(i) **Printed Pages: 2**   Roll No. ....

(ii) **Questions   : 7**   **Sub. Code :** | 0 | 4 | 5 | 0 |

Exam. Code : | 0 | 0 | 0 | 5 |

B.A./B.Sc. (General) 5th Semester

1128

PHYSICS

Paper—C : Nuclear and Particle Physics—I

Time Allowed : Three Hours]   **[Maximum Marks : 22**

Note :— Attempt any *five* questions, selecting *two* questions from each of Unit. Question No. 7 (Unit-III) is compulsory. Use of non-programmable calculator is allowed.

UNIT—I

1. (a) Explain binding energy of a nucleus. Explain how does average binding energy per nucleon vary with mass-number.   3½

    (b) Show that nuclear density is independent of mass number.
                                                                    1

2. (a) What do you mean by L-S and J-J coupling ?   3

    (b) Calculate the atomic number of most stable nucleus for a given mass number 'A'. Given the liquid drop model constants $a_c = 0.7053$ MeV and $a_a = 23.702$ MeV.
                                                                    1½

3. What are the basic features of shell model of nucleus ? How does it account for the existence of magic numbers ?
                                                                    4½

UNIT—II

4. (a) Discuss the theory of successive decay of radioactive substance and obtain the condition for transient and secular equilibrium. 3

   (b) Half life of Na^{24} is 15 hours. Find its average life and also find the time it takes for 93.75% of the sample decay. 1½

5. (a) What are beta rays ? Explain how the theory of beta decay accounted for the existence of neutrino. 3

   (b) What is meant by range of alpha particles and on what factors it depends ? 1½

6. (a) What is Q value of a nuclear reaction ? What is its significance ? Derive an expression for it. 3

   (b) How are neutrons classified according to the energy possessed by them ? 1½

UNIT—III (Compulsory)

7. Attempt any *eight* parts. Each part carries equal marks :

   (a) Why stable nuclei have more neutrons than protons ?

   (b) What is the unit that measures the size of nucleus ?

   (c) Calculate the disintegration constant λ of a sample of Radium whose half life is 1590 years.

   (d) Define the two main units to measure the intensity of radioactivity.

   (e) What happens to atomic number and mass number of nucleus when it emits electron ?

   (f) What is nuclear fission ?

   (g) Which is more, atomic binding energy or nuclear binding energy ? Why ?

   (h) What is nuclear spin ?

   (i) What is the function of moderator in the nuclear reactor ?

   (j) For which projectile particle will be threshold energy be equal to the disintegration energy to an endoergic reaction produced in the target nucleus ? Give reason.

   $½×8=4$