

**MEC 509 Transport Phenomena
Fall 2021**

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Office Hours: Wednesdays 02-04 pm or by appointment
General Information's: check blackboard

Lecture Time: Wednesdays: 04:25 PM – 07:15 PM
Lecture Room: SocBehav Sci N102 West Campus

Course Description

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;

Course Prerequisites: Mass and Heat Transfer
Fluid Mechanics
Thermodynamics

Textbook

Transport Phenomena; Revised Second Edition by R. Byron Bird, Warren E. Stewart and Edwin N. Lightfoot, Wiley

References

1. Introductory Transport Phenomena by R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, and Daniel J. Klingenberg; Wiley

Class schedule

Lectures: Thursdays at 04:25 pm – 07:15 pm; SocBehav Sci N102 West campus

Each Lecture will be Posted on Blackboard prior to class.
Blackboard will be used for posting lectures, making course announcements, grading, and communicating with me.

All lectures, homework, quizzes and exams will be based on text. Quizzes and exams will be OPEN BOOK. Need text for properties and Appendix data.

Grading and Class Policies

Final grade is determined based on your performance on the following areas:

Homework: 20%

Midterm 1: 30%

Final: 30%

Quizzes: 20%

Tentative Course Topics

PART I: MOMENTUM TRANSPORT

Chapter 1. Viscosity and the Mechanisms of Momentum Transport.

Chapter 2. Shell Momentum Balances and velocity Distribution in Laminar Flow

Chapter 3. The equations of change for Isothermal Systems.

Chapter 4. velocity Distributions with More Than One Independent variable.

Chapter 5. velocity Distributions in Turbulent Flow.

Chapter 6. Interphase Transport in isothermal Systems

Chapter 7. macroscopic Balances for Isothermal Flow Systems

Chapter 8. Polymeric Liquids

PART II: ENERGY TRANSPORT

Chapter 9. thermal conductivity and the mechanisms of Energy Transport

Chapter 10. Shell Energy Balances and Temperature Distributions in Solids and laminar Flow

Chapter 11. The Equations of Change for Non-isothermal Systems.

Chapter 12. Temperature Distributions with more than One Independent variable.

Chapter 13. Temperature Distributions in Turbulent Flow.

Chapter 14. Interphase Transport in Non-isothermal Systems

Chapter 15. macroscopic Balances for Non-isothermal Systems.

Chapter 16. Energy Transport by Radiation

PART III: MASS TRANSPORT

Chapter 17. Diffusivity and the Mechanisms of mass Transport

Chapter 18. concentration Distributions in Solids and laminar Flow

Chapter 19. Equations of Change for Multicomponent Systems.

Chapter 20. Concentration Distributions with More than One Independent variable.

Chapter 21. concentration Distributions in Turbulent Flow.

Chapter 22. Interphase Transport in Non-isothermal Mixtures.

Chapter 23. Macroscopic Balances for Multicomponent Systems.

Chapter 24. other mechanisms for mass transport

Course Format

1. Classroom assignments will be given as time allows.

2. Grading weight: homework's, quizzes & exams based on 100-point scale.

3. Homework will be assigned each week and WILL be collected before lecture begins.

I will/will not post solutions each week.

4. You are responsible for checking your work assuring you understand the solutions.

I might/not go over solutions in class.

5. Lectures will be in power point and posted on Blackboard.

6. Homework will be assigned in class or will be posted on Blackboard under the Assignments folder.

Course Policies:

1. Lecture notes will be posted on the blackboard prior to class.
2. Blackboard will be used for posting lectures, making course announcements, grading, and communicating with the class.
3. Lectures are held on Thursdays from 04:25 pm – 07:15 pm;
4. No late homework (HW) is accepted and zero grade will be assigned. Each homework will consist of three to five problems. Homework must be submitted in class before lectures on the due dates. All procedures must be shown in homework's, projects, and tests.
4. The first homework page has to have heading; your name, identification number, course & HW number (MEC 526, HW-2, for example)
5. Submitted homework for grading has to be your own work. You have to **show all work or give related references**. No makeup tests will be given. If you do homework with someone else, you have to understand and stand behind the submitted work on your own. If it is determined that you are not familiar with the homework you may be responsible for plagiarism and cheating, and therefore loose all credits for that homework and all other homeworks to follow.
6. There are five Quizzes and each quiz will be based directly on homework and exams will be based directly on quizzes so the best way to excel in this class is to DO THE HOMEWORK!

Calculator Policy

“Effective Spring, 2008 only the following calculators will be permitted to be used on all midterm and final exams in the department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) Exam that many of you will take in your senior year, as well as the professional Engineering (PE) exam that you may take several years now. The sooner you become comfortable on one of these calculators, the better.

NCEES Allowed calculators as of spring, 2008:

- ▶ Casio: All **fx-115** models. Any Casio calculator must contain fx-115 in its model name
- ▶ Hewlett Packard: The **HP 33s** and **HP 35s** models, but no others.
- ▶ Texas Instruments: All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

The NCEES policy on calculators can be found here:

[http://www.ncees.org/exams/calculators/.](http://www.ncees.org/exams/calculators/)”

Student Accessibility Support Center Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact 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.

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: <http://www.stonybrook.edu/ehs/fire/disabilities>.

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 is 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/commcms/academic_integrity/index.html

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 University Community Standards 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. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.