



DEPARTMENT OF SCIENCES MAHE IV SEMESTER, END SEMESTER EXAMNATIONS JUNE 2018 Subject: NUCLEAR PHYSICS II (PHY-706.6) (REVISED CREDIT SYSTEM)

Time: 3 Hours Date: JUNE 2018 MAX. MARKS: 50

Note: (i) Answer any FIVE FULL questions. (ii) Answer the questions to the point.

(a) Using one experimental observation prove that nuclear forces are spin dependent. [5]
(b) The magnetic moments of proton, neutron, and deuteron are 2.79281±0.00004 nm, -1.913148±0.000066 nm, and 0.8797±0.00015 nm respectively. What nature of nuclear force you can infer from this data? [5]

2. (a) Obtain expression and value of the ground state energy of deuteron nucleus. [5]

(b) Write a comparative note on exchange potential. [5]

3. Obtain the energy level diagram of single particle shell model with harmonic oscillator potential and spin-orbit interaction. Which magic numbers are explained by this model? [8+2]

4. (a) Write the collective model Hamiltonian. What does $\lambda = 0, 1, 2$ mode oscillations mean? What are the angular momentum and parity of such motions? Draw atleast five vibrational energy levels with spin - parity for any one nucleus. [5] (b) Show that the inertial parameter $B_{lambda} = \rho r_o^5 / \lambda$ for nuclear fluid motion, where ρ is the nuclear density, r_o is the radius of the spherical drop, and λ is the order of deformation from spherical equilibrium shape. [5]

5. (a) Consider the reaction of the type X(x,y)Y and employ the standard perturbation theory to calculate cross - section in terms

of nuclei involved in reaction process. Also consider the spin of particles/nuclei. [7]

(b) How does the optical potential explain the scattering and absorption phenomena in nuclear reactions simultaneously? [3]

6. (i) Qualitatively discuss the compound nucleus reaction mechanism. [4]

(ii) What are the differences between the direct nuclear reaction and compound nuclear reactions? [3]

(iii) Show that at low energy compound nuclear reaction mechanism is more probable. [3]