Materials Science ENGR 2322  
School of Engineering and Computing Sciences  
Spring 2015

A. COURSE INFORMATION

Course number/section: ENGR 2322.002  
Class meeting time: Lecture TR 11:00-12:15 PM; Lab TR 12:30-01:30 PM  
Class location: EN 118  
Course Website: https://bb9.tamucc.edu/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Magesh Thiyagarajan  
Office location: EN 222D  
Office hours: W 1:00-3:00 PM  
Telephone: 361-825-2144  
e-mail: magesh@tamucc.edu  
Appointments: Non-office hour appointments must be scheduled in advance through email.

C. COURSE DESCRIPTION

Catalog Course Description  
Structure and properties of metallic and nonmetallic materials; microstructure, mechanical testing, phase diagrams, heat treatment, testing, ceramics, polymers, composites, construction materials, failure analysis, nondestructive evaluation, corrosion and thermal properties of materials.

Extended Course Description  
Electronic materials, optical materials, magnetic materials, sustainable materials, materials selection in engineering design.

D. PREREQUISITES AND COREQUISITES

Prerequisites  
CHEM 1411 - General Chemistry I and PHYS 2425 - University Physics I

Corequisites  
None.

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s)  

Optional Textbook(s) or Other References  
None.

Supplies
None.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Demonstrate an understanding of various groups of materials, different material properties and the types of atomic bonding present in different materials.
2. Demonstrate an ability to classify and analyze crystalline structures and crystalline defects.
3. Demonstrate an understanding of mechanical behaviors of materials and apply the knowledge to conduct mechanical behavior experiments and analyze the results.
4. Demonstrate an understanding of thermal behaviors of materials and apply the knowledge to conduct thermal behavior experiments and analyze the results.
5. Demonstrate an understanding of the fundamentals of phase diagrams and microstructure development.
6. Demonstrate an understanding of structural, electronic, optical and magnetic materials and apply the knowledge to perform materials selection for engineering design based on application requirements.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The instructional method will follow a flipped classroom method. In a flipped classroom, you will listen to audio-visual lecture materials, textbook readings and reading assessments at home before attending lecture class. During the class time you will do homework (problems) and other hands-on activities during the class time for reinforcing the learning content.

Audio-Visual (AV) Lectures

The first step of the flipped class is to complete the AV lectures. The class lectures are provided in an audio-visual (AV) PowerPoint lecture format in blackboard as per the class schedule.

Textbook Readings

The second step following the AV lectures is the textbook readings, which are given at the end of the AV lectures. After completing the AV lectures, the textbook readings must also be completed before attending the class meeting for the week.
Reading Assessments (RA)
The third step is to complete the Reading Assessments (RA’s) which are similar to homework. There will be one RA per week with a total of 15 RA’s in the course. You must complete the AV lectures and textbook readings before attempting to take the RA’s in blackboard. The RA’s must be completed before attending the class meeting of the week. The RA’s are designed to test your overall understanding of the basic concepts of the topic covered in the AV lecture and textbook readings. Each RA’s once started will be timed for 30 minutes (half hour) and it will include approximately 15 questions. You are allowed to take the RA for only one attempt. There will be negative points for wrong answers in some of the multiple choice or multiple answer type questions. The RA’s for the particular week topic will be available to students to take at any time from Sunday at 12 am through Monday 11.59 pm (2 days) of that week. The RA’s must be completed before the closing time on Monday at 11.59 pm and it will not be reopened.

Tests
There will be one Test per topic with a total of 15 Tests in the course. After completing the topic activities for the week, there will be a test on that topic by the end of that week. The Test will include questions similar to RA’s and some additional questions as well as numerical problems that are covered in the class. The Tests will be available to take anytime from Thursday at 6.00 pm through Saturday at 11.59 pm (2.25 days).

Each Test once started will be timed for 60 minutes (1 hour) and it will include approximately 15-20 questions depending on the difficulty level. You are allowed to take the Test for only one attempt. There will be negative points for wrong answers in some of the multiple choice or multiple answer type questions. If you complete the AV lectures, textbook readings, practice in-class problem solving etc. you will be able to do well in the Test.

Final Exam
Final exam will be comprehensive of all topics and their assignments covered in the course.

Project Assessments
Each Project Assessment (PA) include group project report (50 points) and individual test on Blackboard on the project topic (50 pts). There are about 5 projects in the course.

