EMA 4121 Interfacial Engineering
Class Periods: Tuesday, 6th Period, 12:50pm - 1:40 pm.
Thursday, 5 – 6th Periods, 11:45am – 1:40 pm
Location: TUR L005
Academic Term: Fall 2023

Instructor
Dr. Brij M. Moudgil

a. Office location: 205E PS&T Bldg. (Particle Science & technology Bldg.)
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Teaching Assistant/Peer Mentor/Supervised Teaching Student:

TBD

a. Office location:
b. Telephone:
c. E-Mail:
d. Office Hours:

Course Description
Correlation of properties, structural and mechanical history, thermal history, and service behavior of various interfaces. Especially, quantitative, and conceptual treatment of interfacial forces and phenomena. Comparison and contrast of liquid and solid interfaces. Consideration of surfactants and polymers, colloids, surface modification, thin films, coatings, and characterization techniques.

Course Prerequisites/Co-Requisites:
EMA 3050, EMA 3066, EMA 3413, or permission of instructor

Course Objectives
Develop an understanding of the role that interfaces play in determining the properties, behavior, and processing of material systems.

Materials and Supply Fees
none

Relation to program outcomes (ABET)
(TBD)

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	
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	Medium

Required Textbooks and Software

Title: Physics and Chemistry of Interfaces
Authors: Hans-Jurgen Butt, Karlheinz Graf, Michael Kappl
Publication Date and Edition: 2013, 3rd edition
ISBN Number: 978-3-527-41216-7

This course will use Canvas system for all class related communications. All class announcements, handouts, reading assignments, homework problem sets, homework solutions, exam solutions, and grades will be available throughout the semester. Course notes/PowerPoint slides/video clips etc. used by the instructor or the guest lecturers, along with any additional reading material assigned will be posted on Canvas.

Recommended Materials

Recommended reference books:

For solid/liquid, liquid/liquid & liquid gas systems

- Terrence Cosgrove, "Colloid Science Principles, Methods and Applications," Blackwell Publishing Co; 2010 (possibly available on- line or in the UF library).
- Georgios Kontogeorgis and Soren Kiil, "Applied Colloid and Surface Chemistry," John Wiley & Sons, 2016. (possibly available on- line or in the UF library).

For solid/solid systems – thin films

- Robert J. Stokes, D Fennell Evans, "Fundamentals of Interfacial Engineering", Wiley-VCH © 1997. (Ch. 9 & 10)

Reference material:

- Other material assigned and/or posted on the Canvas system. Internet sources.

Course Schedule

(Tentative)

Week 1-5: Defining Interfacial Engineering; Surface Forces – van der Waals, Electrostatic, Solvation, Hydration, Steric and Depletion forces. Systems Containing Fluid Interfaces – Surface tension & surface energy, Young-Laplace, and Kelvin equations, Contact angle, Nucleation Theory (Textbook Chapters 2, 5, 6)

Week 6-10: Charged Interfaces, Electrical Double Layer, Electrokinetic phenomena, Zeta potential, Surfactants (Textbook Chapters 4, 11)

Week 11-15: Solid surfaces, Adsorption, Surface modification (Textbook Chapters 7,8,9)

Attendance Policy, Class Expectations, and Make-up Policy

Attendance in class is important. Lecture attendance is recommended but may not be recorded. Material covered in class will follow the recommended book chapters closely in some areas and will deviate from it in others; in a few cases class notes will be used exclusively. In addition, there may be assignments to be completed in class. Those students not in class for any reason are responsible for the material covered in class, and the homework assigned.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Correct behavior in class is always important. Making noise, talking, reading the paper, leaving your cell phone on, leaving early, or arriving late can be very distracting. Occasionally, your schedule will demand that you arrive late or leave early - in these cases please minimize class disruption.

Homework will be assigned and is due on the dates indicated on the assignment; no late homework will be accepted. Assignments submitted after the solutions are posted will receive a zero grade. Learning from and teaching others is encouraged, but all turned in problem solutions must be your own work. All homework problems and solutions may be downloaded from the Canvas site. Homework grading policy to be decided pending TA/grading assistance availability. In order to enhance the ability to acquire and apply new knowledge using appropriate learning strategies, a team project (or another suitable modality) will be assigned. Details of team project will be provided in class and posted on Canvas.

Exams: will closely follow the material covered in class, in your assigned reading and in homework problems. These will be closed book and without notes and will be given during regular class periods, or at prescheduled times. Students will be responsible for preparing a one-page (8.5 X 11" both sides) list of equation/formulae/constants etc. that will be allowed for exam purposes and must be submitted via course Canvas site immediately after the exam. No descriptive materials or definitions will be allowed on the list of formulae etc.

Requests for re-grading of exams must be made within one week after a graded exam/assignment has been returned.

Exact dates for exams will be announced in the class and posted on the Canvas system, a tentative schedule is as follows: Exam 1 – week of Sept. 25; Exam 2 – week of Oct. 23; Exam 3 – week of Nov. 27.

Pending TA assignment, in-person bonus quizzes may be given during the class periods. Bonus quiz policy will be announced as soon as possible.

Final Exam: There will be no final exam.

Make-up Exam Policy: If you miss an exam through documented illness or for an excused absence, you may take a make-up exam. If you miss an exam for any other reason, you will receive zero points on that exam.

Evaluation of Grades

Assignment	**Total Points**	**Percentage of Final Grade**

Homework Sets (6-7)	50 each	10%
Exams (3)	100 each	(25% each) 75%
Team Project	100	15%
TOTAL	-	100%

Grading Policy

This class will be graded on the following scale:

92-100 A (GPA points = 4.0)

88-91 A- (3.67)

84-87 B+ (3.33)

80-83 B (3.0)

76-79 B- (2.67)

72-75 C+ (2.33)

68-71 C (2.0)

65-67 C- (1.67)

62-64 D+ (1.33)

59-61 D (1.0)

56-58 D- (0.67)

< 56 E (0)

More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

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.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Online Course 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/policies/student-honor-code-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 Program Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@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: 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 suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

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://www.distance.ufl.edu/state-authorization-status/#student-complaint