EMA4125-1E02(13530) - Trans Phenom Mat Proc

Edit

EMA 4125 Transport Mechanisms in Materials Processing

Class #: 13530
Section: 1E02
Course periods: M, W, F 8:30 - 9:20
Location: ZOOM lecture
Academic term: Spring 2021

Instructor:
Michael Tonks
michael.tonks@ufl.edu
158 Rhines Hall (Not currently in use)
(352) 846-3779

TA:
Brandon Battas

Office hours: TBD on ZOOM:

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Course Description

Science and application of momentum, heat and mass transport in materials and materials processing.

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

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/)** . *Free but doesn't always work very well*
3. MATLAB in On Campus Computer Labs

4. **Purchase a student license of MATLAB ($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	1/11	Introduction Diffusion: theory Diffusion: theory
2	1/18	Martin Luther King Day Diffusion: theory Diffusion: analytical
3	1/25	Diffusion: analytical Diffusion: analytical Diffusion: analytical
4	2/1	Diffusion: numerical Diffusion: numerical Diffusion: numerical
5	2/8	Diffusion: numerical Homework 3 work day Heat transport: theory
6	2/15	Heat transport: theory Heat transport: theory Review
7	2/22	Exam1 Heat transport: analytical Heat transport: analytical
8	3/1	Heat transport: analytical Heat transport: analytical Heat transport: numerical
9	3/8	Heat transport: numerical Heat transport: numerical Heat transport: numerical
10	3/15	Phase transformation: Thermodynamics Phase transformation: Thermodynamics

		Phase transformation: Thermodynamics
11	3/22	Review Exam 2 Project discussion
12	3/29	Phase transformation: Solidification Phase transformation: Solidification Phase transformation: Solidification
13	4/5	Phase transformation: Solid phase transformation Phase transformation: Solid phase transformation Phase transformation: Solid phase transformation
14	4/12	Project work day - NO CLASS Review Exam 3
15	4/19	Project work day - NO CLASS Project work day - NO CLASS Reading days
16	4/26	FINALS WEEK

Course Policies

Attendance Policy

Class will be held during our schedule class time on ZOOM. 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 will be taken during class. They will only be graded for completion, not correctness, and I will drop the lowest two. They will be worth 6% of your grade.

Online Course Recording

ur class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or

shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Class Demeanor

Students are expected to join class on time and be respectful to the instructor and to fellow students. Please keep yourself muted in ZOOM unless you have a comment or question.

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 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 e-Learning and will be turned in electronically. No late homework will be allowed without an excuse. The two lowest homework grades 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. It will be worth 15% 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 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. They will be 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 during the normal class time using ZOOM. You will need to have your video on for proctoring. The exams will be worth 54% of your grade (18% each).

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: You are welcome to use any type of calculator on the exams. You can also use MATLAB/Octave or any other online mathematics tools.

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.

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 requesting accommodations should first register with the **Disability Resource Center (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/.)** 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/)** . Summaries of course evaluation results are available to students at **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 F community, pledge to hold ourselves and our peers to the highest standards of honor and integrity b 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/) 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:
• The Academic Services Office, **advising@mse.ufl.edu (mailto:advising@mse.ufl.edu)**
• Robin Bielling, Director of Human Resources, 352-392-0903, **rbielling@eng.ufl.edu (mailto:rbielling@eng.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:

If you or a friend is in distress, please contact **umatter@ufl.edu (mailto: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 (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 assista 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	
Tue Jan 7, 2020	Initial survey (https://ufl.instructure.com/courses/416186/assignments/4469208)	due by 7pm
Wed Jan 8, 2020	Diffusion: theory - review (https://ufl.instructure.com/courses/416186/assignments/4469213)	due by 9:20am
Fri Jan 10, 2020	Diffusion: Theory - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469250)	due by 9:20am
Mon Jan 13, 2020	Diffusion: Theory - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469216)	due by 9:20am
Tue Jan 14, 2020	Quiz 1: Diffusion theory (https://ufl.instructure.com/courses/416186/assignments/4469251)	due by 11:59pm
Wed Jan 15, 2020	Diffusion: Analytical - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469233)	due by 9:20am
Sat Jan 25, 2020	Quiz 2 - Diffusion: analytical (https://ufl.instructure.com/courses/416186/assignments/4469207)	due by 11:59pm

