MSE 3210: Transport Phenomena

Credit hours and contact hours: 3-0-0-3

Instructor: Josh Kacher

Textbook: Theodore Bergman, Adrienne Lavine, Frank Incropera and David DeWitt, *Fundamentals of Heat and Mass Transfer*, John Wiley & Sons, 7th Edition, 2011.

Specific course information

Catalog description: An introduction to transport emphasizing applications to materials.

Prerequisites: MATH 2401 – Calculus III or MATH 2551 – Multivariable Calculus and MATH 2403 – Differential Equations and MSE 3001 – Chemical Thermodynamics of Materials
Prerequisites with concurrency: MSE 3001

Course: Required

Specific goals for the course

Outcomes of instruction:

Outcome 1: The student will demonstrate an understanding of the basic heat transfer mechanisms through solving practical heat transfer problems.
Outcome 2: The student will demonstrate an ability to solve transient heat transfer problems with convective boundary conditions using lumped capacitance, analytical and exact solution, and semi-infinite solid methods.
Outcome 3: The student will demonstrate an ability to determine heat and mass transfer convective heat transfer coefficients and solve basic convection heat and mass transfer problems.
Outcome 4: The student will demonstrate an understanding of basic diffusional mass transfer through solving practical basic mass transfer problems.
Outcome 5: The student will demonstrate an ability to solve transient mass transfer problems with convective boundary conditions using lumped capacitance, analytical and exact solution, and semi-infinite solid methods.

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Topics covered:

1. Basic Principles of Heat Transfer
2. Steady State Conduction
3. Transient Conduction
4. Convection
5. Heat Exchangers
6. Basic Principles of Diffusion Mass Transfer
7. Steady State Mass Transfer
8. Transient Mass Transfer

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. The student will demonstrate an understanding of the basic heat transfer mechanisms through solving practical heat transfer problems.	X						
2. The student will demonstrate an ability to solve transient heat transfer problems with convective boundary conditions using lumped capacitance, analytical and exact solution, and semi-infinite solid methods.	X						
3. The student will demonstrate an ability to determine heat and mass transfer convective heat transfer coefficients and solve basic convection heat and mass transfer problems.	X						
4. The student will demonstrate an understanding of basic diffusional mass transfer through solving practical basic mass transfer problems.	X						
5. The student will demonstrate an ability to solve transient mass transfer problems with convective boundary conditions using lumped capacitance, analytical and exact solution, and semi-infinite solid methods.	X						

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.