

Course Syllabus

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EMA4125 - Kinetics of Materials

Class #: 26918

Section: TPM2

Course periods: M, W, F 10:40 - 11:30

Location: FLG 0285

Academic term: Spring 2024

Instructor:

Michael Tonks

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100D Rhines Hall

(352) 846-3779

TA:

TBD

Office hours: TBD in 100D Rhines Hall

Office hours:

TBD

Course Description

Science and application of diffusion and phase transformations in alloys, semiconductors, ceramics, and polymers, phenomenological description and atomic theory, analytical and numerical solutions, solidification and solid-state transformations, including nucleation, growth, and coarsening.

Course Pre-Requisites

EMA 4314.

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
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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

Octave or MATLAB. You can access them in one of four ways:

1. **Use the open source code Octave**  (<https://www.gnu.org/software/octave/>). Octave is an open source code that is very similar to MATLAB but is free. All work in this course can be done using

Octave. When you download and install it, make sure you have the graphic user interface.

2. MATLAB from [UF Apps](https://info.apps.ufl.edu/)  [\(https://info.apps.ufl.edu/\)](https://info.apps.ufl.edu/). Free but doesn't always work very well

3. MATLAB in On Campus Computer Labs

4. [Purchase a student license of MATLAB](https://www.mathworks.com/products/matlab/student.html) 

[\(https://www.mathworks.com/products/matlab/student.html\)](https://www.mathworks.com/products/matlab/student.html). Most convenient, but costs. It will be useful throughout your time as a student.

Course Schedule

Week	Mon. Date	Topic
1	1/8	Introduction Diffusion: theory Diffusion: theory
2	1/15	NO CLASS (Martin Luther King Day) Diffusion: theory Diffusion: analytical
3	1/22	Diffusion: analytical Diffusion: analytical Diffusion: analytical
4	1/29	Diffusion: numerical NO CLASS (Career Fair) Diffusion: numerical
5	2/5	Diffusion: numerical Diffusion: numerical Heat transport: theory
6	2/12	Heat transport: theory Heat transport: theory Diffusion Review
7	2/19	Exam1 Heat transport: analytical Heat transport: analytical
8	2/26	Heat transport: analytical Heat transport: analytical Heat transport: numerical
9	3/4	Heat transport: numerical (Recorded lecture) Heat transport: numerical (Recorded lecture) Heat transport: numerical

10	3/11	SPRING BREAK
11	3/18	Phase transformation: Thermodynamics Phase transformation: Thermodynamics Phase transformation: Thermodynamics
12	3/25	Heat Transport Review Exam 2 Phase transformation: Solidification
13	4/1	Phase transformation: Solidification Phase transformation: Solidification Phase transformation: Solid phase transformation
14	4/8	Phase transformation: Solid phase transformation Phase transformation: Solid phase transformation Project work day - NO CLASS
15	4/15	Project work day - NO CLASS Phase Transformation Review Exam 3
16	4/22	Project work day - NO CLASS Project work day - NO CLASS Reading days
17	4/29	FINALS WEEK (NO FINAL)

Course Policies

Attendance Policy

Class will be held in person during our schedule class time. 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 and so credit will be given for attendance using in-class exercises.

In-class exercises

In-class exercises will be taken during class. They will only be graded for completion, not correctness, and I will drop the two lowest scores.

They are worth 5% of your grade.

Class Demeanor

Students are expected to join class on time and be respectful to the instructor and to fellow students.

Course Communication

Canvas will be the primary avenue for communication and course management. All announcements for the course will be made using the announcement system on the Canvas site.

Lecture slides will be posted on Canvas before each lecture.

Homework

Homework is used to help you learn the material by actively applying the concepts taught in the lecture. The focus is learning not assessment. Homework problems will be assigned for each module in the course. The assignments will be posted in Canvas and will be turned in electronically. No late homework will be allowed without an excuse. The lowest homework grade will be dropped.

The majority of the homework will help you prepare for the exams. The MATLAB/Octave assignments will help you prepare for the Final Project.

Homework is worth 20% of your grade.

Quizzes

Quizzes are used to help you review the material covered in the lectures. Their focus is learning not assessment. Quizzes will be given through Canvas, 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.

Quizzes are worth 5% of your grade.

Exams

Exams are used to assess how well you have learned the material. You will be given three exams throughout the semester, the exam content may change but the dates will not. Each exam is weighted equally. You will take the exams in person during the normal class time. The exam will be taken using Canvas, so bring an electronic device with internet access to the exam.

The exams are worth 50% of your grade.

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.

If you get a grade below a 70% on any of the exams, you can submit a corrected version of the exam to raise your grade to a 70. For each of the multiple choice questions that you missed, give a short summary explaining the correct answer. For each of the workout questions, correct your answer. Send your corrected version to Dr. Tonks **before 2 weeks after the exam date**.

Calculators: You are welcome to use any type of calculator or phone on the exams.

Final Project

The final project allows you to apply the numerical methods we have learned in the course and assesses how well you have learned the numerical methods. It will be carried out in teams.

The final project is worth 20% of your grade

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	>90	>87	>83	>80	>77	>73	>70	>67	>63	>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 who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>  [\(https://disability.ufl.edu/students/get-started/\)](https://disability.ufl.edu/students/get-started/). It is important for students to share their accommodation letter with their instructor and discuss their access needs, 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/).

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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 Conduct Code

[\(https://sccr.dso.ufl.edu/process/student-conduct-code/\)](https://sccr.dso.ufl.edu/process/student-conduct-code/)  [\(https://sccr.dso.ufl.edu/process/student-conduct-code/\)](https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. 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:

- The Academic Services Office, advising@mse.ufl.edu (<mailto:advising@mse.ufl.edu>)
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu (<mailto:jpennacc@ufl.edu>)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu (<mailto:taylor@eng.ufl.edu>)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu (<mailto: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: <https://registrar.ufl.edu/ferpa.html>  (<https://registrar.ufl.edu/ferpa.html>)

(<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>)

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu (<mailto:umatter@ufl.edu>) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center:

<https://counseling.ufl.edu>  [\(https://counseling.ufl.edu/\)](https://counseling.ufl.edu/), 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**  [\(https://titleix.ufl.edu/\)](https://titleix.ufl.edu/), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu. (<mailto: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 (<mailto: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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>  [\(https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/\)](https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/)