ENBE 415
Bioengineering of Exercise Response
3 Credit Hours

Description:

Exercise physiology in quantitative terms. Modeling and prediction of cardiovascular, respiratory, thermoregulatory, biomechanical, and metabolic aspects of human exercise responses.

Instructor: Dr. Arthur T. Johnson

Textbook: Johnson, A.T., 191 Biomechanics and Exercise Physiology, John Wiley and Sons, New York
ISBN 0-471-85398-4

Prerequisites: Differential equations or permission of department.

Course objectives:

At the end of this course you should be able to:

1. be familiar with physiological adjustments to exercise in humans.
2. be able to predict quantitatively physiological parameters important to design of life support systems, protective equipment, and exercise testing.
3. be familiar with modeling of human physiological systems.
4. be familiar with the terminology of human exercise.

Prerequisite courses in mammalian physiology or exercise physiology are desirable. This course will use math through differential equations, and engineering analysis procedures. It will be helpful if the student is familiar with mathematical model formulation.

Final grades will be determined from four equally weighted components:

1. weekly homework problems 25%
2. midterm examination 25%
3. final examination 25%
4. model 25%

Students in the class will be assigned to groups. Homework problems and semester models will be completed and graded on a group basis. Each group member should feel responsible that all other group members perform to their maximum abilities.

Homework problems will be assigned throughout the semester. Each person will be responsible for knowing how to solve each of the problems. Homework problems may be submitted in neat handwriting in ink. Homework submissions written in pencil will not be accepted.

Each group must develop or implement a computational model of exercise involving one or more of the following:

- metabolism
- ergonomics
- work
- heat/thermoregulation
- respiration
- cardiovascular responses
- biomechanics

Each model submission must include:

- block diagram
- computational program
- results
- documentation

It must be possible in your model to change relevant parameters and see the results change. The model can be an original model or can be based on one appearing in the book or in the literature. The model will be due at the end of the semester.

There will be two class exams, covering chapters 1-3 and 4-5.

At the end of the semester, students will be asked to evaluate the contributions of each group member. Based upon these peer evaluations of group contributions, adjustments of plus or minus one letter grade may be made in an individual student's final grade.

If you have a documented disability, and wish to discuss academic accommodations with me, please contact me (301-405-1184) as soon as possible.

Cyberinfo:
Course information can be found at http://www.ajconline.umd.edu. You will need an email address at the University of Maryland to access this information. Book errata and supplemental material can be found at http://www.bre.umd.edu/johnson.htm.

Cell phones are not welcome in class. If you have one, please make sure it does not ring during class time.

ENBE 415 SYLLABUS

Class	Date	Topic	Text Pages
1	January 28	Introduction/General Exercise Limits	
2	January 30	Exercise Limits/Maximum $\dot{V}O_2$	1-30
3	February 4	Library: Icarus' Children	
4	February 6	Review Chap 1	31-54
5	February 11	Biomechanics	54-70
6	February 13	Biomechanics/Library: Living Body Muscle Power	
7	February 18	Blood and Vessels	71-89
8	February 20	Heart Mechanics & Control/Library: Living Body Two Hearts	89-112
9	February 25	Models/Heart Models	112-131
10	February 27	lab: exercise stress test	
11	March 4	Cardiovascular Review	131-149
12	March 6	Respiratory Anatomy/Library: The Artificial Heart	166-179
13	March 11	Respiratory Gas Exchange	179-200
14	March 13	Respiratory Mechanics	200-222
15	March 18	Respiratory Control/Exercise/Optimization	222-271
16	March 20	Respiratory Models/Library: Living Body Breath of Life	271-341
		SPRING BREAK (3/24-3/30)	
17	April 1	Respiration Review	
18	April 3	Mid Term Exam	
19	April 8	Heat Exchange	361-380
20	April 10	Evaporation, Heat Production, Heat Storage Library: Living Body Skin Deep	381-403
21	April 15	Thermoregulation	403-418
22	April 17	Thermoregulatory Models/Library: Living Body, Hot and Cold	419-435
23	April 22	Body Temperature Response	436-446
24	April 24	Thermoregulation Review	
25	April 29	Integrative Models	
26	May 1	Integrative Models	
27	May 6	Integrative Models	
28	May 8	Integrative Models	
29	May 13	Integrative Models	