

BME4632 Biomedical Transport Phenomena

Class Periods: MWF, Period 3, 9:35 – 10:25 am

Location: Online

Instructors: W. Lee Murfee, wmurfee@bme.ufl.edu, 352-294-8813

Office Hours: Thursday 11:00 AM – 1:00 PM + Thursday 4:00 – 5:00 PM

(Note: Student's will be polled in the beginning of the semester regarding preferred office hour times. Based on the student input, the schedule for office hours might be changed. Also, students can always contact Dr. Murfee via email and set up additional meeting times. Dr. Murfee will do his best to be available to students.)

Class Sessions: Class will be online via Zoom sessions.

(Zoom link: <https://ufl.zoom.us/j/95459324768>)

(Zoom Meeting ID: 954 5932 4768)

Course Description

Introduction to and application of the concepts of momentum, mass and thermal energy transport in the context of problems of interest in biomedical sciences and engineering. Macroscopic and microscopic analysis of momentum, mass, and thermal energy transport problems in biomedical systems.

Course Pre-Requisites / Co-Requisites

BME 3060 (Biomedical Fundamentals) with minimum grade of C.

Course Specific Aims

1. Students will understand the relationship between blood flow and physiological function and dysfunction in the surrounding tissues and organs.
2. Students will be able to solve transport equations using methods from advanced mathematics.
3. Students will become comfortable applying fundamental biotransport fundamentals to the design and interpretation of experiments.

Professional Component (ABET):

This course will prepare students to apply advanced mathematics to solve problems at the interface of engineering and physiology. Specific to the UF BME program educational outcomes, students will gain experience applying a knowledge of biotransport fundamentals to solving open ended biomedical engineering challenges related to therapeutic design and basic science discovery.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. an ability to apply knowledge of mathematics, science, and engineering to identify, formulate, and solve engineering problems	High
3. an ability to develop and conduct appropriate experimentation and testing procedures, and to analyze and draw conclusions from data	Medium
6. an ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately	Low

*Coverage is given as high, medium, or low.

Required Textbooks

G.A. Truskey, F. Yuan, D.F. Katz, *Transport Phenomena in Biological Systems*, 2nd Edition. Pearson Prentice Hall, 2009. ISBN: 0-13-156988-8.

Course Topics (see course schedule for specific class dates, assignments, presentations and exams)

Introduction to biotransport problems
Diffusion and convection
Blood flow through the cardiovascular system
Fluid and mass transport: conservation laws and basic equations
Pathological scenarios associated with altered blood flow
Rheology of blood
Parallel-plate and microfluidic flow systems
Dimensional analysis and scaling
Steady diffusion
Cell adhesion
Facilitated and active transport across the cell membrane
Intracellular signal transduction
Transport in porous media
Pharmokinetics
Drug delivery
Cancer metastasis and anti-cancer therapy

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is expected and noted by the instructor each class. Excess absences, class disruption, and lack of engagement will influence the class participation grade. Class participation constitutes 15% of the total course grade and will be based on attendance and the submission of in class activity deliverables. All assignments are due at the beginning of class. Late work will not be accepted. However, if there are any issues, just let me know. I understand the current scenario and will work with each student to accommodate any special circumstances. Exams may be made up if extenuating circumstances are discussed beforehand or due to medical/family emergency.

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework Assignments	25%
Midterm Exams (2)	30%
Final Exam	25%
Paper Presentation	5%
Class Participation	15%
TOTAL	100%

Grading Policy

Final grades will be influenced by the class average, the guiding grade range below, and the instructor's discretion.

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
≥92	90-91	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	< 60

This course is not a *critical tracking course*. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Online Class Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students

who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/students/get-started/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.a.a.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.a.a.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.
<https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.