EE 709: BIO-MEMS (3-0-0:3)

Introduction to Bio-MEMS and Microsystems

Biochips / Biosensors and device fabrication, Introduction to Cell biology, DNA & Protein sensor, Micro fluidics, Potential of Micro-fluidics, Microarrays and Lab-on-chip devices, Introduction to MEMS Design, Biochip Sensors & detection methods.

Micro-Fluidics

Basics of micro-fluidics, Low Reynolds's no. flows, Gas Flows, Liquid flows, surface tension, Electro-kinetic techniques like electrophoresis, Electro-osmosis and dielectrophoresi, Micro-fluidics for internal flow control (micro-pumps and micro-valves, device building and characterization), Micro mixer design and characterization, Micro-fluidic for Bio-sciences.

Microsystems-Fabrication Processes

Review of basic fabrication processes for silicon: Introduction to microelectronic fabrication, Optical lithography, Photo-resists, Non optical lithography techniques, LIGA processes. Design Considerations: Vacuum science and plasmas, Etching techniques, Physical vapor deposition (evaporation and sputtering), Chemical vapor deposition, Bulk and surface micromachining techniques.

Overview of Lab-On-Chip Technology: Biomedical & Chemical Sensors

Integrated gene analysis systems, Single cell and single molecule analysis using lab-on-chip techniques, Pharmaceutical analysis using lab-on-chip technology, Biomedical and chemical sensors: Electrochemical, Optical (labeled and unlabeled), Piezoelectric sensors, Chemo resistor, Chemo capacitor.

MEMS Packaging, Assembly & Test

Packaging: Encapsulation, Hermetic Encapsulation, Power, Data & RF Safety of Bio-MEMS, Assembly, Testing & calibration.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan, K. N. Bhat, V. K. Aatre, "Micro and Smart System", Wiley India.
2. N. Mahalik, "MEMS". Tata McGrawHill Education.
3. M. Gad-el-Hak, "Mems Application", CRC Press.
4. A. Liu, "RF-MEMS Switching and Integrated Switching Circuits Microsystems", Springer.