BMED 3110 Quantitative Engineering Physiology Laboratory I

Credit: 1-3-2

Prerequisite(s): BMED 3400 and ECE 2025 and BMED 3100 (w/concurrency) and [BMED 2400 (w/concurrency) or CEE/ISYE/MATH 3770 (w/concurrency)]

Catalog Description
A hands-on lab providing an active learning team environment to reinforce selected engineering principles of physiology, emphasizing a quantitative model-oriented approach to physiological systems.

Textbooks
Directed reading of original literature

Objectives
To reinforce selected engineering principles of physiology in a hands-on active learning team environment. The specific objectives of the lab include:

- *Models*: The use of animal models to assess physiological function
- *Instrumentation*: Learn to use and build appropriate instruments to make relevant measurements. Understand limitations and fundamentals that will allow use of instrumentation for other applications.
- *Experimental design and data analysis:* Apply principles of statistical experimental testing and design to implement a coherent series of measurements and analyze them quantitatively.
- *Learning from failure:* Recognize shortcomings of instrumentation, experimental design, controls, materials, and procedures. Redesign experiment to overcome shortcomings.
- *Communication*: Both oral and written communication of lab exercises and peer-reviewed literature including oral, weekly progress reports, and lab reports and abstracts.
- *Teamwork*: Work constructively in a team environment. Maintain an effective work plan to meet milestone timelines.

Outcomes
At the end of the course, the students will:

1. develop the ability to read and apply knowledge gained from scientific literature (Program Outcomes 8 and 9)
2. design and conduct experiments involving biomedical sensors (Program Outcomes 2 and 4).
3. develop the ability to quantitatively measure, statistically analyze, and interpret experimental data from living systems (Program Outcome 4).
4. develop the ability to address the challenges associated with the interaction between living systems and non-living materials and systems when designing and conducting experiments (Program Outcomes 2 and 4).
5. complete a team-based experimental design project that will culminate in a poster presentation (Program Outcomes 4 and 6).

Topical Outline

Week 1-3: Heart - Gross Anatomy and Sound Analysis

Objective: Develop an automated methodology to determine abnormalities in heart sounds *(Instrumentation, and data analysis).*

Deliverable: Presentation/demonstration

Week 4-5: Mechanical Testing

Objective: Understand importance in standardization in testing *(Instrumentation, experimental design, and data analysis).*

Deliverable: Lab report

Week 6-7: Frog Muscle

Objective: Determine sources of variability in for *in situ* measurement. Frog muscle to determine length-tension / force-velocity relationships *(Models, Instrumentation, Experimental design and data analysis).*

Deliverable: Research report

Week 8-9: Earthworm Muscle

Objective: Determine utility of earthworm as a model of smooth muscle interacting with known / unknown chemicals *(Models, Instrumentation, Experimental design and data analysis).*

Deliverable: Research report

Week 10-12: Diffusion/Osmosis

Objective: Understand and apply Fick's law to determine and implement improvements in experimental set-up *(models, instrumentation, learning from failure, experimental design and data analysis).*

Deliverable: Pre-lab presentation; post lab report

Week 12-16: Final Project

Objectives: Complete an open ended team-based project *(models, instrumentation, learning from failure, experimental design and data analysis).*

Deliverable: Poster presentation, Research Report