

M.TECH MATERIAL ENGG FIRST YEAR FIRST SEMESTER – 2025

M.E. METALLURGICAL ENGINEERING FIRST YEAR FIRST SEMESTER – 2025

Subject: SYNTHESIS OF NANOMATERIALS

Total Marks: 100

Time: 3 Hours

Use separate sheets for answering each Parts

Answer FOUR questions from Part-I and ONE question from Part-II

PART-I

Answer any FOUR questions:

20X4=80

1. Write about the top down approaches used for the synthesis of nanomaterials. How plasma is generated and controlled in a sputtering system? Explain the DC sputtering process with proper diagrams. How magnetron sputtering is used for the synthesis of nanomaterials?
2+ 4+7+7
2. Mention the differences between CVD and PVD systems. Write about the different steps involved in PVD process. Explain the operation of a physical vapour deposition (PVD) system. Explain the operations of thermal and electron beam (E-Beam) evaporation systems.
2+ 4+7+7
3. Mention different CVD Reactors used for the synthesis of nanomaterials. Briefly explain arc discharge method. Write about the sequential steps during a CVD process. Explain the operation of a chemical vapor deposition (CVD) system with proper diagrams.
2+ 4+7+7
4. Why Metallization is done in integrated circuits (ICs)? Write about wet and dry etching processes used for device fabrication. Explain the photolithography process in details with appropriate diagrams. Write about simple MOS fabrication process (with diagrams).
2+ 4+7+7
5. Write about the different equilibrium growth/deposition modes. Explain, how nanomaterials can be prepared by Ball Milling process. Draw and explain the operation of a Molecular Beam Epitaxy (MBE) system. Describe the applications of the different In-situ Characterization systems present in a MBE system.
2+ 4+7+7

Part – II

Answer one question

1. (a) Define sol and gel.
Describe synthesis of silica nano particles by sol-gel method mentioning the reactions in details.
Write the parameters that control the rate of the reaction and morphology of the synthesized materials.
(b) How can you synthesis silica – nickel nanocomposite by this method? 2 + 8 + 5 + 5

2. Discuss in details with mechanism, the effect of addition of acid catalyst and base catalyst in the rate of hydrolysis and condensation of sol-gel process synthesis of nanostructured silica. 5 X 4