

Engineering @ Union

*Turning
Ideas
into Reality!*



Dr. Cherrice Traver
Dean of Engineering
Professor of Electrical and Computer Engineering

Overview

1. National Context for Engineering Education

2. Distinctive Features and Opportunities for Student

3. Overview of Programs

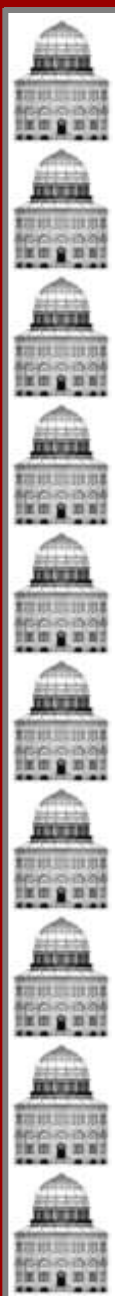
Bioengineering
Computer Engineering
Electrical Engineering
Mechanical Engineering

4. Questions

5. Tours of Facilities



Engineering Facilities





Trends in Science and Engineering

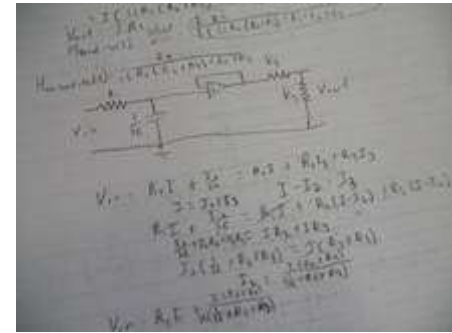
Rising Above the Gathering Storm,
Revisited: Rapidly Approaching Category 5
National Academy of Engineering

The only promising avenue for achieving [competitiveness], in the view of the *Gathering Storm* committee and many others, is through **innovation.**

Why Engineering at Union?



Liberal Arts Context



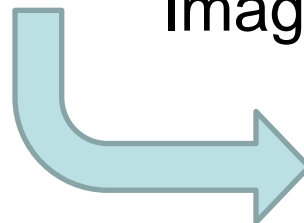
Engineering Rigor



Passion



Imagination



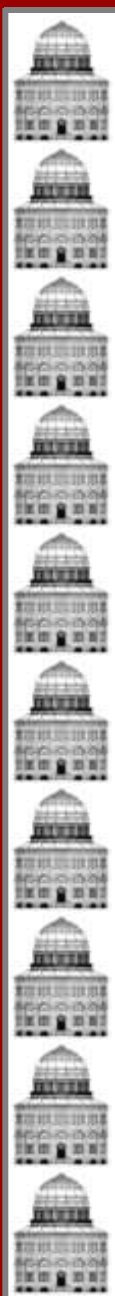
Innovation!

Innovative Teaching

Focus on fundamentals

Small, interactive classes
discussions
demonstrations
student presentations

Emphasis on hands-on learning
studio format classes
laboratories in most courses



Example: First Year Exploring Engineering Course

Engineering Topics

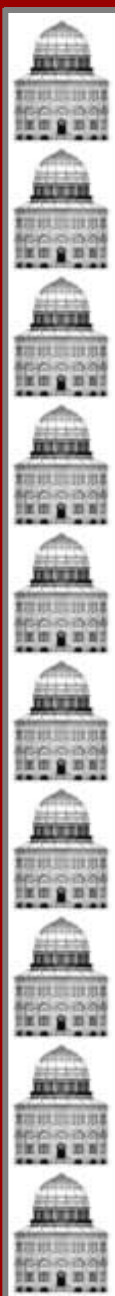
- energy, energy transformation, energy conservation
- combustion, engines, drive trains, gears
- logic, binary numbers, control, feedback, algorithms
- biological signals, systems

Career Exploration - Weekly speakers

- Remote sensing
- Smart grid
- Biosensors and systems
- Renewable Energy

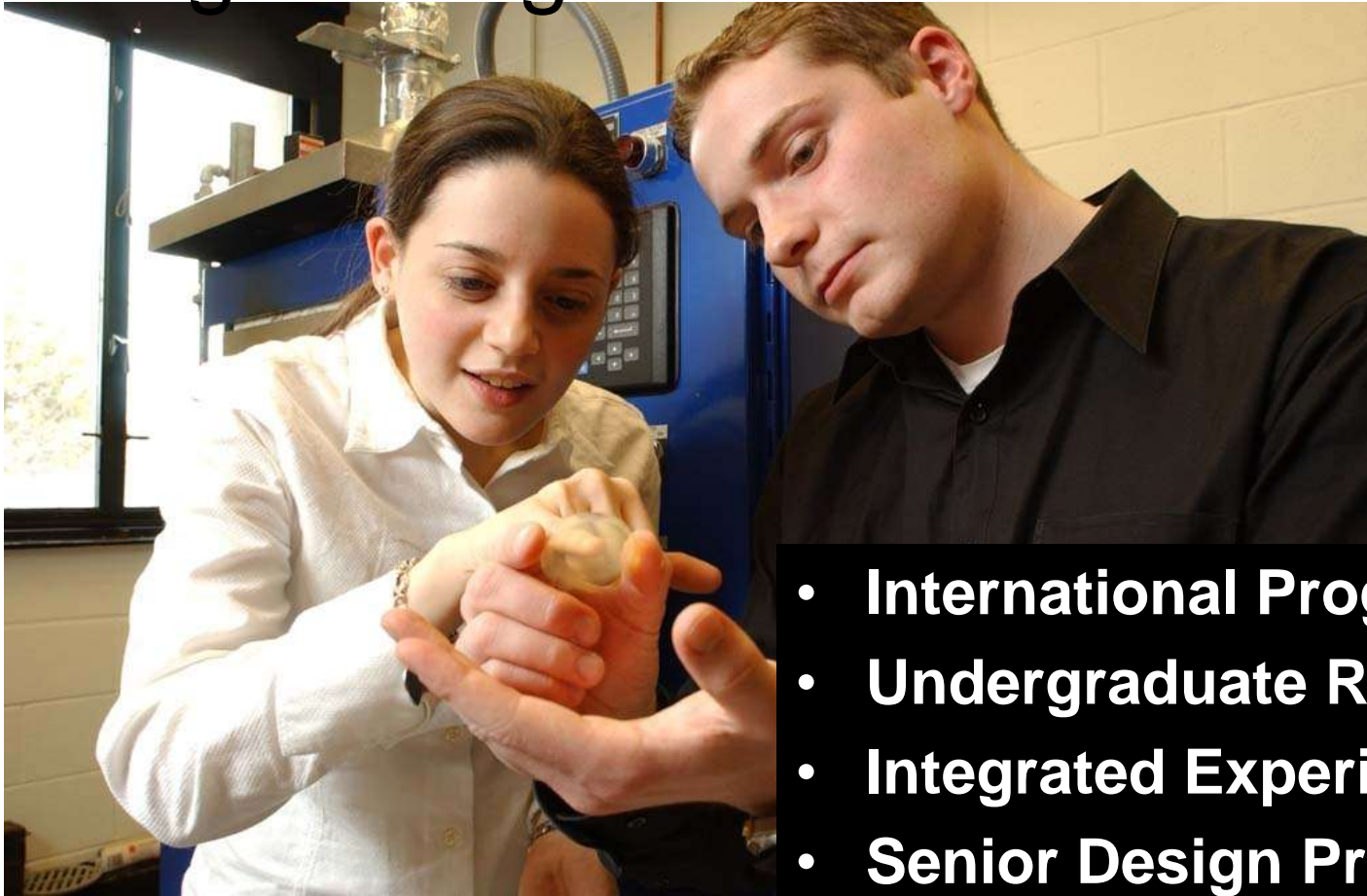
Design Studio

- The design process
- Teamwork



Finding Passion!

