



Seat No. \_\_\_\_\_

**HB-003-0491108**

**B. Sc./M. Sc. (Applied Physics) (Sem. X) (CBCS) Examination**

**April - 2023**

**Swift Heavy Ions for Material Modifications : Paper-15**

**(Group C-3)**

*(New Course)*

**Faculty Code : 003**

**Subject Code : 0491108**

Time :  $2\frac{1}{2}$  / Total Marks : 70

**Instructions :**

- (1) All questions are compulsory.
- (2) Numbers in the right margin indicate marks.

- 1** Attempt any SEVEN short questions : (two marks each) **14**
- (1) Define range distribution of implanted atoms in amorphous target.
  - (2) Calculate the atomic density of Al, where,  $\rho = 2.7 \text{ gm/cm}^3$  and  $A = 27$ .
  - (3) Calculate the energy of an electron in MeV having mass  $m = 9.11 \times 10^{-31} \text{ kg}$ .
  - (4) Write the application of superconducting LINAC in 15 UD Tandem accelerator.
  - (5) What is the role of stripper foil in the 15UD Tandem accelerator ?
  - (6) Write the names of simulation programme used to calculate energy loss, depth distribution and trajectory of energetic ions in solid.
  - (7) Write about the technique used for measure the sputtering and stoichiometry in SHI experiment.
  - (8) How etched ion tracks are used as templates for nanostructures ?
  - (9) Write applications of transparent conducting oxides.
  - (10) Which type of defects responsible for the change in  $T_c$  in superconductor ?

- 2** Write the answer of any two questions : **14**
- (1) Write a note on Screen coulomb potential. Derive an equation for a screening length ( $a_U$ ).
  - (2) Write a note on interatomic forces in solids.
  - (3) Discuss classical scattering theory and kinematics of elastic collision.
  - (4) Discuss about the Bohr velocity and Bohr radius in detail.
- 3** Write the answer of any two questions : **14**
- (1) Write a note on ion implantation and their applications.
  - (2) Discuss the coulomb explosion and thermal spike model.
  - (3) Write a note on 15 UD Tandem accelerator with necessary figure and diagrams.
  - (4) Give the name of different beam line of 15 UD Tandem accelerator in IUAC, New Delhi and write their applications.
- 4** Write the answer of any two questions : **14**
- (1) Explain ion induced self-organization phenomena with one example.
  - (2) Discuss stepwise process of nanostructure formation by ion irradiation.
  - (3) Write a note on modification in metal-dielectric nanocomposite by ion irradiation with any one example.
  - (4) Discuss precipitation of metal particles in oxide by ion irradiation.
- 5** Write the answer of any two questions : **14**
- (1) Describe the effect of SHI irradiation on the transparent conducting oxide with example.
  - (2) Define superconductivity. Explain columnar tracks and flux pinning in high  $T_c$  superconductor in detail.
  - (3) Write a note on modification in transport properties of magnetic thin films by ion irradiation.
  - (4) Explain general aspect for the modifications in the properties of functional oxides by ion beam irradiation.
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