Question of the Day

About 2x10^6 results on Google books from the past two years alone

What is dynamics & why is it important?
Outline for Today

- Question of the day
  - Who am I?
  - Who are you?
  - What is in the syllabus and handouts?
  - Context: Why is dynamics important?
  - Concept: What is dynamics?
  - Calculation: How do we use dynamics?
  - Answer your questions!
Who am I?

- Originally from Florida
Who am I?

- Originally from Florida
- B.S. in Engineering Science from University of Florida in 1996
Who am I?

- Originally from Florida
- B.S. in Engineering Science from University of Florida in 1996
- Biomedical Engineer for Computer Motion, Inc.
Who am I?

- Originally from Florida
- B.S. in Engineering Science from University of Florida in 1996
- Biomedical Engineer for Computer Motion, Inc.
- Ph.D. in Mechanical Engineering from University of Florida in 2006
Who am I?

- Originally from Florida
- B.S. in Engineering Science from University of Florida in 1996
- Biomedical Engineer for Computer Motion, Inc.
- Ph.D. in Mechanical Engineering from University of Florida in 2006
- Postdoc & Engineering Research Associate in Bioengineering at Stanford
Who am I?

- Originally from Florida
- B.S. in Engineering Science from University of Florida in 1996
- Biomedical Engineer for Computer Motion, Inc.
- Ph.D. in Mechanical Engineering from University of Florida in 2006
- Postdoc & Engineering Research Associate in Bioengineering at Stanford
- Married with two children
- Enjoy learning, volleyball, biking, and being outdoors
Who are you?

- **ME**: 31 students
- **AE**: 11 students
- **BME**: 17 students
- **Other**: 10 students

Number of students by major

- **Year**: 49 students
- **Sophomore**: 17 students
- **Junior**: 1 student
- **Senior**: 1 student

Number of students by year
Who are you?

1. Where were you born?
2. What is something unique about where you grew up?
3. What sports do you like?
4. Why are you taking dynamics?
5. What do you want to do after you graduate?
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- Answer your questions!
What is in the syllabus and handouts?

**Course Syllabus**
ME 231 ~ Dynamics
Fall 2012

Course Section: 001
Meeting Time and Place: 10:10AM – 11:00AM | MWF | Min Kao 524
Course Credit Hours: 3

**Faculty Contact Information**
Jeff Reinbolt
Office hours: 11:15AM - 12:05PM MWF
Office: DO 207
Phone: 865.974.5308
Email: reinbolt@utk.edu

**Teaching Assistant Contact Information**
TBD
## What is in the syllabus and handouts?

### Homework Assignments

#### ME 231 ~ Dynamics

<table>
<thead>
<tr>
<th>Month</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td>13</td>
<td>15</td>
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<td>22</td>
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<td>27</td>
<td>29</td>
<td>HW #1</td>
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<td>31</td>
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<tr>
<td>September</td>
<td>3</td>
<td>Labor Day (no class)</td>
<td>5</td>
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<td>10</td>
<td>12</td>
<td>HW #3</td>
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<td>19</td>
<td>HW #4</td>
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<td>24</td>
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<td>HW #5</td>
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<td>28</td>
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</tbody>
</table>
What is in the syllabus and handouts?

**Homework Instructions**

**ME 231 ~ Dynamics**

- Register for Connect using the following:

<table>
<thead>
<tr>
<th>student registration information</th>
</tr>
</thead>
<tbody>
<tr>
<td>course</td>
</tr>
<tr>
<td>Dynamics - ME 231</td>
</tr>
<tr>
<td>instructor</td>
</tr>
<tr>
<td>Jeffrey Reinbolt</td>
</tr>
<tr>
<td>section</td>
</tr>
<tr>
<td>Fall 2012 MWF 10:10am</td>
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</table>
What is in the syllabus and handouts?

<table>
<thead>
<tr>
<th>Exam</th>
<th>Chapters</th>
<th>Date</th>
<th>Time</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1, 2, 6</td>
<td>October 3, 2012</td>
<td>10:10-11:00AM</td>
<td>MK 524</td>
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<tr>
<td>2</td>
<td>3, 5, 7, 8</td>
<td>November 16, 2012</td>
<td>10:10-11:00AM</td>
<td>MK 524</td>
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<td>Final</td>
<td>1-8</td>
<td>December 10, 2012</td>
<td>8:00-10:00AM</td>
<td>MK 524</td>
</tr>
</tbody>
</table>
## What is in the syllabus and handouts?