Engineering in a Liberal Arts Context



- International Programs
- Undergraduate Research
- Integrated Experiences
- Senior Design Projects
- Student Clubs

International Programs



Vietnam



Prague

70-80% of Union engineering students go abroad

Full terms abroad:

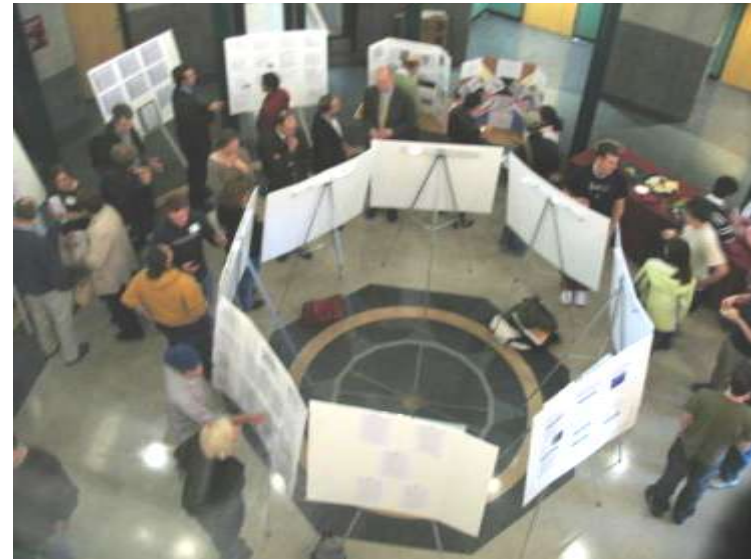
| | |
|---------------------|--------------------|
| Brazil (Sao Paolo) | Spain (Seville) |
| China (Shanghai) | Fiji |
| England (York) | Germany (Freiburg) |
| France (Rennes) | Italy (Florence) |
| Greece (Athens) | Australia |
| Israel (Beer Sheva) | Ireland |
| Japan (Osaka) | Vietnam |
| Barbados | Wales |
| Tasmania | Sweden |
| Mexico (Cuernavaca) | Czech Republic |
| | Korea |

Mini Terms:

| | |
|-------------|--------|
| New Zealand | France |
| Spain | Egypt |

Undergraduate Research

- Summer research (over 100 paid positions each summer)
- Independent study courses
- Senior research or design projects
- Many opportunities to present results
- Excellent facilities and instrumentation

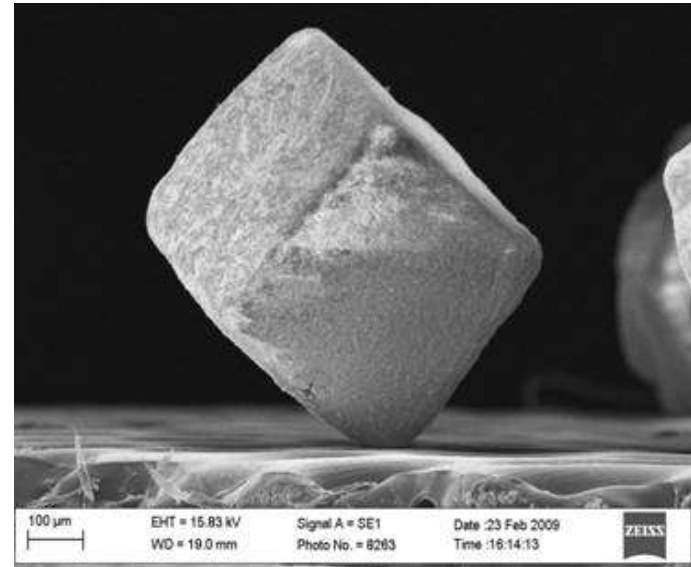
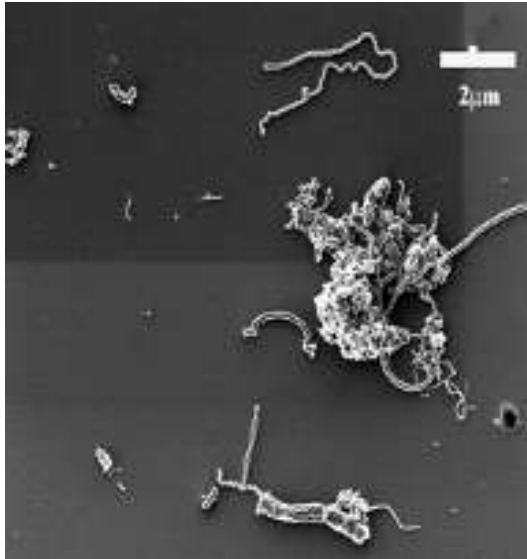


Integrated Experiences

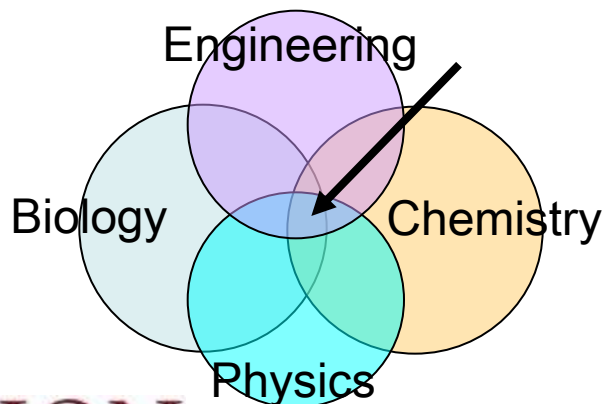
- Engineering/Science/Art → Nanotechnology
- Engineering and Chemistry
- Engineering and Biology
- Engineering and Music
- Engineering and Neuroscience
- Engineering and the Environment

