

Electronic Properties of Materials

EMA 3413

Class Periods: Tue, 10:40 AM- 11:30 AM; Thu, 10:40 AM – 12:35 PM

Location: Zoom online (live)

Academic Term: Spring 2021

Instructor:

Honggyu Kim

Email Address: honggyukim@ufl.edu

Office Phone Number: (352) 846-3766

Office Hours: Wed 3:00 PM – 5:00 PM via Zoom (Zoom link will be provided) or by appointment

Class Website: Login to e-learning at elearning.ufl.edu

Teaching Assistants:

Eitan HersHKovitz

Email Address: ehersHKovitz@ufl.edu (Note: Please contact through the Canvas website)

Office Hours: TBD

Course Description

This 3-credit course introduces the electronic, optical, magnetic and thermal properties of materials (in particular solids) and their applications in technologically important devices. Students will be exposed to the following contents: atomic/electronic structure and bonding of materials; fundamentals of quantum mechanics; quantum-mechanical and classical descriptions of materials properties; electrical conduction in metals and semiconductors; dielectric, magnetic and thermal properties of solids; design principles of devices.

Course Pre-Requisites / Co-Requisites

EMA3010 or equivalent. Basic knowledge of undergraduate-level general physics, chemistry, calculus, and differential equations.

Course Objectives

After taking this course, students will be able to

1. Describe how the electronic, optical, magnetic and thermal properties of (solid) materials originate from their atomic and electronic structures;
2. Understand aforementioned materials properties of different kinds of solid materials;
3. Understand how aforementioned materials properties are utilized to design specific electrical, optical and magnetic applications.

Professional Component (ABET):

This is a 3-credit course. It provides 3 credits towards engineering sciences.

Relation to Program Outcomes (ABET):

The following outcome and coverage table applies to students in the Materials Sciences and Engineering undergraduate program:

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.	

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

Materials and Supply Fees

Not applicable

Required Textbooks and Software

- *Principles of Electronic Materials and Devices*, S. O. Kasap, 4th edition, 2018, McGraw Hill, ISBN 978-0-078-02818-2

Recommended Materials

- *Electronic Properties of Materials*, R. E. Hummel, 4th edition, 2011, Springer, ISBN 978-1-4419-8164-6
([Available as an e-book through UF library](#))

Course Outline: Contents and schedule are subject to change as necessary

Subject	Hours
Basics	
1. Elementary Materials Science Concepts	4
2. Electrical and Thermal Conduction in Solids	4
3. Elementary Quantum Physics & Modern Theory of Solids	12
Materials and Devices	
4. Semiconductors and Relevant Devices	10
5. Dielectric Materials	3
6. Magnetic Properties	3
7. Optical Properties	4
Total	40

Online Course Recording

Our 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.

Attendance Policy and Class Expectations

Synchronous attendance via Zoom is not required, but **highly recommended**. Prompt and regular attendance at each online lecture is essential to student's success in the class. Students are expected to **be punctual** on every online lecture and **behave respectfully** to their peers and the instructor. The Zoom meeting will start 5 minutes before the scheduled times.

Make-Up Policy

Makeup exams will be provided only if students have a valid reason (e.g., medical absences, family emergency, etc.). Excused absences for exams must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentations. If students are not able to take exams, students must inform the instructor at the earliest opportunity.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Problem Sets (~8)	10 each	30%
Midterm Exam (2)	100 each	30%
Final Exam (1)	100	40%
Total		100%

Midterm 1: Feb.15.2021 (Thursday, TBD) – tentative

Midterm 2: Mar.15.2021 (Thursday, TBD) – tentative

Final: 4.30.2020 (Friday, 10:00 AM – 12:00 PM)

Late assignments: ONLY one late homework assignment will be allowed. Any further late homework assignments will be considered as ZERO.

Grading Policy

Percent	Grade	Grade Points
≥ 92	A	4.00
≥ 88	A-	3.67
≥ 84	B+	3.33
≥ 80	B	3.00
≥ 76	B-	2.67
≥ 72	C+	2.33
≥ 68	C	2.00
≥ 65	C-	1.67
≥ 62	D+	1.33
≥ 59	D	1.00
≥ 56	D-	0.67
< 56	E	0.00

Note: In case that the class average for midterm and final exams are low, grades for exams (not for homework assignments) can be curved up at the discretion of the instructor. 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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <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 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 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](mailto:title-ix@ufl.edu), 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://care.dso.ufl.edu>.

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