Dec. 17

Reg. No										

प्रज्ञानं ब्रह्म

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MANIPAL INSTITUTE OF TECHNOLOGY

FOURTH SEMESTER M.Sc. [Physics]
END SEMESTER EXAMINATION, JUNE/JULY, 2016

Make up

SUBJECT: NUCLEAR PHYSICS-II
PHY-706.6

Time: 3 Hours **Max. Marks : 50**

- **Answer any FIVE of the following questions.**
- **Missing data, if any may suitably be assumed.**

1. (a) Outline the theory of s-wave scattering of neutrons by free protons.
   (b) Distinguish p-p scattering from (n-p) scattering. (7+3=10)

2. (a) Describe single particle shell model including spin orbit interaction.
   (b) From the shell model predictions find the ground state spin and parity of the following nuclides.(i) $_{8}O^{17}$ (ii) $_{13}Al^{27}$ (iii) $_{19}K^{39}$ and (iv) $_{21}Sc^{41}$

3. Give the evidences for the collective motion of nucleons in the nucleus. Discuss the collective rotation of nucleons within the nucleus.(10)

4. (a) Obtain an expression for the nuclear magnetic moment of odd A nuclei on the basis of single particle model.

   (b) Calculate the magnetic moment of the following nuclei as predicted by single particle model: (i) $^{7}_{3}Li$ (ii) $^{39}_{19}K$ {g_l=1,g_s=5.5855 for proton and g_l=0,g_s = -3.83 for neutron} (6+4= 10)

5. Explain Compound Nucleus model. Derive Briet-Weigner formula for the low energy elastic scattering of neutrons. (10)

6. State the salient features of the Nilsson model. Use it to predict the ground state spin of odd-A nuclei. (10)

General Data:

1 unified mass unit (u) = 931.5 MeV/c^2

Planck's constant h = 6.63×10^{-34} Js

Boltzmann's constant k = 1.38×10^{-23} JK^{-1}

Avogadro's number = 6.022×10^{23} $(g\text{-mole})^{-1}$

Permittivity constant $\varepsilon_o = 8.85 \times 10^{-12}$ Fm^{-1}

Fundamental charge unit e = 1.60×10^{-19} C

speed of light (vacuum) c = 3.0×10^{8} m/s

electron mass = 9.11×10^{-31} kg = 5.4858×10^{-4} u = 0.511 MeV/c^2

neutron mass = 1.6749×10^{-27} kg = 1.008665 u = 939.573 MeV/c^2

proton mass = 1.6726×10^{-27} kg = 1.0072765 u = 938.280 MeV/c^2

1 year = 3.156×10^{7} s