

No. of Printed Pages : 1

Sl. No.



**21PHY3E1BL**

**M.Sc. III Semester Degree Examination, April / May - 2023**

**PHYSICS**

**Advanced Nuclear Physics**

**(CBCS)**

Time : 3 Hours

Maximum Marks : 70

**Note :** (i) Question No. 1 is **compulsory**.

(ii) Answer **any four** questions from Q.No. 2 to Q.No. 8.

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|----|-----|--|----|
| 1. | (a) | Explain the effect of spin - orbit interaction between the nucleons that leads to shell closure at all magic numbers.                                      | 7  |
|    | (b) | Discuss the vibrational model of the nucleus and comment on the energy eigen values.   | 7  |
| 2. | (a) | Give the theory of ground state of the deuteron under central forces. Show that the nucleons prefer to spend most of their time outside deuteron boundary. | 10 |
|    | (b) | Write a note tensor nature of nuclear forces.  | 4  |
| 3. | (a) | Explain the theory of stripping and pickup reactions.  | 10 |
|    | (b) | Write a note on optical potential.   | 4  |
| 4. | (a) | Give the basic principle of neutron detection and hence discuss the construction and working of BF <sub>3</sub> counters.                                  | 10 |
|    | (b) | Classify neutrons on the basis of their energy.  | 4  |
| 5. | (a) | Discuss principle, theory and instrumentation of the neutron activation analysis (NAA) method for elemental analysis in given soil sample.                 | 10 |
|    | (b) | Explain the principle of PIXE.   | 4  |
| 6. | (a) | Derive the wave mechanical expressions for the elastic scattering and reaction cross sections and discuss their interpretation.                            | 10 |
|    | (b) | What are heavy ions ? Give the special features of heavy ion reactions.  | 4  |
| 7. | (a) | Explain the process of nuclear fusion. Discuss about controlled thermonuclear reactions.   | 10 |
|    | (b) | Bring out the principle of positron annihilation technique.  | 4  |
| 8. | (a) | Explain the process of proton - proton scattering at low energies.   | 5  |
|    | (b) | Explain the significance of Distorted Wave Born Approximation (DWBA).  | 5  |
|    | (c) | Explain the process of Rutherford back scattering.   | 4  |

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