H. MAJOR COURSE REQUIREMENTS AND GRADING

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>15 Reading Assessment (RA) (1% each)</td>
<td>15%</td>
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<tr>
<td>15 Tests (3% each)</td>
<td>45%</td>
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I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>DATE (Week of.)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
<th>ASSIGNMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 21 (Week 1)</td>
<td>Syllabus, Introduction to Materials Science Course</td>
<td>Syllabus, Prerequisites</td>
<td>RA1*, Test 1</td>
</tr>
<tr>
<td>Jan. 26 (Week 2)</td>
<td>Materials for Engineering</td>
<td>Chapter 1</td>
<td>RA2, Test 2</td>
</tr>
<tr>
<td>Feb. 2 (Week 3)</td>
<td>Atomic Bonding</td>
<td>Chapter 2</td>
<td>RA3, Test 3</td>
</tr>
<tr>
<td>Feb. 9 (Week 4)</td>
<td>Crystalline Structure-Perfection (Project 1: Rockwell Test)</td>
<td>Chapter 3</td>
<td>RA4, Test 4</td>
</tr>
<tr>
<td>Feb. 16 (Week 5)</td>
<td>Crystalline Defects</td>
<td>Chapter 4</td>
<td>RA5, Test 5 PA1#</td>
</tr>
<tr>
<td>Feb. 23 (Week 6)</td>
<td>Mechanical Behavior (Project 2: Tensile Test)</td>
<td>Chapter 6</td>
<td>RA6, Test 6</td>
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<tr>
<td>Mar. 2 (Week 7)</td>
<td>Thermal Behavior</td>
<td>Chapter 7</td>
<td>RA7, Test 7 PA2</td>
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<td>Mar. 9 (Week 8)</td>
<td>Failure Analysis (Project 3: Charpy Test)</td>
<td>Chapter 8</td>
<td>RA8, Test 8 PA3</td>
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<td>Mar. 16 – 20</td>
<td>Spring Break – No classes</td>
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<tr>
<td>Mar 23. (Week 9)</td>
<td>Phase Diagrams, Heat Treatment (Project 4: Jominy Test)</td>
<td>Chapter 9, Chapter10</td>
<td>RA9, Test 9 RA10, Test 10</td>
</tr>
<tr>
<td>Mar 30. (Week 10)</td>
<td>Structural Materials – Metals, Ceramics and Glasses</td>
<td>Chapter 11</td>
<td>RA11, Test 11</td>
</tr>
<tr>
<td>Apr. 6 (Week 11)</td>
<td>Structural Materials – Polymers and Composites</td>
<td>Chapter 12</td>
<td>RA12, Test 12 PA4 PA5 Assigned</td>
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<tr>
<td>Apr. 13 (Week 12)</td>
<td>Electronic Materials</td>
<td>Chapter 13</td>
<td>RA13, Test 13</td>
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<tr>
<td>Apr. 20 (Week 13)</td>
<td>Optical and Magnetic Materials</td>
<td>Chapter 14</td>
<td>RA14, Test 14</td>
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<tr>
<td>Apr. 27 (Week 14)</td>
<td>Materials Selection in Engineering Design (Project 5: Materials Selection for Engineering Design)</td>
<td>Chapter 15</td>
<td>RA15, Test 15 PA5</td>
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<tr>
<td>May 4 (Week 15)</td>
<td>Review of Topics</td>
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<td>May 12th, 2 PM</td>
<td>Last Day of Class, May 5th, 2015</td>
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<tr>
<td>May 4 (Week 15)</td>
<td>Final Exam</td>
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* RA = Reading Assessment, *PA = Project Assessment

Note: Changes in this course schedule may be necessary and will be announced to the class by
the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. **COURSE POLICIES**

**Attendance/Tardiness**
Attendance is required.

**Late Work and Make-up Exams**
Late work will not be accepted. No make-up exams will be provided.

**Extra Credit**
Extra Credit questions/problems may be given in some of the assessments or tests.

**Cell Phone Use**
Not allowed to use in class.

**Laptop Use**
Usage of laptops or tablets for course related work may be permitted in class only when instructed by the instructor.

**Food in Class**
Not permitted in class.

**Missed Exam**
No credits will be given for the missed exam and there will not be any make-up exams.

**Participation**
Active participation is required in classroom as well as in labs.

K. **COLLEGE AND UNIVERSITY POLICIES**

- **Academic Integrity (University)**
  It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior. See Full University Policy at [http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity](http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity)

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from
the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course by Friday, April 10, 2015. No student is eligible to receive a W without completing the official drop process by this deadline. Visit the Office of the University Registrar for the Course Drop Form that must submitted. After April 10, 2015 a student will not be allowed to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  Disability Services (DS) is the hub for coordinating services and accommodations to ensure accessibility and utilization of all programs for all Texas A&M University-Corpus Christi students with disabilities. Our services are designed to meet the unique educational needs of enrolled students with documented permanent or temporary disabilities. DS provides intake and consultation services to students seeking to register with our office. DS reviews an individual’s documentation of disability and assesses eligibility for services and the determination of reasonable accommodations. For more information visit the Disability Services Office at 116 Corpus Christi Hall or go to [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

L. **OTHER INFORMATION**

None.

**GENERAL DISCLAIMER**

I reserve the right to modify the information, schedule, assignments, deadlines, and course
policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.