Roll No : .....

Total No. of Questions : **20**] [Total No. of Printed Pages : **3**

SP–709

M.Sc. (Final) Examination, 2021

PHYSICS

Paper - VI

(Nuclear and Particle Physics)

Time : 1½ Hours] [*Maximum Marks : 75*

Section–A **(Marks : 2 × 10 = 20)**

Note :– Answer all *ten* questions (Answer limit **50** words). Each question carries **2** marks.

(खण्ड–अ) **(अंक : 2 × 10 = 20)**

नोट :– सभी **दस** प्रश्नों के उत्तर दीजिए (उत्तर-सीमा **50** शब्द)। प्रत्येक प्रश्न **2** अंक का है।

Section–B **(Marks : 5 × 5 = 25)**

Note :– Answer all *five* questions. Each question has internal choice (Answer limit **200** words). Each question carries **5** marks.

(खण्ड–ब) **(अंक : 5 × 5 = 25)**

नोट :– सभी **पाँच** प्रश्नों के उत्तर दीजिए। प्रत्येक प्रश्न में विकल्प का चयन कीजिए (उत्तर-सीमा **200** शब्द)। प्रत्येक प्रश्न **5** अंक का है।

Section–C **(Marks : 10 × 3 = 30)**

Note :– Answer any *three* questions out of five (Answer limit **500** words). Each question carries **10** marks.

(खण्ड–स) **(अंक : 10 × 3 = 30)**

नोट :– पाँच में से किन्हीं **तीन** प्रश्नों के उत्तर दीजिए (उत्तर-सीमा **500** शब्द)। प्रत्येक प्रश्न **10** अंक का है।

Section–A

2 each

1. What are Tensor Forces ?
2. State reciprocity theorem.
3. What do you understand by Magic Numbers ?
4. Using Shell model predicts the ground state spin-parity of $^{10}_{5}B$.
5. State assumptions of Fermi theory of beta decay.
6. What is Fermi-Kurie Plot ?
7. What is plateau region in GM counter characteristic curve ?
8. Define Scintillation.
9. What is Isospin ?
10. Name any *two* leptons.

Section–B

5 each

11. What are the Nuclear Forces ? Discuss any *two* characteristic properties of nuclear forces.

Or

Explain the Spin dependence of Nuclear Forces.

12. What is Liquid Drop Model ? States merits and demerits of liquid drop model.

Or

What do you mean by Electric Quadrupole Moment ? Using single particle shell model determine the quadrupole moment for $^{17}_{8}O$ and $^{33}_{16}S$.

13. Describe the difficulties associated with continuous beta spectrum.

Or

What is Beta Decay ? Give example. Schematically draw the energy spectrum of electrons emitted in a β^- decay.

14. Although air is widely used as a fill gas for ionization chambers but is seldom used in proportional counters, why ?

Or

Compare properties of a proportional counter and a GM counter.

15. What is Tau-theta Puzzle ?

Or

Using conservation laws, examine possibility of the following transformations :

(a) $\Sigma^+ + n \rightarrow \Sigma^- + p$

(b) $\pi^+ + n \rightarrow K^+ + \Sigma^0$

Section–C 10 each

16. What is the Yukawa-meson theory of nuclear forces ? Estimate the mass of pion.

17. What is fission ? How can you explain using liquid drop model ? Establish condition for fission to occur.

18. (a) What is internal conversation ? Illustrate your answer with an example.

(b) Using γ-ray selection rules determine the multipolarity of the radiation of the isomeric transition from the first excited state at 0.439 MeV $\frac{9^+}{2}$ in Zinc-69 to the ground state $\frac{1^-}{2}$.

19. Discuss the principle and regions of operation of particle detection based on ion collection method using suitable graph.

20. (a) Describe any *two* conservation laws which governs the decay of fundamental particles.

(b) Briefly explain how nuclear emulsion technique can be used to record high energy particles.