COURSE SYLLABUS

70921 ENGR M12 – Engineering Materials, 3.0 Units
Prerequisites: CHEM M12 or M01A and PHYS M20A/M20AL
Class Time: M & W 8:30 AM - 9:45 AM; **Classroom:** PS-204

INSTRUCTOR & DEPARTMENT INFORMATION

Instructor: Scarlet Relle, Ph.D.
Office: PS-235
Office Hours: **M** 11-1 & 3-4; **T** 10-11; **W** 10-11; **Th** 10-12
Voicemail: (805) 553-4162
E-mail: drsrelle@gmail.com OR scarlet_relle1@vcccd.edu

Chair: Prof. Ron Wallingford ; Office PS-236
Dean: Julius Sokenu, Ed. D. ; Office AC-232
Phone: (805) 378-1572

COURSE OVERVIEW

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 design project on material properties, selection, or application is also required.

COURSE OBJECTIVES

Upon completion of the course student should be able to:

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, Eighth Edition, 2010, John Wiley & Sons, Inc.

Handouts: Occasionally, handouts and other reference material will be provided to aid your understanding of the subject matter.

Lecture Notes and Lecture Slides: Occasionally summary lecture notes of the topics and concepts to be covered during each class session and accompanying lecture slides will be provided. 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:

Homework	(10%)
Quizzes	(15%)
Design Project	(10%)
Exams	(30%)
Final Exam	(35%)

A: (90-100%) **B**: (80-89%) **C**: (70-79%) **D**: (60 - 69%) **F**: (below 59%)

HOMEWORK ASSIGNMENTS

Homework will be assigned each week and the solutions will be posted outside of my office the following week when the homework is due. Homework assignments will be collected and graded for thoroughness and completeness. You are STRONGLY ENCOURAGED AND EXPECTED to complete your 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 answer and solve other problems of similar nature. As this course has a tight timeline, and since solutions to the homework problems will be made available immediately after their due date, late homework will not be accepted.

QUIZZES

Solutions to quizzes will be made available. For take home quizzes late work will not be accepted. Occasionally, there may be pop-quizzes. These pop-quiz points will be counted as bonus quiz points towards your final grade. As participation in my class is mandatory, these will be for the benefit of those students who are present and are participating. As such, if you are absent, you cannot make-up a pop-quiz.

EXAMS

There will be 3 exams (possibly 4) covering material from various parts of the course as stated in the class schedule. You will have 1 hr and 15 min to complete each exam. 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. Bring your own scientific calculator to class as you may not share calculators during exams. Please note that programmable or graphing calculators are not allowed in class during exams. I will provide you with a study guide the week prior to each exam.

DESIGN PROJECT

Each student is expected to complete a written technical report on one of the following:
Option I - Materials Application
Option II - Materials Selection
More information on due dates, format, suggested topics, references, etc. will be provided by the professor. This project is worth 50 points.

ADDITIONAL POLICIES

PARTICIPATION
Participation in my class is mandatory. I expect you to come to class prepared, ready to learn and to participate. You must bring with you to class your textbook, a notebook to take additional notes during class discussions, a scientific calculator, and a binder or folder to keep all your papers and handouts organized. I will keep track of your attendance, preparedness, and participation.

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 note taking 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.

STUDENT RESPONSIBILITY
You, as the student, are responsible for **all** material presented in class and in assignments. Make-up exams will be given **only** in case of verified illness or exceptional circumstances. You must contact me in a timely manner to schedule a make-up exam.

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 and is newly located in the LMC.

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, copying from someone else's paper, using "cheat sheets", class notes, the textbook, unauthorized technology, programmable or graphing calculators, or sharing calculators during exams and in-class quizzes. 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.

NO SMOKING POLICY
In the interest of the health and welfare of students, employees, and the public, smoking is not permitted on the Moorpark College campus other than in the parking lot.

