

Diffusion, Kinetics, and Transport Phenomena

EMA 6136

Class Periods: M, W, F Period 6 (12:50-1:40)

Location: NEB 201

Academic Term: Spring 2025

Instructor: Simon R. Phillpot, 164 Rhines Hall, phillpot@ufl.edu

Office hours:

On campus students: M Period 4 (10:40 – 11:25) in Rhines 164 and by appointment.

EDGE students: by Zoom at [ufl.zoom.us/my/Phillpot](https://ufl.zoom.us/j/9123456789). E-mail me for appointment.

Teaching Assistant/Peer Mentor/Supervised Teaching Student: TBD

Course Description (3 credit hours)

Physical basis, equation, and theories of diffusion, tracer, chemical, multicomponent, and multiphase diffusion in general force fields.

Prerequisites:

EMA 4125 or equivalent.

Course Objectives

To become familiar with the fundamental concepts of diffusion and phase transformations in alloys, semiconductors, ceramics, and polymers. The atomistic and phenomenological treatment of diffusion will be introduced and applied to atomic transport under concentration, temperature, electric field and pressure gradients in a variety of technological materials. The kinetics of diffusive and martensitic phase transformations will be developed and applied to nucleation and growth of phases in vapors, liquids and solids. The course will enable students to apply theoretical concepts of diffusion and phase transformations to practical applications of evolution of materials.

Textbooks: (recommended)

Title: Diffusion in Solids

Author: Paul Shewmon

ISBN: 978-3-319-48206-4 or 978-0873391054

Title: Phase Transformations in Metals and Alloys, Third Edition

Author: D. A. Porter, K. E. Easterling, and M. Y. Sherif

ISBN: 1420062107

Supplementary reading and links to various other resources/websites are provided and updated throughout the semester.

Course Website

The course website is on the Canvas system <https://ufl.instructure.com>, where you can find the syllabus, lecture notes, quizzes, homework problems, announcements, and your grades. Please check it frequently.

Lectures

Lectures are critical to success in this MS&E course. Experience of prior instructors has shown that you will be able to get a better grade when regularly attending class. However, I will not require attendance. Questions are highly encouraged. It will make the class more interesting, wake up your fellow students and give me a chance to explain things better. If you do not understand something, chances are that most of the class missed that point too. If you do not ask enough questions, I may start asking you. You are responsible for material presented in lectures, reading assignments, homework, and distributed notes.

Homework

Four homework exercises will be assigned. These homework questions are essential to your study and prepare you for the exams. Some exam questions will be adapted from homework. Homework is usually due back seven days before the corresponding exam. The approximate homework due dates are February 5, February 26, March 25, and April 17. The exact submission dates will be posted in the e-learning assignments. The purpose of homework is to give you an opportunity to evaluate and apply their knowledge. You may collaborate on homework; however, the submitted assignment must represent your own work and preparation. Discussion boards have been set up on Canvas for each homework; I encourage you to use them. The homework assignments are long and you should plan on spending a significant amount of time each week on them. Homework in its entirety must be word processed. For some problems, you will require a suitable math package with graphing capability, e.g., Excel, MatLab, Python. Files have to pdf, doc, docx, or pptx. Picture files (jpg, etc.) are not accepted.

Homework needs to be submitted online on e-learning. Neither Email nor hard copy is acceptable for submission of homework.

Homework will be evaluated on the following basis:

	100	85	70	0
Completion	All assigned work is complete.	Most assigned work is complete.	Some assigned work is complete.	Assignment not complete.
Accuracy	All answers are correct.	Most answers are correct.	Some answers are correct.	Little to no answers are correct.
Work shown (derivations and figures)	All work shown in detail.	Most work shown in detail.	Several steps or figures missing.	Did not show any work.

No credit will be given for late unexcused submissions.

Quizzes and Interactive Learning

We will have online quizzes covering current and recent lecture material. The quizzes will typically consist of about 4 questions that should take about 10 minutes to answer. The quizzes serve as feedback both for you and me.

Exams

We will have four in-class exams. The exams will consist of concept questions to evaluate your familiarity with the course content and numerical problems designed to test your ability to apply concepts to new situations, i.e., to promote critical thinking. Unless otherwise informed, one sheet of prepared personal notes may be used to assist you in completing examinations. Exam work must be that of the individual student: collaboration is never allowed. Observations of cheating will be promptly reported by the exam proctor. Please see UF's statement on academic honesty: <https://www.dso.ufl.edu/%20sccr/process/student-conduct-honor-code>.

There is no final exam in this class. Exam dates are tentatively scheduled for:

Exam 1: Monday, February 10

Exam 2: Monday, March 2

Exam 3: Monday, March 31

Exam 4: Wednesday April 23

EDGE Student Submission Policy

EDGE students must submit all homework assignments electronically by the given deadlines. Exams must be received by 11:59 pm on the following Thursday for an exam scheduled on Monday and 11:59 pm on the following Saturday for an exam scheduled on Wednesday. Please scan documents as a pdf and submit them electronically. The exams will be on Canvas and use HonorLock. If any problems occur, please let me know early. No credit will be given for late unexcused submissions.

Exam Conflicts with other course exams

The official UF policy on exam conflict resolution states that when two exams conflict, the course with the higher number will take priority. There will be no exceptions to this rule.

Make-up exams

Make up exams will be provided only with the prior approval of the instructor. Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>. In general, acceptable reasons for excused absence from an exam include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, and religious holidays. In all cases, you will be required to provide written documentation, and obtain prior instructor approval. You will not be excused from any exam without following the policy above, with no exceptions. Students not in attendance for the scheduled exam will receive a score of zero. **You must notify the instructor by e-mail no less than 1 week of the scheduled exam of your need and justification for missing the exam; you must plan on attending the exam until you receive acceptance of the excused absence from the instructor.** Makeup exams for excused absences as well as exam conflicts must occur within 1 week of the missed exam and may occur before the missed exam.

Grading

Grades will be based on your understanding and mastery of the material as demonstrated by the exams, quizzes, and homeworks.

Homework 25%

Online quizzes 15%

4 exams 80% (15% each)

You have one week after each exam result is posted to present any questions (by e-mail to the instructor) about scores and grades. No reconsideration of your exam score will be made after that time.

Grading Scale

%	>92	>88	>84	>80	>76	>72	>68	>65	>62	>59	>56	<56
Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)

[Grades and Grading Policies](#)

Office Hours

Instructor office hours are Monday 10:40-11:25n. Arrangements for other office hours, particularly Zoom office hours for EDGE students, can be made by e-mail with the instructor. If you have any questions about the class or homework, please come to office hours or e-mail me. I will try to respond to e-mail questions within 24 hours. Important e-mail questions (minus identifying information) and answers may be posted to the class either by e-mail or on the course website for the benefit of other students.

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/>. 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

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/>. 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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.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 Honor 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. 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 TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and

expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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 Coordinator
- HWCoe Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@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: <https://registrar.ufl.edu/ferpa.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 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>, 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 at 392-1111 (or 9-1-1 for emergencies), or <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://elearning.ufl.edu/>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling;
<https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. 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/>.

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

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.