

# eSyst: Electronics Systems Technology Project Workshop

Maricopa Advanced Technology  
Education Center  
NSF ATE Grant #0702753



A presentation of [eSyst.org](http://eSyst.org)



# Agenda for the Workshop

## General schedule:

- 8:30 a.m. to 10:00 a.m. Introduction and project overview
- 10:00 a.m. to 10:30 a.m. Break (Atrium Teak Bells)
- 10:30 a.m. to 12:00 p.m. Web site overview, Concept Inventory Assessment tool, and Evaluations
- 12:00 p.m. to 1:00 p.m. Lunch (Wedgwood-Atrium)
- 1:00 p.m. to 2:00 p.m. eSyst iLabs overview and demo
- 2:00 p.m. to 2:30 p.m. Systems Lab demonstrations
- 2:30 p.m. to 3:00 p.m. Break (Atrium Teak Bells)
- 3:00 p.m. to 4:00 p.m. Systems Lab demonstrations
- 4:00 p.m. to 4:30 p.m. Feedback and evaluations

## **Project Development Team Members**

Mike Lesiecki – Principal Investigator

Lou Frenzel - Project Lead Subject Matter Expert

Jesus A. del Alamo – M.I.T. Project Lead

Roy Brixen – Project Developer

Wayne Phillips – Project Developer

Jesus Casas – Project Developer

Ui Luu – Project Developer

Bassam Matar – Project Developer

James Hardison – M.I.T. Project Developer

Tom McGlew – Project Development Manager

Angela Obolsky – Project Administrator

Darlene Cieplinski – Project Assistant

## Participant Introductions

Please state the following:

- Your name
- What geographical location you are from
- Institution name and your department
- Why are you interested in the eSyst Project

# eSyst Overview Presentation Agenda

- Project overview
  - What has changed?
  - What is a System?
  - Purpose
  - Goals
  - Student Learning Goals
- Project status
  - DC/AC Systems Course
  - Future Courses in development

# So what has changed and what is a System?

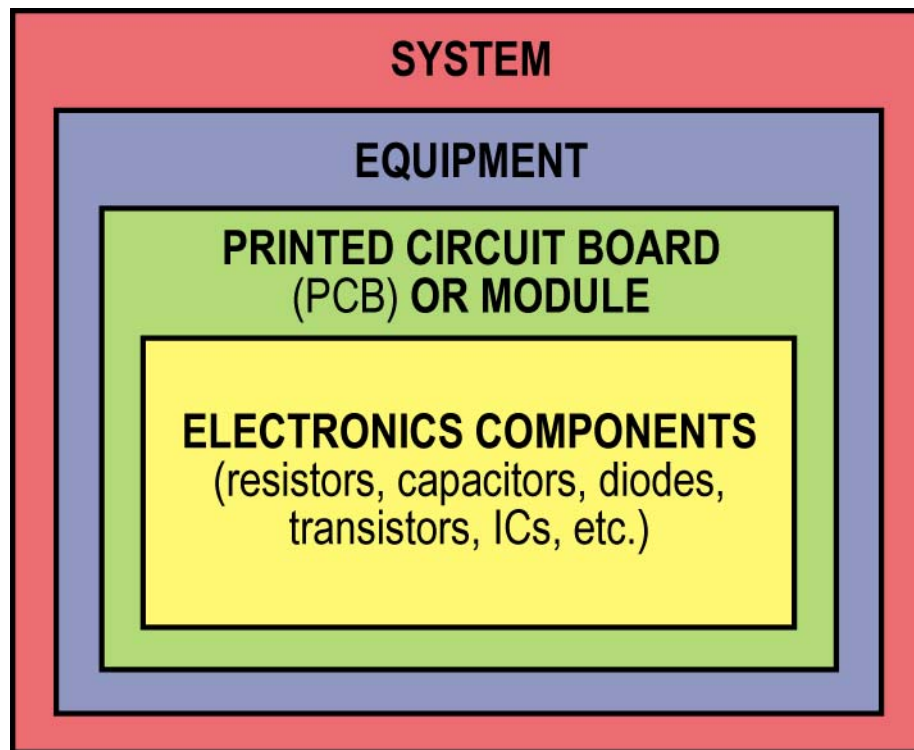
(Show Radio and USB Drive)

A Vision of Students Today

## What has Changed?

Today, the greater part of a tech's work now deals with a higher level. Specifically, he or she works more with larger PCBs containing many ICs, plug-in modules, subassemblies, and complete pieces of equipment, and entire systems as well as their power and cabling. The technician's work is at a higher level. The focus is on signal flow through the system and testing the system to see that it meets specific standards. Rarely does the tech replace individual components as was once the case.

# The Structure of Electronic Equipment



# What is a System?

A system is usually made up of **two or more pieces of electronic equipment** interconnected to do some particular function. For instance, a home entertainment system is made up of a **TV set, VCR, DVD, and DVR** units plus the audio components like a surround sound amplifier, CD player, tuner, speakers, and other equipment to make an entertainment system.

The technician's role today is more in dealing with the whole system than the details of the individual components. Because it costs more to repair a PCB or module at the component level than it does to buy a new module, defective modules are simply discarded and replaced with a new one. Not only is it less expensive to do this but also it is faster and less disruptive to the user.

## What is an Electronic System?

For electronics, we can say that a system is an assembly of electronic and sometimes mechanical components as well as the software that operate together as a unit to perform some function.

## Project Overview

- Purpose:
  - Change the way electronics technology programs prepare students for electronics systems technician roles in today's industry settings.
    - Switch from component/circuit analysis focus to a systems approach focus.

## Project Goals

1. Revise curriculum and courses, create new materials for faculty and student learning and enrichment, and to provide guidance for faculty in the usage of the emerging systems view of electronics resources.
2. Develop a complete web-based delivery system for the resources associated with the Systems View of Electronics Technology.

## **Project Goals continued**

3. Increase enrollments and retention in electronics technology programs.
4. Ensure the curriculum addresses the needs of industry by incorporating the most recent electronic methods, circuits, systems, and practices involving simulations and online laboratories.

## Which Courses Need Updating?

- DC and AC Circuits Analysis (combined?)
- Solid State Devices and Circuits
- Microprocessor Applications
- Test, Measurement, and Data Acquisition
- Digital Logic and Circuits
- Communications

# What courses will be impacted?

## First Semester (Fall)

ELE 105 Algebra/Trig for Technology

*ELE 111 Circuit Analysis 1*

*ELE 132 Digital Logic and Circuits*

ELE 181 Computer Programming

Summer Semester includes ENG 101, CRE 101, SOC and HUM student electives.

## Third Semester (Fall)

ELE 222 Solid State Dev. And Circuits 2

*ELE 243 Microprocessor Applications*

*ELE 261 Communication System 1*

COM 100 Intro to Human  
Communication

GTC 104 Manufacturing Processes

## Second Semester (Spring)

*ELE 112 Circuit Analysis 2*

*ELE 121 Solid State Dev. And Circuits*

ELE 241 Microprocessor Concepts

GTC 106 Industrial Safety

GTC 185 Electro-Mechanical Devices

## Fourth Semester (Spring)

ENG 102 First Year Composition

*ELE 251 Electronic Measurements*

*ELE 263 Communication Systems 2*

## Student Learning Outcomes

1. The program graduate will be able to specify, install, program, operate, trouble shoot, and modify electronics systems.
2. The program graduate will have effective written and oral communication skills.
3. The program graduate will have the attitudes, abilities, and skills for adapting to rapidly changing technologies.

## How to measure SLO

1. Alumni feedback done via Concept Inventory assessment; faculty feedback, and industry feedback via surveys
2. Graduate will build a portfolio to highlight mastery of communication skills both verbal and written
3. Alumni feedback done via Concept Inventory assessment; faculty feedback, and industry feedback via surveys

## Project Development Process

- Review course descriptions from various institutions
- Determine what stays, what goes, or what is modified to create the systems approach
- Convene an industry review panel
- Modify courses per industry recommendations
- Start development of new courses and resources
- Begin pilot testing

# Current Status of the Project

## Project Status

- Project evaluation metrics have been established.
- Project developed a process that was used to evaluate the first three core courses to determine what needs to be modified.
- Project determine what should be included in the first phase of the online system equipment. (iLabs activity)
- Weekly developer meetings began on Friday, September 21.
- Project has completed the DC/AC Systems course materials.

# **New DC/AC System Course**

## **Lou Frenzel**

## DC/AC System Course Recommendations

The following recommendations are congruent with graduates' needs and industry's requirements:

1. There should be less math and computation overall. Employ algebra emphasis with little trigonometry.
2. Remove material related to circuit analysis and design.
3. Add systems concepts to provide an initial broader view and perspective of electronics.
4. Continue to teach the course in essentially the same way but follow the guidelines given in the next few slides.
5. Implement the laboratory suggestions provided.

# **What is changing and what is new in DC/AC Systems**

## DC/AC De-emphasized Topics

- In general, reduce the coverage of most topics to only provide the essential concepts plus that knowledge that translates into real world job application.

**Rationale:** It is essential to minimize coverage of some subjects to make room in the curriculum for the system level instruction and those topics itemized in the general course recommendations. Stick to content that students must know and eliminate content that is only nice to know.

- Retain basic circuit calculations but reduce the extensive analysis. Eliminate design.

**Rationale:** AAS degree programs train technicians and technicians are not engineers and therefore they do not design. In light of the virtual disappearance of engineering technicians from the work force, there is little need to teach design methods.

## DC/AC De-emphasized Topics

- Omit advanced circuit analysis techniques such as mesh and nodal analysis, superposition, Norton's and Miller's theorems, delta-wye resistive calculations, and 3-phase power.

**Rationale:** Technician work does not involve extensive mathematical analysis of circuits therefore theory, analysis methods, advanced design techniques, and related software can generally be eliminated.

- Explain magnetism, magnetic fields, induction, and related concepts but reduce or eliminate discussions of magnetic units (flux density, etc.) and magnetic calculations.

**Rationale:** While technicians must understand magnetic fields and related phenomenon, they rarely if ever perform mathematical analysis using magnetic units, formulas, or theories.

# DC/AC New Systems Topics

- Define systems and the concepts of signal flow, in block diagrams of equipment and sub-systems.

**Rationale:** Most technician work is at the equipment and sub-systems level rather than the circuit or component level.

- Define the function of the most common electronics circuits and assemblies (amplifiers, power supplies, filters, oscillators, embedded controllers, etc.)

**Rationale:** To understand block diagram system level introduction it is necessary to provide this basic introduction. It is also more interesting to students that strict DC/AC theory and may lead to increased course interest and fewer dropouts.

# DC/AC New Systems Topics

- Define and explain semiconductors.

**Rationale:** Virtually all electronics equipment is made with semiconductors. This topic should be introduced as early as possible along with the initial discussion of conductors and insulators to provide the context. No physics theory, just simple how-it-works approach.

- Include a greater emphasis on the higher frequencies (through GHz) and their effect on components and circuits (residuals in components and stray/distributed inductance and capacitance).

**Rationale:** Most DC/AC courses seem to dwell at the power line, audio, and very low frequencies while most real world electronics applications take place at very high frequencies often exceeding many GHz. These higher frequencies are just as common if not more so than lower frequencies, so some attention must be paid to solving problems with these higher frequencies and the effects they produce.

# DC/AC New Systems Topics

- Emphasize surface mount components over the older traditional components.

**Rationale:** Most components in common use today are surface mount rather than the older wire lead, through-hole components of yesterday. Minimize the teaching of color code as it is much less used today.

- Teach the operational principles of diodes and their basic applications, including basic linear power supplies.

**Rationale:** A power supply is a good example of a small “system” that appears in all electronic equipment. It can be introduced early providing an early system example and an interesting application. However, diodes and rectification should be introduced in this course without the in-depth semiconductor theory normally accompanying a diode introduction. Only a how-it-works introduction is necessary.

# DC/AC New Systems Topics

- Stress more test and measurement principles and applications.

**Rationale:** Most technician work today involves the use of test equipment and measuring procedures. There is more testing and less repair in all technician work. Increased instruction is usually warranted to better prepare students for jobs.

- Add coverage of wiring and cabling.

**Rationale:** Technicians constantly work with wire, cables, and connectors. They make cables, install cables, repair cables, and use other wiring as part of most jobs.

# DC/AC New Systems Topics

- Explain the make-up of the electronic industry and the industries that employ electronics technicians. Describe the flow of materials through the industry. Name the most commonly available jobs

**Rationale:** Most students in beginning courses really do not fully understand the industry or the nature of the jobs available. Such knowledge should make the learning more meaningful and motivational to the student and possibly improve retention.

# A sneak peak at the other courses (initial recommendations).

- **Solid State** (Semiconductor devices and basic linear)
  - Reduce coverage of BJTs increase coverage of MOSFETs.
  - Less circuit analysis and design.
  - Greater emphasis on ICs, their specs and applications.
  - More power supply coverage.
- **Digital**
  - Less emphasis on TTL & CMOS SSI/MSI.
  - Greater coverage of PLDs, CPLDs, FPGAs.
  - Less analysis and design. (Karnaugh maps?)
  - Introduce basic embedded controllers as prerequisite for a later micro course. (e.g. Parallax BASIC Stamp)
  - Greater coverage of interfaces and buses.

## The textbook issue

- Name one textbook that addresses this approach.
- Name one textbook that covers electronics technology as it applies to modern tech jobs.
- Alternatives
  - Ask your publisher to address this problem.
  - Use as much as you can from existing texts but edit heavily. Supplement as needed.
  - Develop your own text from online materials.

## Our New Logo and Web Site



[www.esyst.org](http://www.esyst.org)



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**Thank You to everyone for joining the second  
Electronics Systems Project Workshop**



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