

BME 3032: Biomedical Engineering Transport
Spring 2008 (M-W-F 1:00-1:50 pm)

Catalog Description

Basic principles of heat, mass, and fluid transport. Derivation of basic equations and simplification techniques. Applications to physiological systems, artificial organs and pharmacokinetics. Prerequisites: BSC 1010, CHM 1046, MAP 2302, PHY 2049, BME 2740

Major Topics:

1. Introduction to transport processes in biological systems
2. Molecular transport of heat, mass, and momentum in one-dimension.
3. Analogies of heat, mass, and momentum transport.
4. Convective transport of heat, mass, and momentum in laminar and turbulent flow.
5. Modeling of physiological processes.
6. Rheology and flow of blood.
7. Use of differential equations and Matlab programming to model physiological systems.

Textbook(s):

1. *Introduction to Transport Phenomena* by: W. J. Thomson. Prentice Hall PTR, ISBN:0-13-454828 (**required**)
2. *Transport Phenomena in Biological Systems* by: Truskey, Yuan and Katz, Pearson Prentice Hall, ISBN: 0-13-042204-5 (**recommended**)

Contact Hours per week:

Lecture: 2.30 hrs (M-W-F 1:00-1:50 pm)

Office hours:

12:00 pm to 1:00 pm (M-W) or by prior appointment only.

Contact details:

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Course outcomes:

By the end of the course, the student should be able to:

1. Formulate, derive and solve differential equations that describe the energy, mass, and momentum transport phenomena.
2. Understand the physics of the transport phenomena in general, and apply appropriate mathematical tools to solve the problems.
3. Apply numerical techniques in solving complex differential equations associated with transport problems.
4. Apply the principles of transport phenomena in physiological systems as well as in designing artificial organs such as kidneys, lungs, etc.
5. Learn to communicate effectively, which will be developed through active participation in class discussions as well as their assignments.

General:

I. Policy regarding student misconduct: Students at Florida International University are expected to adhere to the highest standards of integrity in every aspect of their lives. Honesty in academic matters is part of this obligation. Academic integrity is the adherence to those special values regarding life and work in an academic community. Any act or omission by a student which violates this concept of academic integrity shall be defined as academic misconduct and shall be subject to the procedures and penalties established by the university. **Students violating academic integrity will receive a failing grade for the course and the incident will be forwarded to Student Academic Affairs.**

Academic misconduct includes, but is not limited to:

1. Copying homework
2. Copying work on exams either in-class or take-home
3. Copying of projects and/or



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4. Plagiarism (i.e. using others' ideas and words without clearly acknowledging the source of that information. This includes, but is not limited to, (i) internet, (ii) textbooks, (iii) journals, and/or (iv) any other material that is not your own work)

It is the responsibility of students to report misconduct, which may include another student copying from your, or another student's exam, homework, projects or any other assignment. Therefore, if a student copies from you, it is your responsibility to report it; otherwise you are responsible. Under no circumstances will any student be permitted to leave and return to the classroom during an exam.

II. Turn OFF your cell phones/pagers during the entire period of your class or exam.

III. Policies regarding exams, projects, or assignments:

1. No excuses (such as car broke down, not prepared for exam, etc.) will be considered for not taking an exam or requesting a separate re-examination for individual students.
2. Late entry for in-class exams will not be given extra time.
3. Late submission of projects, assignments, or take-home exams will affect your grades to a good extent (NO excuses).
4. For any questions please talk to the Professor directly and do not discuss amongst fellow students for homeworks, exams, projects, and/or assignments.

Point Distribution:

Pop Quiz	10 %
Homeworks	10 %
Exam I	25 %
Final Exam	30 %
Project + Presentation	25 %

Active participation means genuine effort in attempting to answer questions and involve in open discussions between Professor and students. The students will be graded for their active participation in the class discussions. Homeworks will be graded and will contribute for your final grade. Exams I, and II (final) can be in-class, and/or take-home exams. Term project will be group and will also require an oral presentation in-class.

NOTE:

You are expected to know how to solve differential equations and use Matlab to solve problems in assignments, exams, and projects.

Tentative Course Outline

<u>Session</u>	<u>Topics</u>	<u>Chapters</u> ⁺
1	Intro to bio-transport eng basic principles	--
2,3	Definition of transport processes (convection & diffusion) Examples	Chapter 1, 2 <i>Chapter 1</i>
4,5,6	Analogies of heat, mass, momentum transport	Chapter 2
6,7,8	Formulation of conservation equations in 1-D + Solve problems	Chapter 2 <i>Chapter 2</i>
9,10	One-dimensional molecular energy transport	Chapter 3
11	Examples : Bio-based	--
12-14	Fluid Statics & Kinematics	<i>Chapter 2</i>
15	Problem solving	Chapter 4
16-17	Molecular momentum transport	Chapter 5
18	Problem solving	Chapter 5
19	Problem solving – bio-based	<i>Chapter 2</i>
20	EXAM I	--
21-23	Non-newtonian rheology, rheology of blood	<i>Chapter 2</i>
24-26	Molecular mass transport Examples	Chapter 4 <i>Chapters 6</i>
27	Problem solving	
28-29	Convective momentum transport in laminar flow	Chapter 8 <i>Chapter 2</i>
30-31	Convective energy transport in laminar flow	Chapter 8
32-34	Using Transport Equation Tables & Problem Solving	Notes
35-37	Project Presentation	
38	FINAL EXAM	

⁺Chapters written in normal font are from Thomson
Chapters written in italics are from Truskey et al