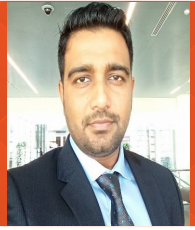

ELECTRONIC SYSTEMS FOR CANCER DIAGNOSIS

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PRE-REQUISITES : Basic Electronics/Microfabrication

INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges

COURSE OUTLINE :

This course is designed with an aim of educating students on the process flow for designing electronic systems for tissue-based cancer diagnosis. An exposure towards developing strategies to discriminate pathological cells from normal ones based on the electrophysiological properties of cells. Design and integrate biochip with electronic module for understanding the electro-thermo-mechanical properties of tissues. microtechnology and its use to fabricate sensors and systems. Students will have an exposure towards how to fabricate the sensors and its application in real world. Several examples of engineering devices used in clinical research will be also covered. Both conventional (class 1000) and non-conventional (class 10000) clean room and some equipment within it will also be shown. Below are some of the course outcomes.The first objective of this course is to understand cancer and its properties: Breast Cancer and Oral CancerThe second objective is to educate the students on the process flow for designing electronic systems for tissue-based cancer diagnosisThe third objective is to develop skills to design electronic systems for cytology-based studiesFourth objective is to develop skills to integrate biochips with electronic system for cancer diagnosisThe fifth objective is to understand how to work in a conventional (class 1000) and non-conventional (class 10000) clean room environment and understand several equipmentsThe final objective is to learn and understand in detail how to design electronic systems with the preexisting knowledge of basic electronics and to add on the 3D printing skills.

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 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. 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. He has taught Design for Analog Circuits, Analog Integrated Circuits, VLSI technology, and Semiconductor Devices to undergraduate and graduate students from Electronic Engineering, Instrumentation Engineering, and Applied Physics. He seek to understand and exploit novel ways of fabricating microengineering devices using glass, silicon, polymers and integrate with unusual classes of micro/ nanomaterials. His research interests include integrating biology/medicine with micro- and nanotechnology to develop innovative tools to solve unmet clinical problems. His current research focuses on flexible sensors for smart catheters, microsensors, microfluidic devices, and microelectromechanical systems, all lately with an emphasis on cancer diagnosis, therapeutics, e-nose, and biomedical device technologies. Before joining IISc, he worked as a postdoctoral scientist in the Department of Mechanical Engineering, Maryland Robotics Center, University of Maryland, College Park and in the Department of Medicine, Brigham and Women's Hospital–Harvard Medical School affiliated with Harvard-MIT Health Science and Technology. His work has resulted in several patents and publications. His work has been highlighted as "Breaking Research News" by The Physicians Committee for Responsible Medicine and has been featured on IEEE Transactions on Biomedical Engineering July 2016 issue cover image as well as IEEE TBME July 2016 feature article for the website and monthly highlights. The work on portable cancer diagnosis tool was also featured on Science Translational Medicine as an Editorial Choice, Breast Cancer Diagnosis, March 2016 and has been highlighted on CapeRay blog as "Biochips and Diagnostic tools" in April 2016. His work has been published in high-quality journals including Lab on a Chip, IEEE Transactions on Biomedical Engineering, IEEE Journal of Microelectromechanical Systems, Sensors and Actuators B, Biosensors and Bioelectronics, Nanoscience and Nanotechnology Letters, Sensors and Transducers, and Journal of Micromechanics and Micromachining.

COURSE PLAN:

Week 1 : Introduction to tissue related cancers (Focusing on Breast Cancer and Oral Cancer)Current Gold Standards

Week 2 : Understanding the change in cells or tissue morphology.Developing strategies for diagnosis based on Morphology changes.

Week 3 : Basics of tissue culture methods: Types of cell growth, Work area and equipment (Laminar flow hoods, CO2 incubators, Microscopes, Preservation, Vessels, Storage)

Week 4 : Maintaining cells (harvesting, media and growth requirements), Safety considerations, Cell counting

Week 5 : Understanding 3D Printing and its use as packaging and press-fit contacts in electronic systems for cancer diagnosis

Week 6 : Hands-on experience in designing a 3D printed casing for electronic system packaging

Week 7 : Process for designing electronic system for early diagnosis of cancer based on tissue images

Week 8 : Process for designing electronic systems for cytology studies (cell extraction, scanning and image capturing).

Week 9 : Electronic Systems integrated with Biochip for understanding change in electro-thermo-mechanical properties of tissue

Week 10 : Working in a Clean Room (non-conventional Class 10000) and inspection of Cancer Diagnosis Tool with a basic training of operating the tools

Week 11 : Hands-on experience on lithography

Week 12 : Hands-on experience on wet-bench