PG/IS/PHS/106/24

M.Sc. 1st Semester Examination, 2024

PHYSICS

(*Experimental Methods in Physics*)

PAPER—PHS-106

Full Marks : 25

Time : 1 hour

Answer **all** questions

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

Answer any **two** questions : 2×2

1. What are the advantages of neutron diffraction over x-ray diffraction ?

2. A beam of x-rays of wavelength 1.54 Å is diffracted by (100) plane of an FCC lattice with a lattice constant of 2.2 Å. Find the glancing angle for the first order diffraction.

3. Why the nano dimensional materials are so active ?

4. When a substance is excited with a light source of $\lambda = 5000$ Å, it shows stokes Raman line at 5100 Å. Calculate the Raman shift of the material.

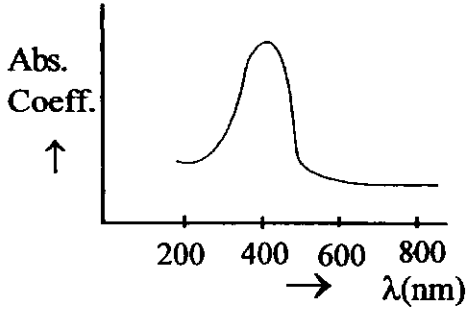
GROUP – B

Answer any **two** questions : 4×2

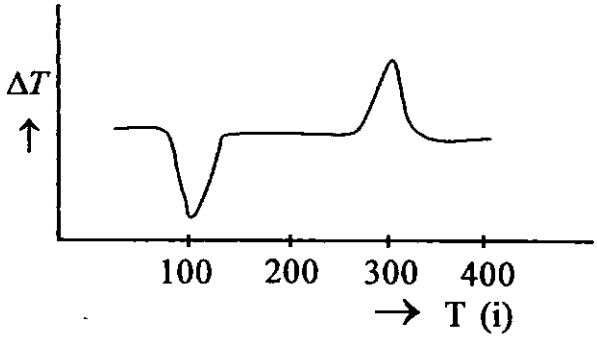
5. Explain the basic working principle of an AFM instrument. How does it differ from STM so far the probing tip is concerned ? $3 + 1$

6. Consider the following graph. Name the associated instrument and explain the findings briefly. 2 + 2

(*i*)



(*ii*)



7. What do you mean by epitaxial growth of a thin film ? Write down the basic concept of molecular beam epitaxy method of thin film deposition. 1 + 3

8. (*a*) Why a single atom tip is the best source of e-gun ?

(*b*) Why do you prefer e-beam lithography over optical lithography ? 2 + 2

GROUP – C

Answer any **one** question : 8 × 1

9. (*a*) What are the information you can get from the following instrument ?
(*i*) TEM
(*ii*) XPS

(*b*) Why 'baking' is required for UHV chamber ?

(*c*) Write a short note on chemical vapour deposition. 2 + 2 + 4

10. (*a*) What is the basic principle of vibrating scanning magnetometer ?

(*b*) Why the SEM image of an object is bright but the TEM image is dark ?

(*c*) What is the approximate pressure difference between the inside and outside of a UHV chamber ?

(*d*) Briefly describe the process of single crystal preparation. 2+2+1+3

[Internal Assessment — 5 Marks]