### Lecture Schedule

**ME 231 ~ Dynamics**

<table>
<thead>
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<th>Month</th>
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<td>Curvilin. Motion 2.3 – 2.4</td>
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<td>Normal, Tangential 2.5</td>
<td>Polar 2.6</td>
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<td>3</td>
<td><strong>Labor Day (no class)</strong></td>
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<td>10</td>
<td>Constrained Motion 2.7</td>
<td>12</td>
<td>14</td>
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<tr>
<td>17</td>
<td>Relative Velocity 6.2</td>
<td>19</td>
<td>21</td>
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<tr>
<td>24</td>
<td>Relative Accel. 6.3</td>
<td>26</td>
<td>28</td>
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<tr>
<td></td>
<td></td>
<td>Space Motion 2.8</td>
<td>Relative Motion 2.7</td>
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<tr>
<td></td>
<td></td>
<td>Rotation 6.1</td>
<td>Absolute Motion 6.1</td>
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<tr>
<td></td>
<td></td>
<td>Instant Center 6.2</td>
<td>Relative Accel. 6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotating Axes 6.4</td>
<td>Rotating Axes 6.4</td>
</tr>
</tbody>
</table>
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- Question of the day
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- Context: Why is dynamics important?
- Concept: What is dynamics?
- Calculation: How do we use dynamics?
- Answer your questions!
Context: Why is dynamics important?

- Analyze and optimize athletic performance
- Design ergonomically safe environments
- Create human and animal characters
- Understand and treat movement disorders
Context: Exercise & Discussion

Investigating the **Spin** Motion of the Dynamic Celt

clockwise = simple spin  
counter-clockwise = simple spin

zero *product of inertia*
Context: Exercise & Discussion

Investigating the **Spin** Motion of the Dynamic Celt

clockwise = simple spin  
counter-clockwise = **wobble and spin reversal**

negative *product of inertia*
Context: Exercise & Discussion

Investigating the **Spin** Motion of the Dynamic Celt

clockwise = **wobble and spin reversal**

counter-clockwise = simple spin

positive *product of inertia*
Concept: What is dynamics?

Main Entry: **dynamics**

Pronunciation: \di-ˈna-miks\

Function: *noun plural but singular or plural in construction*

Date: circa 1789

1: a branch of mechanics that deals with forces and their relation primarily to the motion but sometimes also to the equilibrium of **bodies**

2: a pattern or process of change, growth, or activity <population dynamics>

3: variation and contrast in force or intensity (as in music)
Concept: What is dynamics?

In the field of **physics**, the study of the causes of motion and changes in motion is **dynamics**. In other words, the study of **forces** and why objects are in **motion**. **Dynamics** includes the study of the effect of torques on motion. These are in contrast to **Kinematics**, the branch of classical mechanics that describes the motion of objects without consideration of the causes leading to the motion.

Generally speaking, researchers involved in dynamics study how a physical system might develop or alter over time and study the causes of those changes. In addition, **Isaac Newton** established the undergirding **physical laws** which govern dynamics in physics. By studying his system of mechanics, dynamics can be understood. In particular, **dynamics is mostly related to Newton's second law of motion**.
Concept: What is dynamics?

Dynamics can be subdivided into **kinematics**, which describes motion, without regard to its causes, in terms of position, **velocity**, and acceleration; and **kinetics**, which is concerned with the effect of forces and torques on the motion of bodies having mass. The foundations of dynamics were laid at the end of the 16th century by Galileo Galilei who, by experimenting with a smooth ball rolling down an **inclined plane**, derived the law of motion for falling bodies; he was also the first to recognize that force is the cause of changes in the velocity of a body, a fact formulated by **Isaac Newton** in the 17th century in his second law of motion. This law states that the force acting on a body is equal to the rate of change of the body's momentum.
Concept: What is dynamics?

Chapters 1, 2, 6

Chapters 3, 5, 7, 8

Kinematics

Relationship among *position*, *velocity*, and *acceleration*

Kinetics

Relationship among *forces* and *acceleration*

Dynamics
Calculation: How do we use dynamics?

Newton’s 2nd Law of Motion
The *acceleration* of a particle is proportional to the resultant *force* acting on it and is in the direction of this force.

**Force.** A push or pull exerted on a body, characterized by:
- magnitude
- direction
- point of application

**Mass.** Measure of the resistance of a body to linear acceleration.

**Acceleration.** Velocity rate of change with respect to time
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For Next Time...

- Read Chapter 1
- Begin Homework #1 due next week (8/29)
- Read Chapter 2, Sections 2.1 and 2.2