MI E313 Design of Mechanical Components -- Spring 2000

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Course Outline

- To learn and apply basic mechanical analysis techniques 
  (*Statics, Dynamics, Strength of Materials*)
- To develop insight from analysis & use it in design
- To learn to design to fulfill specific functional requirements 
  (*Engin113, MIE213*)
- To learn solid modeling and finite element analysis 
  computer skills (*LAB*)
- To reinforce (semester-long group Design and Analysis Project)
  - communication (written, oral, and graphical)
  - cooperative problem solving
  - project management skills
Course Overview

- Review: Solid mechanics, work, energy, and power conservation (Ch. 1&2)

Mechanics
- Solid Mechanics
  - Statics
  - Kinematics
- Fluid Mechanics
  - Dynamics

GEAR HOUSING
Text Book & Topics

  - Safety Considerations
  - Load Analysis
  - Stress, Strain, and Deflection Analysis
  - Failure Theories and Modes
  - Finite Element Analysis

- Pro Mechanica
Related Topics

- Solid Modeling
- Fatigue Analysis
- Design Evaluation
- Strength of Material
- Component design
  - springs, bearings, gears
# Grade Distribution

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homeworks</td>
<td>10%</td>
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<tr>
<td>Quizzes &amp; Class Participation</td>
<td>10%</td>
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<tr>
<td>FEA Mini-Project</td>
<td>10%</td>
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<tr>
<td>Midterm Exam</td>
<td>15%</td>
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<td>Final Exam</td>
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<tr>
<td>Project Solid Model Report</td>
<td>10%</td>
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<tr>
<td>Project Baseline Report</td>
<td>10%</td>
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<tr>
<td>Final Project Report</td>
<td>10%</td>
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<tr>
<td>Project Presentation</td>
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Related Links

**MI E313-S99:**
- [http://www.ecs.umass.edu/mie/courses/mie313-s99/](http://www.ecs.umass.edu/mie/courses/mie313-s99/)

**MI E313-Fall99:**
- [http://www.ecs.umass.edu/mie/courses/MIE313-Fall99/index.htm](http://www.ecs.umass.edu/mie/courses/MIE313-Fall99/index.htm)

**Design Library:**
- [http://www.ecs.umass.edu/mie/labs/mda/dlib/dlib.html](http://www.ecs.umass.edu/mie/labs/mda/dlib/dlib.html)
Related Information

- **Academic Honesty Policy:**
  - [http://www.ecs.umass.edu/mie/hon97.html](http://www.ecs.umass.edu/mie/hon97.html)

- **Pro Engineer and Pro Mechanica:**
  - All students expected to have working knowledge of ProE
  - All Students are required to attend a 2 hour training session on Pro Mechanica
Project Selection Criteria

- **Design Against Failure**
- **Geometry Complexity**
- **Operating Conditions**
- **Material Properties**
- **Functional Behaviors:**
  - Linear elastostatic analysis
  - Steady-state thermal analysis
  - Combined linear thermal-elastostatic analysis
  - Buckling & Free vibration

VHS- Tape Pinch Roller Actuator
Project Teams

- Teams of 2 or 3 (3 preferred)

- Goal:
  - To discuss, decide, and to do real work together

- Rotating Leadership
  - Studies have shown that rotating leadership assignments in semester-long projects works well
  - Every member has an opportunity to be the leader for at least one reports
Project Information

- **Goal:**
  - Product Redesign requiring design, analysis, and evaluation of one or more special purpose parts

- **Project Proposal**
- **Force Model & Solid Model Report**
- **Analysis Report**
- **Final Report**
- **Oral Presentation**
All reports will be evaluated based on:

- **Substance:** Quality of contents and quality of drawings
- **Style:** Presentation of materials in an integrated manner that is easy to read with no spelling, grammar, or other errors
Project Proposal

Two-pages to include:

- Member names and rotating leadership assignment
- A brief overview of your design describing:
  - General functions, operating conditions, and overall objectives of your project
- A sketch of the Actual Part or subassembly
- Project Timeline with task schedule
Force & Soild Model Report

- 10% of your grade
- Group report with a leader clearly identified
- Suggested topics:
  - Introduction
  - Objectives
  - Plan of Work
  - Force Model
  - Solid Models of critical components
    - All figures should have figure numbers and figure captions
- Conclusion
Project Analysis Report

- 10% of your grade
- Group report with a leader clearly identified
- Similar in style to Solid Model Report
- Suggested topics:
  - Introduction, Objectives, Plan of Work
  - Solid Models of critical components
    - All figures must be integrated into the text write up
    - **FORCE ANALYSIS**
  - FEA of critical components
    - Discuss in detail your simplifications in the context of your design objectives
    - Clearly detail load conditions
    - Discuss and kinematic constraints
- **Validate your results using simplified hand calculations**
- Conclusion