



University of  
Massachusetts  
Amherst

# Engin112 – Lecture 1

## Introduction

Maciej Ciesielski  
Department of Electrical and Computer Engineering  
09/07/2011

## Welcome

- Who is who in ENGIN 112
- Course topics
- Course organization and schedule
- What is Electrical & Computer Engineering (ECE) ?
  - Areas of study and courses available at UMass ECE
  - Electrical & Computer Engineering careers
  - Incentives to study ECE

# Who is Who in Engin112

- **Instructors:**
  - **Prof. Maciej Ciesielski**
    - » Research area: Electronic design automation, CAD
    - » Office: KEB 309 B, email: [ciesiel@ecs.umass.edu](mailto:ciesiel@ecs.umass.edu)
    - » Office hours: Tu, We 3:30 – 4:45 in KEB 309 B
  - **Prof. Marinos Vouvakis**
    - » Research area: Electromagnetics, EM CAD Design, Antennas.
    - » Office: Marcus 215 J, email: [vouvakis@ecs.umass.edu](mailto:vouvakis@ecs.umass.edu)
    - » Office hours: Mo, Th, Th 2:30 – 3:45 in Marcus 215 J
  - **Prof. T. Baird Soules**
    - » Undergraduate Program Director.
    - » Office: Marcus Hall, M5, email: [soules@ecs.umass.edu](mailto:soules@ecs.umass.edu)
- Graduate TAs: TBA
- Undergrad Instructional Assistants: TBA

# Welcome!

- **ECE is an exciting field of study:**

*microcontrollers*      *multimedia systems*      *superconductivity*      *antenna design*  
*communication*      *VLSI circuits*      *analog devices*      *microwave engineering*  
*computer networks*      *algorithms*      *optoelectronic devices*      *computer architecture*  
*software radio*      *remote sensing*      *radar systems*  
*dielectrics and electrical insulation*      *low-power systems*      *ultrasonics, ferroelectrics, and frequency control*  
*chip packaging*      *electromagnetics*      *real-time systems*  
*nanotechnology*      *wireless communication*      *manufacturing*  
*multiprocessors*      *solid-state circuits*      *magnetics*      *information theory*  
*bioelectronics*      *mixed-signals devices*      *verification*      *power engineering*  
*signal processing*      *computer aided design*      *nano devices*      *feedback control theory*  
*computer graphics*      *reliability*      *product safety engineering*  
*instrumentation and measurement*  
*robotics and automation*      *vehicular technology*      *quantum semiconductor heterostructures*  
*circuit design*      *semiconductor manufacturing*      *hardware programmable logic*      *software engineering*

# Topics of Engin112

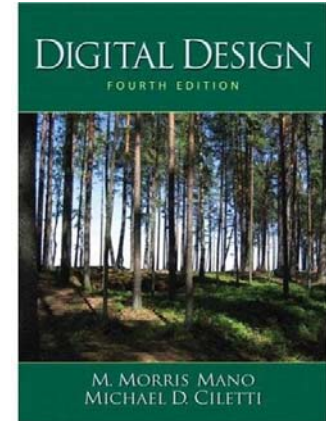
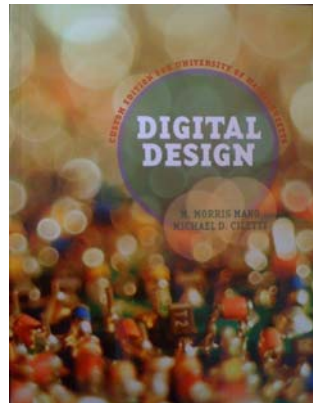
- Digital system
  - How to represent information?
  - How to process information?
- Building blocks of digital systems
  - Logic gates
  - Arithmetic (data-path) elements
  - Memory
  - Controllers, etc.
- Boolean algebra
  - Expressions for digital functions
  - Transformations of logic expressions
- Design and analysis of digital circuits

## Lectures

- Time: Mon, Wed, Fri 1:25–2:15 p.m.
- Location: Engin. & Comp.Science II 119
- Lecture notes posted on web site
- Please be courteous in class
  - Arrive on time
  - Turn off cell phones / sound on laptop
  - Keep quiet ...
  - Drinking or eating is strictly prohibited
- Attendance is important
  - There are just things that you cannot learn from reading notes

# Textbooks

- M. Morris Mano and Michael D. Ciletti, Digital Design 4th Ed., Prentice Hall, 2006.
  - Required text
  - Not all topics covered in class



Choose one

- Custom UMass edition
- Most homework problems come from the book

- Lab textbook:
  - Make: Electronics (Learning by Discovery) [Paperback], Charles Platt, First ed.

