

BMEN 3330 Syllabus

Course Information

Engineering Physiology of the Human Body
BMEN 3330
Fall 2016

Section	Day	Time	Room	Instructor
.001	Mon/Wed	8:30 - 9:45am	JSOM 11.202	Hays
.501	Tues/Thurs	5:30 - 6:45 pm	CB3 1.308	Hayenga

Professor Contact Information:

Dr. Heather Hayenga
Office location: BSB 12.826
Office phone: 972-883-3558
Office hours: Wed 10:00 – 11:00 am
Email: heather.hayenga@utdallas.edu

Dr. Seth Hays
Office location: BSB 14.542
Office phone: 972-883-5236
Office hours: Tue 9:00 – 10:00 am
Email: seth.hays@utdallas.edu

Teaching Assistant:

Sarah Tindle
Office location: BSB 13.685
Office hours: Tues 2:30 – 4:30 pm
Email: sxt160930@utdallas.edu

Course Pre-requisites, Co-requisites, and/or Other Restrictions

BIOL 2311

Course Description

This course will provide a basic overview of human physiology from an engineering perspective. This course will require you to use information drawn from other disciplines such as general cell biology, chemistry, and basic anatomy. You will learn about Engineering principles and applications related to cell biology and its chemistry, cell membrane biophysics, and properties of excitable tissues. You will understand systems physiology including cardiovascular, respiratory, gastric, endocrine, nervous system, sensory, motor, and reproduction. Studying the normal functioning of an organism and its disease state is essential to understanding ways in which bioengineers can provide assistance through the design of biomaterials and devices.

Student Learning Objectives/Outcomes

Program Educational Objectives (PEOs):

Biomedical Engineering Bachelor's graduates are expected to attain the following Program Educational Objectives within a few years after graduation:

- Careers that lead to leadership roles in biomedical engineering or related fields **OR**
- Gain admission to graduate, professional, or health related programs

Course Learning Objective / Student Outcomes:

Course Learning Objective (CLO)	Student Outcome (SO)
1. Apply engineering concepts to physiological systems.	A) An ability to apply knowledge of mathematics, science, and engineering.
2. Design an engineering system to study biophysical processes within realistic and ethical constraints.	C) An ability to design a system component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. Ability to research relevant progress related to an application of physiology.	I) A recognition of the need for, and an ability to engage in life-long learning.
4. Identify diseases or disorders that may be solved using modern engineering tools that couldn't be solved before.	J) A knowledge of contemporary issues.

Required Textbooks and Materials

Human Physiology: An Integrated Approach. 6th Edition. Dee Unglaub Silverthorn ISBN: 0-321-81082-1

Advice:

This course is very fast-paced and challenging. You are highly encouraged to read the chapters on the material before attending the lectures

Assignments & Academic Calendar

Wk 1	Aug 22/23	M/T	Introduction to Physiology (Chapter 1)
	Aug 24/25	W/Th	Molecular Interactions (Chapter 2)
Wk 2	Aug 29/30	M/T	Compartmentation: Cells and Tissues (Chapter 3)
	Aug 31/ Sept 1	W/Th	Energy and Cellular Metabolism (Chapter 4)
Wk 3	Sept 5/6	M/T	Labor Day – NO CLASS for BOTH sections
	Sept 7/8	W/Th	Membrane Dynamics (Chapter 5)
Wk 4	Sept 12/13	M/T	Communication, Integration, and Homeostasis (Chapter 6)
	Sept 14/15	W/Th	Introduction to the Endocrine System (Chapter 7)
Wk 5	Sept 19/20	M/T	Exam I (Chapters 1-6)
	Sept 21/22	W/Th	Neurons: cellular and Network Properties (Chapter 8) Outline for Final Project Report Due – by Midnight
Wk 6	Sept 26/27	M/T	The Central Nervous System (Chapter 9)
	Sept 28/29	W/Th	Sensory Physiology (Chapter 10) - Hays
Wk 7	Oct 3/4	M/T	Efferent Division: Autonomic and Somatic Motor Control (Chapter 11) - Hays
	Oct 5/6	W/Th	Muscles (Chapter 12) - Hays
Wk 8	Oct 10/11	M/T	Integrative Physiology I: Control of Body Movement (Ch 13) - Hayenga
	Oct 12/13	W/Th	Cardiovascular Physiology (Chapter 14) - Hayenga
Wk 9	Oct 17/18	M/T	Exam II (Chapters 7-13)- Hayenga
	Oct 19/20	W/Th	Cardiovascular Mechanics (Chapter 14 and 15) - Hayenga
Wk 10	Oct 24/25	M/T	Blood Flow and the Control of Blood Pressure (Chapter 15) - Hayenga
	Oct 26/27	W/Th	Blood (Chapter 16) - Hays Draft of Final Project Report Due – by Midnight
Wk 11	Oct 31/ Nov 1	M/T	Mechanics of Breathing (Chapter 17)
	Nov 2/3	W/Th	Gas Exchange and Transport (Chapter 18)
Wk 12	Nov 7/8	M/T	The Kidneys (Chapter 19)
	Nov 9/10	W/Th	Exam III (Chapters 14-18) - Hayenga
Wk 13	Nov 14/15	M/T	Integrative Physiology II: Fluid and Electrolyte Balance (Ch 20)
	Nov 16/17	W/Th	The Digestive System (Chapter 21)
	Nov 20	Sun	Final Project Due – by midnight
Wk 14	Nov 21/22	M/T	Thanksgiving Break – NO CLASS for BOTH sections
	Nov 23/24	W/Th	Thanksgiving Break – NO CLASS for BOTH sections
Wk 15	Nov 28/29	M/T	Metabolism and Energy Balance (Chapter 22)
	Nov 30/ Dec 1	W/Th	The Immune System (Chapter 24)
Wk 16	Dec 5/6	M/T	Selected Project Presentation Day
	Dec 7/8	W/Th	Exam IV(Chapters 19-24)
Wk 17	Dec 12-15		

