KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(3 Pages) **Reg. No:……**

Question Code: 26O03306 **Course Code : 24PMPH41**

PG Degree - End Semester Examinations, November 2026

Fourth Semester

M.Sc. PHYSICS

Nuclear and Particle Physics

(For those who joined in July 2024 onwards)

Time : 3Hours **Maximum : 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

CO:3 K:1 1. Which one of the following nuclei has maximum binding energy per nucleon?

(a) ^{18}O (b) ^{56}Fe

(c) ^{138}Ba (d) ^{208}Pb

CO:3 K:1 2. Which of the following number in the volume of an atom is proportional to

(a) Mass (b) Proton

(c) Neutron (d) Electron

CO:4 K:1 3. Which of the following is correct about Nuclear force

(a) Short range repulsive (b) Short range attractive

(c) Long range attractive (d) Long range repulsive

CO:4 K:1 4. What does a deuteron consist of ?

(a) Two proton and one electron

(b) Two neutrons and one positrons

(c) One proton one neutron with opposite spins

(d) One proton and one neutron with parallel spins

CO:1 K:1 5. How long does a compound nucleus remain in an excited states?

(a) 10^{-14} - 10^{-18} (b) 10^{-12} - 10^{-18}

(c) 10^{-10} - 10^{-18} (d) 1 Sec

CO:1 K:1 6. Which one of the following is the expression for Total scattering cross -section?

(a) $2\pi a^2$ (b) $4\pi\sigma(\theta)$

(c) $2\pi\sigma(\theta)$ (d) $2\pi r$

CO:2 K:1 7. The spin and parity of ^{13}N according to the nuclear shell model:

(a) $\frac{1^-}{2}$ (b) $\frac{1^+}{2}$

(c) $\frac{3^-}{2}$ (d) $\frac{3^+}{2}$

CO:2 K:1 8. What is the parity of the ground state of an even-even nuclei?

(a) Odd (b) Even

(c) zero (d) Integer

CO:5 K:1 9. Which one of the following elementary particle is called baryons

(a) Electron (b) μ-meson

(c) Π-meson (d) Neutron

CO:5 K:1 10. Which one of the following represents a proton

(a) udd (b) uud

(c) $u\bar{b}$ (d) $\bar{\alpha}$

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:3 K:4 11. (a) Determine semi empirical mass formula, by applying WeiZacker method.

(OR)

(b) Analyze the magnetic properties of nuclei by Schmidt method.

CO:4 K:4 12. (a) Examine the ground state properties of Neutron.

(OR)

(b) List the properties of Deutron.

CO:1 K:4 13. (a) Analyze the Level width of a Compound nuclei using Compound Nuclear theory.

(OR)

(b) Analyze the working of a Nuclear Chain reaction and derive four factor formula.

CO:2 K:4 14. (a) Examine the reasons for continuous beta spectrum.

(OR)

(b) Compare Gamow Teller and Fermi selection rule for Beta decay.

CO:5 K:4 15. (a) Classify the types of interaction and their conservation laws.

(OR)

(b) Examine the Strangeness and Hypercharge of Elementary particles.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 600 words.

CO:1 K:5 16. (a) Explain the nuclear shell model and discuss its predictions.

(OR)

(b) Explain the Bohr wheeler's theory of nuclear fission.

CO:2 K:5 17. (a) Explain the Meson theory of Nuclear forces.

(OR)

(b) Determine the resonance scattering cross -section of proton-proton scattering at low energy.

CO:3 K:5 18. (a) Explain the resonance scattering and derive Breit Wigner resonance formula.

(OR)

(b) Determine the Q value of a Nuclear reaction kinematics.

CO:4 K:6 19. (a) Discuss the Fermi Theory of Beta decay.

(OR)

(b) Discuss the parity violation in Beta decay.

CO:5 K:6 20. (a) Elaborate the different types of Quarks and discuss the quark model for Mesons.

(OR)

(b) Design the SU(3) matrices for Baryon Octet and Meson Octet.