56:121:568 - Condensed Matter and Materials

50:750:406- Condensed Matter and Material Physics

Instructor	Dr. Sean O'Malley	**E-mail**	omallese@camden.rutgers.edu
Phone	856-225-6159	**Office Hours**	TBA
Office	CNS 216F	**Final Exam**	TBA

Class meeting time: T & R 2:00 – 3:20 pm

Text: "Solid State Physics: An Introduction" by Philip Hofmann
ISBN: **978-3527408610** (paperback)

Alternative texts: "Introduction to Solid State Physics" by Kittel
This is the standard advanced undergraduate (introductory graduate) text on the subject. Earlier editions like the 2nd contain more details in some regards.

"Principles of Condensed Matter Physics" by Chaikin & Lubensky
Good breath of material and presents it well but lacks details.

Description: This course is an introductory approach to condensed matter and materials physics. The fundamentals of electron theory will be introduced and utilized to relate the optical, electrical, and magnetic properties of materials. Topics will include, but not be limited to, semiconductor band structure, atomic binding energies, crystalline structures, and ferroic-type ordering. Additionally, select topics from soft condensed matter physics such as the physics of polymers and electro-optical properties of liquid crystals will be covered.

Learning Goals: At the conclusion of the course students should be aware of (1) the various structures that comprise condensed material systems, (2) the atomic/molecular interactions that bind the materials together, (3) contributing factors that give rise to thermal and electric properties, and (4) the mathematical foundations that describes various behavior.

Details:

1) Office hours are just a formality – You can email and arrange for a meeting (in-person or remote) at any time.
2) There will be **semester exams** pertaining to the material covered during lecture. (100 pts ea.)
3) There will be several **quizzes.** (up to 35 pts ea.)
4) There will be **graded homework assignments** (up to 15 pts ea.)
5) The **final** maybe an examination of the material and/or a presentation on a new topic. (the point value will be determined at a later date)

Grading:

A	90-100%	C	67-75%
B+	87-89%	D	55-66%
B	80-86%	F	<55%
C+	76-79%		

Instructor's Statement:

Do not engage in any form of academic dishonesty. If you do not know what academic dishonesty is, please consult this statement:

https://policies.rutgers.edu/10213-currentpdf

I will report any violations of this policy to the campus Judicial Officer.

Please note that it is necessary to explain all steps that you take on exams – make an effort to ***clearly*** show your work. Answers without justification will not be accepted! You may be asked to explain your reasoning.

Attendance is strongly suggested at all class meetings in accordance with the policies and guidelines set forth in the student manual.

Attending the lecture is not enough. Take notes and read-up on the relevant topics on the web or in relevant textbooks.

Class Resources:

https://canvas.rutgers.edu/

Class Outline:

1 – Crystals & Crystal Structures
2 – Theory of Scattering Waves from Lattices
3 – Bonding of Atoms in Crystals
4 – Mechanical Properties of Crystals
5 – Elastic Theory & Elastic Waves
6 – Phonons & Lattice Vibrations
7 – Thermal Properties
8 – Free Electron Theory of Metals
9 – Semiconductors
10 – Nanostructures
11 – Point Defects & Dislocations
12 – Optical Processes & Excitons
13 – Dielectrics & Ferroelectrics
14 – Liquid Crystals
15 – The Physics of Polymers