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

PHS 558

IV Semester M.Sc. Degree Examination, September/October 2022
PHYSICS
(CBCS)
Nuclear Physics – IV

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer **any four full** questions, choosing **one** from **each** in Part – **I** to **IV**.*
*2) Part – **V** is **compulsory**.*

PART – I

1. a) Show that same fraction of energy is transferred in each successive collision of neutron with the moderator nucleus. **7**
   b) Define the moderating ratio and transport mean free path. **4**
   c) Enumerate the types of nuclear reactors on the basis moderator used. **4**

OR

2. a) Using neutron transport equation, obtain the expression for neutron flux distribution in an infinite medium with point source at the centre. **7**
   b) Define neutron slowing down density and hence arrive at the Fermi age equation. **8**

PART – II

3. a) Give classification of neutrons on the basis of their energy. **4**
   b) What are thermal neutrons ? Describe the principle of detection of thermal neutrons using neutron activation method. Illustrate it with an example. **7**
   c) What are neutron monochromators ? Explain. **4**

OR

4. a) Enumerate the various magnetic confinement systems. Describe any two of them in detail with suitable schematic diagrams. **8**
   b) What is Lawson criterion ? Explain. **4**
   c) Explain the basic principle of fusion process. **3**

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PART – III

5. a) Explain the various conservation laws in fundamental particle interactions with examples. **8**

   b) List the properties of muons. **3**

   c) Discuss the decay nature of Muon. **4**

OR

6. a) Elucidate the method of artificial production of pions. **6**

   b) Discuss the properties of pions. **5**

   c) Distinguish the production mechanisms of pions and muons. **4**

PART – IV

7. a) Write down the Gell-mann and Nishijima formula. Arrange the baryons and mesons separately in a table by listing their masses, isospin, charge Q, Baryon number B and strangeness S. **7**

   b) Explain Glashow-Weinberg-Salam model of unification of the electromagnetic and weak interactions. **8**

OR

8. a) Write a note on CP violations in Kaon-Decay. **5**

   b) Enumerate the fundamental particle interactions, their coupling strength, range of interaction and an example for each of the interactions. **5**

   c) Discuss the experimental measurements which support the quark hypothesis. **5**

PART – V

9. Answer **any two** of the following. **(5×2=10)**

   a) Calculate the ratio of average logarithmic decrement in neutron energy for hydrogen and graphite.

   b) Calculate the diffusion length for thermal neutrons in graphite.

   Given : microscopic absorption cross section = 3.20 mb, microscopic scattering cross section = 4.80 mb and density of graphite = 1.62 gm/cm^3.

   c) Calculate the energy resolution of crystal spectrometer velocity selector for 1eV neutrons undergo first order diffraction in a crystal of lattice spacing 2.32Å. Sharpness of collimation determines $d\theta = 0.1°$.

   d) Give the quark content of five hadrons.

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