18MTOE04	NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

1. To study about nanomaterials and its application

UNIT I	INTRODUCTION	9	+	0

Definition, Length scales, surface area/volume ratio of micron to nanoscale materials, Importance of Nanoscale and Technology, Top down and bottom up approaches, Classification of nanomaterials, Properties of selected nanomaterials including carbon nanotubes (CNT), graphene, metal nanoparticles, clays, nanowires, quantum dots (QDs), effect of size on thermal, mechanical and electrical properties of nanomaterials.

UNIT II	SYNTHESIS OF NANOMATERIALS	9	+	0

Fabrication of Nanomaterials: Top-down approaches-lithography, Mechanical alloyin/milling, Severe Plastic Deformation, Bottom-up approaches-chemical vapour deposition, physical vapour deposition, atomic layer deposition (ALD), and Sol-gel method, Synthesis and purification of CNT, synthesis of expanded graphite (EG) or graphene.

UNIT III	NANOCOMPOSITES	9	+	0

Fabrication of nanocomposites: Fabrication of Clay-rubber, Clay-polymer, CNT-polymer, EG-polymer, magnetic particle-polymer, CNT-metal, trade off between the composites and nanocomposites etc. Consolidation of nanomaterials.

UNIT IV	CHARACTERIZATION OF NANOMATERIALS	9	+	0

Characterization of Nanomaterials:, X-ray diffraction (XRD), Dynamic Light Scattering, Scanning electron microscope (SEM), Transmission Electron Microscope (TEM), UV-Visible spectroscopy, Scanning probe microscopy- Atomic force microscope (AFM) and scanning tunneling microscope (STM). Nanoindentation.

UNIT V	APPLICATIONS OF NANOMATERIALS	9	+	0

Applications of nanomaterials: Electronics, structural, biomedical, sensors nanofluids, optical, magnetic, biomedical fields, solar cells, LED, LCD, electrically conducting polymers, batteries, fuel cells, SMART materials. Environmental and health issues related to nanomaterials.

Total (L+T) = 45 Hours

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Define and differentiate engineering materials on the basis of structure and properties for engineering applications.

CO2	:	Various applications of nanomaterials
CO3	:	Select a material for a particular application based on the requirements.
CO4	:	Predict and apply the necessary protection mechanism to prevent corrosion
CO5	:	Understanding details about SEM,TEM

Text Books:	
1.	B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday, Textbook of Nanoscience and Nanotechnology, University Press (I) Pvt. Ltd., 2013.
2.	Bharat Bhushan (Ed), Springer Handbook of Nanotechnology, Springer-Verlag Berlin Heidelberg, 2004
Reference Books:	
1.	Charles P Poole and Frank J Owens, “Introduction to Nanotechnology”, John Wiley and Sons, New York, 2003.
2.	Michael Wilson, Kamali Kannagara and Geoff Smith, “Nanotechnology: Basic Science and Emerging Technology”, Chapman and Hall, New York, 2002.
3.	Pradeep T, “Nano: The Essentials”, Tata Mc Graw Hill, New Delhi, 2007.