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Reg. No. : .....

Name : .....

Fourth Semester M.Sc. Degree Examination, August 2022

Physics with Specialization in Nano Science/Space Physics

PHNS 541/PHSP 541: NUCLEAR AND PARTICLE PHYSICS

(2020 Admission)

Time : 3 Hours Max. Marks : 75

PART – A

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

I.

a) An incident neutron of 500keV is scattered by a hydrogen molecule (atomic separation~10^{-8}cm). Find out whether the scattering is coherent or incoherent.

b) Give the importance of spin-orbit interaction n the origin if magic numbers in the nuclei.

c) What is meant by plasma confinement in fusion reaction?

d) Explain the term 'resonance reaction'.

e) Explain the working of a GM counter.

f) Give the fundamental difference between baryons and mesons.

g) Will a free proton go through the process $p \rightarrow r + e^{+} + \upsilon_e$? If yes, how? If not, why not?

h) What do you mean by flavors in quarks?

(5 × 3 = 15 Marks)

P.T.O.

PART – B

(Answer **all** questions. Each question carries **15** marks)

II. A

a) Discuss the neutron-proton scattering at low energies.

b) List out atleast five differences between p-p and n-p scattering

OR

B.

a) Discuss the partial wave analysis of nuclear reaction cross section.

b) Explain the Q-value equation

III.A

a) Describe the nuclear fission process and explain the reason why this process does not occur spontaneously in heavy nucleus always.

b) Show that the liquid drop model gives a natural explanation for the process.

OR

B.

a) Describe the nuclear fusion reaction in stellar interior using pp reaction model.

b) Explain how CNO cycle of thermonuclear reactions is used to explain the formation of star.

IV.A

a) Draw the schematic representation of a scintillation counter and explain the various components associated with it.

b) Explain its basic operation.

OR

B

a) What do you understand by fundamental forces? Give the properties of strong, electromagnetic and weak forces.

b) Give an idea of charm, beauty and truth quantum numbers associated with quarks.

(3 × 15 = 45 Marks)

PART – C

(Answer **three** questions. Each question carries **5** marks.)

V

a) Evaluate the approximate minimum energy for a proton to penetrate the Coulomb barrier of a light nucleus.

b) The deuteronis a bound state of a proton and a neutron. Give the total angular momentum J of the deuteron. What are the principal and small states involved. Also obtain the value of its magnetic moment.

c) Each fusion of Uranium nucleus releases about 200 MeV. Find the number of fusion per second in 100 MW reactor.

d) Proton from a van de Graff generator collides with hydrogen. Evaluate the minimum energy required to create anti protons.

e) Write the reaction equation for the decay of a negative muon. Identify in words all the particles involved.

f) Give the quantum number and quark content of neutron which is a hadron.

(3 × 5 = 15 Marks)
