NUCLEAR PHYSICS – III

Semester-V

Time Allowed : 3 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. Why a nucleus has magnetic dipole moment ? Further derive its expression. 8
2. Derive the expression for semi-empirical mass formula and discuss its limitations. 8
3. Discuss the key features of nuclear shell models. Further explain the difference between predications of magic number based on the infinitie potential well and harmonic oscillator potential. 8
4. (a) justify the non-existence of electrons within the nucleus on the basis of uncertainty principle. 5
   (b) Calculate the binding energies of the following isobars and their binding energies per nucleon. It is given that $_{28}Ni^{64}$ = 63.9280 amu, $_{29}Cu^{64}$ = 63.9298 amu. 3

Section - B

5. What do you mean by radioactive equilibrium ? Further deduce the condition for secular equilibrium. 8
6. Discuss the reasons for hypothecation of neutrino and specify its properties. 8
7. (a) A piece of an ancient rock show activity due to C^{14} of 6 disintegrations/min/gm of carbon. Calculate the age of rock. 5
   (b) How you justify spherical shape of the nucleus ? 3
8. Briefly discuss different conservation laws govering the nuclear reactions. 8

Section - C

9. (a) Specify similarities and differences between electron and positron.
   (b) What do you mean by magic numbers for a nucleus ?
   (c) How the nuclear radius for an element varies with its mass number ?
   (d) What do you mean by internal conversion ? Give example.
   (e) What does Q value of a nuclear reaction signify ?
   (f) What do you mean by asymmetry energy as considered in semi-empirical formula ?
   (g) What is the basic assumption underlying the theory of alpha decay ?
   (h) How is the parity of a nucleus specified ? 1×8=8