

Dr. Rama Balasubramanian (a.k.a) Dr. Bala

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Office Hours: MWF 11 am- 12 noon; Th 1-2 pm; Additional Hours: By Appointment

Lectures: Block 2 – MWF 9.40-10.40 am**Required Textbook:** Materials science and Engineering: An introduction by William Callister, 9th Ed, Wiley Publishers**Recommended:**

- *Electronic Properties of Materials*, Rolf Hummel, 2nd Edition, Springer-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, crystal structure, mechanical, 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 solid materials in terms of their interatomic forces and bonds
- describe crystals in terms of lattice structures and dynamics
- explain the basic concepts of crystallography and the importance of periodicity
- describe diffusion principles and phase transformation in materials
- explain the theory of semiconductors and provide common examples and their use
- describe the magnetic 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 weekly, typically on Wednesday, and due at the beginning of class on the announced due date. Late homework will not be accepted, unless you have my prior approval. One low homework score will be dropped.**In-Class Activity:** You will also be required to complete problems assigned in class. In addition, you must participate in discussions of journal articles, latest trends in materials science and technology, e-Kit activities. The evaluation for in class activity will be based on individual participation as well as participation as a team.**Team Roles:** The class will be divided into three teams, viz., **Team FCC, Team BCC and Team HCP**. On each team activity, your team should designate a *coordinator* to organize work sessions, make sure everyone knows where and when to meet and understand who is supposed to be doing what, a *recorder* to prepare and turn in papers/presentations, and/ a *checker* to check the research and the strategies used to prepare the discussion document. The team roles must rotate on every activity – once a team member has carried a role, he/she may not do it again until everyone else on

the team has done it. If a team is unhappy with the performance of a non participative member, he/she can be fired from the team. If you get fired, you will lose points.

MCSP Colloquium Series: You are required to attend at least 3 of the several talks as a part of the MCSP colloquia this semester. You have to write up a paper on your reflections of the talk to get full credit. The papers will be graded on a scale of 1-3. If you show up for the talk and not submit the paper you will get 1 point. If you simply regurgitate the talk you will get 2 points. A well written and reflective paper will be awarded 3 points. You must submit your MCSP papers via *Turnitin* on Inquire.

Quiz: There will be 10 minute long quizzes every week on the lecture material covered during the two week period. Announcement about the quiz will be made in the class.

Exams: There will be two mid-term exams, indicated in your syllabus. If you have any problems with these dates, **tell me soon**. There will also be a 3-hour final exam

Presentation: At the end of the semester you will give a 20 minute presentation as a team. Presentations topics will be related to applications of modern day materials. More information on this will be provided after Spring Break.

Grading:

Homework	10%
Mid-term Exams	30% (15% each)
Presentation (Team Project)	10%
Quiz	12%
MCSP Colloquium	3%
In-class Activity	10%
(Case study, Journal Reading, Discussion, Design Problems)	
Final Exam	25%

Attendance: It is your responsibility to show up for the lecture in a timely manner and complete all the work assigned in class. Should you have a medical condition/emergency situation/participation in a conference or sporting events representing the College, that you cannot attend the class, you must let me know immediately. Proper documentation (like doctor's note, court order, and schedule of conference/sports events) must be presented. **Just sending an email will not be sufficient.** You must meet with me in person. It is your responsibility to make up for the work that you missed. I will not extend the deadline for turning in homework or other work assigned in the class unless you have my prior approval.

Class Disruption: All students are entitled to a professional learning environment. Students should not act in a manner which will distract and disrupt the class learning experience. Such practices will not be tolerated. **Cell-phones, pagers, beepers or any other electronic communication/entertainment devices must be turned off** at all times during the lecture period.

Academic Integrity: Policies of Academic integrity are enforced in all aspects of this course. It is the responsibility of the student to strictly adhere to the policies of Academic Integrity of Roanoke College.

Philosophy: My teaching philosophy is not to make you memorize equations but rather help you understand the Physics. Please talk to me if you have any problems understanding the materials presented. I will not usually offer help over phone/e-mail.

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

Week of	Chapter	Topic
18-Jan	Ch 1, 2	Introduction
25-Jan	Ch 2	Quantum Picture
1-Feb	Ch 3	Crystalline Materials
8-Feb	Ch 5	Diffusion Mechanisms
15-Feb	Ch 9	Phase Diagrams
22-Feb	Ch 10	Phase Transformations
	26-Feb	Exam 1 (Quantum Picture, Ch 2, Ch 3, 5, 9)
29-Feb		Phase transformations (Contd.)
7-Mar	Spring Break No classes	
14-Mar	Ch 18	Electrical properties of materials
21-Mar		Electrical properties of materials (Contd.)
25-Mar	Good Friday No classes	
28-Mar	Ch 20	Magnetic Properties of Materials
4-Apr	Ch 20	Magnetic Properties of Materials (Contd.)
8-Apr	Team Project Research Day	
11-Apr	Ch 21	Optical Properties of Materials
18-Apr		Special Topic : Nanomaterials
22-Apr	Exam 2 (Ch 10, 18, 20, 21)	
25-Apr		Team Presentation
28-Apr	2-5 pm	Final exam

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