Bachelor of Science (Computer Science)(Sem. – 6)

NUCLEAR PHYSICS

Subject Code: BCS-603

M Code: 72783

Date of Examination : 25-05-23

Time: 3 Hrs.   **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SIX questions carrying TEN marks each and students have to attempt any FOUR questions.**

SECTION-A

1. **Write brielfy:**

    a) Show that nuclear density is same for all nuclei.

    b) What is nuclear magnetic moment? Explain.

    c) What do you mean by nuclear reaction cross-section and differential cross-section?

    d) Nuclear forces are non central. Explain.

    e) Shell modal do not work for odd-odd nuclei. Comment.

    f) What is internal conversion? Explain.

    g) Explain Geiger-Nuttal law.

    h) What is the difference between X-rays and gamma-rays?

    i) Why most of the heavy nuclei decay by alpha emission? Explain.

    j) Describe the property which gives information about the shape of the nucleus.

SECTION-B

2. a) What are the forces responsible for holding nucleons together in a nucleus? Discuss their main characteristics, explaining their origin.

   b) What is electric quadrupole moment of a nucleus? Discuss the shapes of the nucleus on its basis.

3. Explain liquid drop model of nucleus? Show that average binding energy per nucleon is given as

$$\frac{B}{A} = a_v - \frac{a_s}{A^{1/3}} - a_c \frac{Z^2}{A^{4/3}} - a_a \frac{(A - 2Z)^2}{A} \pm a_p A^{-3/4}$$

   Give any two achievements of the model.

4. a) Using single particle shell model, predict the ground state nuclear spin, parity and quadrupole moment of $^{15}_{8}O$ and $^{63}_{29}Cu$.

   b) Explain the non existence of electron inside the nucleus on the basis of wave mechanical considerations.

5. a) What are the laws of radioactive disintegration? Show that radioactive decay is exponential in nature.

   b) What do you understand by successive disintegration? What is the condition for permanent equilibrium?

6. What is β-decay? Explain its spectrum. Although nucleus is positively charged, how will you explain β-rays coming out of it? Describe the neutrino hypothesis of β-decay. What is the evidence for existence of neutrino?

7. What is the Q-value of a nuclear reaction? What is its significance? Derive an expression for the Q-value of a nuclear reaction in terms of masses and kinetic energies of the incident particles, product particle and product particles and nuclei.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.