Materials Science
Course Syllabus

Material Science  
ENTC 3410  
Spring 2013  
Lec: MW 10:00-10:50 AM  
Lab: WR 01:00-02:15 PM, EN-118

Instructor: Dr. Magesh Thiyagarajan  
Office Location: EN 222D  
Office Hours: MR: 2:00-4:00  
Office Telephone: 361-825-2144  
E-Mail: magesh@tamucc.edu

Students are welcome to make appointments to see me at times other than those listed above. If I am unavailable or need to relocate during office hours, I will post a note on my office door. You are welcome to come by my office at other times and if I am not busy, I would be happy to help you. A phone call or email is usually the best way to coordinate seeing me outside of office hours. If you need additional help please contact me. Do not wait until it is “too late”.

Course Overview
For any given application, the design and selection of materials in order to meet a set of required properties is pervasive to most disciplines of science and all disciplines of engineering. Most significant technological achievements have as a principal element a “materials breakthrough”. Similarly, many engineering failures have as a principal element a “materials failure”.

Therefore, a thorough working knowledge of engineering materials is of great importance as it not only enables the scientist or engineer to design, develop, create, discover, but also directs to mitigate the risks of failures.

Such knowledge is derived by understanding the structure and properties of materials (the core elements of this course), and will begin to lay the framework for understanding Materials Science and Engineering.

This framework is: STRUCTURE → PROPERTIES → DESIGN → PERFORMANCE

In this course, you will have the opportunity to discover the fundamentals of the structure/properties relationships for all types of materials, including: metals (and their alloys), ceramics, polymers, and composites thereof.

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

Required Materials
Prentice Hall, ISBN-10: 0136012604

Other Resources
The instructor will make additional learning resources (e.g., books, videos, handouts, reserve articles, software, websites) available during the semester through Blackboard. You will be given information about these resources. In addition, invited speakers may address various topics during this class.
Student Learning Outcomes: As a result of the course, the student will

1. Demonstrate an understanding of the six categories of materials (Metals, Ceramics, Glasses, Polymers, Semiconductors and Composites) available to engineers and their fundamental material properties.

2. Demonstrate an ability to analyze electronic configurations of atoms and the types of primary and secondary atomic bonding present in different materials and predict approximate physical and mechanical behavior of a material based on the type of bonding present (covalent, ionic, metallic, and/or van der Waals).

3. Demonstrate an ability to classify and analyze dimensional packing of atoms for different types of materials, the concept of unit cell, Bravais lattices and crystalline structures (BCC, FCC, and HCP), and calculate Miller Indices, atomic packing factor and basic knowledge on crystallography.

4. Demonstrate an understanding of the several types of crystalline defects (point defects, linear defects, planar defects and noncrystalline solids) commonly present in condensed matter.

5. Demonstrate an understanding of the basic principles of stress and strain, and related mechanical properties of materials, and apply the knowledge to conduct tensile test experiments and analyze the results to evaluate the elastic and plastic deformation, yield strength, tensile strength, strain hardening, hardness, and ductility and fracture properties of materials.

6. Demonstrate an understanding of the basic thermal properties of materials and apply the knowledge to conduct heat treatment experiments and to analyze the results of various thermal properties of materials such as thermal expansion, thermal conductivity, thermal shock and the effect of temperature on ductility and brittleness of materials.

7. Demonstrate an understanding of the fundamentals of phase transformation including lever and phase rules, phase diagram, and the relations between composition, temperature and phase fractions applied to equilibrium phase diagrams for given materials systems, and apply the knowledge to predict the equilibrium microstructure of a material comprised of two constituents.

8. Demonstrate an ability to select, analyze and optimize the choices of structural and electronic materials for different applications based on the constraints of the applications.

Course Grading Policy

Grading Metrics:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Homework and Labs</td>
<td>20%</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
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<tr>
<td>Exam 2</td>
<td>20%</td>
</tr>
<tr>
<td>Final Project</td>
<td>20%</td>
</tr>
<tr>
<td>Attendance and Participation</td>
<td>10%</td>
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</tbody>
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Grading Scale:

A = 90% - 100%
B = 80% - 90%
C = 70% - 80%
D = 60% - 70%
F = below 60%
State Adopted Proficiencies/TExES competencies (COE)

Course Policies

Attendance
Attendance will be taken at every scheduled class meeting. Students are expected to attend every scheduled class and laboratory meeting. Routine events should be scheduled to avoid class conflicts. In general, only unavoidable absences are excused with valid proof of documentation (major family illness or accidents, deaths, funerals).

Participation
All students are expected to participate actively in class room discussions, question and answer discussions, working well with team members on lab assignments and contributing at the expected level to the group projects. Participation will be evaluated through instructor evaluation and also by peer-evaluation throughout the semester and it is accounted for grading.

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.

Late work and Make-up Exams
All assignments should be submitted in the class. Late homework after the due class time will not be accepted, except under rare conditions with prior approval from the instructor. Missed Exams – excused only per TAMUCC guidelines. Make-up exams are given only at extremely rare and unavoidable circumstances such as personal injury, health issues, death of an immediate family member and/or a travel with prior approval.

Extra Credit
Extra Credit questions/problems will be given in some of the tests and homeworks.

Cell Phone/Electronic Device Usage
Usage of cell phones and other electronic devices such as laptops, ipod, ipad etc. are strictly not permitted in class during the lecture, unless explicitly instructed by the instructor to use it in classroom.

Academic Integrity/Plagiarism.
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a 0 for the assignment and possibly an F for the class.
Dropping a Class
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. 4/12 is the last day to drop a class with an automatic grade of “W” this term.

Preferred methods of scholarly citations
Homework/project calculations should be submitted in an organized and neatly presented form. Circle or box the answers to each problem. Appropriate units must be included on all answers. All calculations need to be on an engineers pad. Write your name, the course number, the assignment number, and date. Pages are to be numbered and stapled.

Grade Appeals*
As stated in University Rule 13.02.99.C2, Student Grade Appeals, 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 Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

This syllabus is a draft in progress: the instructor reserves the right to modify it’s contents. While the instructor will attempt to notify all students of any changes, it is ultimately the student’s responsibility to keep appraised of those substitutions/changes/additions/deletions/etc.

Disabilities Accommodations*
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

*Required by SACS
Schedule*

1. Materials for Engineering  
   On the week of (1/23)
2. Project - Novel materials  
   On the week of (1/23)
3. Atomic bonding  
   On the week of (2/04)
4. Crystalline Structure  
   On the week of (2/11)
5. Project - Crystalline Structures  
   On the week of (2/12)
6. Crystal Imperfection  
   On the week of (2/18)
7. Project – Impact Test  
   On the week of (2/25)
8. Exam – 1  
   On the week of (3/06)
9. Mechanical Behavior  
   On the week of (3/18)
10. Project – Tensile Test  
    On the week of (3/18)
11. Thermal Behavior  
    On the week of (4/01)
12. Project – Hardness Test  
    On the week of (4/01)
13. Phase Diagrams  
    On the week of (4/15)
14. Materials in Engineering Design  
    On the week of (4/22)
15. Exam -2  
    On the week of (4/29)
16. Final Project  
    On the week of (5/09)

* The schedule given above is only tentative and it may subject to vary.