COURSE INFORMATION

Course Catalog Description:

This course covers the design of modern biomedical instruments including select diagnostic, assistive, therapeutic, prosthetic, imaging, and virtual devices and systems. Techniques for mechanical, electrical, and chemical sensor and transducer design; stimulation and measurement; data acquisition; digital signal processing; and data visualization will be examined.

Credit Hours: 3.0

Prerequisite: Graduate standing

Class Times: Thursdays 4:20-7pm

Class Location: Dragas Hall – Room 2113


Course Materials and Announcements will be posted on Blackboard (https://blackboard.odu.edu)

INSTRUCTOR

Dean J. Krusienski, Ph.D.

Office: 234 Kaufman Hall

Office Hours: R 3-4:20pm (also by appointment)

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POLICIES & GRADING

Course Grade

Exam I 20%
Exam II 20%
Project 30%
Assignments 30%
TOPICS

1) Introduction
   a. General Design Criteria
   b. Sensors and Transducers
   c. Electronics
   d. Signal Processing
   e. Visualization and Output Actuation
   f. Electrical Safety

2) Electrophysiological Techniques
   a. Measurements
      i. Electromyogram (EMG)
      ii. Electrocardiogram (EKG)
      iii. Electroencephalogram (EEG)
      iv. Other: Magnetoencephalogram (MEG), Electroneurogram (ENG),
          Electroretinogram (ERG)
   b. Interventions
      i. Cardiac pacemakers and defibrillators
      ii. Cortical and deep-brain stimulation
      iii. Functional electrical stimulation
      iv. Sensory prostheses

3) Biomechanical Techniques
   a. Measurements
      i. Cardiovascular: blood pressure, flow, and volume
      ii. Respiratory: gas pressure, flow, and volume
      iii. Musculoskeletal: force, displacement, motion
   b. Interventions
      i. Musculoskeletal: orthotics, prosthetics, structural implants
      ii. Cardiovascular: valves, pump oxygenators, artificial hearts, hemodialysis
      iii. Respiratory: ventilators
      iv. Drug-delivery and Infusion Systems
      v. Laser and Ultrasound: Lithotripsy
      vi. Radiofrequency ablation

4) Biochemical Measurements: pH, O2, CO2, pulse oximetry, blood glucose

5) Medical Imaging Systems
   a. Radiography and Computed Tomography
   b. Magnetic Resonance Imaging
   c. Positron Emission Tomography
   d. Ultrasound

6) Surgical Instruments and Radiation Therapy