

Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

P2673

[5022] - 4001

M.Sc.

PHYSICS

PHYUT 801 - Nuclear Physics

(New Course) (2014 Pattern) (4 Credits) (Semester - IV)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any five out of eight questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables & electronic calculator is allowed.*

- Q1)** a) Discuss the method of measurements of nuclear radii based on the principle of electron scattering. **[4]**
- b) Explain the internal pair conversion process. **[3]**
- c) Calculate the activity of 10g of ^{232}Th . Given : λ of $^{232}\text{Th} = 1.58 \times 10^{-18} \text{ S}^{-1}$. **[3]**
- Q2)** a) What is beta decay? Describe neutrino hypothesis of β - decay. **[4]**
- b) Write a short note on nuclear magnetic moment. **[3]**
- c) Find the energy required in joules to break ^{12}C into 3 alpha particles. The atomic mass of $^{12}\text{C} = 12 \text{ amu}$ & $^4\text{He} = 4.0026 \text{ amu}$. **[3]**
- Q3)** a) Discuss the principle, construction & working of a Ge (Li) detector. **[4]**
- b) Give two experimental evidences of magic numbers. **[3]**
- c) In a scintillation detector, the 662 keV photopeak of ^{137}Cs source is observed at 6 V & the full width at half maximum of the photo peak is 0.72V. Find the % resolution of the detector. Also find its resolution in keV. **[3]**

P.T.O.

- Q4)** a) Explain the shell model of nucleus by discussing the role of spin-orbit coupling. [4]
b) What will be the threshold energy for the following reaction. [3]
$$^{238}\text{U} (^4\text{He}, 3\ ^1\text{n})\ ^{239}\text{Pu}$$

Given : $M(^{238}\text{U}) = 238.050785\text{ amu}$
 $M(^4\text{He}) = 4.002603\text{ amu}$
 $M(^{239}\text{Pu}) = 239.052158\text{ amu}$
 $M(^1\text{n}) = 1.00866501\text{ amu}.$
c) What are the conservation laws of nuclear reactions. [3]
- Q5)** a) On the basis of chain reaction derive the Four Factor formula for the Finite size reactor. [4]
b) Explain the principle, working of Van-de-Graff accelerator. [3]
c) What is an electron synchrotron? Discuss its theory. [3]
- Q6)** a) What is nuclear reactor? Name the reactor materials and their uses. [4]
b) Explain the concept of phase stability in the microton. [3]
c) The proton synchrotron can produce protons of nominal total energy 3 GeV. What is the kinetic energy of charge $6^+ ^{14}\text{N}$ ions accelerated by this accelerator. [3]
- Q7)** a) Discuss P-P scattering & also the phase shift analysis of it. [5]
b) Explain in detail the quark model & explain the various types of quarks along with their properties. [5]
- Q8)** a) Explain which of the following reactions are allowed or forbidden under the conservation of strangeness, baryon numbers & charge. [5]
i) $\Pi^+ + p \rightarrow k^0 + k^+$
ii) $\Pi^- + p \rightarrow \Lambda^0 + k^0$
b) Explain: [5]
i) Isospin
ii) Gell-Mann - Nishijima scheme.

