



## Mechanical Engineering

“Scientists discover the world that exists;  
engineers create the world that never was.”

*Theodore von Karman*

# Mechanical Engineering at WPI

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Mechanical Engineering

Mechanical Engineering at WPI

## Outline

- What is Mechanical Engineering?
- Mechanical Engineering at WPI.
- Student Project Presentation.
- Question and Answer Session.



Mechanical Engineering

Mechanical Engineering at WPI

**Mechanical Engineering  
is the broadest and  
largest engineering  
discipline.**



# Mechanical Engineering Introduction

- Mechanical Engineering deals with:
  - Power, engines, material processing, manufacturing
  - Design and analysis of structures and mechanical systems, flow of fluids, heat transfer
  - Lots of interaction with other disciplines:
    - Mechatronics involves electrical and mechanical
    - Robotics involves mechanical, electronic, computers
    - Biomechanical engineering melds engineering and biology



# With an engineering degree you can...

- Design new products, structures, devices
- Discover new technologies (research)
- Create new capabilities by integrating existing technologies (Systems Engineering)
- Pursue related fields:
  - Business
  - Medicine
  - Law
  - Education
  - Public policy



# Mechanical Engineering is the Most Popular Engineering Discipline

## Incoming Freshmen by Engineering Degree Declarations

MAJOR	2005	2006	2007	2008	2009	2010	2011	2012	ME
<b>Aerospace Engineering</b>	<b>33</b>	<b>29</b>	<b>33</b>	<b>37</b>	<b>27</b>	<b>42</b>	<b>53</b>	<b>47</b>	<b>47</b>
Biomed Engineering	20	34	36	37	40	57	104	98	
Civil Engineering	31	30	34	50	61	49	34	39	
Chemical Engineering	20	31	47	58	57	52	68	63	
Engineering - TBD	111	212	150	173	163	166	179	127	
Electrical Engineering	70	45	76	57	58	55	61	57	<b>51</b>
Environmental Eng.	1	0	2	6	11	20	15	21	
Industrial Engineering	6	9	3	3	2	6	8	8	
<b>Mechanical Engineering</b>	<b>96</b>	<b>78</b>	<b>99</b>	<b>111</b>	<b>130</b>	<b>117</b>	<b>115</b>	<b>108</b>	
Management Engineering	0	1	5	3	1	7	4	6	
Robotics Engineering	NA	NA	4	28	29	57	55	46	<b>18</b>
<b>Grand Total of Engineering</b>	<b>388</b>	<b>469</b>	<b>489</b>	<b>563</b>	<b>579</b>	<b>628</b>	<b>696</b>	<b>620</b>	<b>224</b>
Grand Total for all of WPI	752	804	831	921	957	944	1005	948	
Engineering to Total WPI %	52	58	59	61	61	67	69	65	



## Mechanical Engineering at WPI Statistics

WPI was established in 1868.

31 Full-time faculty plus several adjunct faculty in ME

874 Undergraduate students in Mechanical Engineering (in 4 yrs)

285 Graduate students (full and part-time)

Undergraduate Degrees awarded in  
Mechanical Engineering  
Aerospace Engineering  
Robotics Engineering

Within Mechanical Engineering Degree can Concentrate in:  
Aerospace, Biomechanical, Design, Manufacturing,  
Material Science, Mechanics, Robotics, Thermo-fluids



## Mechanical Engineering at WPI Flexible Curriculum

- Need 45 courses minimum to graduate from WPI.  
What courses must I take vs. what I have control over?

- (6) – Humanities Component (All majors)
- (2) – Social Science Courses (All majors)
- (3) – Interactive Qualifying Project (IQP) (All majors)
- (3) – Major Qualifying Project (MQP) (All majors)
- (1) – Physical Education (All majors)
- (12) – Math and Science Component (Required)
- (8) – Required ME Core Component (Required)
- (1) – Electrical Engineering Course (Required)
- (6) – Your Choice of ME (or other) Courses (Elective)
- (3) – Free Electives (Elective)

What should I take as a Freshman?  
What do you want to take?

