E MCH 212, *Dynamics*  
Online Offering  
Course Information

**Instructor**  
Dr. Gary L. Gray  
Associate Professor  
Engineering Science & Mechanics  
Phone: (814) 863-1778  
Email: gray@psu.edu

**Textbook**  

**Prerequisites**  
The prerequisite courses for E MCH 212 are: E MCH 211 or E MCH 210; and MATH 141. If you have not have all of these prerequisites, please contact me as soon as possible. In particular, each student is expected to have a working knowledge of the material covered in all prerequisite courses, which includes, but is not limited to:

- Geometry and trigonometry, including the laws of sines and cosines, direction cosines, and the like.
- Vector calculus. Vectors in 2- and 3-space, inner products, and vector products.
- Statics. How to draw correct free body diagrams, find force and moment equilibrium, write friction laws, and find support reactions.
- Differential and integral calculus. How to differentiate and integrate most simple functions (e.g., polynomials, sine, cosine, exponentials, logarithms, and combinations of these functions); apply simple sequences and series; and apply the chain rule to both differentiate and integrate functions.

**Description**  
E MCH 212 is an introductory course in *dynamics*, which is the science of *motion*. In this course we will develop the ability to analyze engineering problems concerning the motion of objects and the system of forces acting on them. The solution of these problems requires the use of very few basic principles. We will develop and/or improve our engineering problem solving skills (think before beginning the solution, ask what principles apply, and critically judge our results), our visualization skills (e.g., free body diagrams), and our understanding of basic physical principles of dynamics.

**Objectives**  
E MCH 212 is intended to achieve the following educational objectives:

1. Acquire a working knowledge of basic vector calculus and to apply it to the description of kinetic and kinematic quantities such as forces, moments, position, velocity, and acceleration.
2. Apply calculus to relate position, velocity, and acceleration to one another.
3. Model the types of mechanical systems considered in a first course in dynamics using free body diagrams (FBDs) of particles and rigid bodies (i.e., to graphically display the relevant system of forces and moments acting on these bodies) by writing their governing equations of motion. These models may be applicable at either a specific instant in time and/or point in space or they may be applicable over a range of time and space. In general, only two-dimensional motion will be modeled.
4. Apply algebra, trigonometry, calculus, and elementary differential equations, to the solution of the equations of motion.

5. Apply the work-energy principle to relate the energy of a mechanical system to its spatial configuration variables (i.e., position variables).

6. Apply the impulse-momentum principle to relate the momentum of a mechanical system to the system of forces applied to it.

Grading All grades are determined by performance, which is evaluated using objective standards rather than standards based on a notion of average class performance (i.e., I do not grade on a curve). Each grade will be based on a scale of 100 percent. Letter grades will be determined according to the following table:

<table>
<thead>
<tr>
<th></th>
<th>A’s</th>
<th>B’s</th>
<th>C’s</th>
<th>D’s</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90+</td>
<td>80+</td>
<td>70+</td>
<td>60+</td>
<td>below 60</td>
</tr>
</tbody>
</table>

For example, a student with a final average in the 80s will be guaranteed at least some sort of B (i.e., B-, B, or B+). Each part of the course is weighted as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm Exams (3)</td>
<td>20% each</td>
</tr>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
</tr>
</tbody>
</table>

Exams There will be three exams during the semester. The dates of the three exams can be found on the ANGEL web site for the course. While an equation sheet is available on ANGEL, all exams will be open book and open notes.

Homework Homework will be assigned every week. The due date and time for each assignment can be found on our ANGEL web site. You will scan your homework and upload it to our dropbox on ANGEL. Late homework will not be accepted. Homework will be graded largely on effort. A respectable attempt to solve a problem will result in full credit of 3 points for that problem. Little or no attempt to solve the problem will result in 0 points for that problem. I will drop your lowest homework grade. Attempts in between those two extremes will result in 1 or 2 points.

ANGEL ANGEL, Penn State’s online course management system, will be used to:

- post the recorded lectures
- post the course schedule and weekly homework assignments
- post this Course Information document
- post the Equation Sheet and Problem Solving Steps
- send email to the class with announcements, reminders, etc.
- post any supplementary reading material
- post Mathematica files, QuickTime movies, and other things done in class.
Email  I will be communicating with you frequently this semester via email. Unless I am replying to a message sent to me via a non-Access account, email will only be sent to your Penn State Access account. While many students forward their email from their Access account to other accounts (e.g., Gmail), I will not accept as an excuse for not having received a message that one of these service providers was not working.

Academic Integrity  The Department of Engineering Science and Mechanics at the Pennsylvania State University considers academic training to be apprenticeship for practice in the professions. Students are expected to demonstrate a code of moral integrity and ethical standards commensurate with the high expectations that society places upon professional practice. Accordingly, it is the policy of the department to maintain the highest standard of academic honesty and integrity.

Academic dishonesty includes, but is not limited to, cheating (e.g., representing someone else’s work as your own), copying on tests, plagiarizing, acts of aiding or abetting, unauthorized possession of materials, tampering with work, ghosting, and altering examinations. Students are encouraged to report incidents of academic dishonesty to their instructors in order to promote a fair academic climate and equal opportunity learning environment.

A student charged with academic dishonesty will be given oral or written notice of the charge by the instructor. A student contesting such a charge may seek redress through informal discussions with the instructor(s), department head, or college dean. If the instructor believes that the infraction is sufficiently serious to warrant referral to the Office of Conduct Standards, or if the instructor awards a final grade of F in the course because of the infraction, the student and instructor will be afforded formal due process procedures governed by Penn State Senate Policy 49-20. Policy 49-20 and procedures can be found in the document “Policy and Rules for Students” issued annually by the Senate Office and available through each student’s home department or college dean’s office. Academic Integrity policy information can also be found on the web at http://www engr psu edu/CurrentStudents/acadinteg.aspx.

Note to students with disabilities: Penn State welcomes students with disabilities into the University’s educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) located in room 116 Boucke Building at 814-863-1807 (V/T TY). For further information regarding ODS, please visit their web site at http://www equity psu edu/ods/. Instructors should be notified as early in the semester as possible regarding the need for reasonable academic adjustments.