Reg. No: | | | | | | | | | | |

G.T.N. ARTS COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University)
(Accredited by NAAC with 'B' Grade)

END SEMESTER EXAMINATION – APRIL 2021

Programme : M. Sc. Physics **Date: 18.6.2021**
Course Code: 19PPHC43 **Time: 10 am. to 1 pm.**
Course Title : Nuclear and Particle Physics **Max. Marks :75**

SECTION – A **[10 X 1 = 10]**

Answer ALL the Questions.

Choose the Correct Answer.

1. Find the example for photodisintegration nuclear reaction _____.

[a] $_1H^2+\nu \rightarrow {}_1H^1+ {}_0n^1$ [b] $_2H^2+\nu \rightarrow {}_1H^1+ {}_0n^1$

[c] $_1H^1+\nu \rightarrow {}_1H^1+ {}_0n^1$ [d] $_2H^2+\nu \rightarrow {}_2H^1+ {}_0n^1$

2. Which is spallation reaction?

[a] Nuclear fission [b] Nuclear fusion

[c] Radioactivity decay [d] Photodisintegration

3. Alpha particles are _____.

[a] electromagnetic radius [b] helium nuclei

[c] neutral particle [d] negative charged

4. Fermi-selection rule for second forbidden transitions is ____.

[a] $\Delta I=\pm2,\pm1$, except $(0\leftrightarrow1)$ [b] $\Delta I=\pm2,\pm1$, except $(1\leftrightarrow1)$

[c] $\Delta I=\pm0,\pm1$, except $(0\leftrightarrow1)$ [d] $\Delta I=\pm0,\pm2$, except $(1\leftrightarrow1)$

5. The nuclear fission was explained by _____ model.

[a] shell model [b] liquid drop model

[c] single particle shell model [d] collective model

6. The binding energy of the next neutron or proton after a magic number is _____.

[a] very high [b] very low

[c] equal to proton energy [d] zero

7. The nuclear forces are analogous to the _____ of a liquid.

[a] Lorentz force [b] attractive force

[c] surface tension force [d] centripetal force

8. Hydrogen bomb is based on _____reaction.

[a] nuclear fission [b] nuclear fusion

[c] both a & b [d] thermal

9. The gravitational effect depends on _____.

[a] size [b] colour

[c] charge [d] magnitude of the inertia

10. An example for radiative capture reaction is_____.

[a] $n + \gamma \rightarrow \Pi^+ + n$ [b] $n + \gamma \rightarrow \Pi^+ + p$

[c] $p + \gamma \rightarrow \Pi^+ + n$ [d] $n + \beta \rightarrow \Pi^+ + n$

SECTION – B [5 X 7 = 35]

Answer ALL the Questions.

11. a) Analyse the conservation laws of nuclear reactions.

[OR]

b) Derive Rutherford scattering formula.

12. a) Determine q/m values for the α-particle.

[OR]

b) Use indirect method to detect Neutrino.

13. a) Write about the liquid drop model.

[OR]

b) Derive the equation of the mass parabolas for a constant A.

14. a) List the properties of Deuteron.

[OR]

b) Discuss the meson theory of nuclear forces.

15. a) Classify the various types of elementary particles.

[OR]

b) Allocate the isospin to the strange particles from the following equations.

i) $\pi^- + P \rightarrow \Lambda^0 + K^0$ ii) $\pi^+ + n \rightarrow \Lambda^0 + K^+$

SECTION – C [3 X 10 = 30]

Answer Any THREE Questions.

16. Write a note on Q-value of a nuclear reaction using its derivation.
17. Discuss Fermi's theory of β-decay.
18. Describe a single-particle model with the spin orbit potential to explain nuclear energy levels and magic numbers.
19. Derive the equation for the ground state of the deuteron and also discuss it with the magnetic moment of the deuteron.
20. Analyze the unitary symmetry SU (3) Symmetry of elementary particles.