

## COURSE SYLLABUS

### 70921 ENGR M12 – Engineering Materials, 3.0 Units

**Prerequisites:** CHEM M01A and PHYS M20A/M20AL

**Class Time:** M & W 8:30 AM - 9:45 AM; **Classroom:** PS-207 (or PS-208)

#### INSTRUCTOR & DEPARTMENT INFORMATION

**Instructor & Dept. Chair:** Scarlet Relle, Ph.D.

**Office Hours in PS-235:** M 11 am – 1 pm; T 10 am – 11 am; W 10 am – 11 am; Th 10 am – 11 am  
AND by appointment which could be scheduled in person or on Zoom  
(805) 553 – 4162

**Voicemail:**

**E-mail:** srelle@vcccd.edu

**Dean:** Robert Cabral

**E-mail:** rcabral@vcccd.edu

**Phone:** (805) 378-4721

#### IMPORTANT NOTES ABOUT COVID-19 PROTOCOLS:

In order for all of us to have a Safe Return to campus and be able to continue with our on-ground classes, we must all follow the following rules set forth by our College District:

- All faculty, staff, administrators, and students must be fully vaccinated and have their vaccination verification uploaded to the MyVCCCD mobile app by October 15<sup>th</sup>. This is a mandate and not a choice. There are medical and religious exemptions but you must contact the Student Health Center immediately for further details on these exemptions.
- If you have not been vaccinated yet, in order to obtain the required vaccination verification by October 15<sup>th</sup>, you must arrange to receive the first shot of the 2 dose vaccine series no later than September 1<sup>st</sup>.
- Every time you come to campus you must complete a self-assessment health questionnaire using the MyVCCCD mobile app prior to coming to campus. Please see the [Healthy Return to Campus](#) webpage for details.
- Once you complete the questionnaire, you must stop at a check-in location to get a wristband for that day.
- Once you enter a building and/or a classroom, you must scan the QR code of that building for contact tracing notifications.
- Please see the campus map uploaded to Canvas and also on our college website to become familiar with check-in locations around the parking lots.  
<https://www.vcccd.edu/alerts/healthy-return-to-campus>
- Parking during the Fall semester is Free. You do not need to purchase any parking permits.
- Since check-in may take some time, do allow yourself extra time to get to class and complete the self-assessment health questionnaire on the MyVCCCD mobile app prior to coming to campus.

#### ABOUT THIS CLASS

- The class will be on-campus, in-person. You are expected to attend class, take notes, and participate in all class activities.
- This course covers a wide range of topics in materials science and engineering and it draws from concepts in chemistry and physics. This course requires reading and writing in addition to problem solving skills as it is both descriptive and mathematical. Please try hard to be present in class (unless you are ill or have an emergency), otherwise, you'll miss a lot of information and it will be difficult to catch up.
- Most course materials will be posted on Canvas in the course shell, this includes lecture notes, solutions to assigned problems, some assignments, quizzes, study guides, etc.

- Graded assignments will be collected on Canvas on Mondays, Wednesdays, and/or Saturdays (unless otherwise stated) and the grades will be posted on Canvas under Grades. Some assignments may be collected on paper.
- Quizzes will be timed and on Canvas. The time for quizzes will be 30 to 40 minutes, depending on the complexity of the quiz. All exams will be administered in class, in person, on paper. The time for each exam will be 75 minutes but the final exam will be 2 hours. More on quizzes and exams on page 3.

**Technical Content:** A firm and thorough knowledge of engineering materials is critical in developing an optimal design for a given application while minimizing the risk of material failure. This course examines the interrelationships between processing, structure, properties, and performance of various engineering materials such as metals, polymers, ceramics, composites, and semiconductors. The emphasis is upon developing the ability both to select appropriate materials to meet engineering design criteria and to understand the effects of heat, stress, imperfections, and chemical environments upon material properties and performance. A research paper on material properties, selection, and application is also required.

### **COURSE LEARNING OUTCOMES (CLOs)**

Upon completion of the course student should be able to do the following:

1. Explain the interrelationships between processing, structure, properties, and performance for various engineering materials such as metals, polymers, ceramics, composites, and semiconductors.
2. Identify, explain, and calculate various design parameters related to material properties and material failure.
3. Propose an appropriate material for a particular application based on design and performance criteria, material properties, economics, and societal and environmental impacts.