Projects, Research, Courses, Minors,

Nanotechnology

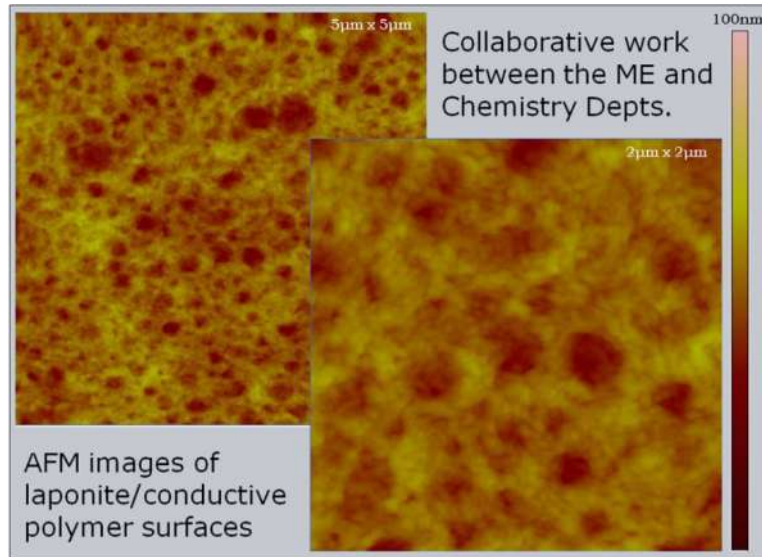


Scanning Electron Microscope (SEM) Images

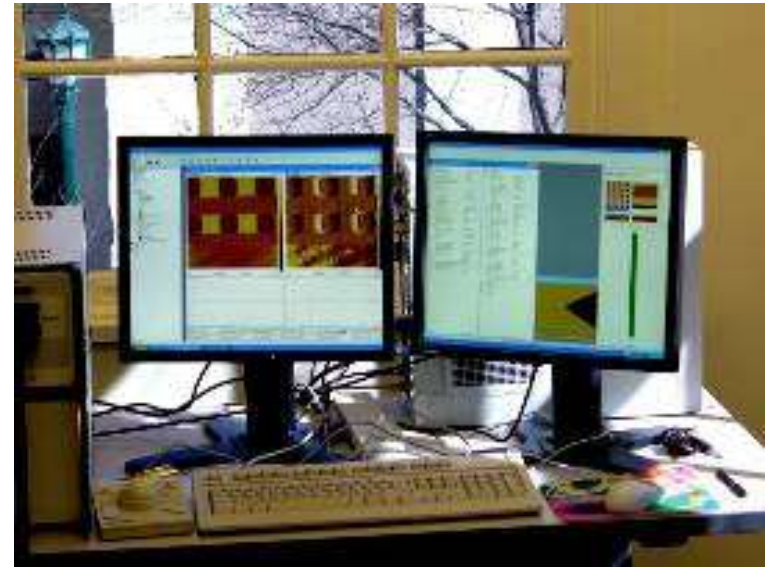


- Nanotechnology Minor
- Nanotechnology research projects
- Courses:
Frontiers of Nanotechnology
Advanced Topics in Nanoscience

Student research: Solar cell design materials
Michael Topka and Charlie Wood



Conductive polymer blend film



Atomic Force Microscope (AFM)

Nano and Art!



A traditional photograph of a paper bag, taken by Kim Floeser '11, is shown at left. An image of the same bag, taken by the scanning electron microscope, is on the right.



Scanning Electron Microscope

Nanotechnology and
Photography Classes

Exploring the SEM
technology and aesthetics

Joint Poster Session



Engineering and Chemistry

Aerogel Research Project

Faculty: Ann Anderson (Mechanical Engineering), Mary Carroll (Chemistry)

Ultra-light matrix material, insulator

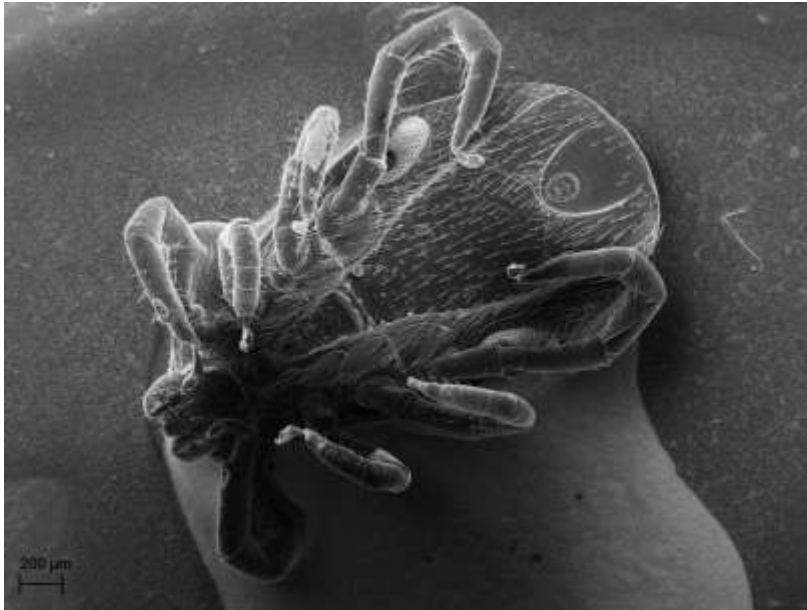
Student-initiated project
- Ben Gauthier '02

