



Course Syllabus



EMA 4125 Transport Mechanisms in Materials Processing

Class #: 13811

Section: 1E02

Course periods: M, W, F 8:30 - 9:20

Location: FAB 0103

Academic term: Spring 2019

Instructor:

Michael Tonks

michael.tonks@ufl.edu

158 Rhines Hall

(352) 846-3779

TA:

Xueyang Wu

Office hours: T Th ? PM

Office hours: M W F ? PM in MSE Library (Rhines 125)

Course Description

This course covers the concepts of mass and heat transport in solid materials, including metals, alloys, ceramics, and polymers. It describes the phenomenological description and atomic theory of these processes, as well as analytical and numerical solutions. It also covers concepts in solidification and solid-state transformations, including nucleation, growth and coarsening of diffusional and diffusionless transformations.

Course Pre-Requisites

EMA 3010 and MAP 2302.

Course Objectives

Students completing this course should know the fundamental mechanisms defining diffusion, heat transport, and phase transformation in solids. They should also be able to predict these behaviors using both analytical solutions and numerical finite difference solutions using MATLAB.

Relation to Program Outcomes (ABET):

Outcome	Coverage
1. An ability to identify, formulate, and solve 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 of 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.	M
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.	



Required Textbooks and Software

Required Textbook

None

Recommended Textbooks

Transport Phenomena in Materials Processing

Author: William D. R. Poirier and G. H. Geiger

Publisher: TMS Publications, Warrendale PA , 1994

Fundamentals of Momentum, Heat and Mass Transfer

Author: James Welty, Charles Wicks, Robert Wilson and Gregory Rorrer

Publisher: 4th edition NY, John Wiley and Sons. 2001

Introduction to Heat and Mass Transfer

Author: Frank Incropera and David Dewitt

Publisher: NY John Wiley and Sons, 2000

Required Software

Matlab. You can access it in one of three ways:

1. **UF Apps** (<https://info.apps.ufl.edu/>). *Free but doesn't always work very well*
2. On Campus Computer Labs
3. **Purchase a student license (\$99)** (<https://www.mathworks.com/products/matlab/student.html>). *Most convenient, but costs. It will be useful throughout your time as a student.*

Schedule

Week	Mon. Date	Topic
1	1/6	Introduction Diffusion: theory Diffusion: theory
2	1/13	Diffusion: theory Diffusion: analytical Diffusion: analytical
3	1/20	Martin Luther King Day Diffusion: analytical Diffusion: analytical
4	1/27	Diffusion: numerical Diffusion: numerical Diffusion: numerical
5	2/3	Diffusion: numerical Heat transport: theory Heat transport: theory
6	2/10	Heat transport: theory Review Exam1
7	2/17	Heat transport: analytical Heat transport: analytical Heat transport: analytical
8	2/24	Heat transport: analytical Heat transport: numerical Heat transport: numerical

9	3/2	SPRING BREAK
10	3/9	Heat transport: numerical Heat transport: numerical Heat transport: numerical
11	3/16	Phase transformation: Thermodynamics Phase transformation: Thermodynamics Phase transformation: Thermodynamics
12	3/23	Review Exam 2 Project discussion
13	3/30	Phase transformation: Solidification Phase transformation: Solidification Phase transformation: Solidification
14	4/6	Phase transformation: Solid phase transformation Project work day - NO CLASS Phase transformation: Solid phase transformation
15	4/13	Phase transformation: Solid phase transformation Project work day - NO CLASS Project work day - NO CLASS
16	4/20	Review Exam 3 Reading days
17	4/27	FINALS WEEK



Course Policies

Attendance Policy

Each class period will be used for course lectures and the working of example problems. Attendance will be a critical aspect of learning the material, as the lectures will not be recorded. However, attendance will not be taken.

Class Demeanor

Students are expected to arrive to class on time and be respectful to the instructor and to fellow students. Please avoid the use of cell phones and conversations that do not contribute to the discussion should be held at minimum.

Course Communication

E-Learning will be the primary avenue for communication and course management. All announcements for the course will be made using the announcement system on the E-Learning site. Discussion groups will be made for each module. All questions regarding the module and the homework assignment should be made using the discussion groups. Course notes will be posted on E-Learning before each lecture.

Homework

Homework problems will be assigned for each module in the course. The assignments will be posted in e-Learning and will be turned in electronically. No late homework will be allowed without an excuse.

Quizzes

Quizzes will be given through e-Learning, one in each module. You will have 15 minutes to take each quiz, and they will be open book, open note, and open internet. However, you must take them alone. The lowest quiz grade will be dropped.

Exams

You will be given three exams throughout the semester, the exam content may change but the dates will not. Each exam is weighted equally.

Make-up exams will be provided only with the prior approval of the instructor or excused absence. In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal

obligations, religious holidays and participation in official university activities such as music performances, athletic competition or debate 

Calculators: Scientific and graphing calculators will be permitted during exams, but using phones as calculators is not allowed. Calculators will not be provided if you forget your calculator.