Date	Details	
Mon Jan 27, 2020	Diffusion: Numerical - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469206)	due by 9:20am
Fri Jan 31, 2020	Diffusion: Numerical - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469209)	due by 9:20am
Mon Feb 3, 2020	Diffusion: Numerical - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469237)	due by 9:20am
Tue Feb 4, 2020	Quiz 3: Diffusion: numerical (https://ufl.instructure.com/courses/416186/assignments/4469231)	due by 11:59pm
Wed Feb 5, 2020	Heat Conduction: Theory - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469248)	due by 9:20am
Fri Feb 7, 2020	Heat Conduction: Theory - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469242)	due by 9:20am
Mon Feb 10, 2020	Heat Conduction: Theory - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469226)	due by 9:20am
Wed Feb 12, 2020	Diffusion: Exam - Review 1 (https://ufl.instructure.com/courses/416186/assignments/4469218)	due by 9:20am
	Diffusion: Exam - Review 2 (https://ufl.instructure.com/courses/416186/assignments/4469244)	due by 9:20am
	Diffusion: Exam - Review 3 (https://ufl.instructure.com/courses/416186/assignments/4469223)	due by 9:20am
	Diffusion: Exam - Review 4 (https://ufl.instructure.com/courses/416186/assignments/4469228)	due by 9:20am
Fri Feb 14, 2020	Exam 1: Diffusion (https://ufl.instructure.com/courses/416186/assignments/4469253)	due by 9:20am
Mon Feb 17, 2020	Heat Conduction: Analytical - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469240)	due by 9:20am

Date	Details	
Tue Feb 18, 2020	Quiz 4: Heat transport - theory (https://ufl.instructure.com/courses/416186/assignments/4469205)	due by 11:59pm
Fri Feb 21, 2020	Heat Conduction: Analytical Solutions - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469211)	due by 9:20am
	Mid-semester Evaluation (https://ufl.instructure.com/courses/416186/assignments/4469238)	due by 11:59pm
Thu Feb 27, 2020	Quiz 5: Heat conduction: Analytical (https://ufl.instructure.com/courses/416186/assignments/4469214)	due by 11:59pm
Fri Feb 28, 2020	Heat Conduction: Numerical Solutions - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469239)	due by 9:20am
Mon Mar 9, 2020	Heat Conduction: Numerical Solutions - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469229)	due by 9:20am
Wed Mar 11, 2020	Heat Conduction: Numerical Solutions - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469243)	due by 11:59pm
Fri Mar 13, 2020	Heat Conduction: Numerical Solutions - Exercise 4 (https://ufl.instructure.com/courses/416186/assignments/4469225)	due by 11:59pm
Sat Mar 14, 2020	Quiz 6: Heat transport - numerical (https://ufl.instructure.com/courses/416186/assignments/4469217)	due by 11:59pm
Mon Mar 16, 2020	Phase Transformations: Thermodynamics - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469210)	due by 11:59pm
Wed Mar 18, 2020	Phase Transformation: Thermodynamics - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469241)	due by 11:59pm
Fri Mar 20, 2020	Phase Transformation: Thermodynamics - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469236)	due by 11:59pm

