COURSE ANNOUNCEMENT
Spring 2019

DESIGN OF IMPLANTABLE MEDICAL DEVICES:
Neuromodulation

ECEN 4021 / ECEN 5021 – 3 Credit Hours
T-Th. 12:30 – 1:45, ECCR 135

Professor: Richard Mihran
Dept. of Electrical and Computer Engineering

The application of engineering in medicine has grown dramatically in recent years. As engineers have entered the clinical and experimental medical arenas, many new devices and procedures have emerged as alternatives to conventional surgical and pharmacological treatments. This course, which is offered for both undergraduate (ECEN 4021) and graduate (ECEN 5021) credit, presents general principles of biomedical engineering as they are applied to the development of a variety of specific implantable devices. It will not assume a background in physiology or biology on the part of the student, but will present relevant anatomy and physiology as part of the class discussion, which will be supplemented by a physiology reference text. Questions, exchanges of ideas, and active classroom discussion are encouraged throughout the course.

The course will be structured into several blocks covering some of the many ways that engineering is applied in medicine, with particular focus on engineering activity which is intended to achieve a therapeutic end. Such engineering almost invariably requires invasive procedures, and thus much of the engineering discussion will be directed towards identifying and studying important design principles of implanted devices, and the interface between the patient and the implanted device, with particular emphasis on neuromodulation. In the area of sensory and motor system implants, some of the applications to be addressed include visual cortex implants and retinal implant devices for restoring basic visual perception, cochlear implants to restore auditory perception, and implantable microstimulator devices for spinal cord and peripheral nerve stimulation and sensing to treat pain and restore control of paralyzed limbs and organs. Coverage of various sensor technologies will also be addressed. In each of these applications, you will learn the basic physiology of the relevant system to provide context for discussion of the design principles for specific types of devices. Techniques of invasive and non-invasive measurement of biological signals will also be introduced, and discussion of biomaterials and biocompatibility will be incorporated throughout the course where applicable in addressing the selection of materials and coatings for implanted devices.

Biomedical engineering is an emerging field which is highly interdisciplinary - engineers and scientists from all fields are therefore invited and encouraged to participate in this course. There are no formal prerequisites for this course.

The initial development of this course was supported in part by a grant from the Engineering Excellence Fund (EEF), whose support is gratefully acknowledged. For further information, you can email Dr. Mihran at mihran@colorado.edu.