Patents

Grants



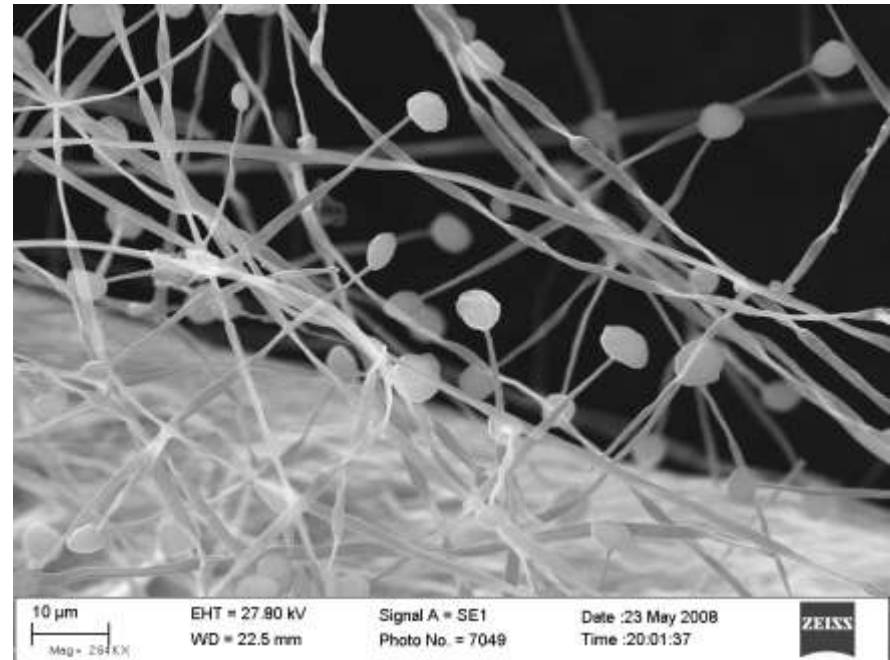
Engineering and Biology



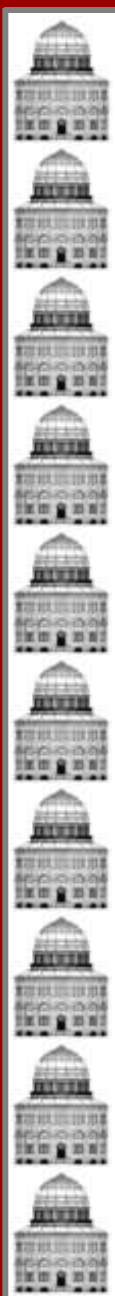
Black-legged tick

SEM Imaging
Research on Lyme disease

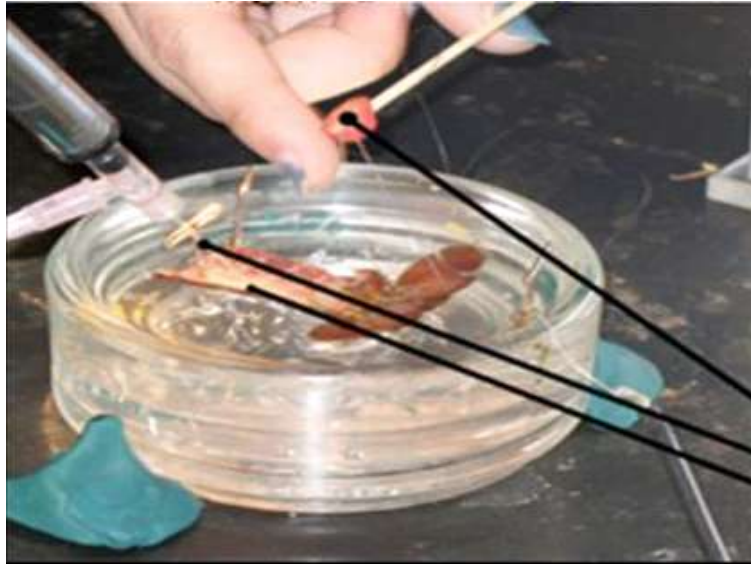
Palma Catravas, Electrical Engineering
Kathleen LoGiudice, Biosciences



Entomopathogenic fungi



Engineering and Neuroscience

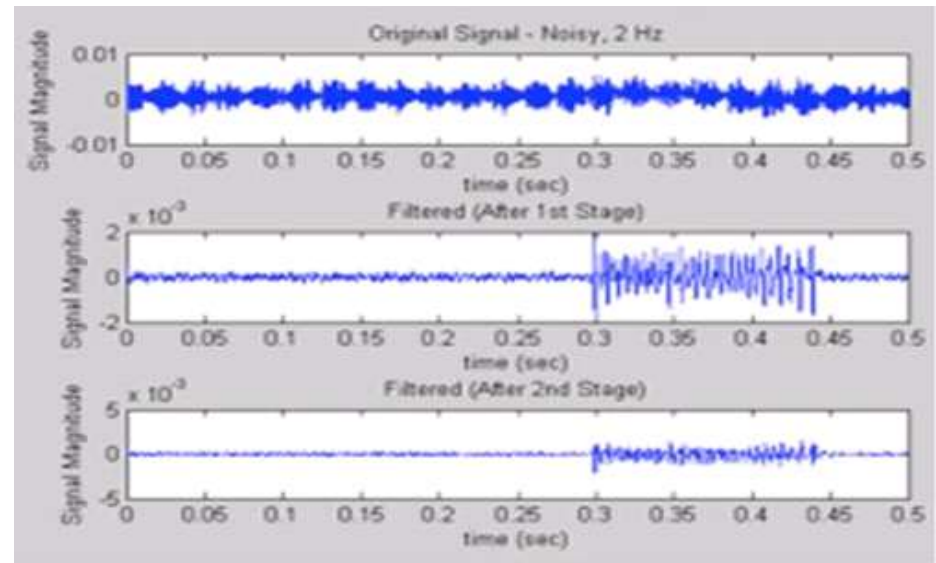


Crawfish Action Potential and
Signal Processing

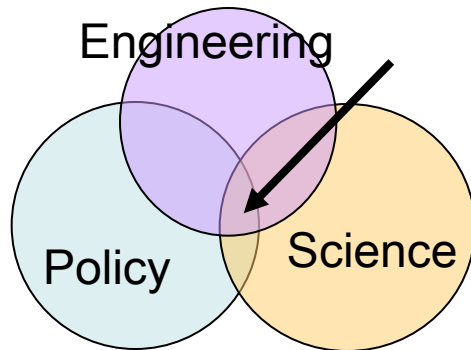
BIO 362 (Introduction to Neurobiology)

ECE 241 (Discrete Systems)

Joint Class Project



Engineering and the Environment



Energy Studies Minor

Courses in Environmental Science Major:

Geographical Information Systems (GIS)

Renewable Energy Systems

Solar Energy

Environmentally Friendly Buildings

New Energy Research Laboratories



Solar Energy Field Trip

Engineering and Music

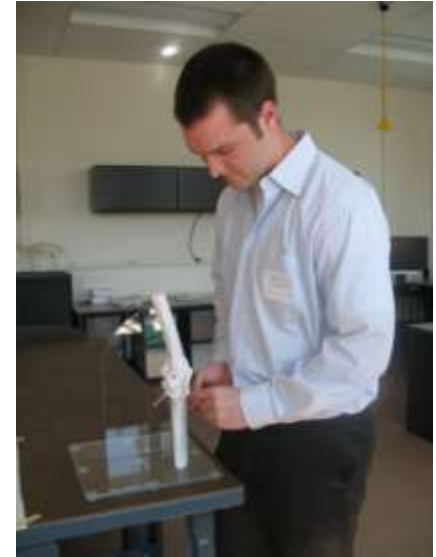
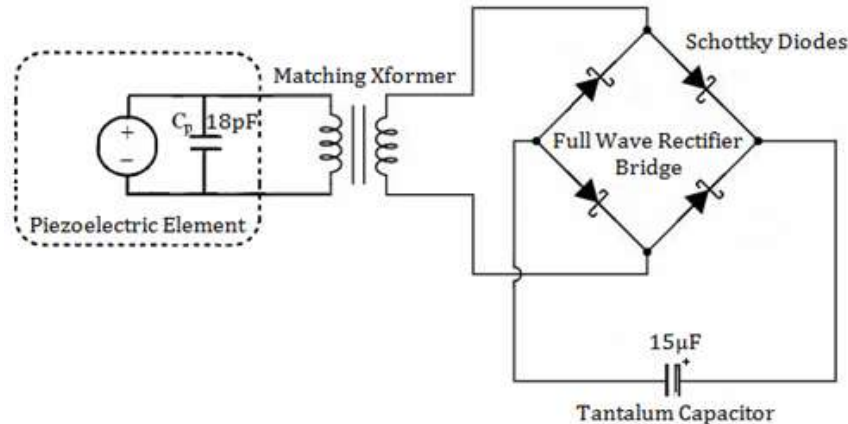
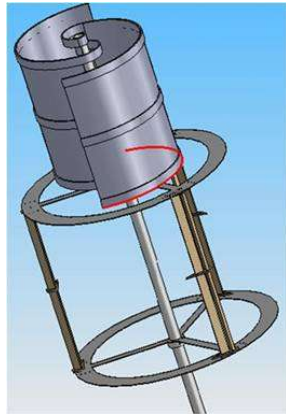
- Engineering Acoustics course
- Music and Engineering projects
- New Laboratory for Electrical Engineering and Music Research



