

P.G. Semester-IV Examination, 2023**PHYSICS****Course ID : 42455 Course Code : PHYS-405ME(C)****Course Title : Nano Science and Nano-technology-III**

Time : 2 Hours

Full Marks : 40

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*1. Answer any **five** of the following questions :

2×5=10

- a) Explain physical significant of loss tangent.
- b) Explain the effect of thermal vibration on XRD of a crystal.
- c) What are TGA and DTA?
- d) What is electronic polarization?
- e) Define thermal conductivity and Seebeck coefficient of thermoelectric material.
- f) What are the applications of DSC in characterizing a sample?
- g) What do you mean by ‘Ductility’?

[Turn over]

h) What are colossal and giant magnetoresistance for nanomaterials?

2. Answer any **four** of the following questions:

5×4=20

a) Determine the amount of crystallinity in a polymer sample.

b) Define the term ‘Annealing’ with its application. What is the use of ‘process annealing’?

c) Explain ‘Precipitation heat treatment’ with proper diagram.

d) Explain the principle of UV-VIS spectroscopy for nanomaterial characterization.

e) A n-type semiconductor is used as a thermoelectric material. Schematically describe the working phenomenon of the device.

f) Explain the low-temperature ordering effect on the magnetic property of nanomaterials.

3. Answer any **one** of the following questions:

10×1=10

a) i) Describe the application of CNT in the field of thermoelectric material.

ii) How Raman spectroscopy is useful to identify different optical modes of CNT.

iii) Explain the existence of both conductivity and dielectric properties simultaneously in CNT.

b) i) Explain the purpose and procedure of two probe measurement. 3

ii) Find the relation between mobility of electrons and holes in a semiconductor with temperature. 3

iii) Show that conductivity is minimum when

$$\frac{n_e}{n_i} = \sqrt{\frac{\mu_h}{\mu_e}} \text{ and prove } \sigma_{min} = 2en_e\mu_e.$$

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