(NO. OF PAGES: 2)

(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2024-25 ONLY)

SUBJECT CODE **24 PPS 412**

REG.NO.:

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : MAY– 2026

M.Sc. – PHYSICS **MAXIMUM MARKS: 75**

IV SEMESTER **TIME : 3 HOURS**

NUCLEAR & PARTICLE PHYSICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. **(K1)**

1. The ground state of the deuteron has _____ mixed states.
   a) s & p b) s & d
   c) p & d d) s & f

2. Which nuclear model best explains the "Magic Numbers"?
   a) Liquid Drop Model b) Collective Model
   c) Shell Model d) Fermi Gas Model

3. In Beta decay, the conservation of which property led to the hypothesis of the neutrino?
   a) Charge b) Mass
   c) Energy and Angular Momentum d) Parity

4. In a nuclear reactor, the "Moderator" is used to
   a) absorb excess neutrons b) speed up the neutrons
   c) slow down fast neutrons d) shield the environment from radiation

5. The concept of 'Color' in Quantum Chromodynamics (QCD) was introduced primarily to solve which problem in the Quark Model?
   a) source of the weak nuclear force b) violation of the Pauli exclusion principle
   c) mass difference between nucleons d) existence of neutrinos

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES **(K2)**

6. List any two properties of nuclear force.

7. What is super conductivity model of nuclear structure?

8. What is meant by K-electron capture?

9. Define nuclear fusion.

10. Give the values of elementary charges of quarks.

(CONTD …. 2)

ETHICAL PAPER

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Explain the properties of the ground state of the Deuteron.

(OR)

b) Briefly explain the Yukawa theory of nuclear forces and the role of mesons.

12. a) Explain the Liquid Drop Model and how it accounts for nuclear binding energy?

(OR)

b) Give the elementary ideas of Unified model of nuclear structure.

13. a) Explain the Fermi and Gamow-Teller selection rules in Beta decay.

(OR)

b) Discuss the concept of Internal Conversion in nuclear de-excitation.

14. a) Describe the energetics of nuclear fission based on the Bohr-Wheeler theory.

(OR)

b) Explain the Proton-Proton cycle involved in Solar Fusion.

15. a) Classify the elementary particles based on their mass and interactions.

(OR)

b) State the CPT invariance principle and its significance in particle physics.

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) Describe the spin dependence of n-p forces at low energies.

(OR)

b) Discuss the scattering length and effective range of nuclear particles. (K4)

17. a) Explain the magnetic moment and prediction of angular momenta of nuclear ground states by Shell model.

(OR)

b) Describe the Collective Model and its explanation of rotational nuclear states. (K4)

18. a) Give a detailed account of Fermi's Theory of Beta Decay.

(OR)

b) Describe the theory of angular correlation of successive radiation in gamma decay. (K5)

19. a) Explain the Four-Factor Formula for a nuclear reactor. Discuss the physical significance of each factor.

(OR)

b) Describe the working of controlled fusion reactors. (K5)

20. a) Discuss Gellmann-Okuba mass formula for Baryons.

(OR)

b) Explain the Grand unification theory and super symmetry. (K4)

ETHICAL PAPER

****