

Title: AGEN/BSEN 344, *Biological and Environmental Transport Processes*

Instructors:

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Description: Introduction to concurrent transport of energy and mass in biological and environmental processes. Modes of heat transfer, steady and non-steady state heat conduction, convective heat transfer, radiative heat transfer, and heat transfer with phase change. Introduction to equilibrium, kinetics, and modes of mass transfer, diffusion, dispersion, and convective mass transfer. Includes soil freezing and thawing, energy and mass balances of crops, diffusivities of membranes, animal energy balances, respiration, and photosynthesis.

Text Book: *Heat and Mass Transfer, Fundamentals & Applications, 6th Edition*, Yunus A. Cengel & Afshin J. Ghajar. McGraw-Hill. ISBN 978-0073398198.

note you must have a hardcopy of this book to use for quizzes

Credit: 3 hours

Prerequisites: Math 221, BSEN 244 or MECH 200 (Thermodynamics, Differential Equations)

Co-Requisites: CIVE 310, MECH 310, or CHME 332 (Fluid Mechanics)

Course Objectives: At the conclusion of this course, students will be able to:

- ~ integrate and extend the concepts of thermodynamics and fluid dynamics to the analysis of transport processes in agricultural and biological systems (see competencies list)
- ~ apply the concepts of heat and mass transport to identify, formulate, and solve complex engineering problems (ABET Outcome 1)
- ~ acquire and apply new knowledge related to heat and mass transport concepts (ABET Outcome 7)
- ~ understand the limitations and applications of the solutions due to modeling assumptions

Topics: Equilibrium, Energy Conservation and Temperature
Modes of Heat and Mass Transfer
Governing Equations and Boundary Conditions of Heat and Mass Transfer
Steady State Heat Conduction and Mass Diffusion
Unsteady State Heat Conduction and Mass Diffusion
Convective Heat Transfer and Convective Mass Transfer
Heat Transfer w/ Phase Change
Equilibrium, Mass Conservation, and Kinetics
Other as determined by instructor

Grading:	Quizzes (approx. 6)	34%	
	Projects (approx.. 2)	33%	90% and above = A range
	<u>Homework (approx. 12)</u>	<u>33%</u>	80% to 89.9% = B range
	Total	100%	70% to 79.9% = C range
			60% to 69.9% = D range
			59.9% or less = F range

TENTATIVE COURSE SCHEDULE:

Week 1: 1/18 – 1/21

Topics Covered: Ch. 1 Introduction and Thermodynamics Review, Ch. 2 General Field Equation
Assessments: Homework 1

Week 2: 1/24 – 1/28

Topics Covered: Ch 2. Boundary Conditions, Ch. 3 Thermal Resistance
Assessments: Homework 2

Week 3: 1/31 – 2/4

Topics Covered: Ch. 3 Finned Surfaces and Shape Factors, Ch. 4 Lumped Parameter Systems
Assessments: Homework 3, Quiz 1

Week 4: 2/7 – 2/11

Topics Covered: Ch 4. Transient Conductions in Multidimensional Systems, Conduction Overview
Assessments: Homework 4

Week 5: 2/14 – 2/18

Topics Covered: Ch 6. Fluid Mechanics Review, Convection Fundamentals, Ch 7. External Forced Convection
Assessments: Homework 5, Quiz 2

Week 6: 2/21 – 2/25

Topics Covered: Ch 8. Internal Forced Convections, Forced Convection Examples
Assessments: Homework 6

Week 7: 2/28 – 3/4

Topics Covered: Ch 9. Natural Convection and Combined Convection Examples
Assessments: Homework 7, Quiz 3

Week 8: 3/7 – 3/11

Topics Covered: Ch. 11 Heat Exchangers and Combined Conduction and Convection Examples
Assessments: Homework 8

Week 9: 3/14 – 3/18 (No Class for Spring Break)

Topics Covered: None
Assessments: None

Week 10: 3/21 – 3/25

Topics Covered: Ch. 12 Fundamental of Thermal Radiation, Ch 13. Radiation Heat Transfer
Assessments: Homework 9

Week 11: 3/28 – 4/1

Topics Covered: TBD
Assessments: Quiz 4, Project 1

Week 12: 4/4 – 4/8

Topics Covered: Ch 14. Mass Diffusion (Steady State), Ch. 14 Mass Diffusion (Transient)
Assessments: Homework 10

Week 13: 4/11 – 4/15

Topics Covered: Ch 14. Mass Convection
Assessments: Homework 11, Quiz 5

Week 14: 4/18 – 4/22

Topics Covered: Ch 14. Combined Heat and Mass Transfer
Assessments: Homework 12

Week 15: 4/25 – 4/29

Topics Covered: TBD

Week 16: 5/2 – 5/6

Topics Covered: TBD

Assessments: Project 2

Emergency Response Information:

- **Fire Alarm (or other evacuation):** In the event of a fire alarm: Gather belongings (Purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.
- **Tornado Warning:** When sirens sound, move to the lowest interior area of building or designated shelter. Stay away from windows and stay near an inside wall when possible.
- **Active Shooter**
 - o **Evacuate:** if there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.
 - o **Hide out:** If evacuation is impossible secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.
 - o **Take action:** As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.
- **UNL Alert:** Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to: <http://unlalert.unl.edu>.
- Additional Emergency Procedures can be found here:
http://emergency.unl.edu/doc/Emergency_Procedures_Quicklist.pdf

Students with Special Needs:

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Homework Policy

Late homework will not be accepted except for medical or emergent circumstances