# Homework, Discussions, Lab


- **Homework** assigned weekly (Wednesdays)
  - Very important!
  - Homework assignments posted on SPARK
  - Homework due before class on due date – no exceptions !
  - Late homework will not be accepted (unless emergency with proof)
- **Discussion** sections
  - Held by Prof. Vouvakis
  - Review material from previous week and work examples
- **Laboratory** projects
  - All lab experiments in M5, Prof. Sules
  - Check lab schedule on web page
  - Lab assignments posted on SPARK
  - Lab sessions start second week of classes

# Grading

- Overall grade composed of
  - Exam I – 20% (Tu. Oct. 18, 7:00 – 9:00 pm)
  - Exam II – 20% (Tu. Nov. 15, 7:00 – 9:00 pm)
  - Final Exam – 30%
  - Homework – 15%
  - Laboratory – 15% (must pass each lab component)
- University academic honesty policy:
  - Please read: [http://www.umass.edu/dean\\_students/code\\_conduct/acad\\_honest.htm](http://www.umass.edu/dean_students/code_conduct/acad_honest.htm)
  - "... Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: *Cheating* [...] *Fabrication* [...] *Plagiarism* [...] *Facilitating dishonesty* [...]. Sanctions may be imposed on any student who has committed an act of academic dishonesty. ..."

# Web Site

- ENGIN 112 web site: <http://www.ecs.umass.edu/ece/engin112/>

ENGIN112 - Introduction to Electrical and Computer Engineering				
Home	Syllabus	Schedule	Homework Assignments	Labs
				
<b>ENGIN 112 - Fall 2011</b>				
Welcome to the ENGIN112 homepage. Here you can obtain all the up-to-date information regarding course. Use the above links to navigate the site and find more information on each topic. Please visit this site frequently to stay current with the course. If you have any questions, feel free to contact the instructors:				
<ul style="list-style-type: none"><li>• Maciej Ciesielski (<a href="mailto:ciesiel@ecs.umass.edu">ciesiel@ecs.umass.edu</a>)</li><li>• Marinos Vouvakis (<a href="mailto:vouvakis@ecs.umass.edu">vouvakis@ecs.umass.edu</a>)</li><li>• T. Baird Soules (<a href="mailto:soules@ecs.umass.edu">soules@ecs.umass.edu</a>)</li></ul>				
<b>Current Announcements</b>				
<ul style="list-style-type: none"><li>• To be posted as applicable.</li></ul>				
© 2011 M. Ciesielski. <a href="#">Site Policies</a> .				

- SPARK (for grades): <https://spark.oit.umass.edu>

# Electrical and Computer Engineering

- What does an Electrical and Computer Engineer do?
  - “**Engineering** is the applied science of acquiring and applying knowledge to design, analysis, and/or construction of works for practical purposes.”
  - “**Electrical engineering** is an engineering discipline that deals with the study and/or application of electricity, electronics and electromagnetism.”
  - “**Computer engineering** is a discipline that combines elements of both electrical engineering and *computer science*. Computer engineers are involved in many aspects of computing, from the design of individual microprocessors, personal computers, and supercomputers, to circuit design.”
  - “**Computer Science** is the study of the theoretical foundations of information and computation and their implementation and application on computer systems.”
- Easier to understand by exploring example systems (in Discussions)

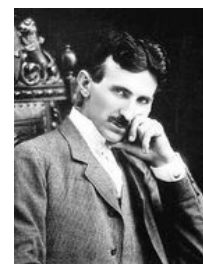
## Electrical Engineering

- It all began with electricity...



Voltiano's battery

- First battery was invented by an Italian chemist Alessandro Voltiano in 1799 using silver & zinc plates separated by cloth soaked in salt water & current began flowing...
- Georg Simon Ohm, a German physicist established the relation between Electric Potential and Current in 1827
- Michael Faraday, an English physicist discovered relationship between electricity & magnetism in 1831
- In 1882 Thomas Edison built a DC Generator that could light 57 homes in Manhattan
- In 1887 Nicola Tesla introduced AC generator that made long distance transmission possible. He also introduced AC motor; and transmitted and detected radio waves in 1895
- Quickly it spread to [radio communication](#), [electronics](#) and then [computers](#)
- First **Electrical Engineering** study: Darmstadt, Cornell 1883



