2019/EVEN/08/21/PHY–402/066

PG Even Semester (CBCS) Exam., May—2019

PHYSICS

(4th Semester)

Course No. : PHYCC–402

(Nuclear and Particle Physics)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting **one** from each Unit

Unit—I

1. *(a)* Discuss with diagram how nucleon density varies with distance *r* from the centre of a nucleus. What type of experiments are performed to estimate the distribution of nucleons in nuclei? 5+1=6

(b) Discuss isospin formalism by introducing the concept of isospin of nucleons. 8

2. *(a)* Find the ground state wave function of deuteron assuming it to be in l 0 state. Also deduce the relation between the range and depth of the potential. 6+4=10

(b) How can you conclude that nuclear force is spin dependent? 4

Unit—II

3. What is the basic assumption of shell model? Assuming a square-well potential of infinite depth, show that shell theory can explain first few magic numbers. How are the rest of the magic numbers explained? 2+6+6=14

4. *(a)* Discuss Bethe-Weizsäcker mass formula explaining various terms. 8

(b) From the collective model, derive the energy eigenvalues of the rotational states of a nucleus. 6

Unit—III

5. *(a)* Discuss the origin of radiation in terms of multipolarities of transition. 8

(b) Write notes on Kurie plot and neutrino helicity. 3+3=6

6. *(a)* Derive Fermi's momentum distribution formula for decay. 10

(b) Discuss direct and compound nuclear reaction. 4

UNIT—IV

7. *(a)* Discuss at length the quark hypothesis. 5

(b) What are the quark constituents of K , K , K , $\overline{\text{K}}$, , ? 3

(c) Why was the concept of colour introduced in quarks? Elaborate on the colour scheme of quarks. 1+5=6

8. *(a)* How are muons produced? 3

(b) Discuss the decay scheme of muon showing the lepton number conservation. 7

(c) Write notes on valence quark and sea quark. 4

UNIT—V

9. *(a)* Derive the expression for stopping power of a medium when heavy charged particles pan through it. 10

(b) What do you mean by straggling of range? State two reasons for straggling of range of heavy charged particles. 2+2=4

10. *(a)* Discuss the mechanism of pulse formation in semiconductor-detector when a particle passes through it. 7

(b) What is the function of a multichannel analyser? Discuss its different modes of operation. 1+6=7

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