C 22587 (Pages : 2) Name...

Reg. No....................................

FOURTH SEMESTER M.Sc. DEGREE [REGULAR/SUPPLEMENTARY] EXAMINATION, APRIL 2022

(CBCSS)

Physics

PHY 4E 16—SYNTHESIS, CHARACTERIZATION TECHNIQUES AND APPLICATIONS OF NANOMATERIALS

(2020 Admission onwards)

Time : Three Hours   Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend **all** questions in each section.*

2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*

3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*

4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

8 Short questions, each answerable within 7.5 minutes
*Answer **all** questions. Each question carries weightage 1.*

1. Four-point probe is better than a two-point probe. Comment.

2. Explain the principle of Hall Effect.

3. What is surface charging in SEM ? How can it be avoided ?

4. Explain the principle of XPS.

5. What is the basic difference between CVD and PVD ?

6. Write a short not on self-cleaning coatings ?

7. List out the challenges faced by nanotechnology.

8. What is LaMer diagram ?

(8 × 1 = 8 weightage)

Turn over

Section B

4 Essay questions, each answerable within 30 *minutes*
Answer any **two** *questions. Each carries weightage* 5.

9. Discuss the different physical methods based on evaporation for the synthesis of nanomaterials.

10. Differentiate between MEMS and NEMS. Discuss the major challenges faced in constructing nano-size devices.

11. What is Bragg's law ? Explain the Scherrer powder method in nanoparticle size analysis with a suitable XRD diagram.

12. Discuss the conductivity measurement technique of nanomaterials with respect to two probe and four probe method.

$(2 \times 5 = 10$ weightage)

Section C

7 Problem questions, each answerable within 15 *minutes.*
Answer any **four** *questions. Each question carries weightage* 3.

13. Explain the principle and working of Vibrating Sample magnetometer.

14. Calculate the angle at which the :

    (a) First-order diffraction and

    (b) Second-order diffraction will occur in an X-ray diffractometer when x-rays of wavelength of 1.54 Å is diffracted by atoms of a crystal whose interplanar spacing is 4.04 Å.

15. A solution of thickness 2 cm, the transmitted light is 0.12 times of the incident light, molar absorptivity is 0.35 M^{-1} cm^{-1}. Calculate the concentration of the solution and the absorbance.

16. An electron microscope uses electrons accelerated by a voltage of 50 kV. Determine the debroglie wavelength associated with the electrons. Also compare the resolving power of electron microscope with an optical microscope that uses yellow light of wavelength 599 nm.

17. Write a short note on molecular beam epitaxy.

18. Write a short note on Antibacterial coatings.

19. Explain the principle of MEMS accelerator with a neat labeled diagram.

$(4 \times 3 = 12$ weightage)