MSE 2090, Section 1 (Spring 2014):

INTRODUCTION TO THE SCIENCE & ENGINEERING OF MATERIALS
via Guided Inquiry

You know that we are living in a material world…. Madonna

Instructor: **Jerry Floro**: floro@virginia.edu 122 Wilsdorf Hall 243-1730
Co-instructor: Micah Schaible ms5vf@virginia.edu Thornton Hall B214 924-9652

Meeting Time and Place: T/R 9:30 – 10:45; MEC 341

Floro Office Hours: Monday, 3:00-4:00 pm, Wednesdays, 3:30-5 pm in WDF 122

Schaible office hours: Wednesdays, 9-11 am in MSE 125

ES/MSE Advanced Mentors: Doug Bae and Elise Poerschke

Textbook: *Introduction to Materials Science and Engineering, A Guided Inquiry*, by Elliott P. Douglas, Pearson Education

Equipment: you will need a web-enabled device (smart phone, tablet or laptop). If you do not have one of these, please contact me.

Text

Materials Science?

- Could we, and should we, make a bridge out of glass?
- Why can we write with graphite, but not with diamond? They're both just carbon…
- Would you wear a soda bottle in the winter for warmth? I do…

Materials are used to construct every technology used by our society, spanning the *seemingly* mundane materials like steel, concrete and plastic, to sophisticated materials like silicon, carbon nanotubes and electroluminescent polymers. But what science underlies the making and the design of these materials? While physics and chemistry are important, Materials Science looks into a different and unique place — the *microstructure* – of a material. In this course, you will learn how the **properties** of a material are influenced by its underlying **structure**, and how we can control this structure using **processing**. By the end of the course, you will look at your smart phone, your car, your home, and your world, through different eyes.

POGIL?

Differentiating this section of MSE 2090, we will use Process-Oriented Guided Inquiry Learning (POGIL), which is a form of *active learning* (rather than passive, as in lecture) where you construct your own understanding in a very direct way. POGIL also exploits *peer instruction* to promote deeper and more significant impact to your learning, since the process of explaining and arguing with others forces you to hone your comprehension. So, much of the work you will do in the classroom will be in a **team** context. For more information, see the description of POGIL

in your textbook. The material covered in this section of MSE 2090 will be the same as the other sections, although the order and overall breadth of coverage may differ.

Accomplishments:

At the end of the semester, here is what you will be able to do:

1. Describe what is meant by material microstructure.
2. Define what is meant by the intrinsic properties of materials.
3. Predict how the microstructure can be controlled by simple processing techniques.
4. Develop a systematic, analytical approach to solving complex problems in materials.
5. Assess and feedback on the work of others, and on your own work.
6. Connect materials to your life, to your interests, and to the needs of society.

Assessments:

These activities will help you and I measure your progress towards the six Accomplishments above. More details will be provided when the activities are assigned.

Evaluation:

Homework – Skills: Homework will help you master each module shown in the schedule below. Assignments include online problems to practice with concepts and skills. There will be 9-10 skills sets depending on our progress.

Homework – Applications: There will be 5 more complex, and/or open-ended problems to be solved with your team. These are designed to evolve you to a more advanced mode of thinking, and help you develop systematic approaches to solving complex problems.

Exams: Three 75 min in-class exams that are "semi-comphrensive", covering Concepts, Skills and Applications.

Materials Challenge Video: This will be a team project due around the end of the semester – an 8 minute video on a material challenge that is critical to advancing a major technology, to include separately a written proposal, a pre-reviewed script, and a source bibliography. Each team will be responsible for assessing 3 other team videos.

Preparation & feedback:

Warm Ups: These are micro-activities done online just prior to class.

ConceptChecks: These are done throughout each classroom session using real-time feedback.

Team and self-assessment: You'll try to realistically evaluate the performance of your team.

Grading:

Activity	Percentage of Total Grade
Skills Exercises (individual)	14
Application Problems (team)	14
Exams	39 (13 each)
Warm Ups/Concept Checks/Team Assessment	6/8/4
Materials Challenge Video (MCV)	15

Schedule of Activities:

Text

Module #	Date	Concept	Textbook Chapter	Number of Class Sessions
0	Jan 14	Our Course		0.5
1	Jan 14	What is MSE?	2	0.5
2	Jan 16	Bonding	3	1
3	Jan 21	Arrangements of Atoms	4	5
4	Feb 11	Structure of Polymers	5	2
Exam 1	*Feb 18*	Modules 1-3		1
5	Feb 20	Microstructure: Phase Diagrams	6	3
6	Mar 4	Diffusion	7	2
	Mar 10-14	*Spring Break*		
7	Mar 18	Microstructure: Kinetics	8	2
8	*Mar 25*	Mechanical Behavior	9	5
Exam 2	*Mar 27*	Modules 4-6		1
9	Apr 15	Electronic Behavior	11	4
MCV Due	Apr 29			
Exam 3	May 1 2-4 pm	Modules 7-9		1
MCV Reviews Due	May 10			

Expectations and Policies

The underlying goal of this new approach to the course is to create an environment that promotes and motivates your active engagement in your own learning and professional development. My expectation is that if you are signing up for this, you will come in with an open mind, and give it a fair try. Ultimately, this is for you, not for me.

Attendance: You lose 2% off your course grade for each unexcused absence.
Assignments: Late work is not accepted.
Honor System: Every student in this course must comply with all provisions of the UVa honor system. On tests and exams you are to pledge that you have neither received nor given unauthorized aid.

From your Honor Reps:
The Honor System and the School of Engineering and Applied Science
The School of Engineering and Applied Science relies upon and cherishes its community of trust. We firmly endorse, uphold, and embrace the University's Honor principle that students will not lie, cheat, or steal, nor shall they tolerate those who do. We recognize that even one honor infraction can destroy an exemplary reputation that has taken years to build. Acting in a manner consistent with the principles of honor will benefit every member of the community both while enrolled in the Engineering School and in the future.
If you have questions about your Honor System or would like to report suspicions of an Honor Offense, please contact a SEAS Honor Committee member.