
MEC 509 Transport Phenomena

Fall 2020

Prof. Carlos E. Colosqui

Email: carlos.colosqui@stonybrook.edu

Lectures (synchronous online): Wednesdays 4:25-7:00 PM

+ Meets virtually via Zoom through Blackboard. The students must use the Stony Brook University (SBU) email address registered in Solar/Blackboard.

+ Lecture notes will be posted on Blackboard and emailed to the students prior to the online lecture.

Office Hours (online): Wednesdays 3PM-4:20PM & Fridays 9-10AM

Virtual conferencing via Zoom.

Instructions:

Lectures will be delivered live using the software Zoom, which is freely available to SBU students. To join the live lectures the students will employ a web link provided by the instructor and login using their SBU email address and credentials. The contents of the lectures will be additionally provided by email and/or blackboard in .pdf format. Homework assignments will be posted on SBU Blackboard and each student must upload their solutions in Blackboard before the deadline.

The midterm examination will be administered in blackboard on the date to be determined by the instructor. The examination is open-book format and the instructor will provide specific instructions on how students will take the examination online. Academic honesty will be strictly enforced with software that includes securing online exams (e.g., LockDown Browser) and algorithms to detect plagiarism.

The final project to complete the course will require the electronic submission on blackboard of a report in electronic format.

Course Topics: Fundamentals of mass, momentum, and energy transport in isothermal and non-isothermal systems. The physical origin and meaning of transport coefficients such as shear viscosity, mass and heat diffusivity. Physical and mathematical derivation of transport equations and conservation laws for solving engineering problems. Fickian and Non-Fickian diffusion. Transport processes in multiphase and interfacial systems. Fundamentals of non-equilibrium thermodynamics, Onsager reciprocal relations. Special topics in micro/nanoscale systems and energy conversion if time permits. **Emphasis will be placed on the connection between macroscopic descriptions based on partial differential equations and the modeled microscopic physical phenomena.**

Credits: 3

Grade: A-F; Final project 40% + Midterm exam 30% + Homework assignments 30%

Tentative Lecture Schedule

week	Topic
1	Transport processes: Physical phenomena and mechanisms
2	Derivation of transport equations and conservation laws I
3	Derivation of transport equations and conservation laws II
4	Isothermal systems I: 1D problems
5	Isothermal systems II: 2D-3D problems
6	Isothermal systems III: Turbulent flows
7	Isothermal systems III: Multiphase/multicomponent systems
8	Non-isothermal systems I: 1D problems

9	Non-isothermal systems II: 2D-3D problems
10	Non-isothermal systems III: Turbulent flows
11	Non-isothermal systems III: Multiphase/multicomponent systems
12	MIDTERM EXAMINATION
13	Special Topics: Fundamentals of non-equilibrium thermodynamics
14	Special Topics: Transport phenomena in energy conversion & storage

Course Learning Outcomes/Objectives

Upon completion of this course, students will be able to:

1. Understand fundamental mechanisms of mass, momentum, energy, and charge transport
2. Understand how to apply transport equations to solve engineering problems
3. Understand assumptions involved in deriving continuum-based transport equations
4. Model and solve analytically problems involving transport in systems with multiple phases, components, and interfaces.
5. Model and solve problems involving transport in turbulent flows

Learning Objectives

The learning objective of this course is to (1) learn the fundamentals physics involved in mass, momentum, and energy transport and (2) learn the analytical techniques required to solve transport equations for relevant problems in engineering, chemistry, and physics.

DISABILITY SUPPORT SERVICES (DSS) STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact the Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748.

They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

<https://www.stonybrook.edu/commcms/studentaffairs/sasc/facstaff/syllabus.php>

[In addition, this statement on emergency evacuation is often included, but not required):

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: <https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities>

- To access mental health services, call Counseling and Psychological Services at 631-632-6720; Counselors are available to speak with 24/7.
- For updated information on the Academic Success and Tutoring Center please check www.stonybrook.edu/tutoring for the most up-to-date information.
- For IT Support: Students can visit the Keep Learning website at <https://sites.google.com/stonybrook.edu/keeplearning> for information on the tools you need for alternative and online learning.

Need help? Report technical issues at <https://it.stonybrook.edu/services/itsm> or call 631-632-2358.

For information on Library services and resources please visit the [Continuity of Library Operations](#) guide.

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at <http://www.stonybrook.edu/uaa/academicjudiciary/>

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.