### **COURSE OBJECTIVES**

Upon completion of the online course student should be able to do the following:

1. Explain the interrelationships between processing, structure, properties, and performance for various engineering materials such as metals, polymers, ceramics, composites, and semiconductors.
2. Discuss the nature of chemical bonds and their effects on microscopic structure and macroscopic properties of crystalline and non-crystalline materials.
3. Discuss and calculate mechanical properties, chemical properties, electrical properties, thermal properties, and magnetic properties for various engineering materials.
4. Discuss imperfections in solids and examine their role in determining material properties.
5. Distinguish between steady-state and non-steady state diffusion, explain what factors influence diffusion, and solve for diffusion rates.
6. Identify, explain, and calculate various design parameters related to material failure.
7. Propose an appropriate material for a particular application based on design and performance criteria, material properties, economics, and societal and environmental impacts.

### **INSTRUCTIONAL MATERIALS**

**Textbook:** William D. Callister, Jr. and David G. Rethwisch, Materials Science and Engineering, An Introduction, 9<sup>th</sup> Edition, 2014, John Wiley & Sons, Inc. ISBN#: 978-1-118-32457-8

**Lecture Notes and Lecture Slides:** Summary lecture notes or lecture slides will be posted on Canvas. These are to serve as study guides and to help you stay organized.

**EVALUATION & GRADING POLICY**

The following rubric will be used in determining your final grade in this course:

Class Participation/Posts	(15%)
Quizzes	(15%)
Research Paper	(15%)
Exams	(30%)
Final Exam	(25%)

**A:** (90.0-100%)

**B:** (80.0-89.9%)

**C:** (70.0-79.9%)

**D:** (60.0 – 69.9%)

**F:** (less than 60.0%)

**Please note that grades are rounded to one digit to the right of the decimal and grades are absolutely not negotiable.**

**RECEPIE FOR SUCCESS IN THIS COURSE**

For students to be successful in this course, the following actions and student engagement activities are strongly recommended and encouraged:

- Attend the lectures and take notes. Study every week, don't wait until a week before the exam to begin studying.
- Read the lecture slides and the relevant sections in the textbook before class and after the lectures.
- Do not hesitate to ask questions: Write down any questions that you may have and bring your questions to class or to my office hours or email them to me.
- Complete the assigned homework from the textbook and check your work against the solutions provided.
- Turn on your Canvas Notifications so that when I post an Announcement about the course you get notified immediately as Announcements are going to be one of my primary means of communication with you.
- Use the Study Guides provided for each exam as the topics on the Study Guide will be used directly in the exams.
- Late work will not be accepted. However, if life circumstances happen contact me immediately before the due date so that we can have a discussion and find a path forward, in other words, communicate with me. Exams have their own rules. See below under EXAMS.
- Be sure to find classmates that you can study with. If you need help in connecting with a class mate, please let me know and I will help you.

**TEXTBOOK HOMEWORK ASSIGNMENTS**

Homework from the textbook will be assigned for each chapter and the solutions will be posted on Canvas. Homework assignments will not be collected; however, you are **STRONGLY ENCOURAGED** to complete the homework assignments as this is the best way to learn the material! The assigned problem sets are only a representative set of the type of problems that you should know how to solve or answer. Therefore, it is **STRONGLY RECOMMENDED** that you attempt to solve other problems of similar nature.

**DISCUSSIONS ON CANVAS**

Discussion topics will be posted on Canvas to ensure regular effective contact between you and me, your instructor, and between you the students. These discussion topics will be graded as class participation points.

QUIZZES

Occasionally, online timed quizzes will be assigned on Canvas. These quizzes maybe a combination of short answers, multiple choice or problem solving type questions. Instructions for each quiz will be provided. If you miss a quiz, it will be a zero. I do not drop any quiz grades. Quizzes will be available for 12 hours, but as soon as you sign on to take the quiz, the timer will begin for the allotted time on the quiz.

