GEN ENG 205-2
Engineering Analysis 2: Statics and Dynamics
Winter 2007

Instructor: Jose´ E. Andrade
Office: Tech A124
Office Hours: T 12 – 1, Th 10 – 11, and by appointment
Phone: (847) 491-5884
Email: j-andrade@northwestern.edu

Teaching Assistants: Kirk Ellison & Izzat Katkhuda
Class Times and Locations: MTWThF 11-11:50, Tech L361
Class Website: Northwestern Course Management System
http://courses.northwestern.edu

REQUIRED TEXTBOOK

COURSE OBJECTIVES

• Introduction to basic concepts in engineering mechanics, including statics and dynamics of particles and rigid bodies, and linear elastic deformation;

• Understanding the process of engineering analysis in which fundamental concepts are employed through a logical step-by-step method of problem solving;

• Further understanding and application of mathematical tools: vectors, linear algebra, calculus, etc; and

• Extending the programming skills and concepts introduced in Engineering Analysis 1 to make MATLAB an everyday tool for solving engineering design and analysis problems.

PREREQUISITES

• Engineering Analysis 1 (GEN ENG 205-1)

• Calculus 1 (MATH 214-1)

COURSE ASSESSMENT

Grading is based on the following components that are weighted as described below:
1. Homework: 20%
2. Design Problem: 20%
3. Midterm Examinations (2): 15% each
4. Final Exam: 30%

Each of the components is described below. Grades will be posted periodically on the class website. Please check your grades to make sure your scores are recorded correctly.

**Homework**

- Homework will be assigned weekly and will be due on Fridays. The general policy is that homework is to be turned in during class on Friday. **Extensions to turn the homework in by 5 PM on Friday are granted in advance and under special circumstances.**

- There will be at least one problem assigned each week that will require you to use MATLAB.

- Solutions to the homework problems will be posted on the course website at 5 PM on Fridays. Therefore, no late homework can be accepted, except for those with extensions granted in advance (see first item above).

- Be professional, e.g., use engineering graph paper, write neatly, write on one side of page only, and show all work.

Please make sure to start early so that you can ask questions during class, recitations, or office hours.

**Design Problem**

The design problem will be assigned in week 5 and will be due on week 9. It will be an in-depth problem emphasizing creative thinking, integrating the material from the class, and requiring an organized written report. Detailed instructions will be included with the assignment.

**Examinations**

We will have 3 exams as detailed below. Additional information will be provided as we near the exam dates.

1. EXAM #1: Thursday, February 1 in class.
2. EXAM #2: Thursday, February 22 in class.
3. FINAL EXAM: Thursday, March 15 from 12-2 pm (Room TBA).

Special arrangements must be discussed with the instructor at least 2 weeks in advance of the exam dates. Travel plans ARE NOT sufficient to warrant special accommodations.
COMMENTS, SUGGESTIONS, AND ADDITIONAL INFORMATION

1. There will be two TAs who will be assigned to our section. Their contact information and office hours will be posted on the class website on Wednesday, January 3.

2. Take advantage of office hours! This is time we have set aside to meet with students. In addition to our office hours, you will have access to office hours of the TAs for other EA2 sections. All office hours will be posted on the class website.

3. Announcements, hints for homework problems, homework solutions, grades, errata, etc. will be posted on the class website (frequently). Check the site once or twice per week.

4. The best way to reach us is via email. We can usually get back to students within 24 hours.

5. Questions about grading should be raised with the TA during his/her office hours. If a question is not answered to your satisfaction, then (and only then) you should raise it with the instructor (also during office hours).

6. Suggestions:

   • Spend time mastering the fundamental concepts introduced in the early part of the course.
   • Solve problems! Learning Mechanics is like learning to play a musical instrument. It is possible, albeit extremely unlikely, to learn to play by watching somebody else play. At a minimum, you should understand the homework problems, the examples presented in class, and the examples in the textbook.
Preliminary Course Outline

Week 1
Lecture 1  Wed, 1/3  Chapter 1: Fundamental Concepts
Lecture 2  Thu, 1/4  Chapter 2: Vectors §2.1, §2.2, §2.3 (Vector basics)
Lecture 3  Fri, 1/5  Chapter 2: Vectors §2.4, §2.5  Dot product

