



B.E/B.Tech (Full-Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2019  
MATERIALS SCIENCE AND ENGINEERING BRANCH  
REGULATION 2012

ML8017 NANOSTRUCTURED MATERIALS

Time: 3Hr

Answer ALL Questions

Max.Mark:100

Part –A (10x2=20 Marks)

1. Surface atoms in the particles are increased on reducing the size of the particles: True or false-Justify your answer
2. What are the effects of size reduction in nanomaterials on the thermal properties of the materials?
3. When large number of atoms are brought together to form a solid, the energy levels of the individual atoms becomes a continuous energy band- True or false: Justify your answer
4. What are the reasons for quantum confinement?
5. Differentiate endohedral and exohedral fullerene.
6. Compare nanowire and nanotubes.
7. What are the desirable important properties of superhard coatings?
8. What are the drawbacks of ARB process?
9. Berkovich indenter is recommended for nanoindentation studies-Why?
10. Differentiate SPM and STM.



Part – B (5x16 = 80 Marks)

- 11 (i) Argue the effect of size on the mechanical properties of nanostructured materials (6)
- (ii) Discuss the different types of nanostructures formed by modifying chemical composition, dimensionality and crystallites. (10)
- 12a (i) Explain the mechanism of nanoparticles formation during mechanical milling and also explain the role of process variables on the nanoparticles formation (16)
- OR
- 12b (i) What are quantum dots? Explain the synthesis of quantum dots by droplet epitaxy technique with an example. (10)
- (ii) Discuss the nanoparticles production by flame synthesis (6)
- 13a (i) What are functionalization? What are the different types of functionalization employed in CNTs (8)
- (ii) Discuss the Tip-growth and base-growth mechanism proposed for CNT growth (8)
- OR
- 13b (i) Explain the principle involved in thermal evaporation method for synthesizing ZnO nanowire (8)
- (ii) Explain the three stages involved in VLS technique for nanowire synthesis (8)

- 14a (i) What are Superhard coatings? and explain the major factors responsible for achieving super hardness (8)
- (ii) Explain the mechanism responsible for super hardness in nc-TiN/a-Si<sub>3</sub>N<sub>4</sub> coating (8)

OR

- 14b (i) What are the challenges in consolidation of nanoparticles to fabricate bulk nanostructures? How severe plastic deformation overcomes the challenges of consolidation techniques (8)
- (ii) Explain the principle of ECAP and discuss the different variables affect the strain imparted in the specimen. (8)

- 15a (i) Explain the principle of AFM and discuss the different modes of operation. (10)
- (ii) Explain the principle of SNOM (6)

OR

- 15b (i) Why nanoindentation is called as depth sensing indentation. Explain how the different properties are estimated from the load-displacement curve (16)

