



SENSORS AND ACTUATORS

PROF HARDIK J PANDYA

Department of Electronic Systems Engineering
IISc Bangalore

PRE-REQUISITES : Basic Electronics

INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges

COURSE OUTLINE :

This course is designed with an aim of educating students in microtechnology and its use to fabricate sensors and systems. The students will have an exposure to sensors and its importance in the real world. The students will also be able to understand how to fabricate some of those sensors. They will have an exposure towards how to fabricate the sensors and its application in real world and understand and also learn modern day microsensors and micro actuators, how to simulate some of those sensors and characterise before fabricating it.

ABOUT INSTRUCTOR :

Prof. Hardik J. Pandya is an Assistant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is heading an Advanced Microsystems and Biomedical Devices Facility for Clinical Research as well as Biomedical and Electronic Engineering Systems Laboratory which focuses on the cutting-edge research on novel devices for solving unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc.

COURSE PLAN :

Week1: Basics of Energy Transformation: Transducers, Sensors and Actuators

Week2: Understanding of thin film physics: Application in MOSFET and its variants

Week3: Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)

Week 4: Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)

Week 5: Basic understanding of Photolithography for patterning layer. Detailed overview of Etching methods.

Week 6: Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors

Week 7: Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications

Week 8: Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications

Week 9: Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques.

Week 10: Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics

Week11: Understanding of Sensor Interfacing with Microprocessor to build electronic system

Week12: Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems