

EE 230

Circuits and Systems in Electronics

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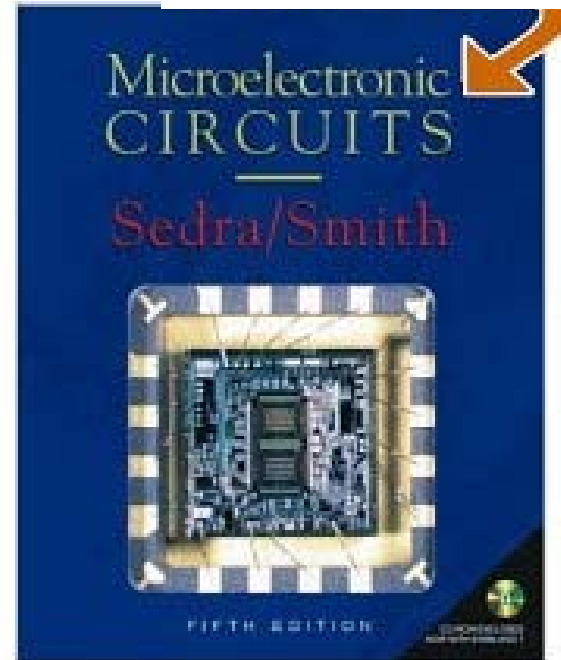
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Course Description

- Linear Systems
 - Frequency domain characterization of electronic circuits and systems
 - transfer functions
 - sinusoidal steady state response
- Models of linear and nonlinear electronic circuits
 - Linearization
 - small signal analysis
- Stability and feedback circuits
- Operational amplifiers
 - Models
 - linear and nonlinear applications
 - Transfer function realizations.
- Phase-locked Loops
 - Characteristics and applications
- A/D and D/A converters
 - sources of distortions
 - converter linearity and spectral characterization
 - applications

Required Text:

Microelectronic Circuits – Fifth Edition by Sedra and Smith, Oxford, 2004



This text will be heavily augmented with lecture notes

Instructional Approach:

- Emphasis will be placed upon developing and understanding basic concepts and on how basic concepts relate to the much bigger picture
- Lectures will present an alternative approach to material covered in the text
- Testing will attempt to determine if basic concepts are mastered and will generally not be comprised of questions that are minor variants of examples in text, in notes, or in homework problems

Grading Policy:

3 Exams	100 pts each
1 Final	100 pts.
Homework	100 pts.total
Lab and Lab Reports	100 pts.total
Quizzes	15 pts each
Design Project ?	50-100 pts.?

Grade will be assigned based upon total points accumulated

Instructor Access:

- Office Hours
 - Open-door policy
 - MWF 9:00-10:00
 - reserved for EE 230 and EE 434 students
 - By appointment
- Email
 - rlgeiger@iastate.edu
 - Include EE 230 in subject

How does it work or fit in challenge:

Opportunity depends heavily upon being aware of how existing systems operate and understanding their limitations

Questions about how existing electronic systems operate or how material presented in the course relates to the electronics field are encouraged.

Cell Phone Policy:



190 million sold in 2005

Estimate 780 million in use by end of year

Cell Phone Policy:



190 million sold in 2005

At \$100/phone, this is a \$19Billion Business
Infrastructure to support approximately 750
million cell phones is much larger

Electronics Market in Perspective



Corn and Beans are Big Business in Iowa and in the United States

Electronics Market in Perspective



How much corn is produced in the US each year?

What is the value of all of the corn produced in the US ?



How many soybeans are produced in the US each year?

What is the value of all of the soybeans produced in the US ?

Electronics Market in Perspective



How much corn is produced in the US each year?

Approx 11 Billion Bushels

What is the value of all of the corn produced in the US ?

Approx \$22 Billion



How many soybeans are produced in the US each year?

Approx 3.1 Billion Bushels

What is the value of all of the soybeans produced in the US ?

Approx \$17 Billion

Electronics Market in Perspective

How big is the electronics market?

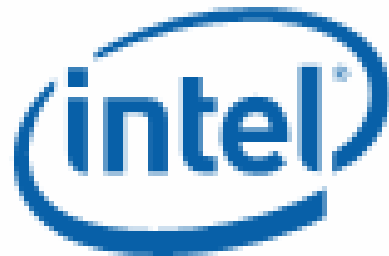
Semiconductor Industry Approx \$226 Billion in 2005

Electronics Industry is Much Larger !!

Electronics Industry is one of the largest industries in the world and Will continue to grow in importance for the foreseeable future

Electronics Market in Perspective

Consider one large electronics company



Market Capitalization \$106 Billion

Annual Sales Approx \$34 Billion in 2005

91,000 Employees

Electronics Market in Perspective

Annual sales of one electronics company comparable to value of all corn and all beans produced in the US

Electronics Market in Perspective

Annual sales of one electronics company comparable to value of all corn and all beans produced in the US

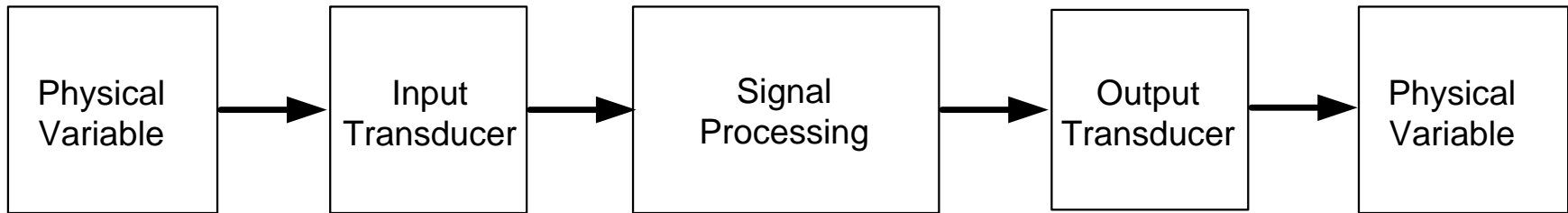
Use of electronic components and systems by consumers is a major reason substantial career opportunities for electrical engineers !!

Cell Phone Policy:

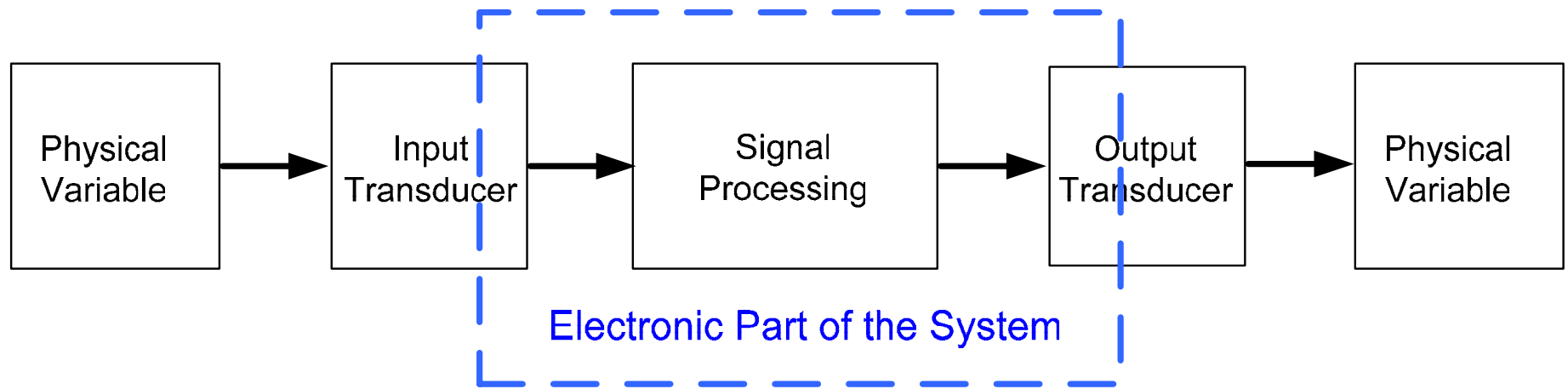


Let them ring !!

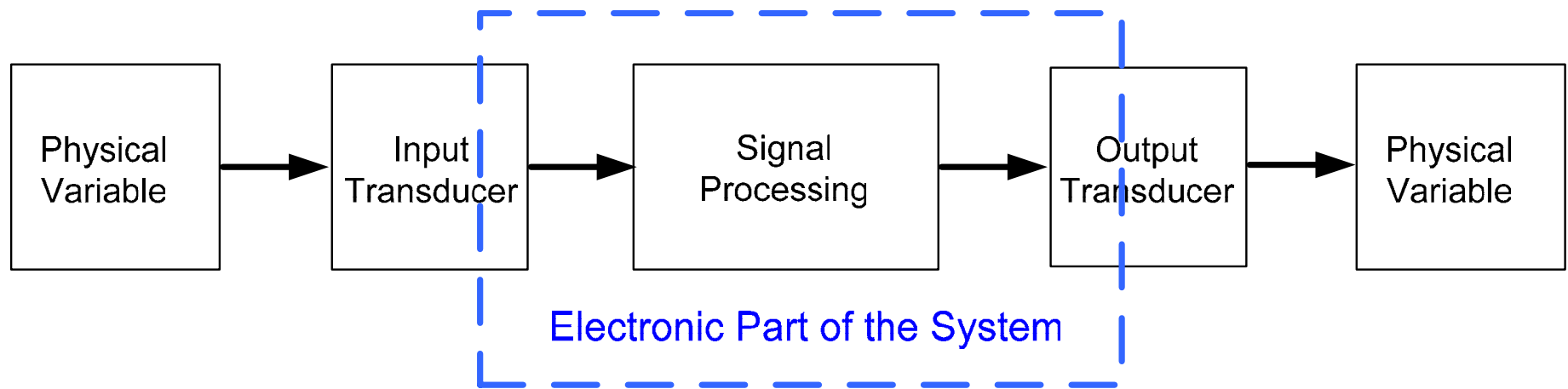
Typical Electronic System



Typical Electronic System



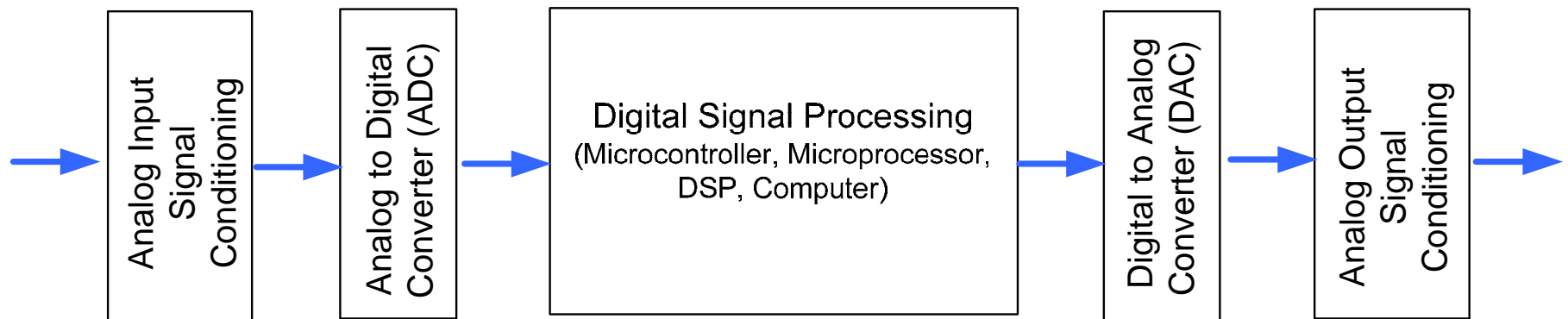
Typical Electronic System



Electronic Part of the System

- Primarily Resistors, Capacitors, Inductors MOSFETS, BJTs Diodes
- As few as 1 or 2 components or as many as several billion
- Groups of Components often interconnected and re-used
dependent sources, amplifiers, logic gates, ALU, microprocessor, adders, PLLs, computer, ...

Typical Electronic Part of the System



Integrated Circuits and some Passive Components Invariably Used in each of these 5 Blocks

Groups (often very large) of transistors used to build ICs but very limited use of individual transistors external to the integrated circuits

Engineers Role in Electronic System Design

- Connects groups of components or blocks together to design the system
- Primarily Two Types of Electronics Designers
 - Connects integrated circuits and some components together to form electronic system (Electronic System Designer)
 - Connects individual transistors and components together to form integrated circuits (IC designer)

Engineers Role in Electronic System Design

- Primarily Two Types of Electronics Designers

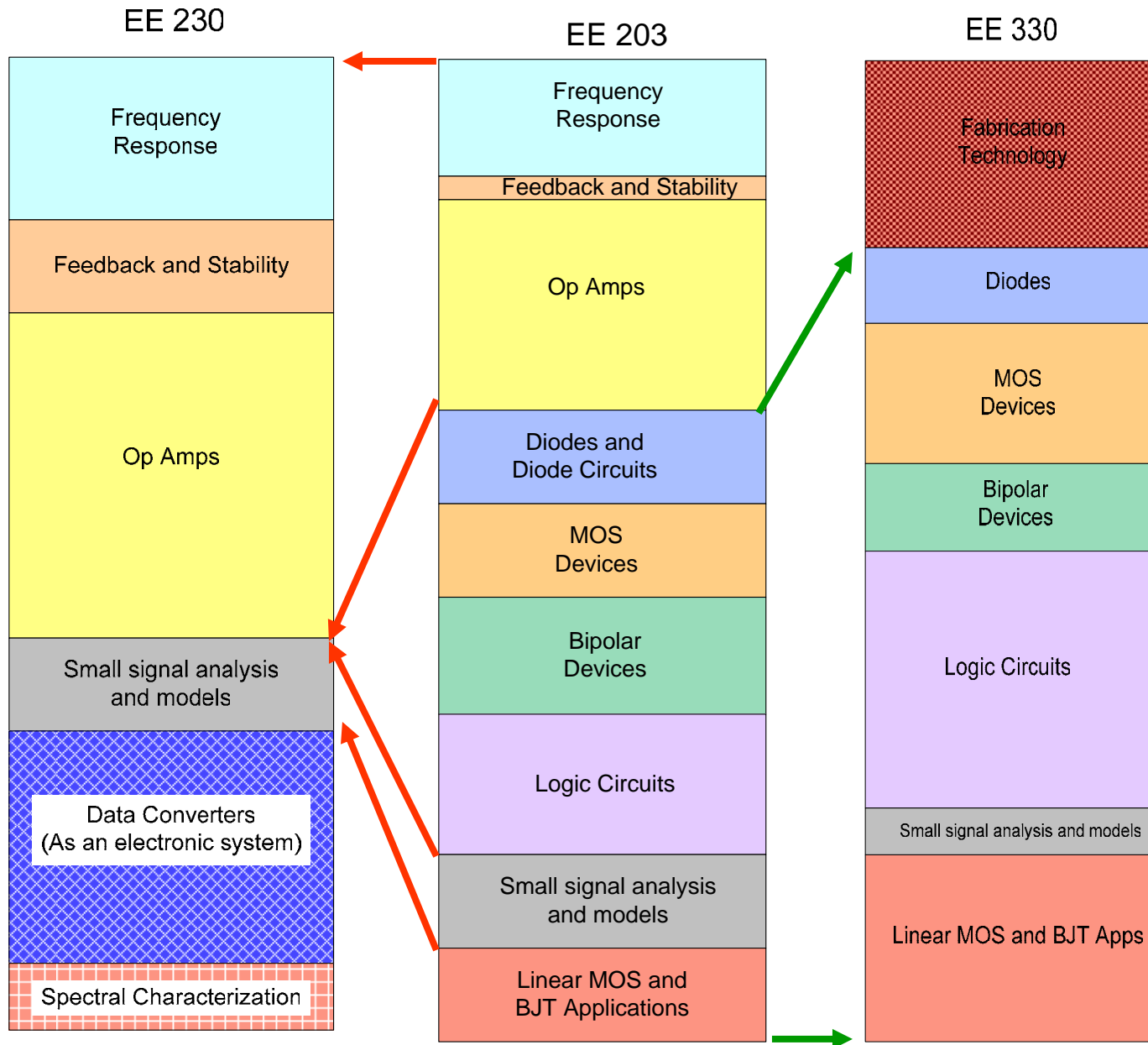
– Connects integrated circuits and some components together to form electronic system (Electronic System Designer)

EE 230

– Connects individual transistors and components together to form integrated circuits (IC designer)

EE 330

Material Partitioning in 05-07 Catalog



Course Objectives: EE230

- **Objective 1:** Determine the frequency response of linear electronic systems and relationship with sinusoidal steady state response
- **Objective 2:** Determine frequency selective properties of electronic circuits from their frequency domain response
- **Objective 3:** Determine stability of simple circuits and systems by analyzing their time domain response or by investigating characteristics of their frequency domain response
- **Objective 4:** Know concepts of feedback and implications of feedback on stability, sensitivity, and frequency response

Course Objectives: EE230

- **Objective 5:** Describe ideal and non-ideal characteristics of Op Amps and determine Op Amp specifications through simulation or measurement
- **Objective 6:** Design inverting and non-inverting amplifiers, buffers, filters, and other basic feedback circuits using Op Amps
- **Objective 7:** Perform small signal analysis of nonlinear circuits via local linearization at a given operating point and obtain linear models in time and frequency domains

Course Objectives: EE230

- **Objective 8:** Determine the ideal and non-ideal characteristics of analog-to-digital and digital-to-analog converters in both voltage and frequency domains
- **Objective 9:** Design simple analog-digital interface circuits using ADCs and DACs with suitable specifications to meet a given performance requirement
- **Objective 10:** Compute static and dynamic distortion of circuits and systems using spectral characterization