Final Project Topics:

You will design a system, using engineering components, to replace the function of one of the systems listed below. This must be an *original design*, not a description of an existing solution. Make sure to consider all of the functions performed by this system, and design your solution to compensate for all of these processes. The system should be designed using existing components. You will write a report which includes potential diseases that would warrant the need to replace the organ, your proposed design and the specific features of the components.

1. The lungs
2. The musculature of the lower leg
3. The femur
4. The eye
5. The kidney
6. A segment of the median nerve
7. A section of skin
8. The heart
9. The tongue

Alternatively:

1. Design a metabolomic array to diagnose a chronic pain.
2. Develop a gene therapy treatment for muscle dystrophy.
3. Propose a device, material or method that can release oxygen in response to hypoxia.
4. Develop a method to provide cells with more ATP when in need.
5. Propose a method or material that can to restore the insulation of axons in patients with multiple sclerosis.
6. Develop an intracellular sensor that can be used to visualize protein-protein interactions *in vitro*.
7. Propose a closed-loop mechanism to help people with neurogenic bladders.
8. Engineer a system that would sense a loss of equilibrium in an elderly patient and restore posture.
9. Develop a mechanism for *in situ* bone repair of fractures.
10. Design a device that can provide real-time information on caloric input/output.
11. Propose a device that can improve oxygen delivery to patients with emphysema.
12. Develop a bone-integration method to permanently implant limb prosthesis.
13. Replace the coil electrode in the artificial cochlear implant with an implanted Nano-device.
14. Engineer a cell with double capability for oxygen/CO₂ transport.
15. Develop a way to boost the immune system against specific viruses.
16. Design a vascular stent that can respond to autonomic regulation.
17. Propose a test for most major genetic disorders in pregnant women.
18. Engineer a device that can be swallowed and perform a tumor resection in the intestine.
19. Develop a system that would assist in heat dissipation to prevent heat strokes.

Clicker Quizzes:

This class will require the use of a clicker. Pop quizzes will be given in class via the use of clickers. Questions will be straightforward to gauge the preparedness of the students. Class summary results are displaced graphically, providing students and the instructor to gauge as to how well the class is grasping the material.

Grading Policy

The course will contain four exams (20% each, 80% total), participation - random pop quizzes, engagement and questions (5%), project (15%).

1. Exams

- a. No phones, notes, computers, or any aids will be allowed during the exam.

2. Final Project

- a. The elements to the final project are:
 - i. A maximum of 5-page (minus references) research proposal.
 1. Single-spaced, 12-point Times New Roman Font, with citations in Science, Nature, or IEEE format, with normal 1" margins. Include a figure of the overall design.
 2. Please select from the list above. If you want to have a different topic, you will need approval.
 - ii. *If your written report is selected* by the instructor, you will be asked to prepare and present an oral ~7 minute slide show on your research plan. This will count as extra credit and is worth up to 5% on your semester grade. If not selected, you can still receive up to 2% extra credit by asking intelligent questions after the presentation.

Grade	Points	Grade	Points	Grade	Points	Grade	Points
A+	97-100	B+	87-89.9	C+	77-79.9	D+	67-69.9
A	93-96.9	B	83-86.9	C	73-76.9	D	63-66.9
A-	90-92.9	B-	80-82.9	C-	70-72.9	D-	60-62.9
						F	<60

Course & Instructor Policies

Late/Missed Work

Late or missed work will not be accepted unless University-approved excuse is received within one week of the assignment.

Attendance and Drop Policy:

No mandatory attendance. If you are dropped from this class for non-payment of tuition, you may secure an Enrollment Loan through the Bursars Office. You may not continue to attend class until your Enrollment Loan has been applied to outstanding tuition fees.

Academic Dishonesty:

Academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form at The University of Texas at Dallas. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. (see Regents Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2., Subdivision 3.22).

Disability Services

Disability services are offered to students who have or feel they may have a disability. Please visit the Student AccessAbility at UTD (<http://www.utdallas.edu/studentaccess/>) to learn more about physical, mental or sensory disabilities and how to get documentation for special requests.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.