

**SECOND SEMESTER M.TECH. (NANO SCIENCE AND TECHNOLOGY)
DEGREE EXAMINATION, APRIL 2020**

NST 204—PROPERTIES AND APPLICATIONS OF NANO MATERIALS

(2019 Admissions)

Time : Three Hours

Maximum : 60 Marks

Section A

Answer all questions.

2 marks each.

1. What is evanescent wave ?
2. What is magneto resistivity ?
3. What is quantum wave guide ?
4. What is magnetic anisotropy ?
5. What is the difference between Mott-Wannier and Frenkel exciton ?
6. What is surface plasmon resonance ?
7. What is ballistic conductance ?
8. What is hard magnetic material and soft magnetic material ?

(8 × 2 = 16 marks)

Section B

Answer any five questions.

4 marks each.

9. Discuss the direct and indirect band gap materials. Describe the band structure modification in 2-D nanostructure
10. Explain type-I, type-II nanoparticles.
11. How core-shell nanoparticles are synthesising ? Discuss some of the advantages of core-shell nanoparticles.
12. What is nanocomposite ? What are the advantages of nanocomposites ?
13. How the magnetism is getting modified in low dimensional systems ?
14. Describe the structure of carbon nanotubes.

Turn over

15. Explain Nabarro-Herring mechanism and Coble mechanism.
16. Discuss the mechanical properties of polypropylene/single walled carbon nanotube composite.

(5 × 4 = 20 marks)

Section C

Answer any four questions.

6 marks each.

17. What is Density of state ? How it varies with the quantum confinement ?
18. What is quantum waveguide ? Discuss the applications of it.
19. Explain electron spin transistors.
20. How Nano systems can be used for single electron transfer devices ?
21. What is photonic crystals ? How optical filters can be designed with photonic band gap materials ?
22. How nanotechnology is useful for large area optoelectronic devices ?
23. What is magnetic domain ? Explain the superparamagnetic effect based on domain theory.
24. Explain two-atom chain mechanism.

(4 × 6 = 24 marks)

SECOND SEMESTER M.TECH. DEGREE (NANO SCIENCE AND TECHNOLOGY) EXAMINATION, APRIL 2020**NST 203—BIO-NANO MATERIALS**

(2019 Admissions)

Time : Three Hours

Maximum : 60 Marks

Section A*Answer all questions.**2 marks each.*

1. What is calcite ?
2. What are biominerals ? Give some examples.
3. Give the characteristics of polyplexes.
4. What are liposomes ?
5. What is simulated body fluid ?
6. Give the merits of grafting method.
7. What are the materials used for MEMS manufacturing ?
8. Name the application corresponding to NEMS.

(8 × 2 = 16 marks)

Section B*Answer any five questions.**4 marks each.*

9. Explain bioassay along with its classification.
10. Differentiate intercellular and extracellular bio-mineralization.
11. Demonstrate the advantages of liposomes.
12. Discuss the role of magnetic nanoparticles for therapeutic application of cancer.
13. Emphasis in details the artificial implants.
14. Write a short note on osteogenesis.
15. Write a note on biochips.
16. Enumerate how DNA is employed as template in nanocircuitry.

(5 × 4 = 20 marks)

Turn over

Section C

*Answer any **four** questions.
6 marks each.*

17. Illustrate the synthesis of oxide nanoparticles using root extract with few examples.
18. Give the medical application of metallic nanoparticles.
19. Write a detailed note on injectable nanoparticles.
20. Write a detailed note on the molecular labels.
21. What is bone grafting ? And list out their merits.
22. Discuss the role scaffolds in tissue engineering.
23. Explain the applications of NEMS in detail.
24. Write about the nanoparticle-biomaterial hybrid systems.

(4 × 6 = 24 marks)

**SECOND SEMESTER M.TECH. (NANO SCIENCE AND TECHNOLOGY)
DEGREE EXAMINATION, APRIL 2020**

NST 202—CHARACTERIZATION TECHNIQUES OF NANO MATERIALS

(2019 Admissions)

Time : Three Hours

Maximum : 60 Marks

Section A

Answer all questions.

