

Junior Materials Lab 2

EMA3013C Sections

Class Periods: EMA3013C-M 1:55-4:55 (13721)

EMA3013C-F 1:55-4:55 (13747)

EMA3013C-T 1:55-4:55 (13748)

EMA3013C- W 11:45-1:40 (13749)

Lecture M 12:50-1:30 PM NEB 202

Location: Rhines B06

Academic Term: Spring 2020

Instructor:

Nancy Ruzycki

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352 846 2991

Office Hours: Wednesday 2-3 or by appointment

Teaching Assistants:

Please contact through the Canvas website

- Stefano Barba
- TBA

Course Description

General undergraduate materials laboratory. (WR)

2 Credits

Attributes: Satisfies 2000 Words of Writing Requirement

Course Pre-Requisites / Co-Requisites

Prerequisite: EMA 3080C.

Course Objectives

The Table below has the Module and Objectives for each of the Modules

Module/Weeks	Objectives	Main Activities/Labs	Professional Products
Heat Transfer in Materials (5 weeks)	<p>Complete background readings on how heat flows in materials.</p> <p>Program a TMP sensor using Arduino programming, and then program it for multiple sensors. Set up and record data using the TMP sensor, and calibrate the sensors.</p> <p>Use the TMP sensor to determine heat flow through bars of varying materials and calculate the diffusivity and conductivity and compare these numbers to literature.</p> <p>Use Matlab to model heat flow thorough your materials.</p>	<p>1. Conductivity and Diffusivity measurements using Arduino</p> <p>2. Phase Transformations in Lead Free Solders using Thermocouples and LabView</p>	<p>1. Analysis of conductivity and diffusivity in materials by category</p> <p>2. IEEE format paper for Phase Transformations in Lead Free Solders (2000 words)</p>

	<p>Complete readings on how thermocouples work to measure temperature.</p> <p>Use LabView to program a data acquisition device for multiple thermocouple readings.</p> <p>Calibrate thermocouples using ASTM standards. Complete some readings on solders and lead based solders.</p> <p>Model two phase systems for solder using Thermocalc.</p> <p>Complete some readings on phase transformations in materials.</p> <p>Using calibrated thermocouples, measure heat transformations for multiple compositions of a lead free solder alloy and then construct a phase diagram from the transformation data.</p> <p>Prepare a IEEE style research paper on your results for the lead free solder study.</p>		
Failure Analysis (2 weeks)	<p>Learn the elements of a case study for failure analysis, and apply it to actual cases.</p> <p>Learn to differentiate the modes of failure.</p> <p>Learn to differentiate different models/types of failure.</p> <p>Learn about the Weibull statistics and apply them to failure in ceramic materials.</p> <p>Learn about the Brittle to Ductile transition in materials, and test materials for presence of this transition.</p>	Failure Analysis and Product redesign	<p>1. Case Study paper presentation (250 words)</p> <p>2.Failure Analysis Report (1000 words)</p>

	Conduct an independent case study on a material failure, and prepare a case study paper.		
Electronic Materials (2 weeks)	<p>Gain background knowledge for electrical and optical properties of semiconductors and compound semiconductors for use as electronic materials.</p> <p>Gain background knowledge of electron transport in semiconductor materials and basics of PN junction devices.</p> <p>Conduct experiments for a facile synthesis route of Quantum Dots and materials characterization..</p> <p>Conduct experiments to determine cutoff voltage in LEDs and compare to manufacturer value, and to band gap of compound semiconductor used in the LED. Complete a technical report.</p> <p>Use materials screening and engineering design process to propose an LED design using a new combination of materials to produce a novel color.</p>	<ol style="list-style-type: none"> 1. Determining Cut Off Voltage on LEDs 2. Quantum Dot Synthesis 	<ol style="list-style-type: none"> 1. STAR report (500 Words) 2. LED Design paper(500 Words) 3. Key Findings Report (250 words)
Ceramic Processing (4 weeks)	<p>Gain knowledge of the structure property relationship for dielectric ceramics</p> <p>Conduct an experimental design for making a dielectric ceramic</p> <p>Understand and apply the processing steps of calcining, pressing and sintering of a ceramic dielectric pellet in order to produce a high dielectric material with a density of > 85 % of theoretical value.</p>	<ol style="list-style-type: none"> 1. Ceramic Design Proposal 2. Solid State Synthesis of Ceramics 3. Analysis of Dielectric Material 	<ol style="list-style-type: none"> 1. Oral group Proposal and Presentation 2. Final group presentation

	Prepare and test produced dielectric ceramics for dielectric constant		
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Materials and Supply Fees

List if applicable

Professional Component (ABET):

State the contribution of the course to meeting the professional components of the ABET-accredited degree.