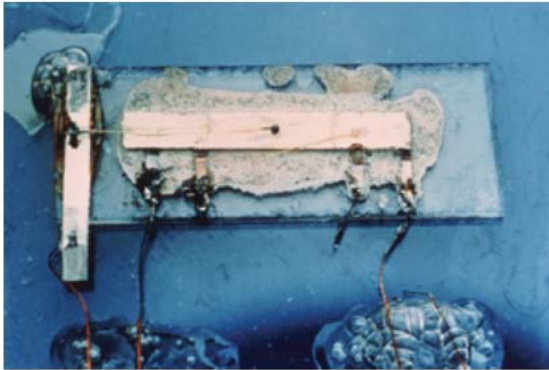
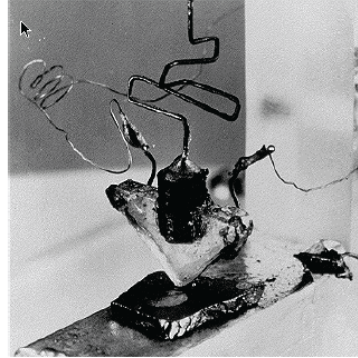
Nicola Tesla

Courtesy IEEE virtual museum

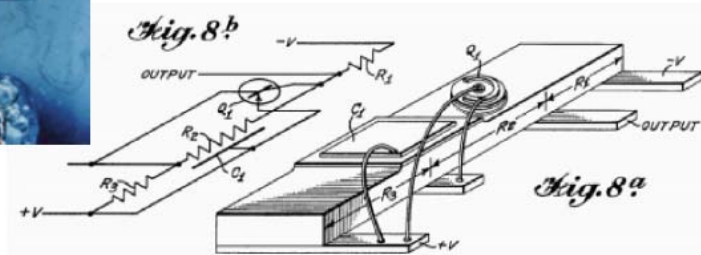
# IC (R)evolution

## Transistor Invention (1947)

- Bardeen and Brattain of Bell Labs
- 1956 Nobel prize in Physics



The first IC (Jack Kilby, 1958)



# Electrical Engineering at UMass

## ▪ Electronics

- ECE 211-212 Circuit Analysis
- ECE 323-324 Electronics

## ▪ Fields & Waves

## ▪ Control

- ECE 580 Control Theory



- ECE 333-334 Fields & Waves
- ECE 584-585 Microwave Engineering

# Electrical Engineering at UMass

## ▪ Communications

- ECE 314 Probability/Random Processes
- ECE 564 Communication Systems



## Signal Processing

- ECE 313 Signals and Systems
- ECE 563 Signal Processing & Communications
- ECE 565 DSP

## ▪ Power Systems

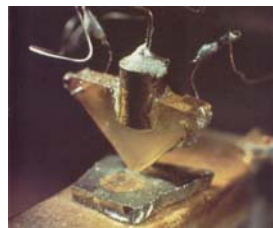
- ECE 597 D



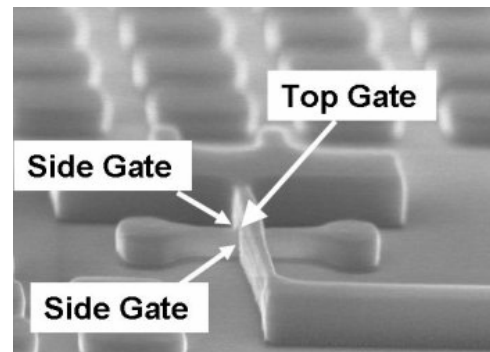
# Electrical Engineering at UMass

## ▪ Semiconductor Technologies

- ECE 344 Semiconductor Devices
- ECE 372 Optoelectronics
- ECE 597NE Nanoelectronics



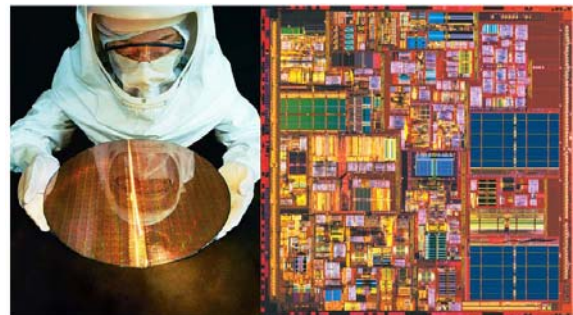
First Transistor: 1947



32nm TRIGATE Transistor: 2005

## ▪ Microelectronics Design

- ECE 558/559 VLSI Design
- ECE 597IC Analog ICs

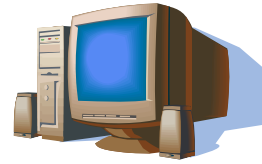


Pentium processor

# Computer Engineering

## ■ Computer Programming, Software

- ECE 122 Object Oriented Programming
- ECE 242 Data Structures & Algorithms
- ECE 373 Software Engineering
- ECE 570 Operating Systems