IMPORTANT DATES

August 30th: Last day to drop with full refund or credit (All students/Fall semester only)
September 6th: Last day to drop a semester-length class without a "W"
November 22nd: Last day to drop a semester-length class with a "W"

CLASS SCHEDULE

DATE	TEXT	TOPICS	QUIZ (DATES ARE TENTATIVE)	EXAM
8/19	Chapter 1	Introduction to class rules Introduction to the course		
8/21	Chapter 22	Economic, environmental, and societal issues in materials science & eng.		
8/26	Chapter 2	Atomic Structure & Interatomic Bonding		
8/28	Chapter 3 3.1 – 3.7	Crystal Structure Miller Indices	Q1 In-Class Ch. 1,22,2	
9/2	**Labor Day – College Closed**			
9/4	Chapter 3 3.8 – 3.17	Miller Indices Continued Noncrystalline materials X-Ray Diffraction		
9/9	Chapter 4	Imperfections in Solids	Q2 Take Home Ch. 3	
9/11	Chapter 5 5.1 – 5.7	Steady State Diffusion Unsteady State Diffusion		
9/16	Review Chapter 6 6.1 – 6.4	Problem Solving Ch. 5 Mechanical Properties Elastic Deformation Mech.	Q3 Take Home Ch. 4,5	
9/18	Chapter 6 6.5 – 6.12	Prop. Continued – Plastic Deformation Dislocations and		
9/23				Exam I Ch.1,22,2,3,4,5
9/25	Chapter 7	Dislocations and Strengthening Mechanisms	Q4 Take Home Ch. 6	
9/30	Chapter 8 8.1 – 8.11	Failure of Materials Fracture and Its Principles		
10/2	Chapter 8 8.12 – 8.15	Fatigue and Creep		
10/7	Chapter 9 9.1 – 9.5	Introduction to Phase Diagrams	Q5 Take Home Ch. 7,8	

10/9	Chapter 9 9.6 – 9.17	Phase Diag. – Continued Equilibrium		
10/14	Chapter 9 9.18 – 9.20	Iron-Carbon System	Q6 Take Home Ch. 9	
10/16	Chapter 10 10.1 -10.4 10.5 – 10.9	Kinetics of Phase Transformations Metastable vs. equilibrium Isothermal and Continuous Cooling Diagrams Changes in Fe-C Alloys Mechanical Behavior of Fe-C Alloys		
10/21	Chapter 11 11.1 – 11.9	Types of Metal Alloys Fabrication of Metal Alloys Thermal Processing Annealing Processes Precipitation Hardening		
10/23				Exam II Ch.6,7,8,9,10
10/28	Chapter 12 12.1 – 12.7 12.8 – 12.11	Structure and Properties of Ceramics Mechanical Properties of Ceramics	Q7 In Class Ch. 11	
10/30	Chapter 13 13.1 – 13.8 13.9 – 13.12	Types and Application of Ceramics Fabrication and Processing of Ceramics		
11/4	Chapter 14 14.1 – 14.7	Polymer Structures Their Chemistry, Shape, Structure	Q8 In Class Ch. 12	
11/6	Chapter 14 14.8 – 14.14	Molecular Configurations Thermosetting & Thermoplastic Polymers Polymer Crystals, Defects, Diffusion	Q9 Take Home Ch. 13	
11/11	**Veterans Day – College Closed**			
11/13	Chapter 15 15.1 – 15.9 15.10 – 15.24	Polymer Characteristics and Applications Mechanical Behavior & Deformation Crystallization, Melting, Glass Transition Polymer Synthesis and Processing	Q10 Take Home Ch. 14	

11/18	Chapter 16	Composites Particle & Fiber Reinforced Composites Structural Composites	Q11 Take Home Ch. 15	
11/20	Chapter 17 17.1 – 17.13	Corrosion of Metals Rates Environmental Effects Corrosion of Ceramic Materials Degradation of Polymers	Q12 Take Home Ch. 16	
11/25	Chapter 18 18.1 – 18.25	Electrical Properties Conduction Semiconductivity Conduction in Ionic Ceramics and Polymers		
11/27				Exam III Ch.11,12,13,14, 15,16
12/2	Chapter 19	Thermal Properties		
12/4	Chapter 20	Magnetic Properties	Q13 Take Home Ch. 17, 18, 19	
12/9	Chapter 21	Optical Properties		
12/11	All Chapters	Review: Selected Topics		
12/18 W	**FINAL EXAM -- Selected topics from the entire course 8:00 – 10:00 AM**			

The instructor reserves the right to change class policies and class schedule if necessary.