

# Ph.D. Coursework Examination, July 2023

## PHYSICS

### Course-IV:B. Materials Science (20PHCW104)

[Time: 3Hours]

[Max. Marks: 70]

- Instructions:** 1) Answer all the questions. z  
2) Part A: Questions 1-8 carries 15 marks each.  
3) Part B: Questions 9-12 carries 5 marks each

#### Part A

- 1 a) Explain how the structure at different levels influences the properties of materials. 5+10  
b) Give an overview of chemical bonding in solids with at least two examples.  
OR
- 2 a) What are composite materials? Explain metal-matrix composites. 6+9  
b) Discuss the optical and electrical properties of materials.
- 3 a) Give a general classification of ferroelectric crystals. Emphasize on their Curie temperatures. 10+5  
b) Explain the structure of cubic ferrite.  
OR
- 4 a) Discuss the influence of temperature on the magnetic behavior of ferrites. 6+7  
b) What is ME effect? Explain the properties of ME composites.
- 5 a) What are polymers? List some unique features of polymers. 5+10  
b) With a neat sketch, describe the processing of polymers through injection moulding.  
OR
- 6 a) Explain the Glass Transition temperature in polymers. 7+8  
b) What are ferroelectric polymers? Explain how they are synthesized.
- 7 a) What are nano materials? Show by simple calculation that the surface area is increased in these materials. 5+10  
b) Describe with a schematic the technique of chemical vapor deposition for the preparation of nanomaterials.  
OR
- 8 a) Explain the use of organic capping in the preparation of nano materials. 6+7  
b) Discuss the size dependent changes in the materials properties.

#### Part B

- 9 Explain the nucleation and growth process in crystals. 5  
OR
- 10 Briefly discuss the applications of ferrites. 5
- 11 Distinguish between thermoplastics and thermosets. 5  
OR
- 12 Explain the colloidal route for the synthesis of any one type of semiconductor. 5

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