

## **BIO-MEMS AND NANOTECHNOLOGY**

### **Module-I**

**Mems and Microsystems:** Mems and Microsystems-General principles, advantages, materials used properties, Technology involved in MEMS. Fabrication techniques-Lithography- etching- Ion implantation wafer bonding. Integrated processing- Bulk Micro machining- Surface micro machining-coating technology and CVD- LIGA process.

### **Module-II**

**Microsensors and Microactuators:** Microsensors and Microactuators –working principle, types-pressure sensors, thermal sensors and actuators, piezoelectric crystals-Intelligent materials and structures, Magnetic sensors and actuators- magnetic materials used for MEMS.

### **Module-III**

**Mems and Microfluidic System:** Principle of MOEMS- light modulator, beam splitter, digital micro mirror device, light detectors and optical switch. Micro fluidic System- Fluid actuation method, dielectrophoresis, micro fluid dispenser, micro needle, micro pumps. Application of BioMEMS: Healthcare, drug delivery, micrototal analysis system detection and measurement methods, electronic nose, biochip.

### **Module- IV:**

**Introduction to Nanotechnology:** Essence of Nanotech, Nanofying electronics, Properties of nanomaterials, metal nano clusters, semiconductor nano particles, nano composites. Introduction to carbon nano structure, carbon molecules, carbon clusters, nanotubes application.

**Nanotechnology for photonics:** Photonic crystal 1d,2d,3d; light propagation in photonic crystal and fiber, photonic band gap, fiber bragg grating, coupled mode theory, and fiber Bragg grating spectrum. Applications of photonic crystal in optical logic gates , sensing and communication. Applications of fiber grating. Numerical techniques (PWE,FDTD,FEM) to design nanophotonics devices.

**Medical Applications of Nanotechnology:** Nanotechnology and Biomedicine-Drug synthesis and delivery– Nanobiomedicine and diagnostic-nano fabrication methods-nanomaterials in human body-toxicity in nanomaterials.

### **Text books:**

1. Tai Ram Hsu, “Mems and Microsystems, Design and Manufacture”, McGraw Hill, 2002.
2. Mohamed Gad-el-Hak, “MEMS: Introduction and Fundamentals”, CRC Press, 2005.
3. Neelina H. Malsch, “Biomedical Nanotechnology”, CRC Press, 2005

### **Reference books:**

1. Marc J Madou, “Fundamentals of Microfabrication and Nanotechnology”, CRC Press, 2011.
2. Hari Singh Nalwa, “Encyclopedia of Nanoscience and Nanotechnology”, American Scientific Publishers, 2004.
3. ELLIS MENG “Biomedical Microsystems”, CRC Press, 2011
4. J. Joannopoulos, S.G. Johnson, J. Winn, R.D. Meade, Photonic Crystals: Molding the Flow of Light, 2nd ed., Princeton University Press, Princeton, 1995