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J – 4866

Reg. No. :

Name :

Fourth Semester M.Sc. Degree Examination, May 2020

Branch : Physics

PH 242 : NUCLEAR AND PARTICLE PHYSICS

(2018 Admission)

Time : 3 Hours

Max. Marks : 75

PART – A

Answer **any five** questions. Each question carries **3** marks.

- I. (a) Write down the salient features of nucleon – nucleon interactions.
- (b) Write down any three basic assumptions of Collective model.
- (c) State the fundamental differences between leptons and mesons.
- (d) Explain plasma confinement in fusion reactions.
- (e) Explain the basic concepts in the working of GM counter.
- (f) What is meant by flavours in quarks?
- (g) Explain the term “resonance reactions”.
- (h) Explain “Lawson criterion” in a nuclear reactor.

(5 × 3 = 15 Marks)

P.T.O.



PART – B

Answer each question. **Each** question carries **15** marks.

- II. (A) (a) Outline the features of magic number nuclei.
(b) Discuss the meson theory of nuclear forces.

OR

- (B) (a) Explain the concept of compound nucleus hypothesis.
(b) Derive the Breit- Wigner one level formula.

- III. (A) (a) Explain the nitrogen cycle and explain the importance of the four factor formula.
(b) Give the general features and classification of nuclear fission reactors.

OR

- (B) (a) Explain nuclear fission reactions in Stellar interior using pp interaction model.
(b) Explain how CNO cycle of thermonuclear reaction is used in the formation of star.

- IV. (A) (a) Bring out the essential differences between particle accelerators and electrostatic accelerators.
(b) Explain in detail the principle and working of a cyclotron accelerator.

OR

- (B) (a) Explain the quark model of elementary particles. Bring out the ideas of charm, beauty and truth.
(b) What do you understand by fundamental forces? Give the properties of strong, electromagnetic and weak forces.

(3 × 15 = 45 Marks)



PART – C

Answer **any three** questions. **Each** question carries **5** marks.

- V. (a) A GM counter has a plateau slope of 3% per 100 volts. If the operative point is at 1100 volts, what is the maximum permissible voltage fluctuation if the counting is not to be affected by more than 0.1%.
- (b) The first excited state of W^{182} is 2^+ and is 0.1 MeV above the ground state. Estimate the energies of the lowest lying 4^+ and 6^+ states of W^{182} .
- (c) Calculate the fission rate for U^{235} required to produce 2 watt and the amount of energy that is released in the complete fissioning of $\frac{1}{2}$ kg of U^{235} .
- (d) For the deuteron assume that $b \sim \lambda/4 \sim \pi/2$ K where the parameters have the usual meaning. From this obtain the approximate radius of the deuteron in the rectangular well model.
- (e) ^{17}N nucleus decays to the nucleus ^{12}C with a Q value of 16.38 MeV. Estimate the maximum recoil energy of the ^{12}C nucleus.
- (f) State the proton – proton interaction and the interactions between the proton and one of the nucleons in the deuteron nucleus.

(3 × 5 = 15 Marks)

