BMED 3100 Systems Physiology

Credit: 3-0-3

Prerequisite(s): BIOL 1510 (minimum grade of "C")

Catalog Description
An introduction to human physiology emphasizing biomedical engineering approaches to the understanding of basic organ function, disease states, and medical intervention.

Text
B. Koeppen and B. Stanton, *Berne and Levy Physiology*, 6th Edition, Elsevier, 2008.

Objectives
The goals of this course are to introduce students to the major organ systems and the corresponding function(s). The concepts of homeostasis and the means by which several organ systems combine to maintain homeostasis will be discussed. In addition, the students will apply engineering skills to solving physiological problems.

Outcomes
By the end of this course the students will:

1. become familiar with anatomical structures and physiologic functions of major organ systems (Program Outcome 1)
2. understand homeostatic processes and integration of human organ systems (Program Outcome 1)
3. develop quantitative skills for analyzing physiologic processes in both normal and disturbed states (Program Outcomes 1 and 2)
4. develop the ability to simplify and model physiologic processes (Program Outcomes 1, 2, and 8)
5. become familiar with medical terminology as it relates to physiology, pathophysiology, and biomedical engineering (Program Outcomes 1, 2, 5, 6, 7, and 9)
6. become familiar with patient variability and its impact on biomedical engineering challenges (Program Outcomes 1, 7, and 9)
7. develop the ability to identify problems, analyze, and interpret data from medical case studies (Program Outcomes 2, 6, and 9)
8. understand the challenges associated with the interaction between non-living materials and living systems using real-world biomedical problems (Program Outcomes 7 and 9)
9. develop the ability to read and critique scientific / medical literature (Program Outcomes 1, 2, and 9)
10. identify and discuss ethical issues associated with medical intervention and modern biomedical engineering applications (Program Outcomes 5 and 9)

Topical Outline

1. Tissues of the body
2. Homeostasis
3. Physiologic control systems
4. Introduction to pathophysiology
5. Cell membranes and transport
6. Body compartments and fluids
7. Diffusion, osmosis, and tonicity
8. Action potentials and synapses
9. Sensory physiology
10. Central nervous system
11. Autonomic nervous system
12. Muscle physiology
13. Neuromuscular integration and movement
14. Hormones and chemical messengers
15. Endocrine glands
16. Heart physiology
17. Vasculature and blood
18. Blood pressure
19. Respiratory function
20. Gas transport
21. Renal function
22. Fluid balance
23. Digestion and metabolic rate
24. Control of energy and temperature
25. Selected topics and case studies in integrative physiology, pathophysiology, and biomedical engineering applications, e.g.,
    a. Inflammation/immune function
    b. Exercise physiology
    c. Sleep physiology
    d. Neuromuscular integration
    e. Tissue engineering
    f. Biomaterial implants
    g. Cell /organ transplantation
    h. Neural system injury
    i. Neurodegenerative diseases
    j. Aging
    k. Diabetes
    l. High blood pressure
    m. Atherosclerosis and stents