Phys 450 Physics of Materials Spring 2025

Dr. Fatima
Room No: Life Science 401B
Phone: 540-375-2057; E-mail: fatima@roanoke.edu
Office Hours: MW 1:00PM – 2:00PM, Th 1:10PM – 1:40PM, & F 9:40AM-10:30AM
(Life Science 401B /via zoom by appointment)

Lectures: MWF 12.00-1.00 PM, Room: Trexler 274
Required Textbook: Materials science and Engineering: An introduction by William Callister, 10th Ed, Wiley Publishers
Recommended:

- *Electronic Properties of Materials*, Rolf Hummel, 2nd Edition, Spring-Verlag
- *An Introduction to Semiconductor Devices*, Donald Neamen, First Edition, 2006
- *Nanophysics and Nanotechnology*, Edward Wolf, 2005

Overview: An introduction to the physics of materials including the collective behavior of atoms and molecules, electrical, magnetic properties of metals, electronic materials, composites, and nanostructures.

Learning Objectives: By the end of this course, successful students will be able to

- describe phase transformation in materials
- explain the theory of semiconductors and provide common examples and their use
- describe the magnetic properties of materials
- describe the optical properties of materials
- understand the role of nanomaterials for future applications

Expectation: Students are expected to put in a minimum of 12 hours/ week work outside the class in order to successfully complete this course.

Homework: Homework will be assigned bi-weekly and due at the beginning of class on the announced due date. Late homework will not be accepted, unless you have my prior approval.

Participation: Participation will include a variety of in-class activities, including problem-solving, and worksheets. The grade in this category will be based on completion of these in-class activities, as well as attendance and summaries of one MCSP Colloquium Talks.

Exams: There will be two one-hour mid-term exams and a comprehensive final exam. Exam make-up for excused reasons (family or medical emergencies, and university-recognized commitments) must be discussed and arranged with me at least one week in advance, unless it is an emergency. To limit your time commitment to this class, exams will be held in class. If you receive academic accommodations or you cannot make it to class that day, you can complete the test at a different time, but please communicate this with me ahead of time.

MCSP Conversation Series: You are required to attend ONE talk in the MCSP Conversation Series and submit a well-written reflection on the talk within one week of the presentation. The submission must present a brief summary of the key ideas of the talk and include a description of the parts of the presentation that were interesting, confusing, and relevant to this course. Your work must be grammatically-correct, typed, double-spaced, and approximately one page in length. Note that a simple summary of the talk is not sufficient to receive credit. Your reflection on the MCSP talk will contribute to your participation grade.

Presentation: At the end of the semester you will give a presentation as a team. Presentations will be on the Lab output. More information on this will be provided after Fall Break.

Grading:

Homework	20%
Mid-term Exams	30% (15% each)
Presentation (Team Project)	15%
Participation	15%
Final Exam	20%

Your final letter grade will be determined based on your final numerical score as per the guidance below.

60-62	D-	80-82	B-
63-66	D	83-86	B
67-69	D+	87-89	B+
70-72	C-	90-92	A-
73-76	C	≥93	A
Points	Grade	Points	Grade
<60	F	77-79	C+

Use of Electronic Devices: Electronic devices are valuable tools; therefore, my general policy is to allow the use of electronic devices in the classroom. Laptops or tablets may be used for note-taking during regular class sessions if this seems useful to you. Scientific calculators may be used during class when needed and during exams.

However, I expect your phones to be on silent mode and out of reach at all times, and I expect that any electronic devices will not be used to browse the internet or communicate with anyone inside or outside of class. A violation of this policy during an exam will be considered violation of Roanoke College's Academic Integrity policy, and I reserve the right to limit the use of electronic devices in the classroom if I feel this policy is being abused

Accessible Education Services (AES): located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Becky Harman, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Becky Harman at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Academic Integrity: Your learning and integrity are at the core of your RC education. For this reason, you must follow the rules outline in the College's AI policies. See https://www.roanoke.edu/inside/a-z_index/academic_affairs/academic_integrity. Collaboration is an important skill that you will be asked to develop in class and in lab, and I would encourage you to extend this practice beyond the classroom as you work on problem sets. However, for the homework in particular, the final write-up should reflect your own understanding of the problem and I ask that you include the names of anyone you collaborated with when you turn in your problem set.

Course Plan: We will cover as much of the following material as possible.

Week of	Chapter	Topic
13-Jan	Ch 9	Phase Transformations
22-Jan		Phase Transformations (Contd.)
27-Jan	Ch 20	Magnetic Properties of Materials
3-Feb		Magnetic Properties of Materials (Contd.)
10-Feb	Ch 18	Electrical properties of materials
17-Feb		Electrical properties of materials (Contd.)
	26-Feb	Exam 1
24-Feb	Ch 21	Optical Properties of Materials
3-Mar		Spring Break No classes
10-Mar		Optical Properties of Materials (Contd.)
17-Mar		STM, AFM
24-Mar	24 Mar	Exam 2
		Lab
31-Mar		Lab
7-Apr		Lab
14-Apr		Group Presentation
	18 Apr	Good Friday, No Classes
21-Apr		Group Presentation
28-Apr	2-5 pm	Final exam

Disclaimer: Everything above is subject to change with notice and, where appropriate, your approval.