EXAMS

There will be 3 exams as stated in the class schedule. All exams including the final exam will be administered in class in person. You will have 1 hr and 15 min to complete each exam unless otherwise stated. The final exam will cover selected topics from the entire course, and you will have 2 hours to complete the final exam. All exams will consist of problem sets, short answers, and perhaps some multiple-choice questions. I will provide you with a study guide the week prior to each exam. If you miss an exam, you will receive zero points on that exam. However, if life circumstances happen and if you contact me before the exam date and time to inform me of a legitimate conflict or an extenuating circumstance, we may have a conversation. The legitimacy of the conflict or the extenuating circumstance will be decided on a case by case basis according to my judgement. If you wait to contact me after the exam is administered, then there will be no conversation, and you will receive a grade of zero on that exam. I do not drop any exam grades. Exams will be given during regularly scheduled class times.

RESEARCH PAPER

Each student is expected to complete a research paper on a topic related to Material Selection. I will provide you with more information on due dates, format, suggested topics, references, etc. as the due date for the research paper approaches. You may also need to prepare a short oral presentation on your research paper.

ADDITIONAL POLICIESPARTICIPATION

Participation in my class is mandatory. I expect you to be present in class and be prepared to take notes and to participate. I will occasionally ask you to upload to Canvas the notes that you have taken during our lectures for participation points.

STUDENT RESPONSIBILITY

You, as the student, are responsible for **all** material presented in class and in assignments.

USE OF LISTENING, VIDEO, OR OTHER RECORDING DEVICES

I do not permit the use of any electronic listening or recording devices by anyone in my classroom. If you need to use a recording device as an authorized disability accommodation, then you must provide me with verification from ACCESS prior to the use of the device.

USE OF LAPTOP COMPUTERS

You may use laptop computers in the classroom only for classroom purposes. You may not surf the web, play games, or engage in any activity which I would consider disruptive to your learning process.

USE OF CELLPHONES

You may not use your cell phone during class, it must be turned off. Also, you may not use your cell phone in lieu of a scientific calculator.

DISABILITIES ACCOMODATION

Appropriate accommodations will be made for students with disability related needs. Students with a disability, whether physical, learning, or psychological, who believe they will need accommodations in this class, are encouraged to contact ACCESS as soon as possible so accommodations can be set up in a timely fashion. Accommodations are based on eligibility and can only be provided if you have submitted verification from ACCESS in the form of a Confidential Memo. The ACCESS office can be reached at (805) 378-1461.

<https://www.moorparkcollege.edu/departments/student-services/access>

**ACADEMIC INTEGRITY**

Academic integrity and honesty is of utmost importance. Cheating of any kind will not be tolerated in this course. Cheating includes turning in someone else's work as your own, using the textbook or any course material and online resources such as Chegg during quizzes and exams. Cheating will result in a letter grade of "F" equivalent to zero points for that particular assignment/quiz/test, and any previous assignments will be called into question. In addition, a report will be made to the Behavior Intervention Team (BIT).

**TITLE IX / SEXUAL MISCONDUCT**

Incidents of sexual misconduct can involve students and employees and include: sexual harassment, gender/sexual orientation based slurs, social media harassment related to sex/gender/sexual orientation/gender identity, sexual assault of any type, stalking (including text/digital stalking), dating/domestic violence, gender/sex-based hate crimes, etc. If you or another student has experienced any of these types of events, regardless of where they occurred or who the perpetrator may have been, please immediately contact your instructor, Dean or the Title IX Coordinator: Priscilla Mora ([pmora@vcccd.edu](mailto:pmora@vcccd.edu)). It is the responsibility of the College to investigate the matter and provide support and appropriate assistance to the student who may have been affected. Questions? Visit our website on TIX/Sexual Misconduct: [MC Title IX / Sexual Misconduct website](#) .

**HEALTH, SAFETY, BEHAVIOR**

Your health, safety, and behavior in our classroom and when you are on campus are of utmost importance. If I see, recognize, or find out about a concerning behavior or a health and safety issue, I will both approach you first and then make a report to the BIT team, or I may just directly make a report to the BIT team. The BIT team is committed to helping protect everyone's safety and well-being, in addition to helping to maintain the integrity of our academic environment.

