks each, and the entire Section C consisting of 8 short answer type questions carrying 1 marks each.

### Section - A

1. A charged particle (charge  $Z_e$ ) having mass 'M' and kinetic energy 'E' is passing through a certain medium having 'n' electrons per unit volume. If the motion of the particle is along X-direction, derive an expression for the rate of loss of energy  $\left(-\frac{dE}{dx}\right)$ . Define stopping power. 8
2. Describe the principle construction and working of cyclotron. Derive an expression for the maximum kinetic energy achieved by a particle of mass 'm' in terms of the applied magnetic field and dee radius. Also state the relation in terms of frequency of applied electric field. Discuss its limitations. 8
3. (a) How does radiation lose energy during passage through matter? Derive the law of absorption of r-ray in matter. 4  
 (b) Define linear absorption co-efficient and mass absorption coefficient to interaction of radiation with matter. What is half thickness and radiation length? 4
4. Explain pair production and give Dirac theory. Prove that photon energy shared by particle in pair production is equal. 8

### Section - B

5. (a) Explain the construction and working of a G.M. Counter. What is dead time and recovery time? What do you mean by quenching of a G.M. Counter? What is its necessity? How is it achieved internally? 6  
 (b) Describe briefly its operation and testing. What is plateau as applied to a GM Counter? 2
6. (a) Explain the construction, principle and working of an ionisation chamber. 6  
 (b) What do you understand by parity and charge conjugation? 2
7. What are elementary particles? What are the broad categories into which elementary particles in each category fall and discuss their main characteristics? 8
8. (a) Discuss the following intrinsic quantum number in connection with elementary particles (i) Charge number (ii) Lepton number (iii) Baryon number (iv) Hyper charge (v) Multiple number (vi) Strangeness 6  
 (b) Which Baryon with Strangeness-2 and which Baryon with strangeness-1 is there? 2

### Section - C

9. Attempt all parts in short :
  - (i) Pion family
  - (ii) What are quarks?
  - (iii) A betatron working on an operating frequency of 80 Hertz has a stable orbit of diameter 2.0m. Find the energy gained per turn if the magnetic field at the orbit is 0.5 Tesla.
  - (iv) Photoelectric absorption
  - (v) What is 'good geometry' and 'poor geometry'?
  - (vi) What is a positron?
  - (vii) Bremsstrahlung.
  - (viii) Concept of isospin.

1×8=8