

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

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Exam. Code :

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M.Sc. Physics 4th Semester
(2056)

NUCLEAR PHYSICS-II

Paper : PHY-8041

Time Allowed : Three Hours]

[Maximum Marks : 80

Note :— Attempt **five** questions in all, selecting **one** question each from units I to IV. Unit-V is compulsory to attempt.

UNIT—I

1. (a) Define Racah coefficients and state its symmetry properties.
How is it related to 6-j symbols? 8
- (b) Discuss Nuclear shell Model and various potentials used in single particle shell model. 8
2. (a) Calculate the coupled state and corresponding C.G. Coefficients for the two particles with $j=1$ and $j=1/2$. 8
- (b) Calculate the Magnetic moments and Quadrupole moments of ^{25}Mg , ^{39}K and ^{207}Pb . Also write the shell configuration for $_{30}\text{Zn}^{67}$ and $_{43}\text{Tc}^{99}$. 8

UNIT—II

3. (a) Derive the expression for rotational energy and wave function for the odd-A nucleus. Also discuss the case for $K=\Omega \neq 0$ and $K=\Omega=0$. How does the Coriolis term affect the Hamiltonian? 8
- (b) Define the Rotation matrix and explain how the rotation about an arbitrary axis X can be expressed in terms of Euler angles of rotation. 8
4. (a) What are nuclear rotational motions? Derive rotational energy spectra and nuclear wave functions for even-2 nuclei. 8
- (b) Write a note on β and γ vibrations in spheroidal nucleus. 8

UNIT—III

5. (a) What are Stripping and Pick-up reactions? Explain with example. Discuss the relationship between angular momentum transferred in a direct reaction and the angular distribution of the emitted particles. 8
- (b) Derive the Breit-Wigner Dispersion formula. 8
6. (a) What is optical Model? Derive the theoretical cross-sections with optical model and compare it with experimental results. 8
- (b) Explain the statistical theory of nuclear reactions. 8

UNIT—IV

7. (a) Describe Nilsson model of nuclei and its use to explain the nuclear properties. 8
- (b) Explain the phenomenon of Back-bending. 8
8. (a) Explain in detail the Cranking shell model. 8
- (b) Write a note on the production of super heavy elements. 8

UNIT—V

9. (a) What are Giant Resonances and how do they differ from normal resonances?
- (b) What are radioactive ion beams?
- (c) Why are there no Magic numbers that are odd?
- (d) In what situation can the statistical model be used for fusion?
- (e) Write a brief note on nuclear isomerism.
- (f) What do you mean by nuclear halos?
- (g) What are iso-scalar vibrations?
- (h) What is Nordheim's Rule? Show its utility giving examples.

$$8 \times 2 = 16$$