MATSCEN 3151 (Approved): Transport Phenomena and Kinetics

Course Description

To provide students with the concepts related to transport phenomena and kinetics as applied to processing of metals, ceramics, polymers, and composite materials.

Prior Course Number: MSE526
Transcript Abbreviation: Transport Kinetics
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Junior
Course Offerings: Autumn
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: Yes
Exam Types: EM Tests via Office of Testing
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: MSE 2010; MSE 2241; Math 415 (differential equations); or permission of the instructor.
Exclusions:
Cross-Listings:

The course is required for this unit's degrees, majors, and/or minors: Yes
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: No

Subject/CIP Code: 14.3101
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

Course Goals

Students will learn the concepts related to fluid flow, heat and mass transfer, and kinetics as applied to processing of metals, ceramics, polymers, and composite materials.
Students will learn to calculate momentum, heat, and mass flux in one and/or two-dimensional system.
Students will learn how to solve analytically and numerically one and/or two-dimensional heat transfer and diffusion problems.
Students will learn concept related to chemical reaction kinetics and rate controlling steps in various processes.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Fluxes, Phenomenological laws, and Conservation laws	3.0							
Momentum transfer and viscosity	2.0							
Convective and diffusive momentum transport	2.0							
Momentum transport in turbulent flow	2.0							
Modes of heat transfer (conduction, convection, and radiation)	3.0							
Steady and unsteady heat conduction	3.0							
Heat transfer coefficients	3.0							
Ficks law and diffusivity of materials	2.0							
Solution of diffusion equation (error function, and numerical)	3.0							
Vacancy and interstitial mechanisms of self-diffusion	2.0							
Interdiffusion and Darkens equation	2.0							
Mass transfer in fluid systems, mass transfer coefficients	3.0							
Chemical reaction kinetics, rate controlling steps	6.0							
Interface reaction controlled processes	3.0							
Diffusion controlled processes	3.0							

Representative Assignments

One homework will be assigned every week. This may consist of problems from the book and/or additional problems on a handout.
The homework may be writing a simple computer program and solving assigned problems.

Grades

Aspect	Percent
Homework (one per week)	10%
Weekly quiz	10%
Midterm examination 1	25%
Midterm examination 2	25%
Final examination	30%

Representative Textbooks and Other Course Materials

Title	Author
"An Introduction to Transport Phenomena in Materials Engineering"	David R. Gaskell (Published by Macmillan Publishing Company)

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.

Course Contribution		College Outcome
***	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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