

BioMEMS and Nanotechnology

Course Code: BMED-6302

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Course Description:

This course is designed to introduce to students about the fundamentals of BioMEMS & Nanotechnology (NT) and their applications in biomedical and health sciences fields.

1) Introduction to BioMEMS

BioMEMS is the application of MEMS (Microelectromechanical Systems) technology in the fields of biomedical and health sciences. Due to their small size ($1\mu\text{m}\sim 1\text{mm}$), BioMEMS have the advantages of low weight, quick response, high throughput, high efficiency, requiring much less sample/reagent, and easy system integration.

BioMEMS found broad applications in disease diagnosis, prevention and treatment. Various bioMEMS products have been developed, such as microfluidic devices, μTAS (micro total analysis systems), lab-on-a-chip, DNA chips, micro drug delivery system, microsurgical tools, bio-sensors.

It teaches the underlying physical principles, methods of fabrication (hard and soft lithography techniques, thin-film deposition, 3D printing and materials printing) and applications of a broad range of mechanical and optical devices and systems as well as biomedical systems (BioMEMS).

2) Introduction to Nanoscience and Nanotechnology.

The 2nd part of this course is to provide an introduction to and an overview over nanotechnology (NT). It will show that the nano-regime is so different from other regimes because both classical and quantum effects can be active thus leading to unique properties of nanomaterials and -devices.

The followings will be provided in this section:

Features of nanostructures, Background of nanostructures: nanoparticle size and its specific area effects, Techniques of synthesis of nanomaterials: bottom-up vs. top-down strategies, Applications of nanomaterials and technologies, especially in the fields of biomedical and health sciences.

References:

1. Ting L.H. and Sniadecki N.J. (2011) Biological Microelectromechanical Systems (BioMEMS) Devices. In: P. Ducheyne, K.E. Healy, D.W. Hutmacher, D.W. Grainger, C.J. Kirkpatrick (eds.) *Comprehensive Biomaterials*, vol. 3, pp. 257-276 Elsevier.
2. *Bio-MEMS Technologies and Applications*, WJ Wang • S. A. Soper (eds), 2007, CRC Press
3. What is nanotechnology? J. J. Ramsden, *Nanotechnology Perceptions*, March 2005
4. *Nanotechnology and its Applications in Medicine*, A. P. Nikalje, *Medicinal Chemistry*, 2015, 5:2.