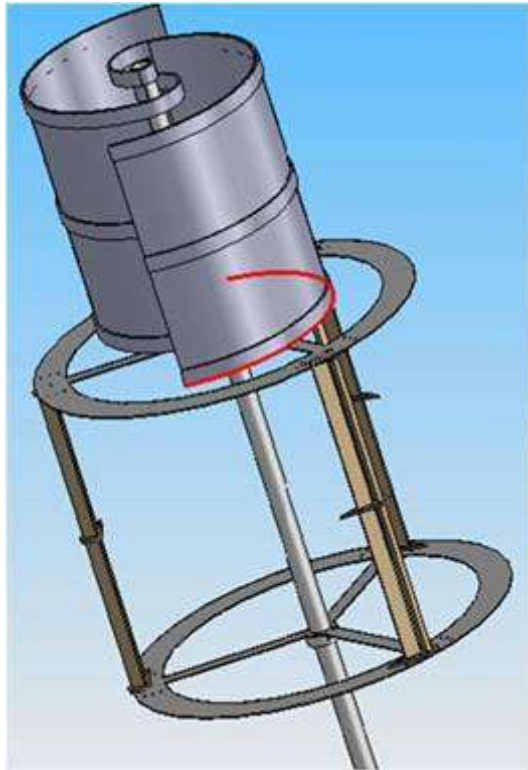
Collaborative projects with the music department on auditorium acoustics and signal processing

Senior Projects

- Year-long experience
- Faculty project mentors
- Student selects project
 - Research projects
 - Design and build
 - Industry partnerships
 - Individual or team
 - Some multi-disciplinary



Student Project:
Hybrid Darrieus-Savonius Vertical-axis Wind Turbine (VAWT)
Malysa Cheng, Kevin Donnavan

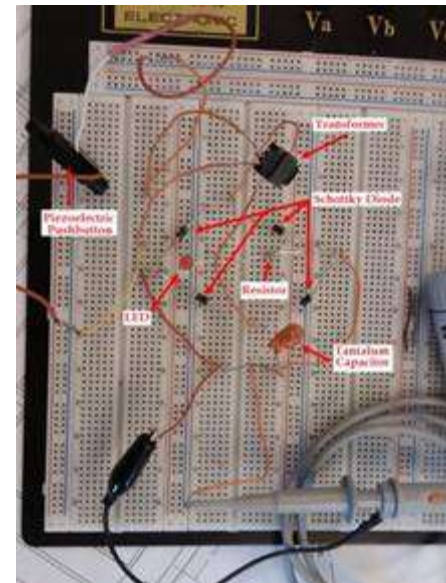
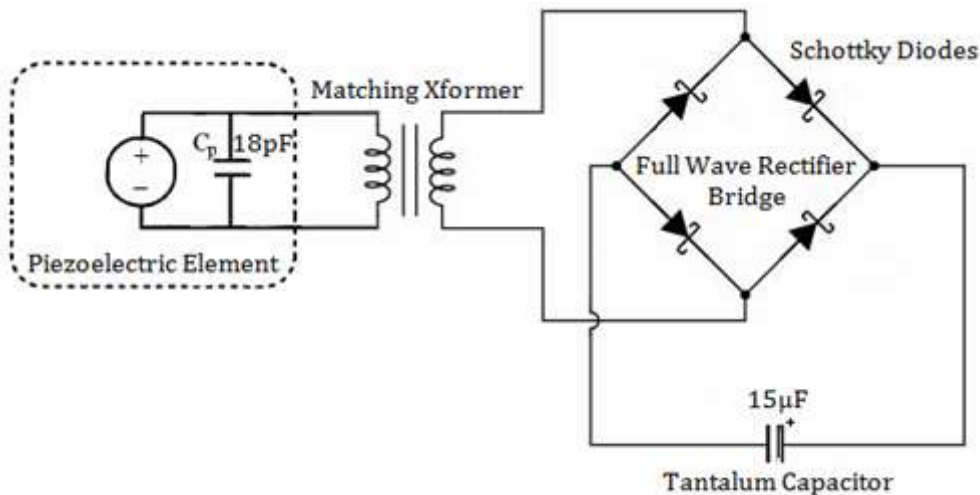
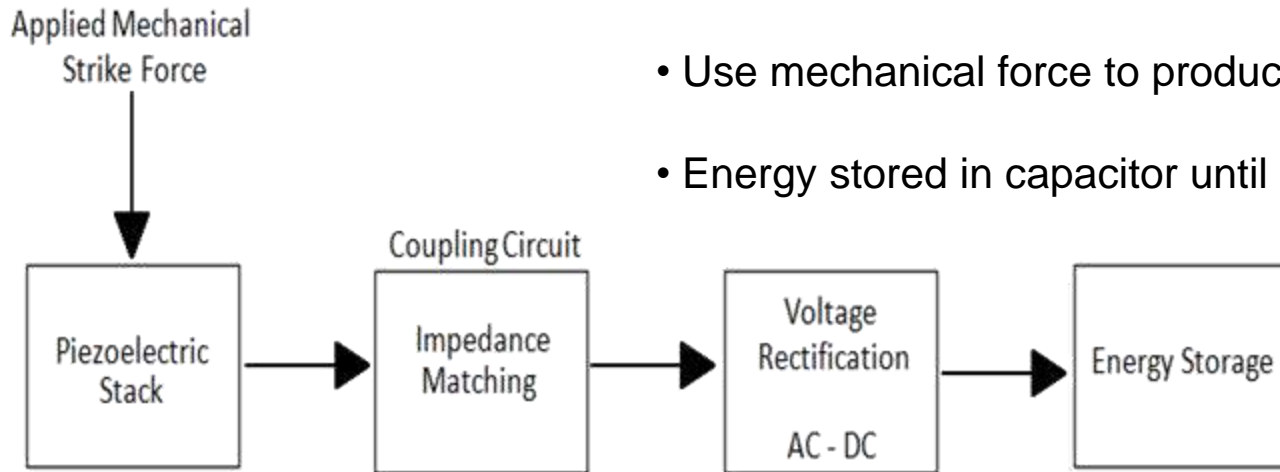


