

BME 345: Biotransport Phenomena (4 credits)

West Chester University of PA, Spring 2022

Instructor	Dr. Zhongping Huang
Office Room	SECC 304
Office Phone	610 – 436 – 6932
Email Address	zhuang2@wcupa.edu
Office Hours	Monday 10 am – 12 pm, Tuesday 3:30 pm – 4:30 pm, Thursday 4 pm – 5 pm, or by appointment
Class Meeting Time	Monday 2 – 2:50, TTR 2 – 3:15
WCU Emergency Number	610 – 436 – 3311

TEXTBOOK: Fundamentals of Momentum, Heat, and Mass Transfer, James Welty, Gregory L. Rorrer, David G. Foster. 7th Edition, Wiley 2019.

OTHER READING MATERIALS:

M.J. Moran & H.N. Shapiro, “Fundamentals of Engineering Thermodynamics”, 9th Edition, John Wiley & Sons, 2020.

COURSE DESCRIPTION: This course provides the fundamental biomedical applications of fluid mechanics, heat, and mass transfer. Topics include: the principles and applications of biotransport fundamentals, fluid mechanics, macroscopic biotransport, 1-D steady and unsteady state transport, and general multidimensional microscopic transport.

PREREQUISITES: [BIO 265](#), [BME 310](#), and [MAT 315](#)

COURSE STUDENT LEARNING OUTCOMES:

Upon completion of this course, students will be able to:	As measured by:
1. apply the fluid mechanics, heat, and mass transfer to general engineering solutions	Semester Exams, Quizzes, Homework Assignments
2. apply these principles to the solutions of biomedical engineering problem	Semester Exams, Homework Assignments
3. analyze and design a simple biomedical engineering component/system	Homework Assignments, projects

Program Goals / ABET Student Outcomes:

This course will contribute to developing the following program goals / ABET student outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics, (Homework, exams, project)
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (Homework, exams, project)

ATTENDANCE POLICY: While I do not grade on attendance, attendance is crucial to success in this course. Come to class prepared to learn and take good notes. Please refrain from answering phone calls or text messaging while in class. Please set all electronics to silent or “vibrate mode” and put them away.

D2L: All course materials including homework assignments and solutions, grades, and important communications will be posted on WCU’s D2L website at <https://d2l.wcupa.edu>. *You may want to set D2L to notify you when new content is posted.*

EVALUATION & GRADING

Homework: Homework assignments will be announced in class and posted on the course website hosted on D2L with the due date and time noted. Homework assignments are to be submitted electronically through D2L course website or in class submission, typically one week after giving assignments.

Late homework will not be accepted unless prior permission is granted. No homework assignments are accepted after the graded assignments have been returned. If you want your homework grade reconsidered, you must see me within one week of the original grade being given.

Quizzes: Quiz will be given without notice during the semester. Typically, a quiz will cover last lecture contents. The quiz problem solutions will be posted in D2L after the quiz was graded. Students who are not able to attend a quiz (medical or other emergency) must notify the instructor by email before the quiz.

Project: An end-semester project will be assigned to each student. The project is typically a design of a biomedical component or a system using what they learn from the principles of biotransport. The final project will be submitted in the technical report format. It is to be submitted electronically through D2L course website or in class submission, typically by the end of the last week of semester.

Exams: The two midterms and the final exam are closed-book tests for which you are only required to bring a calculator and a pen. The final exam covers all course material during the entire semester (that is, it is a cumulative test). All tests use the problem format or short essay. Students who are not able to attend a test (medical or other emergency) must notify their instructor by email before the test.

Make-up Policy: In the case of a university sanctioned event, please schedule a makeup exam/quiz with me in advance. If you should miss an examination/quiz due to a certifiable emergency or illness, please notify me as soon as possible providing appropriate documentation and either a makeup exam/quiz will be arranged or your final exam score will replace the missed exam. All unexcused absences will result in a grade of zero.

Evaluation: Your grade in the class is calculated as follows:

Homework: 5%

Quizzes: 5%

Two Middle Term Exams (25% each): 50%

Final Exam: 25%

Project: 15%

A letter grade will be assigned based on performance in the course according to the following scale:

Grade	Quality Points	Percentage Equivalents	Interpretation
A	4.00	93-100	Excellent
A-	3.67	90-92	
B+	3.33	87-89	Superior
B	3.00	83-86	
B-	2.67	80-82	
C+	2.33	77-79	Average
C	2.00	73-76	
C-	1.67	70-72	
D+	1.33	67-69	Below Average
D	1.00	63-66	
D-	0.67	60-62	
F	0	< 60%	Failure

Refer to the Undergraduate Catalog for description of NG (No Grade), W, Z, and other grades.

TENTATIVE COURSE OUTLINE: The following schedule is subject to change at the discretion of the instructor. Every effort will be made to announce changes in advance, but students are responsible for changes.

Week	Topic	Notes
1	Introduction and Basic Concepts	Chapter 1, 2, 3,7
2 - 3	Macroscopic Balances	Chapter 4,5,6
4	Differential Equations for Fluid Flow	Chapter 8, 9
5 - 6	Viscous Flow, Pipe Flow	Chapter 12,13, Exam 1
7	Fundamental of Heat Transfer	Chapter 15,16
8 - 9	Steady, Unsteady Heat Conduction	Chapter 17,18
10 - 11	Convective Heat Transfer	Chapter 19,20, Exam 2
12 - 13	Heat Exchanger in BME Application	Chapter 22
14 - 15	Fundamental of Mass Transfer	Chapter 24
	Final Exam	TBD

Statements Common to All WCU Undergraduate Syllabi

ACADEMIC & PERSONAL INTEGRITY

It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu.

STUDENTS WITH DISABILITIES

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at

<https://www.wcupa.edu/universityCollege/ossd/>. In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the “responsibility for meeting academic requirements rests with the student,” that this policy does not excuse students from completing required academic work, and that professors can require a “fair alternative” to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

REPORTING INCIDENTS OF SEXUAL VIOLENCE

West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University’s commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University’s Title IX Coordinator. The only exceptions to the faculty member’s reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at:

https://www.wcupa.edu/_admin/diversityEquityInclusion/sexualMisconduct/default.aspx

INCLUSIVE LEARNING ENVIRONMENT AND ANTI-RACIST STATEMENT

Diversity, equity, and inclusion are central to West Chester University’s mission as reflected in our Mission Statement, Values Statement, Vision Statement and Strategic Plan: Pathways to Student Success. We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of

oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real,

sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time. Resources for education and action are available through WCU's Office for Diversity, Equity, and Inclusion (ODEI), DEI committees within departments or colleges, the student ombudsperson, and centers on campus committed to doing this work (e.g., Dowdy Multicultural Center, Center for Women and Gender Equity, and the Center for Trans and Queer Advocacy). Guidance on how to report incidents of discrimination and harassment is available at the University's Office of Diversity, Equity and Inclusion.

EMERGENCY PREPAREDNESS

All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

ELECTRONIC MAIL POLICY

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.

BASIC NEEDS STATEMENT

WCU is committed to ensuring that all students are able to reach their full academic potential. We know that basic needs are essential for effective learning, and we are working to address economic insecurity among our students in a number of ways. In particular, the WCU Resource Pantry is open to all students who lack access to food and supplies. Resources are also available for students facing housing insecurity. Please contact the Office of Service-Learning & Volunteer Programs for more information. As these factors directly affect academics, students who are comfortable doing so should contact faculty for further support.