**IMPORTANT DATES**

August 27<sup>th</sup>: Last day to add and drop with full refund or credit (All students/Fall semester only)

September 3<sup>rd</sup>: Last day to drop a semester-length class without a "W"

November 19<sup>th</sup>: Last day to drop a semester-length class with a "W"

Follow this link to double check the more up-to-date information regarding add/drop dates and other important dates:

<https://www.moorparkcollege.edu/apply-and-enroll/academic-calendar/fall-2021>

**CLASS SCHEDULE**

DATE	TEXT	TOPICS	EXAMS
8/16	Chapter 1 Chapter 22	Introduction to class rules Introduction to Materials Science and Engineering Economic, environmental, and societal issues in materials science & engr.	
8/18	Chapter 2	Atomic Structure & Interatomic Bonding	
8/23	Chapter 3 3.1 – 3.7	Crystal Structure Miller Indices	
8/25	Chapter 3 3.8 – 3.16	Miller Indices Continued Non crystalline materials	
8/30	Chapter 3 3.17	X-Ray Diffraction	
9/1	Chapter 4	Imperfections in Solids	

No Class – Labor Day Holiday			
9/6			
9/8	Chapter 5 5.1 – 5.7	Steady State Diffusion Unsteady State Diffusion	
9/13	Chapter 5	Continue	
9/15	Chapter 6 6.1 – 6.4	Mechanical Properties Elastic Deformation Mech.	
9/20	Chapter 6 6.5 – 6.12	Mech. Prop. Continued – Plastic Deformation; Hardness	
9/22		<b>(Assign first article)</b>	<b>Exam I Ch.1,22,2,3,4,5</b>
9/27	Chapter 7	Dislocations and Strengthening Mechanisms	
9/29	Chapter 7	Continued	
10/4	Chapter 8 8.1 – 8.15	Failure of Materials Fracture and Its Principles Fatigue and Creep	
10/6	Chapter 8	Continue	
10/11	Chapter 9 9.1 – 9.5	Introduction to Phase Diagrams	
10/13	Chapter 9 9.6 – 9.17	Phase Diag. – Continued Equilibrium	
10/18	Chapter 9 9.18 – 9.20	Iron-Carbon System	
10/20	Chapter 10 10.1 -10.4 10.5 – 10.9  Chapter 11 11.1 – 11.9 (Student led)	Kinetics of Phase Transformations Isothermal and Continuous Cooling Diagrams Mechanical Behavior of Fe-C Alloys  Types of Metal Alloys Fabrication of Metal Alloys Thermal Processing, Annealing Processes Precipitation Hardening	
10/25		<b>(Assign second article)</b>	<b>Exam II Ch. 6,7,8,9</b>
10/27	Chapter 12 12.1 – 12.7 12.8 – 12.11	Structure and Properties of Ceramics Mechanical Properties of Ceramics	
11/1	Chapter 13 13.1 – 13.8 13.9 – 13.12	Types, Application, Fabrication, and Processing of Ceramics	
11/3	Chapter 14 14.1 – 14.7	Polymer Structures, Chemistry, Shape	
11/8	Chapter 14 14.8 – 14.14	Molecular Configurations Thermosetting & Thermoplastic Polymers	

	Chapter 15 begin	Polymer Crystals, Defects, Diffusion <b>(Assign Research Paper)</b>	
11/10	Chapter 15 15.1 – 15.9	Polymer Characteristics, Applications, Mechanical Behavior	
11/15	Chapter 15 15.10 – 15.24	Mechanical Behavior, Deformation, Crystallization, Melting, Glass Transition Synthesis and Processing	
11/17	Chapter 16	Composites Particle & Fiber Reinforced Composites Structural Composites	
11/22	Chapter 17 17.1 – 17.13	Corrosion of Metals Rates Environmental Effects Corrosion of Ceramic Materials Degradation of Polymers	
11/24		<b>(Research Paper Outline Due)</b>	<b>Exam III Ch.10,12,13,14,15,16</b>
11/29	Chapter 18 18.1 – 18.25	Electrical Properties/Conduction Semiconductivity	
12/1	Chapter 18	Continue	
12/6	Chapter 19 Chapter 20	Thermal Properties; Magnetic Properties	
12/8		Research Paper Presentations	
<b>W - 12/15</b>	<b>Final Exam - Cumulative Time: 8 am – 10 am</b>		

**The instructor reserves the right to change class policies and class schedule if necessary.**  
**Also, the instructor reserves the right to drop you after 5 absences.**