(i) Printed Pages : 3 Roll No. .....

(ii) Questions : 9 Sub. Code : 3718

Exam. Code : 0474

M.Sc. Physics 3rd Semester

1128

NUCLEAR PHYSICS–II

Paper–PHY-7003

Time Allowed : 3 Hours] **[Maximum Marks :60**

Note :– Candidates are required to attempt **one** question each from Sections A, B, C, D carrying **12** marks each and Section E is compulsory and its parts carry **2** marks each.

SECTION–A

1. (a) Discuss nuclear shell model and describe the success and failures of this model. Also write down the shell configurations for $_{30}Zn^{67}$ and $_{43}Tc^{99}$. 8

   (b) Evaluate all the C.G. coefficients which relate the coupled representation of two nucleons having J = 1/2 each with uncoupled representation. 4

2. (a) Take a harmonic-oscillator potential well with a spin orbit coupling and determine the single spectrum. Also determine both the individual and cumulative occupation of single particle energy spectrum.

   (b) Write a brief note on nuclear isomerism. 9,3

SECTION–B

3. (a) Define the Rotation matrix and explain how the rotation about an arbitrary axis X can be expressed in terms of Euler angles of rotation. 6

   (b) List some of the evidences which led to the development of Collective model. 6

4. (a) What is nuclear rotational motion ? Derive rotational energy spectra and nuclear wave functions for odd-A nuclei. 8

   (b) Write a brief note on E2 and M1 transition probabilities. 4

SECTION–C

5. (a) What is optical model ? Derive the theoretical cross-sections with optical model and compare it with experimental results. 8

   (b) Write a brief note on direct reactions with examples. 4

6. (a) Derive the Breit-Wigner Dispersion formula. 8

   (b) Write a brief note on statistical theory of nuclear reactions. 4

SECTION–D

7. (a) Write a brief note on the population of high spin states. 4

   (b) Describe Nilsson model of nuclei and its uses to explain nuclear properties. 8

8. (a) Explain and derive the Cranking shell model. 8

(b) Write a note on the production mechanism of super heavy elements. 4

SECTION–E

9. (a) Write note on Electric quadrupole Moment.

(b) Write short note on the Configuration mixing.

(c) What do you mean by vibrational nucleus ?

(d) What are giant resonances ?

(e) What are radioactive ion beams ?

(f) What do you mean by nuclear halos ? 6×2=12