

# KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(3 Pages)

Reg. No:.....

Question Code: 26E03310

Course Code: 24PMPH41

PG Degree - End Semester Examinations, April 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:1 1. Which of the following is not a magic number?

- K:1
- (a) 2 (b) 8  
(c) 18 (d) 20

CO:1 2. The value of the nuclear magneton is

- K:2
- (a)  $3.1524 \times 10^{-8}$  eV-  
 $m^2/\text{Weber}$  (b)  $3.1524 \times 10^{-8}$   $m^2/\text{Weber}$   
(c)  $3.1524 \times 10^{-8}$  eV- $m^2$  (d)  $3.1524 \times 10^{-8}$  eV /Weber

CO:2 3. The relation between nuclear radius and mass number is

- K:2
- (a)  $R=R_0A$  (b)  $R=R_0/A^{1/3}$   
(c)  $R=A^{1/3}$  (d)  $R=R_0A^{1/3}$

CO:2 4. The nuclear force is

- K:1
- (a) Charge independent (b) Short range  
(c) Attractive (d) All of these

CO:3 5. In any nuclear reaction, the heavy nuclei splits mainly into two nuclei is called as

- K:1
- (a) Heavy ion reaction (b) Direct reaction  
(c) spallation (d) Radioactive capture

CO:3 6. The compound nuclear reaction is represented as

- K:2
- (a)  $X=C^*$  (b)  $X+x=C^*$   
(c)  $X+x=A$  (d)  $X+x=C$

- CO:4 7. The parity gives the  
K:2 (a) Nuclear symmetry (b) Nuclear stability  
(c) Nuclear isomerism (d) All of these
- CO:4 8. The charge of a neutrino is  
K:1 (a) 1 (b) negative  
(c) positive (d) 0
- CO:5 9. Which of the following is a pion?  
K:2 (a)  $\Pi^+$  (b)  $\mu^+$   
(c)  $\mu^0$  (d)  $\mu^-$
- CO:5 10. A massless boson is called as  
K:1 (a) electron (b) neutron  
(c) graviton (d) proton

**PART - B (5 X 5 = 25 Marks)**

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

**Answer should not exceed 250 words.**

- CO:1 11. (a) Derive an expression for isobaric mass parabola.  
K:3 **(OR)**  
(b) Write short notes on the electric quadrupole moment of nucleons.
- CO:2 12. (a) Why nuclear forces are treated as tensor forces? Explain.  
K:4 **(OR)**  
(b) Explain about isospin formalism.
- CO:3 13. (a) Deduce an expression for the Q value of the nuclear reaction.  
K:4 **(OR)**  
(b) What is meant by scattering and scattering cross section? Explain.
- CO:4 14. (a) Draw Fermi-Curie plot and explain it.  
K:3 **(OR)**  
(b) Explain how parity is violated in nuclear reaction.
- CO:5 15. (a) Explain about the different types of interactions between the elementary particles.  
K:3

**(OR)**

(b) Explain about quark model of nucleus.

**PART - C (5 X 8 = 40 Marks)**

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

**Answer should not exceed 600 words.**

CO:1 16. (a) Explain the liquid drop model of atomic nucleus.

K:4

**(OR)**

(b) Describe the Bohr Wheeler theory of nuclear fission.

CO:2 17. (a) Explain about the meson theory of nuclear force.

K:5

**(OR)**

(b) Discuss about the effective range theory of nucleus.

CO:3 18. (a) State and explain the reciprocity theorem.

K:4

**(OR)**

(b) Describe nuclear chain reaction with diagram.

CO:4 19. (a) Discuss the Fermi's theory of  $\beta$  decay.

K:5

**(OR)**

(b) Describe about internal conversion.

CO:5 20. (a) Explain about SU(2) and SU(3) symmetry.

K:4

**(OR)**

(b) Derive Gell Mann Okuba Mass formula.