Open Elective Course for M.Tech and M.Sc students of other Departments

MNL-751/MBL-751 Introduction to Nano Science & Technology (4+0)

MM:70 **TIME: 3 h**

Unit-I

Introduction & Background: Introduction to Nanotechnology, Insights and intervention into the Nanoworld, Historical Background, recent advances and future aspects, Applications of Nanotechnology in different fields- Agriculture, medical applications, Environmental applications,Space, Defence, Food processing, consumer durables, textiles,. cosmetics etc, Safety, Health and environmental issues, Societal implications and ethical issues in Nanoscience and Nanotechnology.

Unit-II

Instrumentation Techniques for Nanotechnology: FTIR, Thermal analysis, Scanning Probe Microscopy-principle of operation, instrumentation and probes, SEM, TEM, XRD (Powder/Single crystal), AFM, Scanning Tunneling Microscopy (STM), Particle size analyzer and Zeta Sizer.

Unit-III

Nanomaterials- Types, Properties and applications; Synthesis methods- Physical, Chemical and Biological methods of synthesis; Carbon Nanotubes – Synthesis methods, characterization and applications; Nanowires- synthesis methods, physical properties, applications; Smart materials.

Unit-IV

Micro and Nanofabrication Techniques- Concept of MEMS and NEMS, Fabrication techniques- A brief account, applications of Micro and Nanodevices, Micro fluidic devices and their Applications; Material aspects for Micro fluidic devices, active and smart passive Micro fluidics devices, Lab-on-a-chip, Nanomedicine and Drug Delivery, Nanotechnology in Cancer Therapy and Detection.

Books/ References:

1. Kulkarni, S, K. 2014. Nanotechnology- Principles and Practices. 3rd Edition, Capital Publishing Company.
2. Vajtai, R 2013. Handbook of Nanomaterials, Springer.
3. Hari Singh Nalwa 2011. Encyclopedia of Nano Science & Nanotechnology. American Scientific Publishers.
4. Balzani, V., Credi, A. & Verturi, M. 2003. Molecular Devices and Machines- A Journey into Nanoworld. Wiley-VCH Verlag.
5. Albert Folch (2013) "Introduction to BioMEMS", CRC Press.
6. Wolfson, J.R.: 2003, 'Social and Ethical Issues in Nanotechnology: Lessons from Biotechnology and Other High Technologies', *Biotechnology Law Report*, **22**, no 4, 376-96.
7. Bhushan, Bharat. 2004. Handbook of Nanotechnology. Springer.

(Examiner will set Nine questions in all, Q. No. 1 will be compulsory & based on the entire syllabus. It will contain 7 short answer type questions each of 2 marks. Among the 8 questions are to be given two question from each unit. Candidates are required to attempt other four questions in all by selecting at least one from each unit. All question carry equal marks)