FABRICATION TECHNIQUES FOR MEMS-BASED SENSORS: CLINICAL PERSPECTIVE

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TYPE OF COURSE: Rerun | Elective | UG
COURSE DURATION: 12 weeks (26 Jul’21 - 15 Oct’21)
EXAM DATE: 24 Oct 2021

INTENDED AUDIENCE: Engineering Students, Faculty from Engineering Colleges
PRE-REQUISITES: Basic Electronics
INDUSTRIES APPLICABLE TO: Companies working in semiconductors and integrated circuits: Intel, AMD, Samsung, Texas Instruments, Analog Devices etc.

COURSE OUTLINE:
This course is designed with an aim of educating students in the area of 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. Several examples of engineering devices used in clinical research will also be covered. Class 10000 non-conventional clean room and some equipment within it will also be shown. Below are some of the course outcomes. Ability to understand microfabrication process; Understand sensors used in electronics and biomedical areas; Understand Clean Room (Class 1 to Class 10000); Understand Microengineering Technology; Design the process flow for fabricating microheater required in gas sensors; Design the process flow for fabricating forces sensors for biomedical application; Design microheater for gas sensors as per specifications; Design force sensors as per specifications; Understand fabrication of microfluidic platforms, micro-cantilevers, flexible force sensors, inter-digitated electrodes, polymer-glass bonding etc. for clinical research.

ABOUT INSTRUCTOR:
Dr. Hardik J. Pandya is a core faculty member in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is developing Advanced Microsystems and Biomedical Devices Facility for Clinical Research and Biomedical and Electronic (10-6-10-9) Engineering Systems Laboratory to carry out cutting-edge research on novel devices to solve unmet problems in biology and medicine.

COURSE PLAN:
Week 01: Introduction to microengineering devices and its applications
Week 02: Clean room, contaminants, wafer cleaning processes (DI water, RCA, metallic impurities, etc.).
Week 03: Introduction to the microheater, force sensors, microfluidic devices, its specifications, and applications.
Week 04: Masks: Types of masks, Types of Photoresists, Spin Coaters Lithography process: optical lithography, x-ray, and e-beam lithography, lift-off techniques, soft lithography, Use of resists (spin coating, positive and negative photoresists), photoresist pre-baking, exposure, and development.
Week 05: Etching: Isotropic/anisotropic, selectivity, wet and plasma assisted etching.
Week 06: Types of wafers and orientations. Techniques of metallization: PVD [(Sputtering – DC, RF and Magnetron), thermal evaporation, e-beam evaporation, Chemical Vapor Deposition: Dielectric films (Plasma Enhance Chemical Vapor Deposition (PECVD)), Atomic Layer Deposition
Week 07: Understanding and designing the process flow for fabricating microengineering devices. Process flow for microheater, force sensors, and microfluidic devices.
Week 08: Wafer dicing and bonding techniques. Microfluidic Chips
Week 10: Clinical Research: Problems and Solutions using Microengineering Device
Week 11: Visit to non-conventional Class 10000 Clean Room and discussing few equipment within.