- Designed for conditions at Union College
- Evaluate the feasibility of wind power generation on campus
- Better performance in lower-class wind
- Microcontroller-based power conversion system

Student Project: Applications of Piezoelectrics as a Battery-less Power Source

Jonathan T. Gold

- Use mechanical force to produce electrical energy
- Energy stored in capacitor until needed



Student Project: Analysis of Color in Biological Species
Long Nguyen



Analyze the coloration of lizards
Link the coloration back to habitat and lizard vision
Utilizes theory of information compression and image processing

Student Project:

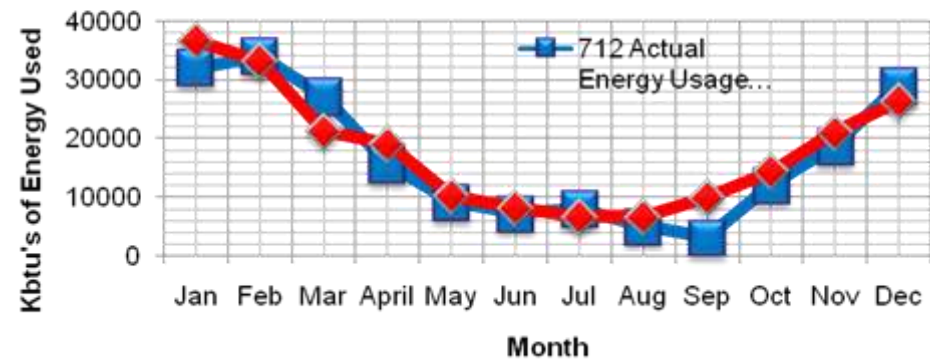
Analysis of Building Energy on 712 Roger Hull Place

Matthew R Adams



712 Roger Hull Place

Energy Comparison Simulation with occupancy change vs. 2008 Energy Data



Correlated within 6%

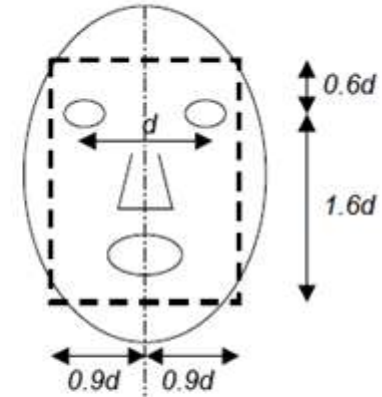
- Verification of accuracy of model
- Analysis of building parameter impact on energy usage
- Suggestion of lower energy alternatives

Student Project: Automated Emotion Recognition Christopher Matthew

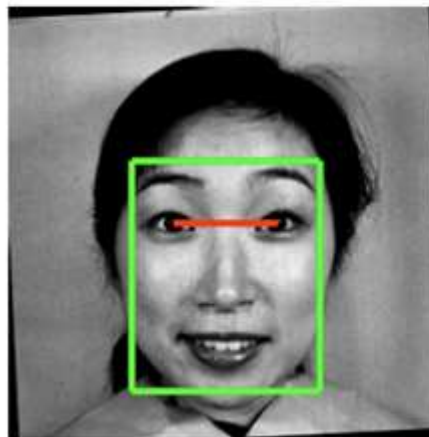
(a)



(c)



(b)



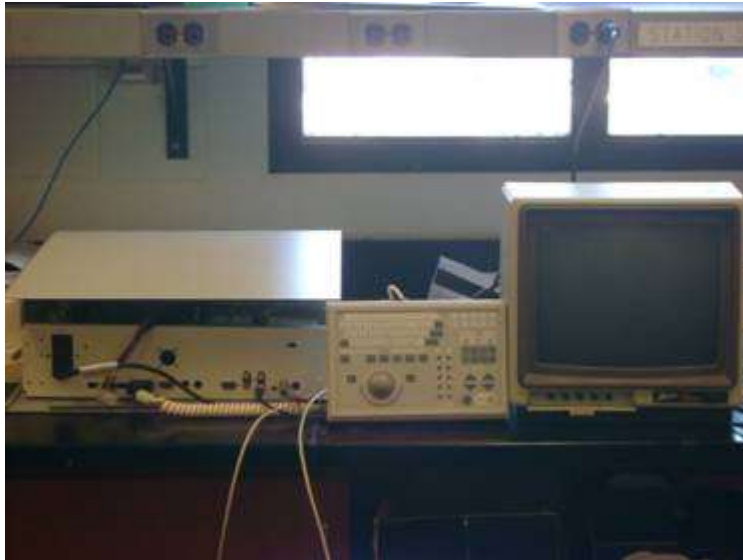
(d)



Image processing steps involved



Student Project:
Using the Doppler Ultrasound to Measure Vibrations
Kathleen Rucci and Andy Barhite



- Prototype and experiment on piano signals
- Target application – human vocal tract