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

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	Medium
3. an ability to communicate effectively with a range of audiences	High
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	Medium
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	Low
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

None

Recommended Materials

- Fundamentals of Materials Science and Engineering, an Integrated Approach.
- Callister

- 2015, 5E
- ISBN:9780471395515

Course Schedule/(see objectives for outcomes)

Weeks -1-5 Heat Transfer in Materials
 Weeks 6-8 Failure Analysis
 Weeks 9-10 Electronic Materials
 Weeks 11-15 Ceramic Design Challenge

Attendance Policy, Class Expectations, and Make-Up Policy

Laboratory Attendance is Required and there are no make ups for a missed lab. : Excused absences are allowed with prior notification and lab make-up conducted in advance. These policies are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. Medical Absences requires a doctors note.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Laboratory Notebooks	100 each	15%
Skills Assessment	25 each	10%
Student Products	Varies	60%
Final Project		10%
Formative Assessments (pre-labs & Quizzes)	25 each	5%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

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

Writing Requirement.Each Topic listed above will have a student product which will be graded as a formal assessment. There will be a rubric for each product. Student products may include, but are not limited to; lab reports, posters, abstracts, research proposals, users manuals, program codes, technical letters, oral presentations.

The writing assignments/student products for this course are designed to meet the minimum requirements of the University Writing Requirement credit of **2,000 words**. To satisfy this requirement, every assignment's word count must be fulfilled (see Table below). Due dates are subject to change based on class progression and exams in other classes.

Assignment	Draft Due Date	Draft Revision Due Date	Final Due Date
IEEE format paper for Phase Transformations in Lead Free Solders (2000 words)	Jan 28, 2020	Feb 4, 2020	Feb 18, 2020
Case Study paper presentation (250 words)			Feb 11, 2020
Failure Analysis Report (1000 words)	Feb 25, 2020	March 10, 2020	March 17, 2020
STAR report (500 Words)			March 20, 2020
LED Design paper(500 Words)			March 25, 2020
Key Findings Report (250 words)			March 27, 2020

The instructor will evaluate and provide feedback on the student's written assignment in accordance with both the UF writing rubric and the course content rubric for that particular assignment, including, but not limited to, grammar, punctuation, usage of standard written English, clarity, coherence, and organization. Students who do not meet minimum requirements for the written assignment will have 1 week from the return of the assignment to make changes, meet the rubric requirements and hand the assignment back in for regarding. Students will receive some loss of points for the re-grade. All feedback on writing assignments will be provided prior to the last class meeting.

Resources for Writing include:

Recommended Writing Manual: Alley, Michael "The Craft of Scientific Writing", 3rd Edition, Springer ISBN-10 0387947663

University's Writing Studio (www.writing.ufl.edu)

Recommended style manual is: IEEE Editorial Style Manual.

http://www.ieee.org/conferences_events/conferences/publishing/style_references_manual.pdf

All written assignments must be turned in early to receive feedback on the draft version. These dates will appear on the course website and will be approximately 1 week before main assignment due date. All writing assignments will be turned in through the class web portal and will be subjected to anti-plagiarism detection. Students found to have plagiarized will be subject to university policies.

Below is the UF writing rubric which will be used to judge mechanics and flow of the written student product. Each student product will also carry a content based rubric. The student products carry two grades, one for the writing mechanics, and one for the content mechanics. Students must satisfactorily meet both rubrics for a passing assignment.

	SATISFACTORY (Y)	UNSATISFACTORY (N)
CONTENT	Papers exhibit at least some evidence of ideas that respond to the topic with complexity, critically evaluating and synthesizing sources, and provide at least an adequate discussion with basic understanding of sources.	Papers either include a central idea(s) that is unclear or off- topic or provide only minimal or inadequate discussion of ideas. Papers may also lack sufficient or appropriate sources.

ORGANIZATION AND COHERENCE	Documents and paragraphs exhibit at least some identifiable structure for topics, including a clear thesis statement but may require readers to work to follow progression of ideas.	Documents and paragraphs lack clearly identifiable organization, may lack any coherent sense of logic in associating and organizing ideas, and may also lack transitions and coherence to guide the reader.
ARGUMENT AND SUPPORT	Documents use persuasive and confident presentation of ideas, strongly supported with evidence. At the weak end of the Satisfactory range, documents may provide only generalized discussion of ideas or may provide adequate discussion but rely on weak support for arguments.	Documents make only weak generalizations, providing little or no support, as in summaries or narratives that fail to provide critical analysis.
STYLE	Documents use a writing style with word choice appropriate to the context, genre, and discipline. Sentences should display complexity and logical sentence structure. At a minimum, documents will display a less precise use of vocabulary and an uneven use of sentence structure or a writing style that occasionally veers away from word choice or tone appropriate to the context, genre, and discipline.	Documents rely on word usage that is inappropriate for the context, genre, or discipline. Sentences may be overly long or short with awkward construction. Documents may also use words incorrectly.
MECHANICS	Papers will feature correct or error-free presentation of ideas. At the weak end of the Satisfactory range, papers may contain some spelling, punctuation, or grammatical errors that remain unobtrusive so they do not muddy the paper's argument or points.	Papers contain so many mechanical or grammatical errors that they impede the reader's understanding or severely undermine the writer's credibility.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) 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

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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/>) 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 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: <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: <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 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://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.