PMM322: NANO-STRUCTURED MATERIALS

L	T	P	Cr
3	1	0	3.5

Course Objective(s): Understand the influence of dimensionality of the object at nanoscale on their properties. Various synthesis techniques for the preparation of 0-D, 1-D and 2-D nanostructures, industrial applications of nanostructures in future technologies.

Introduction to Nanomaterials: Features of nanosystems, Characteristic length scales of materials and their properties, Density of states in 1-D, 2-D and 3-D, Variation of density of states and band gap with crystal size.

Quantum Size Effect: Electron confinement in infinitely deep square well, Confinement in one dimensional well, Idea of quantum well structure, Formation of quantum well, Quantum dots and quantum wires.

Synthesis of Nanoscale Materials: Top down and bottom up approach, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and mechanical milling methods, Chemical methods and self-assembly.

Nanomaterials: Nanoparticles, Nanocoatings and Nanocomposites, Nanotubes, Fullerenes, Thin film chemical sensors-gas sensors, and biosensors, Smart materials, Fuel and solar cells, Drug delivery systems and Optoelectronic devices.

Course Learning Outcomes (CLO):

Students will be able to:

1. Acknowledge the influence of dimensions of the object(s) at nanoscale on their properties;
2. Choose appropriate method and conditions for synthesis of desired nanostructures;
3. Make selection of appropriate nanostructures for various industrial applications.

***Recommended Books**:*

1. *Bimerg, D., Grundmann, M., and Ledentsov, N.N., Quantum Dot Heterostructures, John Wiley (1999).*
2. *Jain, K.P., Physics of Semiconductor Nanostructures, Narosa (1997).*
3. *Fendler, J.H., Nano particles and Nano-structured Films, John Wiley &Sons (1998).*
4. *Timp, G., Nanotechnology, Springer-Verlag (1999).*