The Engineering Programs

An Integrated Approach

Biology

Computer Science

Economics

*Advanced
Materials*

Bioengineering

Energy

Robotics

**Electrical
Engineering**



**Mechanical
Engineering**

Acoustics

**Computer
Engineering**

Aerogels

Entrepreneurship

*Environmental
Engineering*

Nanotechnology

Music

Physics

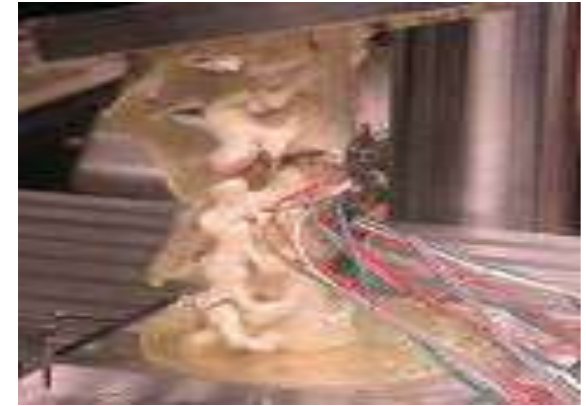
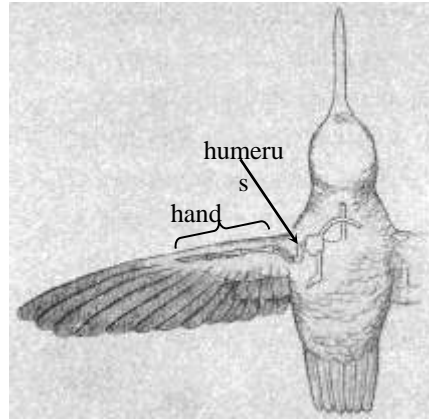
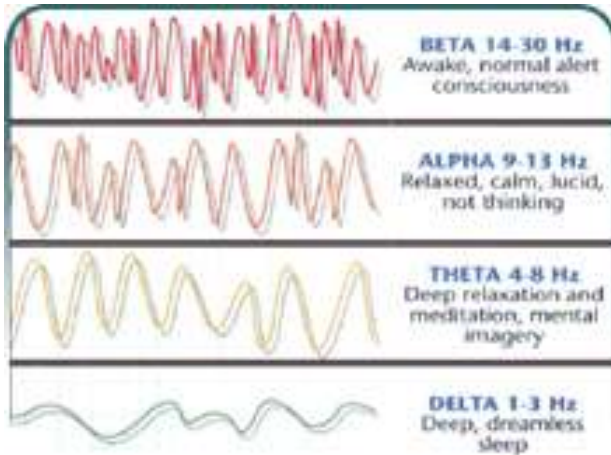
Geology

Chemistry



Bioengineering

Application of engineering principles to analyze biological systems and solve biological and medical problems



You study:

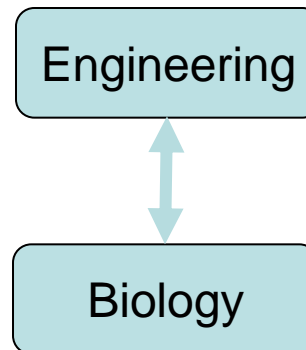
Biomaterials

Biomechanics

Bioelectrical sensors and circuits

Biomedical imaging and signal processing

Biomedical instrumentation



Computer Engineering

Design digital electronic hardware and software systems to solve problems.

You study:

Embedded systems

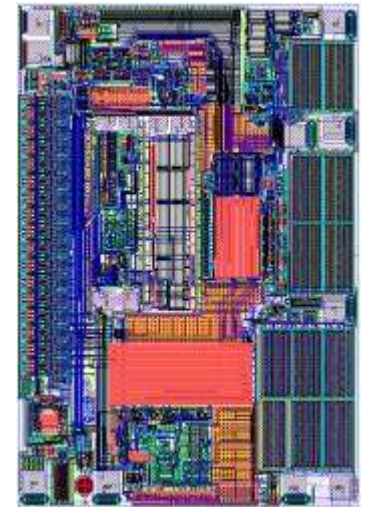
Computer hardware design

Software design

Electronic and circuit design



Sensor Interfacing

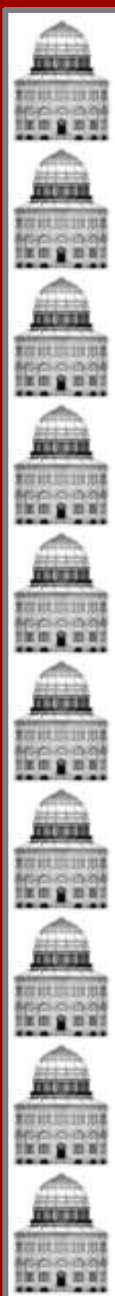


Chip Design

Electrical
Engineering



Computer
Science



Electrical Engineering

Apply electricity and magnetism to solve problems

You study:

Circuit and electronics design

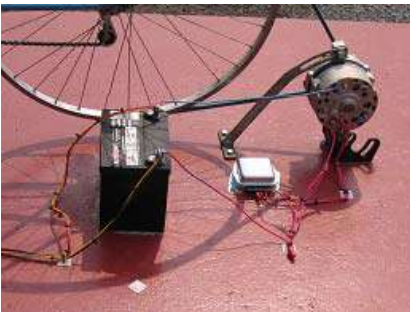
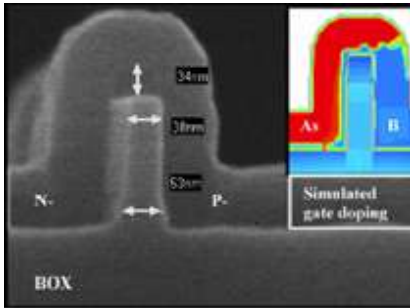
Wireless communications

Control systems

Audio and image processing

Electric power systems

Robotics



Acoustics



Music

Nanotechnology



Physics,
Chemistry

Bioengineering



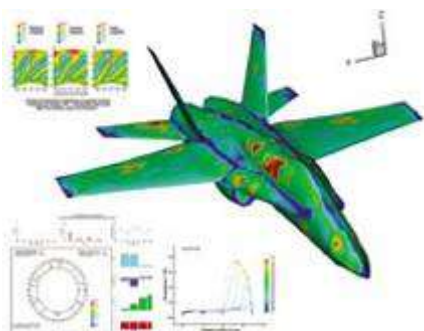
Biology

Mechanical Engineering

Deals with all applications of machine design and energy analysis

You study:

- Mechanics**
- Manufacturing**
- Energy**
- Materials**
- Mechatronics**
- Engines**



Aerogels

Chemistry

Entrepreneurship

Economics

Nanotechnology

Physics,
Chemistry

Our Engineering Students

- 254 Engineering students (12% of Union Students)
- 20% Female



Recent Classes

- 28% Athletes
- 13% Double Majors
- 32% Minors
- 80% International experience
- 75% Presented at symposium or conference
- 46% Summer Internship

Student Engineering Groups

Engineering Honor Societies:

Tau Beta Pi
Eta Kappa Nu
Pi Tau Sigma



Professional Societies:

IEEE
ASME
SWE
SHPE
NSBE
BME



Other Clubs:

SAE Aero
Robotics Club
SAE Baja



Engineers Without Borders

Boru, Ethiopia

Clean Water Source Development



Accelerated 5-Year Options

- Master of Science in Mechanical Engineering
- Master of Science in Electrical Engineering
- Master of Science in Engineering & Management Systems



Robert Kozik
Dean, School of Engineering
Union Graduate College
Nott Terrace, Schenectady, NY

518-388-8068

fax: 518-388-6789

kozikr@uniongraduatecollege.edu

After Graduation (Engineering)

- **Graduate/Professional School – 20% (Last 4 years)**

- Villanova University
- University of Massachusetts, Amherst
- Rensselaer Polytechnic Institute
- Boston University
- Cornell University
- Georgia Institute of Technology
- Union Graduate College
- University of California, Santa Barbara
- Duke University
- Northeastern University



- **Industry – 71%**

- Covidien
- GE Global Research
- Lockheed Martin
- Raytheon
- Simutech
- General Dynamics
- Knoll's Atomic Power Lab
- Central Hudson Gas and Electric
- GE Energy
- BAE Systems
- NAVAIR
- Serica Technologies
- ARUP
- Boeing

