MCT3100  Mechanics of Materials

Course Description:

The course covers the basic principles of Engineering Materials and
The following elastic and plastic behavior of materials:
a) Response under applied forces of tension, compression, shear, etc.
b) Parameters used in describing mechanical properties, and
c) Additional stresses induced by other parameters (internal and external)
d) Analysis of failure when the stress field exceeds its limit

Credit Hours: 3     Pre-requisite: ET3030     Co-requisite: ET3430

Textbook:  Engineering Materials – Properties and Selection by KG and MK Budinski,

Instructor:  Jean C. Lynn, PhD  el2222@wayne.edu

Office Hours: Prior to class time or by appointment

Grading:

No late homework will be accepted. All exams are close book and without notes.

Homework  15 x 3 = 45
Exams 15 x 3 = 45
Efforts & attendance  10

Total 100

Course Learning Objectives:

Upon completion of this course, students should be able to:

1. Apply mathematical analysis in mechanics of materials for designing structural and mechanical
   components [SOb, SOd, M1]
2. Analyze multiple/combined loads in two- and three-dimensional parts and perform stress analysis in
   axial, torsion, bending, and transverse loading conditions [SOb, SOf, M1]
3. Evaluate stress concentration in complex geometrical parts [SOb, SOc, SOd, SOf, M1]
4. Apply safety factor in designing structural/mechanical components [SOb, SOd, SOf, M1]
5. Translate structural and mechanical component problems into free body diagrams and establish
   equivalent equations [SOa, SOb, SOd, SOf, M1]
6. Describe stress-strain curves in material tensile tests [SOb, SOc, SOe, SOf]
7. Evaluate and calculate material characteristics from stress-strain curves [SOa, SOb, SOc, SOf]
8. Explain and interpret the fatigue test and correlate it with the real case [SOa, SOb, SOc, SOe, SOf]
9. Communicate effectively in oral and written formats [SOg]
Class Schedule:  Wednesday  9:30 AM - 12:30 PM, Room 2005 ETB

No class on **Sept 6 & November 24, 2010** (holiday)

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<tr>
<th>Date</th>
<th>Course Outline with Chapter Reference</th>
<th>Homework #</th>
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| 9/ 1 | + What is Engineering Materials   
+ Forming Engineering Materials from elements | Chap 1  
Chap 2 | |
| 9/ 8 | + Chemical & physical properties   
+ Mech. properties - tensile, impact, fatigue, etc | Chap 3  
Chap 4 | HW 1 assigned |
| 9/ 15 | + Loading and safety factor   
+ Stress concentration factor | | |
| 9/ 22 | + Load diagram, bending moment, inertia, etc.   
+ Centroid, stress induced by bending, etc. | | |
| 9/ 29 | + Residual stress – tempered glass and others   
+ Review HW 1 | | HW 1 due |
| 10/ 6 | + **Exam 1**   
+ Exam review | | |
| 10/ 13 | + Steel products - type and code   
+ Strain hardening to change properties | Chap 12  
Chap 13, 14 | HW 2 assigned |
| 10/ 20 | + Heat treatment to change properties   
+ Cast iron, cast steel & powder metallurgy | Chap 15, 16  
Chap 17 | |
| 10/ 27 | + Non ferrous materials (Cu, Al, Ti, Zn, Mg, etc.)   
+ Review HW 2 | Chap 18, 19, 20 | HW 2 due |
| 11/ 3 | + **Exam 2**   
+ Exam review | | |
| 11/ 10 | + Polymeric materials, composite & fabrication   
+ Ceramics & glass products, nano-materials | Chap 7, 8, 9  
Chap 11, 22 | HW 3 assigned |
| 11/ 17 | + Lab – tensile and hardness testing   
+ Tribology, corrosion   
+ Surface engineering | Chap 5, 6  
Chap 21 | |
| 12/ 1 | + Failure analysis and documentation   
+ Material selection   
+ Review HW 3 | Chap 10, 23 | HW 3 due |
| 12/ 8 | + **Exam 3** (cover third group only)   
+ Exam and course review | | |

Prepared by:  Jean C. Lynn, PhD  
ei2222@wayne.edu

MCT 3100  
Mechanics of Materials  
September 8, 2010
Contributions to MCT Program Student Outcomes:

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<tr>
<th>Level</th>
<th>BSMCT Program Student Outcomes</th>
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<tbody>
<tr>
<td>1</td>
<td>a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities</td>
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<tr>
<td>2</td>
<td>b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies</td>
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<td>c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes</td>
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<td>1</td>
<td>d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives</td>
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<tr>
<td>1</td>
<td>e. an ability to function effectively as a member or leader on a technical team</td>
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<td>2</td>
<td>f. an ability to identify, analyze, and solve broadly-defined engineering technology problems</td>
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<td>g. an ability to communicate effectively regarding broadly-defined engineering technology activities</td>
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<td></td>
<td>h. an understanding of the need for and an ability to engage in self-directed continuing professional development</td>
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<td></td>
<td>i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity</td>
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<td>j. a knowledge of the impact of engineering technology solutions in a societal and global context</td>
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<td>k. a commitment to quality, timeliness, and continuous improvement</td>
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<td>3</td>
<td>M1 – MCT Design Track: Students in this track will demonstrate the ability to apply principles of materials and mechanics to the design and analysis of mechanical components and mechanisms.</td>
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<td>M2 – MCT Energy Track: Students in this track will demonstrate the ability to apply principles of thermo-fluid sciences to the design and analysis of energy systems</td>
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<td>M3 – MCT Manufacturing Track: Students in this track will demonstrate the ability to apply principles of materials and production techniques to the planning, implementation, and control of manufacturing processes</td>
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WITHDRAWAL POLICY:

Last day to drop with a tuition refund: End of 2\textsuperscript{nd} Week of Semester
Last day to drop without a notation of W on the transcript: End of 4\textsuperscript{th} Week
Final day to drop with W (ET Students): End of 8\textsuperscript{th} Week

All drop/add activity during the first four weeks should be done by the student through Pipeline. Withdrawal after the fourth week requires the instructor’s permission and must be submitted on a Drop/Add form to the Registrar’s Office. Withdrawal after the ‘final drop’ date will only be permitted under exceptional circumstances and requires the permission of the Chair of the ET Division. A failing grade is not an acceptable reason for withdrawal after the ‘final drop’ date.

POLICY ON CHEATING:

Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course and may be subject to additional penalties.

University / Department Policies:

Academic Misconduct
http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html
Withdrawal from Engineering Tech classes
http://www.et.eng.wayne.edu/et/withdrawal/withdrawal.html
Deferred Grades
http://www.et.eng.wayne.edu/et/deferredgrade/deferredgrade.html

Code of Ethics for Engineers:
http://cems.alfred.edu/courses/ces120/ethics/abet.html
http://cems.alfred.edu/courses/ces120/ethics/ieee.html
http://onlineethics.org/codes/
http://www.iit.edu/departments/csep/codes/coe/abet-a.html