Final Project

There is a final project in this course that will be carried out in teams. It will be worth the same as one exam.

Grade Appeal

Your homework will be graded by the TA. If you feel there is a problem with a homework grade, contact the TA. For questions on exams, also contact Dr. Tonks. After two weeks have passed since the due date, no grades will be changed.

Grading Scheme

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Score	>93.4	>90	>86.7	>83.4	>80	>76.7	>73.4	>70	>66.7	>63.4	>60	<60

Note that the score listed on the table for each grade is the lower bound for that grade.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the [Disability Resource Center \(http://www.dso.ufl.edu/drc/\)](http://www.dso.ufl.edu/drc/) (352-392-8565) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Approximately half way through the course, a mid-term evaluation will be given to the students. The comments and suggestions provided during the mid-term evaluation will be carefully considered by Dr. Tonks and appropriate changes will be made to the course to address the comments, if possible.

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. [\(https://gatorevals.aa.ufl.edu/students/\)](https://gatorevals.aa.ufl.edu/students/). Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/> [\(https://ufl.bluera.com/ufl/\)](https://ufl.bluera.com/ufl/). Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/> [\(https://gatorevals.aa.ufl.edu/public-results/\)](https://gatorevals.aa.ufl.edu/public-results/).

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code."

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

[The Honor Code \(https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/\)](https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TA in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:



- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html> (<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>)

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center:

<http://www.counseling.ufl.edu/cwc> (<http://www.counseling.ufl.edu/cwc>), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS):

Student Health Care Center, 392-1161.

University Police Department:

392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/> (<http://www.police.ufl.edu/>).

Academic Resources

E-learning technical support

352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml> (<https://lss.at.ufl.edu/help.shtml>).

Career Resource Center

Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/> (<https://www.crc.ufl.edu/>).

Library Support

<http://cms.uflib.ufl.edu/ask> (<http://cms.uflib.ufl.edu/ask>). There are various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center

Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/> (<https://teachingcenter.ufl.edu/>).

Writing Studio

























302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/> (<https://writing.ufl.edu/writing-studio/>).



Student Complaints

https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf (https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf)

Course Summary:

Date	Details
Mon Jan 20, 2020	 HW 1 - Diffusion: Theory (https://ufl.instructure.com/courses/388761/assignments/4056177) due by 11:59pm
	 Exam 1: Diffusion (https://ufl.instructure.com/courses/388761/assignments/4056173)
	 Exam 2: Heat transport (https://ufl.instructure.com/courses/388761/assignments/4056174)
	 Exam 3: Phase transformation (https://ufl.instructure.com/courses/388761/assignments/4056175)
	 Final Project (https://ufl.instructure.com/courses/388761/assignments/4056176)
	 HW 2 - Diffusion: Analytical (https://ufl.instructure.com/courses/388761/assignments/4056178)
	 HW 3 - Diffusion: Numerical (https://ufl.instructure.com/courses/388761/assignments/4056179)
	 HW 4 - Heat transport: theory (https://ufl.instructure.com/courses/388761/assignments/4056180)
	 HW 5 - Heat conduction: Analytical (https://ufl.instructure.com/courses/388761/assignments/4056181)
	 HW 6 - Heat Conduction: Numerical (https://ufl.instructure.com/courses/388761/assignments/4056182)
	 HW 7 - Phase transformation: Thermodynamics (https://ufl.instructure.com/courses/388761/assignments/4056183)
	 HW 8 - Phase transformation: Solidification (https://ufl.instructure.com/courses/388761/assignments/4056184)
	 HW 9 - Phase transformation 3 (https://ufl.instructure.com/courses/388761/assignments/4056185)
	 Initial survey (https://ufl.instructure.com/courses/388761/assignments/4056169)
	 Mid-semester Evaluation (https://ufl.instructure.com/courses/388761/assignments/4056168)
	 Quiz 1: Diffusion theory (https://ufl.instructure.com/courses/388761/assignments/4056171)
	 Quiz 2 - Diffusion: analytical (https://ufl.instructure.com/courses/388761/assignments/4056172)
	 Quiz 3: Diffusion: numerical (https://ufl.instructure.com/courses/388761/assignments/4056165)
	 Quiz 4: Heat transport - theory (https://ufl.instructure.com/courses/388761/assignments/4056164)
	 Quiz 5: Heat conduction: Analytical (https://ufl.instructure.com/courses/388761/assignments/4056166)
	 Quiz 6: Heat transport - numerical (https://ufl.instructure.com/courses/388761/assignments/4056167)
	 Quiz 7: Phase transformation: Thermodynamics (https://ufl.instructure.com/courses/388761/assignments/4056163)
	 Quiz 8: Phase transformation: Solidification (https://ufl.instructure.com/courses/388761/assignments/4056170)
	 Quiz 9: Phase transformation 3 (https://ufl.instructure.com/courses/388761/assignments/4056162)