- **Other (travel, etc) – 8%**

After Graduation 2010 Statistics

Graduate School: 27%

Boston University

Union Graduate College

MIT MS Mechanical Engineering

Penn State University

University Of Washington

Entering workforce: 72%

Lighthouse Solar

Cannon Design

Burns Mechanical

IBM

GE Energy

Hoodgroup Inc

General Electric

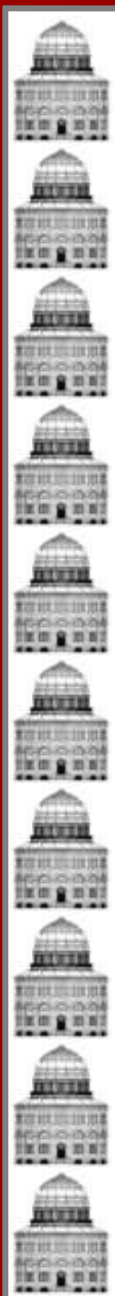
Temper Corporation Project Engineer

General Dynamic

Point Lighting

MIT Corp Draper Labs

ITT Communication



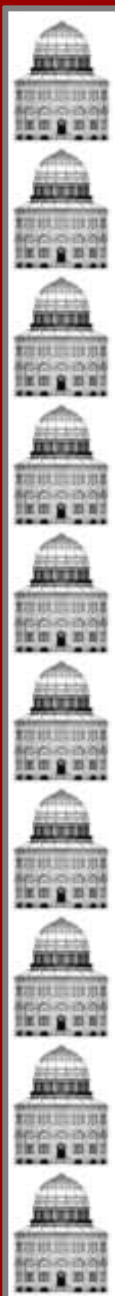
Tour Preview....

- Research Labs
- Teaching Labs
- Studio Classrooms
- Project Labs
- Senior Projects
- Engineering Lab



Just Opened!!

Peter Irving Wold Center

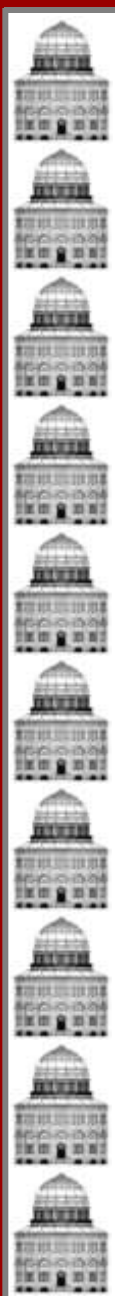


World Science and Engineering Center

High performance computing lab
Phasor Lab (Electrical Engineering & Music research)
Environmental & Energy Engineering research & teaching labs
Rooftop energy research lab
Science, technology & sustainability features on display
Aerogel Fabrication and Characterisation Lab (AFCAL)
Environmental science research labs
Public computing lab
Student/student and faculty/student interaction spaces
Biochemistry research and teaching labs
Faculty offices
Multi-purpose atrium



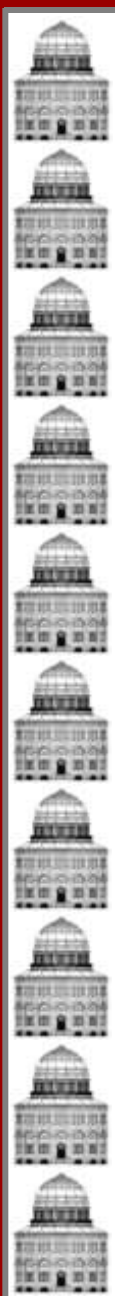
Bioengineering Curriculum



| | | |
|--------------------|--|------------------------|
| Free Electives (4) | Capstone Design (1) | |
| | Bioengineering Electives (5) | |
| | Bioengineering Core Courses (6) | |
| | Bioengineering Foundation Courses (7) | |
| | General Engineering (2) | |
| | Liberal Arts Foundation (3) | Language & Culture (2) |
| | Critical Thinking/Writing/Research (2) | |
| | Math/Science (8) | |

40 Courses

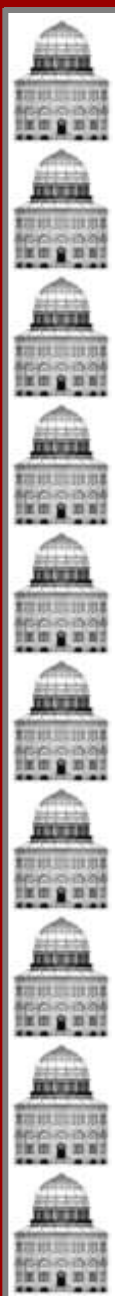
Computer Engineering Curriculum



| | | |
|--------------------|---|------------------------|
| Free Electives (3) | Capstone Design (2) | |
| | Computer Engineering Depth and Electives (6) | |
| | Computer Science Foundation Courses (6) | |
| | Electrical Engineering Foundation Courses (6) | |
| | General Engineering (1) | |
| | Liberal Arts Foundation (3) | Language & Culture (2) |
| | Critical Thinking/Writing/Research (2) | |
| | Math/Science (9) | |

40 Courses

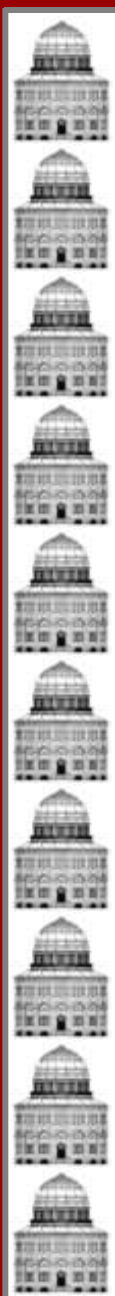
Mechanical Engineering Curriculum



| | | |
|--------------------|---|------------------------|
| Free Electives (3) | Capstone Design Courses (4) | |
| | Engineering Electives (2) | |
| | Mechanical Engineering Core Courses (6) | |
| | Mechanical Engineering Foundation Courses (7) | |
| | General Engineering/CS (3) | |
| | Liberal Arts Foundation (3) | Language & Culture (2) |
| | Critical Thinking/Writing/Research (2) | |
| | Math/Science (8) | |

40 Courses

Electrical Engineering Curriculum



| | | |
|--------------------|---|------------------------|
| Free Electives (7) | Capstone Design (2) | |
| | Electrical Engineering Electives (3) | |
| | Electrical Engineering Core Courses (5) | |
| | Electrical Engineering Foundation Courses (5) | |
| | General Engineering/CS (3) | |
| | Liberal Arts Foundation (3) | Language & Culture (2) |
| | Critical Thinking/Writing/Research (2) | |
| | Math/Science (8) | |

40 Courses