TEXAS A&M UNIVERSITY

SYLLABUS

Course title and number	ECEN 489: At the Interface of Engineering and Life Sciences
Term	Spring 2016
Meeting times and location	M/W 3:00 – 4:15 PM, HELD 109

Course Description and Prerequisites

Course Description: This course aims to provide a broad overview of electrical and computer engineering principles that are being applied to various areas in life sciences and introduce recent trends in interfacing engineering and various life science disciplines to address emerging grand challenges.

Prerequisites: None (suitable for junior and senior students, but not limited to)

Learning Outcomes or Course Objectives

Engineering principles are revolutionizing our understanding in various life science disciplines, from biological sciences to medical sciences. The objective of this course is to provide a broad overview of electrical and computer engineering principles, and more broadly engineering principles, that are being applied to various areas of life sciences. Recent trends in interfacing engineering and life science to address emerging grand challenge problems in health, bioenergy, and biosecurity will be introduced. This will be a team-taught course by several faculties.

Instructor Information

Name	Profs. Arum Han and Xiaoning Qian
Telephone number	979-845-6268
Email address	arum.han@ece.tamu.edu, xqian@ece.tamu.edu
Office hours	TBD
Office location	WEB 214H

Textbook and/or Resource Material

Handouts and Lecture Notes

Grading Policies

Assessment will be through homeworks. These homeworks will be a mixture of multiple-choice questions, short questions, mini-projects, and essays. There will be no exams.

Tentative Lecture Schedule and Instructor

Lecture 1 (1/20): Introduction - At the Interface of Electrical Engineering and Life Sciences (Xiaoning/Arum)

- Introduction to life science areas where electrical and computer engineering technologies have made - and will continue to make - impacts
- Sensing techniques, imaging techniques (MRI/CT/PET/Ultrasound), brain-machine interfaces, implantable devices (e.g. pace makers), defibrillators, etc.
- Bio-signal processing (EEG/ECG) and biomedical image processing
- Bioinformatics

Lecture 2 (1/25): Introduction to Biology and Medicine (Aniruddha Datta)

- How biological systems function (DNA, RNA, Cell, Protein)
- Traditional measurement technologies (DNA microchip, fluorescence technology, western blot, mass spectrometry, biosensors, etc)

Lecture 3 (1/27): Translational Science and Scientific Epistemology (Ed Dougherty)

Lecture 4 (2/1): Introduction to Medical Imaging (Jim Ji)

Lecture 5 (2/3): Medical Image Processing (Jim Ji)

Lecture 6 (2/8): Magnetic Resonance Imaging Part 1 (Steve Wright)

Lecture 7 (2/10): Magnetic Resonance Imaging Part 2 (Steve Wright)

Lecture 8 (2/15): Ultrasound Imaging Part 1 (Raffaella Righetti)

Lecture 9 (2/17): Ultrasound Imaging Part 2 (Raffaella Righetti)

Lecture 10 (2/22): Biomedical Signal/Image Processing (Xiaoning Qian)

Lecture 11 (2/24): Genomic Signal Processing: Microarray & Microarray Data Analysis (Ivan Ivanov)

Lecture 12 (2/29): Genomic Signal Processing: Current and Next-Generation High Throughput DNA/RNA Sequencing Technology, Hardware (Noushin Ghaffari)

Lecture 13 (3/2): DNA Sequence Assembly, Alignment, and Gene Prediction (Xiaoning Qian)

Lecture 14 (3/7): Structure and Function Prediction (Yang Shen)

Lecture 15 (3/9): Genomic Signal Processing: Classification and Prediction for Disease Prognosis and Diagnosis (Ulisses Braga-Neto)

Lecture 16 (3/21): Cancer and Genomics (Mike Bittner)

Lecture 17 (3/23): Genomic Signal Processing: TBD & Mini-Project (Ivan Ivanov)

Lecture 18 (3/28): Micro/Nano Systems Technology for Life Science (Arum Han)

Lecture 19 (3/30): Microfluidics for Next Generation High Throughput Assays (Arum Han)

Lecture 20 (4/4): Lab-on-a-Chip for Point of Care Diagnosis (Arum Han)

Lecture 21 (4/6): Biological Network (Xiaoning)

Lecture 22-25 (4/11, 13, 18, 20): **Recent Trends in Interfacing Electrical Engineering and Life Sciences**

- Enabling technology for personalized medicine
- Computational prediction of drug response, computational toxicology
- Brain activity maps
- Next-generation prosthetics (e.g. brain-machine interface)
- Microphysiological systems
- Enabling technologies in global and remote healthcare

Instructor Contact

Prof. Aniruddha Datta: datta@ece.tamu.edu

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