GPS	GPS	CAD	Machining
Physics 1	Physics 2	Humanities	Humanities
Math 3	Math 4	Intro Materials	Math 5

Humanities	Humanities	GPS	GPS
CAD	Machining	Humanities	Humanities
Math 1	Math 2	Math 3	Math 4

GPS	GPS	Physics 1	Physics 2
Chem 1	CAD	Humanities	Humanities
Math 1	Math 2	Machining	Intro Design



## Mechanical Engineering at WPI

### Major Qualifying Project

- Every student must do a senior project in their major called the Major Qualification Project.
  - Is worth three-course equivalents.
  - Is usually done in teams of 3 or more students.
  - Is a capstone experience.
    - Ties together what was learned in prior years.
  - Often involves building a model or system.
  - Can be done
    - over three terms on campus,
    - or in one 7-week term at an off-campus project center.





## Mechanical Engineering Student Competitions

Society of Automotive Engineering (SAE) Car, or Baja Vehicle  
FIRST Robotic Team (with the Mass Academy)  
Micro-Aerial Vehicle (MAV)





## Mechanical Engineering at WPI

### What Makes WPI Different?

- Flexible curriculum.
  - Project model allows customization of interest areas.
- Strong ties to industry.
  - A significant fraction of ME MQP's are real world problems sponsored by companies.
- Good access to senior faculty.
  - Primarily an undergraduate institution.
  - Many faculty do research that incorporates undergraduate students.
  - WPI faculty spend significant time with students in small groups and care about their development.





## Mechanical Engineering at WPI

### What Makes WPI ME Dept Different?

- TAs don't teach classes.
  - All courses are taught by faculty.
  - Introductory classes are usually taught by experienced faculty.
- High Quality Teaching.
  - The M.E. Department has 15% of the faculty (and 25% of the student body). Over 41 years, 11 different M.E. professors have won the annual *Trustees Award for Outstanding Teaching*, more than any other department. One was selected as a U.S. Professor of the year in 2007. Multiple Faculty-of-the-State Awards.
  - The M.E. Department has 3 *Trustees Award for Service to Community*, more than any other department (initiated 2003).
  - The M.E. Department has 6 of the 11 Endowed Professorships at WPI.



# Recognized for Excellence and Results



#1 in the country for  
student / faculty  
interaction



One of the top 25 "most  
wired campuses"



#1 in the US Part-Time MBA  
#2 US in Academic Quality  
Rated best for Career Advancers



*Top Colleges for Getting Rich*  
#9 in the Country



*... one of 16 national Leadership  
Institutions that will define the  
future of liberal education*



*"... best career prospects" for  
graduates of the MBA program*  
# 9 in the Country

## New York Times Highlights WPI's Success in Retaining STEM Students

Studies show that, nationwide, about 40 percent of students who plan to major in engineering and science end up switching to another major or fail to get a degree. Even students who excel in STEM courses in high school often wash out after experiencing the “math-science death march” in college. So how come 74 percent of WPI undergraduates earn bachelor's degrees in four years, and 80 percent in six years?





## Mechanical Engineering at WPI

### Where do the Graduates Go?

- Where do our graduates go?
  - Some to top graduate schools such as:
    - Purdue, U. Michigan, U. Minnesota, Stanford, Cal Tech
  - Most to jobs in industry at companies such as:
    - Gillette, Raytheon, General Electric, Westinghouse.  
Pratt & Whitney, Sikorsky, Stanadyne, Teradyne, Foster-Miller, Genzyme, IRobot, Bose, Boston Scientific, QA Technologies, Siemens, Textron, Tyco Valves, Jacobs Technology, Accellent, Naval Research Labs, Lightolier, ITT Marine, Exxon Mobil, and many others.



## Mechanical Engineering at WPI Summary

- A strong program in engineering fundamentals
- Opportunities for freshman to take ME courses
- Opportunity to work closely with members of the faculty
- Emphasis on technical and professional aspects of M.E.
- Pioneered project-based education: 40 years of experience
- Projects in foreign and domestic off-campus centers.
- Strong industrial connections (Theory and Practice)
- Five-year BS/MS program



## Five-year BS/MS program

- A MS in Mechanical Engineering requires 30 credits
- The BS/MS allows 12 credits to count in both degrees
- The WPI undergraduate degree requires 45 courses or 135 credits, yet 144 credits are within the 4 years
- Using only the 12 credits double counted, a MS degree can be completed in the 5<sup>th</sup> year.
- Alternately, using the additional 9 credits within the 4 year UG schedule, a MS can be completed in 1 subsequent semester.