Date	Details	
Sat Mar 21, 2020	HW 6 - Heat Conduction: Numerical (https://ufl.instructure.com/courses/416186/assignments/4469260)	due by 11:59pm
Mon Mar 23, 2020	Exam 2: Heat Conduction - Exercise (https://ufl.instructure.com/courses/416186/assignments/4469246)	due by 11:59pm
Wed Mar 25, 2020	Exam 2: Heat Conduction (https://ufl.instructure.com/courses/416186/assignments/4469245)	due by 9:40am
Fri Mar 27, 2020	Survey about the virtual course (https://ufl.instructure.com/courses/416186/assignments/4469224)	due by 11:59pm
	Final Project Description: Exercise (https://ufl.instructure.com/courses/416186/assignments/4469215)	due by 11:59pm
Mon Mar 30, 2020	Phase Transformation: Solidification - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469227)	due by 11:59pm
	Quiz 7: Phase transformation: Thermodynamics (https://ufl.instructure.com/courses/416186/assignments/4469234)	due by 11:59pm
Thu Apr 2, 2020	Phase Transformation: Solidification - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469220)	due by 11:59pm
Fri Apr 3, 2020	Final Project Group Selection (https://ufl.instructure.com/courses/416186/assignments/4469221)	due by 11:59pm
	HW 7 - Phase transformation: Thermodynamics (https://ufl.instructure.com/courses/416186/assignments/4469261)	due by 11:59pm
Sat Apr 4, 2020	Phase Transformation: Solidification - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469247)	due by 11:59pm
	Quiz 8: Phase transformation: Solidification (https://ufl.instructure.com/courses/416186/assignments/4469219)	due by 11:59pm

Date	Details	
Tue Apr 7, 2020	Phase Transformation: Solid Transformation - Exercise 1 (https://ufl.instructure.com/courses/416186/assignments/4469249)	due by 11:59pm
Thu Apr 9, 2020	Phase Transformation: Solid Transformations - Exercise 2 (https://ufl.instructure.com/courses/416186/assignments/4469230)	due by 11:59pm
Fri Apr 10, 2020	HW 8 - Phase transformation: Solidification (https://ufl.instructure.com/courses/416186/assignments/4469262)	due by 11:59pm
Sat Apr 11, 2020	Phase Transformation: Solid Transformations - Exercise 3 (https://ufl.instructure.com/courses/416186/assignments/4469212)	due by 11:59pm
	Quiz 9: Phase transformation 3 (https://ufl.instructure.com/courses/416186/assignments/4469222)	due by 11:59pm
Fri Apr 17, 2020	HW 9 - Phase transformation 3 (https://ufl.instructure.com/courses/416186/assignments/4469263)	due by 11:59pm
Mon Apr 20, 2020	Exam 3 review - Exercise (https://ufl.instructure.com/courses/416186/assignments/4469235)	due by 11:59pm
Wed Apr 22, 2020	Exam 3: Phase Transformation (https://ufl.instructure.com/courses/416186/assignments/4469232)	due by 9:40am
Fri Apr 24, 2020	University of Florida GatorEvals – Spring 2020 (https://ufl.instructure.com/calendar?event_id=1751130&include_contexts=course_416186)	11:59pm
Mon Apr 27, 2020	Final Project (https://ufl.instructure.com/courses/416186/assignments/4469254)	due by 11:59am
Wed Jan 27, 2021	HW 1 - Diffusion: Theory (https://ufl.instructure.com/courses/416186/assignments/4469255)	due by 11:59pm
Fri Feb 5, 2021	HW 2 - Diffusion: Analytical (https://ufl.instructure.com/courses/416186/assignments/4469256)	due by 11:59pm

Date	Details	
Mon Feb 15, 2021	HW 3 - Diffusion: Numerical (https://ufl.instructure.com/courses/416186/assignments/4469257)	due by 11:59pm
	Attendance extra credit (https://ufl.instructure.com/courses/416186/assignments/4469252)	
	HW 4 - Heat transport: theory (https://ufl.instructure.com/courses/416186/assignments/4469258)	
	HW 5 - Heat conduction: Analytical (https://ufl.instructure.com/courses/416186/assignments/4469259)	