Week 2
Lecture 4  Mon, 1/8  Chapter 2: Vectors §2.6, §2.7,  Chapter 3: Forces §3.1 (Basics)
Lecture 5  Tue, 1/9  Chapter 3: Forces §3.2, §3.3  2D force systems
Lecture 6  Wed, 1/10  Chapter 3: Forces §3.3  2D force systems (finish)
Recitation 1  Thu, 1/11  Review of 2D force systems
Lecture 7  Fri, 1/12  Chapter 3: Forces §3.4  3D force systems

Week 3
No class on Monday 1/15 (MLK day)
Lecture 8  Tues, 1/16  Chapter 3: Forces §3.4  3D force systems (finish)
Lecture 9  Wed, 1/17  Chapter 4: Moments §4.1, §4.2, §4.3  (Moment basics)
Recitation 2  Thu, 1/18  Review three-dimensional force systems, moments
Lecture 10  Fri, 1/19  Chapter 4: Moments §4.4  Couples

Week 4
Lecture 11  Mon, 1/22  Chapter 4: Moments §4.5, 4.6 Equivalent systems
Lecture 12  Tue, 1/23  Chapter 5: Objects in Equilibrium §5.1, §5.2  2D equilibrium
Recitation 3  Wed, 1/24  Review equilibrium, Equivalent systems
Lecture 13  Thu, 1/25  Chapter 5: Objects in Equilibrium §5.2  2D equilibrium
Lecture 14  Fri, 1/26  Chapter 5: Objects in Equilibrium §5.3  Static Indeterminacy

Week 5
Lecture 15  Mon, 1/29  Chapter 5: Objects in Equilibrium §5.4  3D Applications
Lecture 16  Tue, 1/30  Chapter 5: Objects in Equilibrium §5.5 Two and three force members
Lecture 17  Wed, 1/31  Chapter 6: Structures in Equilibrium
EXAM 1  Thu, 2/1
Lecture 18  Fri, 2/2  Chapter 6: Structures in Equilibrium §6.1, 6.2 Trusses

Design Project Assigned (Due March 2)
<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Mon</td>
<td>2/5</td>
<td>Lecture 19: Chapter 6: Structures in Equilibrium §6.3 Method of sections</td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>2/6</td>
<td>Lecture 20: Chapter 6: Structures in Equilibrium §6.3 Method of sections (finish)</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>2/7</td>
<td>Lecture 21: Chapter 6: Structures in Equilibrium §6.5 Frames and Machines</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>2/8</td>
<td>Recitation 4: Review Trusses, Frames and Machines</td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>2/9</td>
<td>Lecture 22: Chapter 6: Structures in Equilibrium §6.5 Frames and Machines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Mon</td>
<td>2/12</td>
<td>Lecture 23: Chapter 6: Structures in Equilibrium §6.5 Frames and Machines</td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>2/13</td>
<td>Lecture 24: Linear Elastic Deformation</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>2/14</td>
<td>Lecture 25: Linear Elastic Deformation</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>2/15</td>
<td>Recitation 5: Review axial deformations</td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>2/16</td>
<td>Lecture 26: Linear Elastic Deformation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Mon</td>
<td>2/19</td>
<td>Lecture 27: Linear Elastic Deformation</td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>2/20</td>
<td>Lecture 28: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>2/21</td>
<td>Lecture 29: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>2/22</td>
<td>Exam 2: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>2/23</td>
<td>Lecture 30: Chap. 13: Kinematics of Particles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Mon</td>
<td>2/26</td>
<td>Lecture 31: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Mon</td>
<td>2/27</td>
<td>Lecture 32: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>2/28</td>
<td>Lecture 33: Chap. 13: Kinematics of Particles</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>3/1</td>
<td>Recitation 6: Kinematics, Normal and Tangential Components</td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>3/2</td>
<td>Lecture 34: Chap. 14: Force Mass and Acceleration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Mon</td>
<td>3/5</td>
<td>Lecture 35: Chap. 14: Force, Mass and Acceleration</td>
</tr>
<tr>
<td></td>
<td>Tue</td>
<td>3/6</td>
<td>Lecture 36: Chap. 14: Force, Mass and Acceleration</td>
</tr>
<tr>
<td></td>
<td>Wed</td>
<td>3/7</td>
<td>Lecture 37: Chap. 14: Force, Mass and Acceleration</td>
</tr>
<tr>
<td></td>
<td>Thu</td>
<td>3/8</td>
<td>Recitation 7: Review</td>
</tr>
<tr>
<td></td>
<td>Fri</td>
<td>3/9</td>
<td>Lecture 38: Review</td>
</tr>
</tbody>
</table>

**FINAL EXAM:** Thursday, March 15 from 12-2 pm, room TBA