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DEPARTMENT OF SCIENCES, II SEMESTER M.Sc. (Physics) END SEMESTER EXAMINATIONS, JUNE-JULY 2022

SUBJECT: NUCLEAR AND PARTICLE PHYSICS [PHY 5254] (CHOICE-BASED CREDIT SYSTEM-2020)

Time: 3 Hours	Date: 01/07/2022	MAX. I	MARKS: 50
Note: (i) Answer ALL ques	tions		
(ii) Assume missing da	ıta, if any		

1. (a) What are mirror nuclei? Derive the expression for nuclear radius using this concept.

(b) Using liquid drop model, explain the expression for binding energy in terms of various terms. Given the coefficients of the five terms, which make up the binding energy in the mass formula, have the approximate values (in MeV): volume, 15.5; surface, 16.8; coulomb, 0.72; asymmetry, 23; pairing, 34. Show that the difference between the total binding energy of the uranium isotope $^{235}U_{92}$ and the compound nucleus formed upon slow neutron absorption is 6.7 MeV, while the corresponding difference for $^{238}U_{92}$ is 5.2 MeV.

(c) What are the properties of nuclear forces? [3+5+2]

2. (a) What are meson? Describe Yukawa's theory of mesons.

(b) Discuss the origin of continuous beta spectrum. What is the role of Pauli in suggesting a new particle? What are the properties of that "New Particle"?
(c) Discuss in details three types of interaction of matter with gamma rays. What are the applications of gamma rays? [3+4+3]

- **3.** (a) Describe any two nuclear models.
 - (b) Describe the principle and working of GM counter.
 - (c) Discuss Pauli's neutrino hypothesis. [3+4+3]
- 4. (a) What are the types of interaction of electrons with matter? Discuss in details the inelastic interactions. Draw the necessary diagrams.
 - (b) What is pair production? Give an example of pair production.
 - (c) Define specific ionization and half value layer. [5+2+3]
- 5. (a) What are elementary particles? Deliberate the modern classification of elementary particles. What are quarks? Describe the protons and neutrons in terms of the constituent quarks.

(b) Elucidate the concepts of conservation of Baryon and Lepton numbers by giving appropriate examples. Describe iso-spin conservation. [5+5]