April – 2015

M.Sc. Physics Examination

Semester - IV

Subatomic Physics

Paper No- Phys C-402 Paper Code 4753 / 3558

Time : 2 Hours 30 min Maximum Marks 70

Q-1 **(a)** Define one neutron separation energy and one proton separation energy. What is the significance of these quantities? **[06]**

(b) Describe an experimental method to determine radius of nucleus. What are the types of nuclear radii? How the mean charge radius does depend on the mass number? Estimate it for O^{16} nucleus. (take r_o=1.07 fm) **[08]**

OR

Q-1 (a) Draw the experimental binding energy per nucleon Vs. mass number characteristics curve and discuss various features. With the help of this curve explain why fission of heavy nuclei and fusion of light nuclei can release energy? **[08]**

(b) Applying Lepton conservation laws, check whether the following decay are possible or not: **[06]**

(c) $\tau^- \rightarrow e^- + \nu_e + \nu_\tau$

(d) $\tau^- \rightarrow \mu^- + \mu^+ + \mu^-$

Q-2 **(a)** Describe the various properties of two-nucleon force which follows from empirical observations. **[06]**

(b) What are exchange forces in nuclear physics? **[08]**

OR

Q-2 **(a)** Discuss Yukawa's theory of nuclear force. **[07]**

(b) Explain why a di-neutron state does not exist in nature? **[07]**

Q-3 **(a)** What is fissility parameter? What is its significance? **[07]**

(b) Explain why fission of heavy nuclei and fusion of light nuclei can release energy? **[07]**

OR

Q-3 **(a)** Explain the thermonuclear fusion process. Compare the energy liberated in nuclear fusion and fission. **[07]**

(b) Explain the moderation process in a nuclear reactor. Give an account of energy released in the fission process. **[07]**

Q-4 **(a)** Argue why baryons have to be three quark systems and why mesons have to be made up of a quark-antiquark pair. **[08]**

(b) What is meant by the color of quarks? Why is it needed? What colors quarks can have? **[06]**

OR

Q-4 **(a)** What are strange particles? Why are they called so? What is associated particle production? **[07]**

(b) What are leptons and baryons? Write conservation laws in particle physics. Discuss conservation of lepton and baryon numbers in a decay of a neutron to proton. **[07]**

Q-5 **(a)** Write a note on G.M. Counter. **[07]**

(b) Explain Gamow's theory for alpha decay. **[07]**

OR

Q-5 **(a)** Discuss various experimental evidences which led to the nuclear shell structure. **[07]**

(b) What is origin the origin of γ-gamma rays? Explain the gamma decay in detail. What are the selection rules for various γ-transitions? **[07]**