

NANO TECHNOLOGY

Course Code	22MEMD2T5D	Year	I	Semester	II
Course Category	Programme Elective	Branch	ME	Course Type	Theory
Credits	4	L-T-P	4-0-0	Prerequisites	Nil
Continuous Internal Evaluation:	40	Semester End Evaluation:	60	Total Marks:	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Recognize importance of nano materials	L2	1
CO2	Characterize nano materials by SEM, STM, AFM etc	L2	2
CO3	Describe different nano particle fabrication methods	L2	3
CO4	Identify different synthesis methods for semi conductor and metal nano particles	L2	3
CO5	List the applications of carbon nano tubes	L2	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	2	2	2				1			2	2	1
CO 2	3	1	2	2	2				1			2	2	1
CO 3	3	1	2	2	2				1			2	2	1
CO 4	3	1	2	2	2				1			2	2	1
CO 5	3	1	2	2	2				1			2	2	1

Syllabus		
Unit	Contents	Mapped CO
1	INTRODUCTION: Size and shape dependence of material properties at the nanoscale, Nanoscale elements in conventional technologies. NANO FABRICATION: Top-down and bottom-up nanofabrication lithography, etching, ion implantation, thin film deposition, Electron beam lithography, Soft lithography: nano imprinting and micro contact printing, Solution/plasma-phase nanofabrication, sol-gel methods, template techniques.	CO1

2	<p>SELF ASSEMBLY AND SELF-ORGANIZATION: Functional coatings with self assembled monolayers of molecules and nanoparticles Langmuir-Blodgett films, layer-by-layer growth.</p> <p>IMAGING/CHARACTERIZATION OF NANOSTRUCTURES: General considerations for imaging, Scanning probe techniques: SEM, STM, AFM, NSOM.</p>	CO2
3	<p>METAL AND SEMICONDUCTOR NANOPARTICLES: Synthesis, stability, control of size, Optical and electronic properties, Ultra-sensitive imaging and detection with nano particles, bioengineering applications, Catalysis.</p> <p>SEMICONDUCTOR AND METAL NANOWIRES: Vapor/liquid/solid growth and other synthesis techniques, Nano wire transistors and sensors.</p>	CO3, CO4
4	<p>CARBON NANOTUBES: Structure and synthesis, Electronic, vibrational, and mechanical properties, enabling faster computers using carbon nano tubes, brighter TV screens and stronger mechanical reinforcement, Mechanics at nanoscale Enhancement of mechanical properties with decreasing size, Nano electromechanical systems, Nano machines, Nano fluidics, filtration, sorting, Molecular motors.</p>	CO5

Learning Resources

Text Book(s):

1. Nanoscale Science and Technology by Kelsall, Hamley, and Geoghegan, Wiley (2005)
2. Introduction to Nanoscale Science and Technology by Di Ventra, Evoy, and Heflin, Kluwer Academic Publishers (2004).

References:

1. Introduction to Nanotechnology by Poole and Owens, Wiley (2003).
2. Nanochemistry: A Chemical Approach to Nanomaterials by Ozin and Arsenault, RSC PublishinG

Course coordinator:

HOD