

DEPARTMENT OF ELECTRONICS
MSc Electronics

III Semester

ELS 504 – NANO ELECTRONICS

Unit -I

8 Hours

Nanoscience and Nanoelectronics

Introduction to Nanoscience and nanoelectronics, the top-down approach, the bottom-up approach, Miniaturization of Electrical and Electronic Devices, Moore's Law and the SIA Roadmap.

Nanolayers

Production of Nanolayers, Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD) Epitaxy, Ion Implantation, Formation of Silicon Oxide, Characterization of Nanolayers, Thickness, Surface Roughness, Crystallinity, Chemical Composition, Doping Properties, Optical Properties, Applications of Nanolayers, Evaluation and Future Prospects.

Unit -II

12 Hours

Nanoparticles

Fabrication of Nanoparticles, Grinding with Iron Balls, Gas Condensation Laser Ablation, Thermal and Ultrasonic Decomposition, Reduction Methods, Self-Assembly, Low-Pressure, Low-Temperature Plasma, Thermal High-Speed Spraying of Oxygen/Powder/Fuel, Atom Optics, Sol gels, Precipitation of Quantum Dots, Other Procedures, Characterization of Nanoparticles, Optical Measurements, Magnetic Measurements, Electrical Measurements, Applications of Nanoparticles, Evaluation and Future Prospects.

Extension of Conventional Devices by Nanotechniques

MOS Transistors, Structure and Technology, Electrical Characteristics of Sub-100 nm MOS Transistors, Limitations of the Minimum Applicable Channel Length, Low-Temperature Behavior, Evaluation and Future Prospects, Bipolar Transistors, Structure and Technology, Evaluation and Future Prospects.

Unit -III

10 Hours

Innovative Electronic Devices Based on Nanostructures

General Properties, Resonant Tunneling Diode, Operating Principle and Technology, Applications in High Frequency and Digital Electronic, Circuits and Comparison with Competitive Devices, Quantum Cascade Laser, Operating Principle and Structure, Quantum Cascade Lasers in Sensing and Ultrafast Free, Space Communication Applications, Single Electron Transistor, Operating Principle, Technology, Applications, Carbon Nanotube Devices, Structure and Technology, Carbon Nanotube Transistors

- 1) **Nanotechnology and Nanoelectronics:** Materials, Devices, Measurement Techniques by W. R. Fahrner (Editor)