## Mechanical Engineering Transportation

Mechanical Engineers have always been leaders in the development of transportation systems

18<sup>th</sup> century: Railroads

19<sup>th</sup> century: Ships/Submarines

20<sup>th</sup> century: Automobiles/Airplanes/Aerospace

21<sup>st</sup> century: ??????????

This trend will continue!



# Mechanical Engineering

## Many Facilities, including

WPI Haas Technical Center  
Professor Brown, Director



Micro Electro/Mechanical Systems  
(MEMS) Laboratory

Professor Pryputniewicz, Director









# Mechanical Engineering Transportation



"SKYCAR"  
from Moller  
Corporation



Autonomous  
vehicles for  
remote  
places:  
The NASA  
2003 Rover



The  
International  
Space  
Station



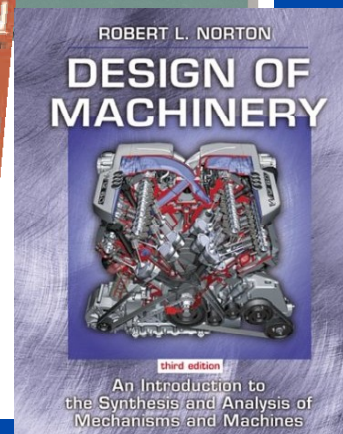
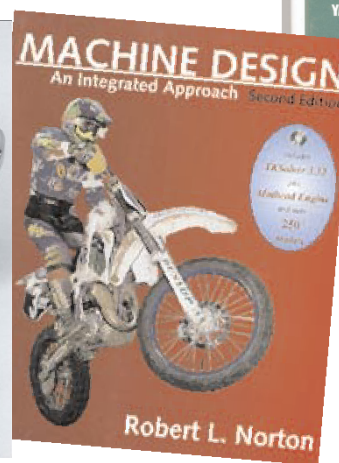
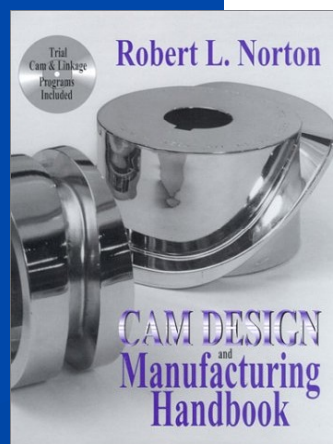
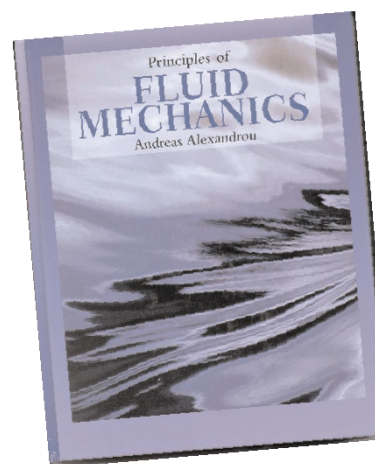




## Mechanical Engineering The Faculty

- Recognized authorities in their specialties
- Fellows of various societies such as ASME
- Editors of professional journals
- Authors of leading text books

### Recent Books by ME Faculty





## Mechanical Engineering Software development and applications

Mechanical Engineers have led the development and application of computer software for design and manufacturing

- Computer Aided Design and Manufacturing (CAD/CAM)
- Finite Element Methods for Structural Analysis (FEM)
- Computational Fluid Mechanics and Heat Transfer (CFD)
- Dynamics and Control of Mechanical Systems



Mechanical Engineering

Mechanical Engineering at WPI

Student Project Presentations:

## **Soft Robotics Exo Muscular Arm**

*Benjamin Leone\*, Christopher Molica\**

*Michael Brauckmann, Elliott Calamari, Seth Lipkind,*

*Amanda Piscopiello, William Terry*

## **Intelligent Preprocessing of Electronic Waste for Recycling: a Source for Critical Materials**

*Amy Loomis\*, Patrick Ford,*

# Student Presentations



Questions?



