

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



M.Sc. DEGREE EXAMINATION – PHYSICS

THIRD SEMESTER – NOVEMBER 2022

PPH 3301 – NANO SCIENCE

Date: 30-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART - A

Q. No Answer all questions

(10 x 2 = 20 Marks)

- 1 List out the advantages of bottom-up approach over top-down approaches.
- 2 Write short note on nanomedicines.
- 3 Determine the average crystallite size using the given XRD data of the nanoparticles (Peak position $(2\theta) = 31.8^\circ$, FWHM = 0.5° and X-Ray wavelength = 0.154 nm).
- 4 What is X-Ray diffraction (XRD).
- 5 Distinguish between crystallite size and particle size.
- 6 Compare the potential energy curve of He_2 with H_2 .
- 7 How are semiconductor nanocomposites classified?
- 8 Name any two bottom-up liquid phase methods to synthesis nanomaterials.
- 9 What is the significance of BET constant?
- 10 What are volatile organic compounds? Give examples.

PART – B

Answer any four questions

(4 x 7.5 = 30 Marks)

- 11 Briefly explain the role of nanotechnology in the field of energy and information & communication.
- 12 Draw the block diagram SEM and explain its essential components and operation.
- 13 What are semiconductor quantum dots? Derive the expression for its energy gap.
- 14 How are nanoparticles and nanopolymers synthesized using sol-gel process?
- 15 How is specific surface area of solid adsorbents determined using BET equation?
- 16 What are the major inelastic scattering events? How are continuum and characteristic X-rays generated?

PART – C

Answer any four question

(4 x 12.5 = 50 Marks)

- 17 Discuss in detail the procedure for developing nanomaterials employing Ion implantation technique.
- 18 With suitable diagram, discuss the electronic band structure of nanocrystals and solids
- 19 With suitable diagram, Explain the working principle of AFM and TEM.
- 20 Explain the energy of the following interactions with suitable equations:
i) ion-dipole ii) dipole-dipole iii) ion-induced dipole iv) dipole-induced dipole
- 21 Discuss the synthesis of nanomaterials and types of reactions involved in chemical vapour deposition.
- 22 a) Discuss the types and advantages of core-shell nanoparticles. **(6.5 Marks)**
b) Describe the components and working principle of biosensors. **(6 Marks)**

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