**DSE: Nano Materials and Applications (32227612)**

**Credit: 06 (Theory-04, Practical-02)**

**Theory: 60 Hours**

**Practical: 60 Hours**

**Course Objective**

The syllabus introduces the basic concepts and principles to understand nanomaterial.

Various nanomaterial synthesis/growth methods and characterizations techniques are

discussed to explore the field in detail. The effect of dimensional confinement of charge carries on the electrical, optical and structural propertie are discussed. The concept of micro- and nano- electro mechanical systems (MEMS and NEMS) and important applications areas of nanomaterials are discussed.

**Course Learning Outcomes**

On successful completion of the module students should be able to

 Explain the difference between nanomaterials and bulk materials and their properties.

 Explain the role of confinement on the density of state function and so on the **various** properties exhibited by nanomaterials compared to bulk materials.

 Explain various methods for the synthesis/growth of nanomaterials including top down and bottom-up approaches.

 Analyze the data obtained from the various characterization techniques

 Explain the concept of Quasi-particles such as excitons and how they influence the

optical properties.

 Explain the Interger Quantum Hall Effect and the concept of Landau Levels, and edge states in conductance quantization.

 Explain the conductance quantization in 1D structure and its difference from the 2DEG system.

 Explain various applications of nano particles, quantum dots, nano wires etc

 Explain why nanomaterials exhibit properties which are sometimes very opposite, like magnetic, to their bulk counterparts.

 In the Lab course students will synthesize nanoparticles by different chemical routes and characterize them in the laboratory using the different techniques, learnt in the theory. They will also carry out thin film preparation and prepare capacitors and evaluate its performance. They will fabricate a PN diode and study its I-V characteristics.