

# BIOE - Bioelectronics

## **BIOE 454/554 Introduction to Bioelectronics (3 Credit Hours)**

Covers the electrical properties of cells and tissues as well as the use of electrical and magnetic signals and stimuli in the diagnosis and treatment of disease. Typical topics to be covered include basic cell physiology, endogenous electric fields in the body, electrocardiography, cardiac pacing, defibrillation, electrotherapy, electroporation, and electrotherapy in wound healing. In addition, ultrashort electrical pulses for intracellular manipulation and the application of plasmas to biological systems will be covered.

**Prerequisites:** PHYS 111N or higher and MATH 200 or higher

## **BIOE 554 Introduction to Bioelectronics (3 Credit Hours)**

Covers the electrical properties of cells and tissues as well as the use of electrical and magnetic signals and stimuli in the diagnosis and treatment of disease. Typical topics to be covered include basic cell physiology, endogenous electric fields in the body, electrocardiography, cardiac pacing, defibrillation, electrotherapy, electroporation, and electrotherapy in wound healing. In addition, ultrashort electrical pulses for intracellular manipulation and the application of plasmas to biological systems will be covered.

**Prerequisites:** PHYS 111N or higher and MATH 200 or higher

## **BIOE 754 Advanced Bioelectronics (3 Credit Hours)**

Bioelectronics is a new field encompassing both the science and technology of applying electrical stimuli to biological systems. This course covers the pulsed power technology that is required to generate electrical stimuli as well as the biological responses they evoke in cells and tissues. Particular emphasis is placed on the medical applications of bioelectronics, including tumor ablation, gene electrotransfer, wound healing, decontamination with cold plasma, and treatment of cardiac arrhythmias.

**Prerequisites:** ECE 454 or ECE 554 or BIOE 454 or BIOE 554

## **BIOE 755 Biomembranes and Ion Channels (3 Credit Hours)**

This course will give an overview of the structure and dynamics of biomembranes, the ion channels that are embedded in them, and the electrical properties of biomembranes. Topics include molecular dynamics modeling of biomembranes, membrane damage and repair, ion channel dynamics and their experimental assessment using patch clamping, and excitability in neurons and cardiomyocytes.

**Prerequisites:** ECE 454 or ECE 554 or BIOL 523

## **BIOE 854 Advanced Bioelectronics (3 Credit Hours)**

Bioelectronics is a new field encompassing both the science and technology of applying electrical stimuli to biological systems. This course covers the pulsed power technology that is required to generate electrical stimuli as well as the biological responses they evoke in cells and tissues. Particular emphasis is placed on the medical applications of bioelectronics, including tumor ablation, gene electrotransfer, wound healing, decontamination with cold plasma, and treatment of cardiac arrhythmias.

**Prerequisites:** ECE 454 or ECE 554 or BIOE 454 or BIOE 554

## **BIOE 855 Biomembranes and Ion Channels (3 Credit Hours)**

This course will give an overview of the structure and dynamics of biomembranes, the ion channels that are embedded in them, and the electrical properties of biomembranes. Topics include molecular dynamics modeling of biomembranes, membrane damage and repair, ion channel dynamics and their experimental assessment using patch clamping, and excitability in neurons and cardiomyocytes.

**Prerequisites:** ECE 454 or ECE 554 or BIOL 523

## **BIOE 890 Graduate Seminar (2 Credit Hours)**

This course can be taken either as an attendee or as a presenter. Attendees will receive a pass/fail grade based on whether they satisfy the attendance requirements. Presenters will receive a letter grade for their presentation from a committee of faculty in the audience.

## **BIOE 891 Graduate Seminar (1 Credit Hour)**

This course can be taken either as an attendee or as a presenter. Attendees will receive a pass/fail grade based on whether they satisfy the attendance requirements. Presenters will receive a letter grade for their presentation from a committee of faculty in the audience.