4535/MPC

MAY 2010

ATOMIC AND NUCLEAR PHYSICS

(For those who joined in July 2003 and after)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

All questions carry equal marks.

$(5 \times 20 = 100)$

1. (a) State the exclusion principle. Describe the electronic structure of atoms and the effect of L.S. Coupling.

Or

(b) Define atomic scattering factor. What is meant by structure factor? Obtain the expression for geometrical structure factor for bcc lattice.

2. (a) What are magic numbers? How does the stell model account for it? On the basis of stell model, find the spin, parity and magnetic moments of He^3 and N^{15}.

Or

(b) What are nuclear forces? List the properties of nuclear forces. Describe in detail Meson theory of nuclear forces.

3. (a) Explain Geiger – Nuttel law. Describe Gamow's theory of alpha decay with diagrams and show that it leads to Geiger – Nuttel law.

Or

(b) What is meant by parity violation in beta decay process? Explain WV's experiment and prove the non–conservation of parity in beta decay.

4. (a) Show that the energy released in the fission of Uranium (185 MeV/atom) is equivalent to 8.3×10^{13} J Kg^{-1}. Calculate, at what rate Uranium Fission should take place, so that 1 MW of power is generated.

Or

(b) Write down the properties of neutron. Give the classification. Explain the method of production and detection of neutrons.

5. (a) State and prove CPT theorem. Mention its application.

Or

(b) What is a quark? Explain the concept of color and flavors. Describe the quark structure of mesons and baryons.
