Roll No. □□□□□□□□□□□□ **Total No. of Pages : 02**

Total No. of Questions : 09

M.Sc.(Physics) (2015 to 2017) (Sem.–2)

NUCLEAR & PARTICLE PHYSICS

Subject Code : MPH-204

Paper ID : [A2818]

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTION TO CANDIDATES :

1. **Attempt FIVE questions in ALL including the compulsory question No.-9.**

Q1. a) What is partial wave analysis? Based on this analysis derive expression for total scattering cross section. (12)

b) Derive relationship between differential scattering cross-section and scattering amplitude. (8)

Q2. a) Describe the concept of effective range and scattering length while studying the low energy neutron-proton scattering and deduce expression for S-wave scattering cross section. Hence explain the spin dependence of nuclear forces. (12)

b) Describe meson theory of nuclear forces. How this theory is useful to know the approximate value of nuclear radius? (8)

Q3. a) State the assumptions involved in liquid drop model of nucleus and hence derive expression for stability criteria of nucleus in terms of atomic and mass number of nucleus based on Bohr-Wheeler theory. (12)

b) What is spin-orbit coupling? Describe its role in shell model of nucleus. (8)

Q4. a) State and explain any six evidences in favor of shell structure of nucleus. (12)

b) Write salient feature of collective model of nucleus. (8)

Q5. a) State assumptions made in Fermi theory of beta decay. Based on these assumptions, derive expression for the occurrence of total probability per sec for beta disintegration. (12)

b) Show that :

i) $O^{14}(0^+) \rightarrow \mathrm{N}^{14}(0^+)$ follow Fermi transition

ii) $B^{13}\left(\frac{3^-}{2}\right) \rightarrow C^{13}\left(\frac{1^-}{2}\right)$ follow Gamov-Teller transition (8)

Q6. a) Write notes on :

i) Internal conversion

ii) Nuclear isomerism. (12)

b) Let nucleus is in excited state E_i and it decays to lower state E_f by emitting a gamma ray photon of energy E_y. Show by calculations that $E_i - E_f \cong E_y$ (8)

Q7. a) Write note on conservation laws followed by elementary particles. Give at least one example in each case. (12)

b) Based on SU(3) symmetry write Gellmann-Okuba mass formula and verify it for baryon octet. (8)

Q8. a) Write note on significance of symmetries followed by elementary particles. Describe meson octet and baryon decuplet. (12)

b) What are quarks? Explain' hadrons model' based on quarks. (8)

Q9. Answer briefly :

a) What is the physical significance of Breit-Wigner's single level formula?

b) What is the role of surface binding energy of nucleus in liquid drop model?

c) Based upon shell structure of nucleus, predict the magnetic moments of $_2He^3$ and $_2He^4$

d) What are Schmidt lines? State their importance in nuclear physics.

e) What do you understand by 'Comparative Half Life'? State its importance in beta decay.

f) Why 'Internal Conversion' generally occurs in high Z elements?

g) Evaluate the isospin quantum number each of pions, kaons and sigma particles.

h) What do you know about CP symmetry? (8×2.5=20)