

**Properties of Functional Materials**  
**EMA 6114**  
**Sections: 13876 (Campus); 13878, 13879 (EDGE)**  
**Location: NEB 102**  
**Spring 2020**

*This course is one of the four key technical courses foundational to the MSE graduate program: Materials Thermodynamics (EMA 6316), Diffusion, Kinetics and Transport in Materials (EMA 6136), Structure and Mechanical Properties of Materials (EMA 6313), and Properties of Functional Materials, (EMA 6114). As a core course, this class covers a significant amount of graduate-level material and it is designed to challenge you to advance your knowledge and skills. Success will require a considerable investment in preparing for lectures by using textbooks and other sources that you seek out, solving problems, and studying for exams. It is expected that you will have to exhibit significantly more independence, initiative, and ownership of the learning process than was required for success at the undergraduate level.*

2. Pre-requisites and Co-requisites – EMA 6313

3. Course Objectives

To gain an understanding of the principles underlying the properties of functional materials. The specific objectives for the course include understanding the electrical, thermal, magnetic, and optical properties of materials.

4. Instructor – Prof. Simon R. Phillpot

a. Office location: 164 Rhines Hall

c. E-mail address: [sphil@mse.ufl.edu](mailto:sphil@mse.ufl.edu)

d. Class Web site: login to e-Learning at <https://lss.at.ufl.edu/>

e. Office hours:

On campus students (Sec. 13876): M 12:50 – 1:40, R 9:35 – 10:25

Off campus students: e-mail (expect up to 24 hrs. for response). Phone/Skype by Arrangement

I strongly encourage use of the Discussion feature on Canvas to work out technical questions and ask for/provide clarifications from and to the instructor, TA and peers.

5. Teaching Assistant – TBD

6. Meeting Times – Lecture: M, W, F period 2 (8:30 – 9: 20 am)

7. Class/laboratory schedule – Three 50-minute lecture periods per week.

8. Meeting Location – 102 NEB

9. Material and Supply Fees – None

## 10. Textbooks and Software Recommended:

- Principles of Electronic Materials and Devices, S.O. Kasap, 4th Edition, McGraw-Hill 2018, ISBN: 0072957913

*The 3<sup>rd</sup> edition is also OK, but the student is responsible for any differences between the editions. First and second editions are not acceptable substitutes.*

## 11. Recommended Reading:

- Introduction to Solid State Physics, C. Kittel.  
*This is a classic solid-state physics book, now in its 8<sup>th</sup> edition; first published in ~1953. Essentially any edition of this will be a useful supplemental text. Many are available cheaply online.*
- Electrical Properties of Materials, L. Solymar and D. Walsh, Oxford University Press  
*This book is in its 9<sup>th</sup> edition. I have 7<sup>th</sup> Edition which is a good text; I assume other editions are useful also.*
- For basics of quantum physics, consult a standard introductory physics book. An open source text is available at <https://openstax.org/details/books/college-physics>

12. Course Outline - General topics are electronic, magnetic, and optical properties, materials processing, and materials selection. List of specific topics covered in lectures will be provided.

The following is an approximate outline of the 43-class schedule. This may be subject to change:

1. Introduction (1 class)
2. Classical electronic and thermal properties; successes and failures of classical physics (~3 classes)
3. Lattice Vibrations, Phonons and Thermal Conductivity (~4 classes)
4. Quantum theory (~6 classes)
5. Electronic Properties of Semiconductors: Basics (~4 classes)
6. Electronic Properties of Semiconductors: Devices (~4 classes)
7. Electrical Properties of Organic Systems (~2 classes)
8. Optical Properties (~5 classes)
9. Magnetic, Dielectric, Ferroic Properties (~6 classes)
10. Functional Materials: Surfaces, Interfaces, Growth and Nanostructures (~4 classes)

13. Attendance and Expectations - Attendance in lecture is not part of the course grade; however, all on-campus students are expected to attend class. I strongly encourage active participation and questions – it makes the class more fun for all and improves learning. The more questions from students, the more learning takes place. If you have a question, it is likely others have (or should have!) the same question, so please ask it. Cell phones should be turned off in class. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during class time.

#### 14. Grading –

- Four exams – 20% each
- Homework - 20%

Homework deadlines will be provided during the semester. Homework assignments are posted on the website. All HW must be submitted electronically by the deadline. Canvas will not accept submissions after the deadline.

Much of the HW will be problems from the assigned text. There are electronic solution manuals for the text online. Copying from the solution manual is a violation of your honesty pledge. Any such violations will be reported and prosecuted.

Exam Schedule (Tentative – to be finalized by January 17, 2020)

All exams will be ~6 – 8pm in locations to be determined:

Wednesday January 29<sup>th</sup>

Wednesday February 26<sup>th</sup>

Wednesday March 25<sup>th</sup>

Wednesday April 22<sup>nd</sup>

Unexcused absences from the exam will result in a grade of zero.  
The content and format of the exams will be made clear in advance.

15. Grading Scale - The grading scale is indicated below. Grades are not curved.

Percentage	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

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 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](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>

### ***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:** <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](mailto: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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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