CIVE.3100 ENGINEERING MATERIALS

FALL 2016

SECTION 201: M, W, & F – 2:00 TO 3:15 PM, KI-309
SECTION 202: M, W, & F – 3:30 TO 4:45 PM, KI-309

Instructor: Edward L. Hajduk, D.Eng, PE
Lecturer
Office Location: PA105D
E-Mail: Edward_Hajduk@uml.edu
Office Hours: See office door or website. Also by appointment.

Prerequisites: 14.204 Strength of Materials
84.122 Chemistry II

Co-requisites: 14.311 Engineering Materials Laboratory


Course Description
Discusses the properties of engineering materials that influence the design, construction and maintenance of Civil Engineering works. Included are such materials as ferrous and non-ferrous metals, timber, asphalt, and cementitious materials. This course is supplemented by laboratory testing of various engineering materials in CIVE.3110.

Course Objectives
Upon completion of CIVE.3100, a student should be able to:

1. Describe the structure of atoms, atomic numbers, atomic masses, quantum numbers, electron configuration of elements, atomic & molecular bonds.
2. Derive the relationships between lattice constants and atomic radius for cubic systems & hexagonal close packed crystal structures.
3. Determine direction indices and Miller indices, and sketch the directions and the planes (given the direction indices and Miller indices).
4. Interpret an x-ray diffractometer chart, to determine the crystal structure, lattice constant, and to identify the element.
5. Describe the stages in the solidification of metals, the two types of solid solutions, edge and screw dislocations, and the influence of grain boundaries and grain size on strength.
7. Analyze phase diagrams.
8. Plot and interpret stress-strain diagrams (determine the modulus of elasticity, Poisson’s ratio, yield strength, tensile strength, & ductility etc.).
10. Design an asphalt-concrete mix.
11. Describe different types of wood, and their physical and mechanical properties.
12. Apply the rule of mixtures, and determine moduli for iso-stress & iso-strain conditions for a fiber reinforced composites.

Basis of Course Grade:
Individual course grades are determined as follows with the subsequent grading breakdown:

\[
Grade (\%) = \frac{\sum (Total \ Points \ Earned \ including \ extra \ credit)}{\sum (Total \ Points \ Possible \ not \ including \ extra \ credit)} \times 100
\]

93% ≤ A  
90% ≤ A- < 93%  
87% ≤ B+ < 90%  
83% ≤ B < 87%  
80% ≤ B- < 83%  
77% ≤ C+ < 80%  
73% ≤ C < 77%  
70% ≤ C- < 73%  
67% ≤ D+ < 70%  
65% ≤ D < 67%  
F < 65%

The tentative breakdown of points for this class is as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Approximate % of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Three (3) Tests (10% each)</td>
<td>30%</td>
</tr>
<tr>
<td>Research Project</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
</tr>
</tbody>
</table>
Assignment guidelines are provided in a separate handout. Grades will be dependent on your work and performance. Grading will NOT be conducted on a curve; it is theoretically possible for the whole class to earn an A or an F. **Students have one week after the return of assignments and weekly tests to discuss grading with the Instructor.**

Assignments will have 20% late penalty deduction from the *earned* points for each day past the assignment due date unless an extension is granted by the Instructor. Note the assignment due date will be determined by the Instructor and told to students in class the day the assignment is given. Any assignment extensions will also be told to students in class and/or via email. For example, an assignment due on a Friday is turned in the following Monday. The student earned a grade of 82/100 points for the assignment. The assignment is three days late (Saturday is 1 day late, Sunday is 2 days late, Monday is 3 days late). 20% of 82 points is 16.4 points, times 3 equals 49.2 points. The final assignment grade = 82 - 49.2 = 32.8 points.

Everyone makes mistakes: no one is perfect. If the Instructor makes a mistake in class and you are the first to notify him during that class, you are eligible for two (2) extra credit points towards your assignment grade. To receive these extra credit points, you must email the Instructor within one (1) day of noting the mistake. The email should have the course number in the Subject Field and you need to summarize the mistake and state the solution within the body of the email (e.g. “the equation in Slide 4 on your lecture notes on 09/07/16 was F=me. The equation should have been F=ma”).