## ■ Computer Design

- ECE 232 HW Organization & Design
- ECE 353-354 Computer Systems Lab
- ECE 568 Computer Architecture



Pentium microprocessor

# Computer Engineering

## ■ Networking

- ECE 374 Computer Networks & Internet
- ECE 597XX Cryptography
- ECE 597LL Trustworthy Computing
- ECE 597WE Wireless Networks

## ■ Bioengineering

- ECE 597M  
Computational Biology
- ECE 597BE Bioelectronics

## ■ Systems Engineering

- ECE 597SE Systems Engineering
- ECE 597S System Simulation



# Engin 112 in ECE Curriculum

- Computer Systems Engineering (CSE) program
- Electrical Engineering (EE) program

See the ECE Flow charts

[http://www.ecs.umass.edu/ece/dept/undergrad/current\\_students](http://www.ecs.umass.edu/ece/dept/undergrad/current_students)

# EE Curriculum

## EE 10-13

Date: \_\_\_\_\_

Curriculum Worksheet for the Electrical Engineering Classes of 2010 through 2013.

FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR	
Fall [17cr]	Spring [15cr]	Fall [17-18cr]	Spring [17-18cr]	Fall [17cr]	Spring [15-16cr]	Fall [14-16cr]	Spring [14-16cr]
ENGIN 112 Intro. to ECE [3cr] [Note 1]	ECE 122 Intro. to ECE II (Object-Oriented Programming, Java) [4cr] [Note 1] or CMPSCI 121	ECE 211 Circuit Analysis I [4 cr]	ECE 212 Circuit Analysis II [4 cr]	ECE 313 Signals & Systems [4 cr]	ECE 314 Intro. Prob. & Random Procs. [4 cr]	ECE 415 Senior Design Project I [2 cr]	ECE 416 Senior Design Project II [2 cr]
ENGLWRIT 112 College Writing [3cr] [Note 2]	ECE 197SA ECE Systems Appreciation [1cr] [Highly recommended – see Note 6]	ECE 242 Data Structures & Algorithms (w/ Java) [4 cr]	ECE 232 Hardware Organization & Design [4 cr]	ECE 323 Electronics I [4 cr]	ECE 324 Electronics II [3 cr]	EE Elective [3 cr] [Note 5]	EE Elective [3 or 4 cr] [Note 5]
PHYSICS 151 Gen. Physics I - Mechanics [3 cr]	PHYSICS 152 Gen. Physics II - Thermo, E&M. [3 cr]	MATH 331 Differential Equations [3 cr]	MATH 235 Linear Algebra [3 cr]	ECE 353 Computer Systems Lab I [3 cr]	ECE 333 Fields and Waves [4 cr]	EE Elective [3 or 4 cr] [Note 5]	EE Elective [3 or 4 cr] [Notes 4 & 5]
PHYSICS 153 Gen. Physics I - Mechanics lab [1 cr]	PHYSICS 154 Gen. Physics II - Thermo, E&M. lab [1 cr]	Social World Elec. [3 cr] [Note 2]	MATH 233 Multivariate Calculus [3 cr]	ECE 344 Semiconductor Devices and Materials [3 cr]	Thematic Elective 2 [3 or 4 cr] [Note 4]	Thematic Elective 3 [3 or 4 cr] [Note 4]	Social World Elective [3 cr] [Note 2]
MATH 131 Calculus I [4 cr]	MATH 132 Calculus II [4 cr]	Thematic Elective 1*  *See Notes 3 & 4 for details	BIOLOGY 102*  *See Notes 3 & 4 for details	ENGIN 351 Writing in Engineering [3 cr]	ECE 303 Junior Seminar [1cr]	Social World Elec. [3 cr] [Note 2]	Social World Elec. [3 cr] [Note 2]
Social World Elec. [3 cr] [Note 2]	Social World Elec. [3 cr] [Note 2]	(Take ENGIN 112, Intro. to ECE I, unless it was taken previously. See advisor to adjust schedule. [3 cr] [Note 1])					

# CSE Curriculum

## CSE 10-13

\_\_\_\_\_ Date: \_\_\_\_\_  
 Last Name First Name Curriculum Worksheet for the Computer Systems Engineering Classes of 2010 through 2013.

FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR	
Fall [17cr]	Spring [15cr]	Fall [17-18cr]	Spring [17-18cr]	Fall [17cr]	Spring [15-16cr]	Fall [14-16cr]	Spring [14-16cr]
ENGIN 112 Intro. to ECE I [3 cr] [Note 1]	ECE 122 Intro. to ECE II (Object-Oriented Programming, Java) [4 cr] [Note 1] or CMPSCI 121	ECE 211 Circuit Analysis I [4 cr]	ECE 212 Circuit Analysis II [4 cr]	ECE 313 Signals & Systems [4 cr]	ECE 314 Intro. Prob. & Random Procs. [4 cr]	ECE 415 Senior Design Project I [2 cr]	ECE 416 Senior Design Project II [2 cr]
ENGLWRIT 112 College Writing [3 cr] [Note 2]	ECE 197SA ECE Systems Appreciation [1 cr] [Highly recommended – see Note 7]	ECE 242 Data Structures & Algorithms (w/ Java) [4 cr]	ECE 232 Hardware Organization & Design [4 cr]	ECE 323 Electronics I [4 cr]	ECE 374 Computer Networks & the Internet [3 cr]	CSE Elective [3 cr] [Note 6]	CSE Elective [3 or 4 cr] [Note 6]
PHYSICS 151 Gen. Physics I - Mechanics [3 cr]	PHYSICS 152 Gen. Physics II - Thermo., E&M. [3 cr]	MATH 331 Differential Equations [3 cr]	MATH 235 Linear Algebra [3 cr]	ECE 353 Computer Systems Lab I [3 cr]	ECE 354 Computer Systems Lab II [4 cr]	CSE Elective [3 or 4 cr] [Note 6]	CSE Elective [3 or 4 cr] [Notes 4 & 6]
PHYSICS 153 Gen. Physics I - Mechanics lab [1 cr]	PHYSICS 154 Gen. Physics II - Thermo., E&M. lab [1 cr]	Social World Elec. [3 cr] [Note 2]	MATH 455 Discrete Structures [3 cr] [Note 5] or CMPSCI 250	ECE 373 Software Intensive Engineering [4 cr]	Thematic Elective 2 [3 or 4 cr] [Note 4]	Thematic Elective 3 [3 or 4 cr] [Note 4]	Social World Elec. [3 cr] [Note 2]
MATH 131 Calculus I [4 cr]	MATH 132 Calculus II [4 cr]	Thematic Elective 1*  *See Notes 3 & 4 for details	BIOLOGY 102*  *See Notes 3 & 4 for details	ENGIN 351 Writing in Engineering [3 cr]	ECE 303 Junior Seminar [1 cr]	Social World Elec. [3 cr] [Note 2]	Social World Elec. [3 cr] [Note 2]
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# EE/CE Salary

- In Electrical Engineering salary rises fast with experience
  - Mobility, flexibility, job satisfaction among highest
  - Do not focus just on starting salaries
- Salary survey 2009 (EE Times)
  - Median salary in EE/CE = \$ 117,000

MAJOR	AVERAGE
Aerospace Engineering (AERSP)	\$59,060
Architectural Engineering (A E)	\$55,740
Bioengineering (BIOE)	\$54,500
Biological Engineering (B E)	\$51,330
Chemical Engineering (CH E)	\$66,250
Civil Engineering (C E)	\$48,820
Computer Engineering (CMPEN)	\$56,670
Computer Science (CMPSC)	\$63,850
Electrical Engineering (E E)	\$59,330
Engineering Science (ESC)	\$56,000
Industrial & Manufacturing Engineering (I E)	\$57,390
Mechanical Engineering (M E)	\$59,880
Nuclear Engineering (NUCE)	\$62,500
<b>OVERALL AVERAGE ANNUAL STARTING SALARY</b>	<b>\$58,070</b>

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# Final Note

- A few recommendations (from years of experience):
  - It really isn't that complicated...
    - » We try to be explicit about what is expected
  - Woody Allen: "Eighty percent of success is showing up."
    - » Come to lectures, discussions, lab
  - If you are not sure: ask!
    - » Talk to us after class, send email, come to office hours
    - » Early communication solves problems easiest
    - » Don't wait until it's too late
- Email protocol
  - » Sign with your full name !! We need to know who you are.
  - » State ENGIN 112 in the subject line
  - » Be professional