

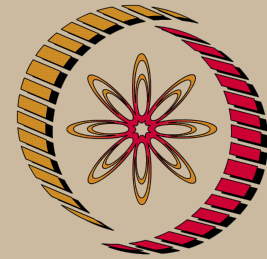
# NOC:BioMEMS and Microsystems - Video course

## COURSE OUTLINE

This course covers topics on Introduction to BioMEMS and microfluidics, Important materials for fabrication of BioMEMS platforms, Design of ISE. Finding selectivity coefficient for a mixed ion system., Introduction to Cell biology, Basic structure of DNA, Protein charging at different pH range, Amino acids, protein polymerization, Transcription, Translation, Micromixers: Design and mixing principles, Etching techniques, evaporation and sputtering & Photolithography techniques.

## COURSE DETAIL

Week. No	Topics
1.	<ul style="list-style-type: none"> <li>• Introduction to BioMEMS and microfluidics</li> <li>• Introduction to Bio nano technology, Biosensors, fluidics.</li> <li>• Introduction to device fabrication (Silicon and Polymers)</li> <li>• Introduction to device fabrication (Silicon and Polymers) continued..</li> <li>• Sensors, Transduction and Performance factors.</li> <li>• Sensors, Transduction and Performance factors continued</li> </ul>
2.	<ul style="list-style-type: none"> <li>• Important materials for fabrication of BioMEMS platforms</li> <li>• Introduction to silicon device fabrication</li> <li>• Some Fabrication Methods for soft materials</li> <li>• Transduction Methods. About cell potential and SHEs</li> <li>• Cell reaction, Nernst equation, Construction of Ion selective electrodes</li> <li>• Measurement and calibration of electrodes, ion-solvent interaction</li> </ul>



NP-TEL

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## Mechanical Engineering

### Coordinators:

**Dr. Shantanu Bhattacharya**  
Assistant Professor Department of  
Mechanical Engineering IIT Kanpur

3.	<ul style="list-style-type: none"> <li>• Design of ISE. Finding selectivity coefficient for a mixed ion system.</li> <li>• ISE continued.. Gas sensing electrodes</li> <li>• Applications for biosensors in Diagnostics , Zeta potential and the model for electrode.</li> <li>• Flow between two fixed plates. Comparison between plug like flow of electro-osmosis Vs parabolic flow.</li> <li>• Electro-kinetic flow in silicon channels. Design of electro-kinetic network.</li> <li>• Design of electro-kinetic network. Flow rate calculations. Selection of good materials, Streaming potential.</li> </ul>	
4.	<ul style="list-style-type: none"> <li>• Introduction to Cell biology, Basic structure of DNA</li> <li>• DNA hybridization, , DNA polymerization, PCR</li> <li>• Thermal cycle , Real Time PCR.PCR design</li> <li>• Electrophoresis, Gel and Capillary electrophoresis, Agarose</li> <li>• DNA microarrays (concepts, and utility). Affymetrix and Nanogen approaches in realization of micro-arrays.</li> <li>• DNA sequencing (Sanger's reaction). DNA nano-pores. DNA detection using Mechanical Cantilevers. Basics of Protein structure.</li> </ul>	
5.	<ul style="list-style-type: none"> <li>• Protein charging at different pH range, Amino acids, protein polymerization, Transcription , Translation</li> <li>• Antibody, Microencapsulation, Cyclic voltametry</li> <li>• Microfluidics, Similarity of Streamlines, Pathlines, Sreaklines and Timelines for a steady flow</li> <li>• Stress tensor. Viscosity. Newtonian, non-Newtonian fluids, Pseudoplastic, Dilatant, Bingham Plastic materials, Thixotropic fluids.</li> <li>• Flow over infinite plates, laminar and turbulent flow, Compressible and Incompressible flows</li> <li>• Flow over an infinite plate. Types of flows. Types of Fluids. Kinematics of fluids</li> </ul>	
6.	<ul style="list-style-type: none"> <li>• Micromixers: Design and mixing principales</li> <li>• Microvalves : Designing of pneumatic and thermo pneumatic valves.</li> <li>• Hydrogel based valves. Electrochemical valves.</li> <li>• Micropumps</li> <li>• Microelectronic-fabrication processes: Review of basic fabrication processes for silicon</li> <li>• Introduction to microelectronic fabrication,</li> </ul>	

Optical lithography, photo-resists.

7.

- Etching techniques, evaporation and sputtering.
- Vacuum science and plasmas, Theory of plasma
- Review of basic fabrication processes for polymers
- Polymer materials for microsystems, Polymeric micromachining technology.
- Bulk and surface micro machining, Replication technologies, laser machining,
- micro-stereo lithography, micro-molding, Assembly and packaging.

8.

- Photolithography techniques
- Functionality of Polymer PDMS used in micro technology
- Additive techniques, Thermal oxidation
- Single crystalline silicon, Subtractive technique.
- Overview of Lab-on-chip technology/ biomedical and chemical sensors, specific cases: Integrated gene analysis systems
- Chip technology (Integrated analysis of pathogenic bacteria), Electrochemical and optical (labeled and unlabeled).