**Honor and Ethics:**
Engineers have a trust placed on them by society to ensure that the public safety is held paramount. People constantly depend on engineers to provide safe bridges, buildings, drinking water, etc. **This trust must not be violated.** For this reason, no form of academic dishonesty will be tolerated in this class. Students are encouraged to work together on homework assignments and class projects (if assigned). However, any evidence of direct copying of a homework assignment will result in a zero grade for that assignment for all students involved. Any evidence of academic dishonesty during a weekly test or the final exam will also result in a zero grade for that assignment for all students involved. Refer to the University of Massachusetts Lowell’s Academic Integrity Policy for additional details, which can be found at this URL: (http://www.uml.edu/Catalog/Undergraduate/Policies/Academic-Policies/Academic-Integrity.aspx)

During weekly tests and the final exam, only calculators that cannot communicate with other electronic devices are allowed. Students are encouraged to use calculators approved for the Fundamentals of Engineering (FE) exam to prepare themselves for the FE Exam. Refer to the National Council of Examiners for Engineering and Surveying (NCEES) Calculator Policy (http://ncees.org/exams/calculator-policy/) for additional
details. While the use of the approved NCEES FE calculators is not required, you cannot use calculators that can communicate with other devices. All other electronic devices, such as mobile phones, music players, computers, tablets, etc. are not allowed during the weekly tests and the final exam.

You must cite and acknowledge all people and sources used in your work. Students submitting academic work for an individual grade are individually held to not plagiarize. Plagiarism is defined as representing the words or ideas of another as one's own work in any academic exercise. Materials from outside sources must be documented using the American Society of Civil Engineers (ASCE) Author-Date format. This reference system can be found within the ASCE E-Books Publishing in ASCE Journals: A Guide for Authors or Publishing Books with ASCE: A Guide for Authors, Editors, and Committees.

Attendance:
The University of Massachusetts – Lowell’s Policy on Class Attendance is in effect for this course. This policy can be found at this URL: http://www.uml.edu/Catalog/Undergraduate/Policies/Academic-Policies/Attendance-Policies.aspx

All tests/exams, including the final examination, must be taken on the assigned day. Any exceptions to this policy must be approved by the Instructor in advance. Exceptions will be granted only for reasons beyond the control of the student.

Classroom Demeanor:
The expectation for students to participate as engineering professionals is implicit. In addition, no active cell phones, pagers, or sound or image recording devices shall be allowed in the classroom.

Email Policy:
When required, I will send class information to students via email using the Student Information System (SiS) system. SiS sends emails to your UML student email address. Every student who registers for courses at the University of Massachusetts – Lowell receives a UML student email address. Students are responsible for checking this email account for messages from the Instructor for this course.

Academic Support:
Please contact me privately if you need accommodations because of a disability. The University’s Policy for Students with Disabilities will be followed for this course. This policy can be found at http://www.uml.edu/student-services/Disability/Policies.aspx.
### Tentative Schedule of Class Activity:

<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Atomic Structure &amp; Bonding</td>
<td>3</td>
</tr>
<tr>
<td>Crystal Structure &amp; Geometry</td>
<td>3.5</td>
</tr>
<tr>
<td>Solidification, Crystalline Imperfections &amp; Diffusion</td>
<td>3.5</td>
</tr>
<tr>
<td>Mechanical Properties</td>
<td>3.5</td>
</tr>
<tr>
<td>Phase Diagrams</td>
<td>3</td>
</tr>
<tr>
<td>Wood</td>
<td>2</td>
</tr>
<tr>
<td>Fiber Composites</td>
<td>2</td>
</tr>
<tr>
<td>Concrete (including Portland Cement)</td>
<td>3.5</td>
</tr>
<tr>
<td>Asphalt Concrete</td>
<td>2</td>
</tr>
</tbody>
</table>

### Key Dates (Check Academic Calendar):

- **09/05/16** Labor Day (University Closed)
- **09/08/16** Last Day to Add a Course without Permission Number
- **09/15/16** Add/Drop Period Ends
- **10/10/16** No Class (Columbus Day)
- **10/11/16** Monday Class Schedule (on a Tuesday)
- **11/10/16** No Class (Veteran’s Day Observed)
- **11/15/16** Last Day to Withdraw from Course with grade of W
- **11/25/16** No Class (Thanksgiving Recess)
- **12/02/16** Last Day to give Examinations in Courses
- **12/09/16** Last Day of Class
- **12/10/16** Reading Day