Dr Abhigeel Ofthe

National Institute of Technology Hamirpur End Semester Examination -2023 MS-381: Nanomaterials and Nanotechnology Open elective-II

Time: 3 Hours

Max. Marks: 50

Note: This question paper contains 9 questions, and it is mandatory to attempt all the questions.

1. Write brief description/short note on the following :

- (a) Ostwald ripening
- (b) Magnetron sputtering
- (c) Laser ablation
- (d) Self-assembled monolayers (SAMs)
- (e) Surface Plasmon Resonance (SPR)

 $(5^{*}2 = 10 Marks)$

2. State the differences between the following :

- (a) Epitaxial and non-epitaxial film growth
- (b) Dry etching and Wet etching
- (c) PECVD and MOCVD
- 3. When the size of a nanocrystal is smaller than the de Broglie wavelength, how the electronic configuration is changed? Show the discrete electronic configurations of nanocrystals, nanowires, and thin films by a neat sketch.
 (1.5+1.5 = 3 Marks)

4. Explain 'Sol-gel' processing of nanomaterials with key reactions involved. (2+2= 4 Marks)

- 5. What are 'Nanobots'? Enlist some of the key challenges scientific community is facing to realize the nanobots in real.
 (2+2= 4 Marks)
- 6. Describe the electrostatic and steric stabilization mechanisms to prevent the agglomeration of nanostructures in a colloidal solution in details.
 (2+2= 4 Marks)
- 7. Describe the key features and attributes of 'Molecular Beam Epitaxy (MBE)' method with a clear instrumentation diagram. How it prevents the interaction of various sources in vapor phase?

(2+1+2=5 Marks)

- 8. What is Atomic Layer Deposition (ALD) method of thin film growth? Mention it's most distinctive features, chemical reactions involved, and the advantages. (2+1+1+1=5 Marks)
- 9. Explain DLVO theory of electrostatic stabilization of particles in a suspension. Enlist its key assumptions, conditions and limitations with a neat sketch.
 (2+1+1+1=6 Marks)

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(3*3 = 9 Marks)