2 marks each.

1. What are the different Fourier Transform techniques available for nanomaterial characterization ?
2. Name the different x-ray diffraction techniques used for material characterization.
3. How AFM works ?
4. What are the different modes of operations in SEM ?
5. How hardness of a material can be tested ?
6. How gaseous nanomaterials are characterized ?
7. How NMR spectroscopy works ?
8. What is the working principle of VSM ?

(8 × 2 = 16 marks)

Section B

Answer any five questions.

4 marks each.

9. How IR spectroscopy works ? Explain the technique with applications.
10. Discuss Raman spectroscopy with appropriate diagrams and explain the working principle.
11. Explain the working principle of SPM with neat diagram. Mention the applications.
12. Discuss the different contrast modes in TEM.
13. How mechanical tension of a nanomaterial can be characterized ?
14. What is combustion calorimetry ? How it works ?
15. How the electrochemical impedance of nanomaterial can be measured ?
16. How Mossbauer spectroscopy is useful in nanomaterial characterization ? What are the suitable sources for this technique ?

(5 × 4 = 20 marks)

Turn over

Section C

Answer any four questions.

6 marks each.

17. Explain Raman spectroscopy. What is the difference between Raman and FT Raman spectroscopic techniques ?
18. What are the applications of XPS ? Explain its working principle in detail.
19. Discuss the working and applications of STM.
20. Discuss about scanning probe microscopes. What are the various modes of operation ?
21. How tension and hardness of nanomaterials can be measured ?
22. Explain various thermal analysis techniques used for material characterization.
23. How does ESR spectroscopy work ? Explain its applications.
24. Discuss the working principle and instrumentation of VSM in detail.

(4 × 6 = 24 marks)

**SECOND SEMESTER M.TECH. (NANO SCIENCE AND TECHNOLOGY)
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NST 201—DESIGN AND SYNTHESIS OF NANO MATERIALS

(2019 Admissions)

Time : Three Hours

Maximum : 60 Marks

Section A

Answer all questions.

2 marks each.

1. Give a comparison of evaporation and sputtering.
2. How monosized metallic nanoparticles are synthesizing ?
3. What is protic and aprotic solvent ?
4. What is mean free path of molecule ? How it effect the evaporation growth technique ?
5. Differentiate between homo epitaxy and hetero epitaxy.
6. Discuss the effect of homogeneous and inhomogeneous nucleation in nanoparticle growth.
7. Describe the growth of metaloxide nanostructures by electrochemical method.
8. What is soft lithography ?

(8 × 2 = 16 marks)

Section B

Answer any five questions.

4 marks each.

9. Explain electrostatic stabilization.
10. Explain Ostwald ripening.
11. What is chemical potential ? Describe its variation with surface curvature.
12. Explain Molecular beam epitaxial with the help of schematic diagram.
13. Distinguish between solvothermal and hydrothermal synthesis.
14. What is self-assembly ? Discuss the driving forces. Discuss the types of self-assembly methods for organic monolayers.

15. How growth control can be achieved with diffusion ?
16. Explain the subsequent growth technique of nuclei.

(5 × 4 = 20 marks)

Section C

Answer any four questions.

6 marks each.

17. Explain photo-lithography and discuss the minimum resolvable features.
18. What is mean by spatial confinement of growth process in nanoparticle synthesis ? Discuss available methods for spatial confinement.
19. Explain evaporation condensation growth of ZnO nanobelts.
20. Explain the fabrication of ordered mesoporous materials.
21. Explain Near field Scanning Optical Microscopy. How classical optical diffraction limits can be overcome ?
22. Explain the electrochemical deposition of nanorods and nanowires.
23. Explain the use of microorganisms in nanoparticle synthesis. Compare the advantages of biological methods with conventional chemical methods ?
24. Explain dip-pen lithography and discuss the role of humidity in that process.

(4 × 6 = 24 marks)