

**EGN-3365 Materials Engineering
Spring 2017
W-F 1:00-2:50 PM; Engineering Center- EC 1104**

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Office hour: Wed Fri 4:00-5:00pm, **Location:** MME department

Text book: Materials Science and Engineering, by William D. Callister, Jr,
7th Edition

Grading:

A: ≥ 90
A - : 89-86
B+ : 85-82
B : 81-78
B- : 77-74
C+ : 73-70
C : 69-66
C- : 65-62
D+ : 61-58
D : 57-50
F: 49-0

Exams:

3 – One hour exams @ 30 points =	90
5 quizzes @ 2 pts	<u>10</u>
Total Points	100

Make-up tests will not be given and may require taking one make-up cumulative final during the final exam week to make up the grade

1. Quizzes will be approximately bi-weekly.
2. Tests: one 8 ½ X 11 hand written note sheet may be used during each test. Otherwise, tests and quizzes will be closed book

Homework:

Homework will be assigned but not collected. The solutions to problems will be given by the TA in TA session. Selected problems will be worked in class. Quizzes will reflect the homework assigned and topics covered during class.

This class moves at a fast pace and covers a lot of material. If you miss class or are having problems understanding materials, please see us or you could get behind *very* quickly.

Syllabus

Subject	Reading
Introduction; atomic bonding	Ch. 1,2
Crystal structure, X-ray diffraction	Ch. 2, 3
Defects in Solids, Dislocations	Ch. 4
Diffusion	Ch. 5
Exam 1	
Mechanical Properties	Ch. 6
Dislocations, Failure Mechanisms	Ch. 7, 8
Phase Diagrams	Ch. 9
Microstructure, TTT diagram	Ch. 10
Exam 2	
Thermal processing, Metal alloys	Ch.11,12
Ceramics and glasses	Ch. 12,13
Composites, Electrical properties	Ch. 16, 18
Exam 3	
Makeup exam: to be determined	

Course Objectives:

Understand chemical bonding. Briefly describe ionic, covalent, and metallic; understand the general use of the periodic table and how it related to electron states.

Understand the crystallographic properties if crystalline materials. Draw unit-cell structures and derive relationships unit-cell length and atomic radius; compute densities based on cell structure; specify Miller indices for planes within unit cells.

Describe crystalline defects and edge, screw, and mixed dislocations; understand the role of defects thru dislocations, slip systems and plastic deformation, solid solution strengthening, and strain hardening.

Describe the mechanisms of atomic diffusion; write and use Fick's first and second laws in equation form, and define all parameters; determine concentrations of diffusion species over time in a solid.

Understand the meaning and use of common mechanical properties of materials including yield strength, ultimate tensile strength, Poisson's ratio, ductility and elongation.

Understand the meaning and use of phase diagrams for binary systems to determine phases present, the composition of the phases, and the mass fraction of the phases; understand the states that are present during solidification and melting. Understand the use of phase diagrams in predicting microstructure

Understand the effect of kinetics on the phase transformation. Determine the role of transformation kinetics on steel alloys and the mechanical characteristics of the micro constituents that exist such as pearlite, martensite and bainite.

Understand the ionic bonding structure of ceramics and the role of coordination number on the crystal structure. Understand the amorphous properties of glass. Relate both to mechanical properties and manufacturing processes.

Evaluate the electrical properties of materials, including band gap effects on conductors, insulators and semiconductors. Evaluate n and p type semiconductors and methods used in manufacturing of integrated circuits.

ME Program Educational Objectives
Broad and in-depth knowledge of engineering science and principles in the major fields of Mechanical Engineering for effective engineering practice, professional growth, and as a base for life-long learning.
The ability to communicate effectively and to articulate technical matters using verbal, written, and graphic techniques.
The ability to utilize analytical and experimental methods and modern computer technology for decision making, engineering design, and to solve realistic engineering problems.
A sense of professional and social responsibility, including a commitment to protect both occupational and public health and safety, developed through consideration of moral, social, and ethical paradigms related to the engineering profession and practice.

ME Program Outcomes?
A. Ability to apply knowledge of mathematics, science, and engineering.
D. Ability to function on multi-disciplinary teams.
E. Ability to identify, formulate, and solve engineering problems.
G. Ability to communicate effectively.
I. Recognition of the need for, and an ability to engage in, life long learning.
K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
L. Knowledge of probability and statistics, including applications to mechanical Engineering.
M. Knowledge of mathematics and of basic and engineering science necessary to carry out analysis and design appropriate to Mechanical Engineering.

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook."