Electronics Systems Concept Inventory

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A presentation of eSyst.org

Objectives/Agenda

- Introduction
- Brief history of past STEM CIs
- Overview of the elements/process required to develop a CI. Sample CI questions will be provided.
- Application to Systems Electronics
- A brainstorm discussion will follow to determine if attendees have question ideas/submissions.
- Time will be remaining for questions and answers.

Introduction

- The Electronics for the 21st Century Project will provide a new approach that will re-invigorate electronics curriculum by inserting a systems point of view for every phase of instruction.
- An Electronic Systems Concept Inventory (CI) will evaluate student learning.
- Anyone desiring a broad overview of a CI application will benefit from this session.
- Attendees can expect a brief history of past STEM CIs and an overview of the elements/process required to develop a CI.

Brief History of Past STEM CIs

- Force Concept Inventory and Evaluations (1992)
- Wave Concept (1999)
- Thermodynamics, Strength of Materials, Signals and Systems, Electromagnetics (2000-01)
- Circuits, Fluid Mechanics, Materials (2001-02) (Foundation Coalition n.d.)

Developing a CI

1. Determine the concepts to be included in the inventory.

2. Study and articulate the student learning process regarding those concepts.

3. Construct several multiple-choice questions for each concept.

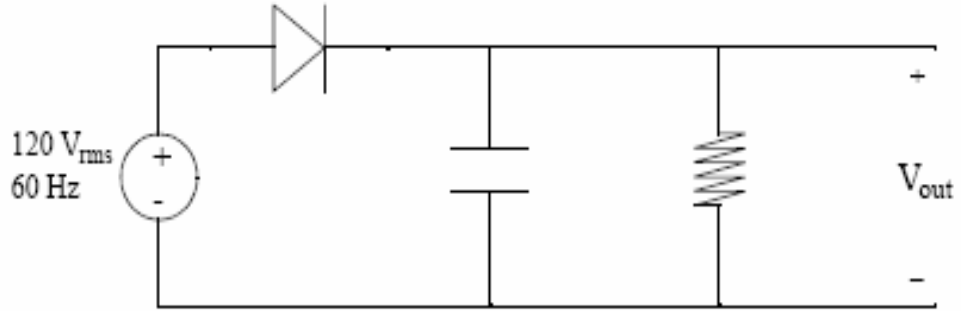
4. Administer the beta version of the inventory to as many students as possible.

5. Perform statistical analyses on the results to establish validity, reliability, and fairness.

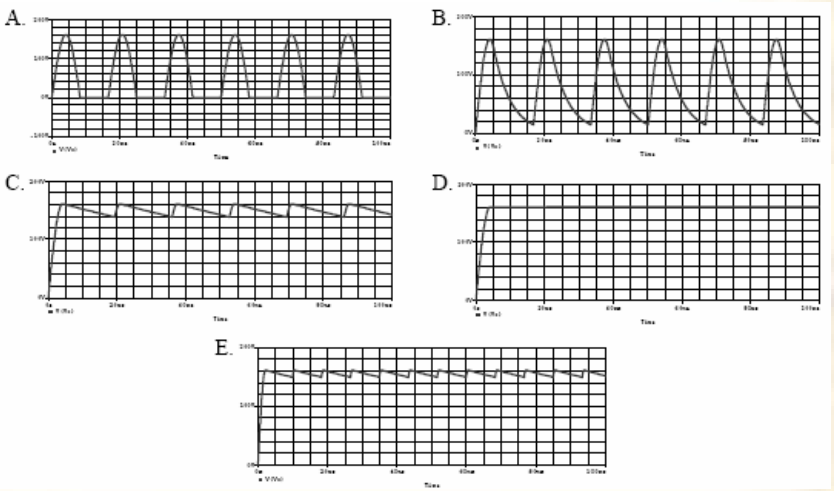
6. Revise the inventory to improve readability, validity, reliability, and fairness (Richardson, 2004).

Sample CI Question

Problem: Given the circuit below, assume that the time constant is large, but not infinite. Which of the following graphs most accurately represents the behavior of this circuit.



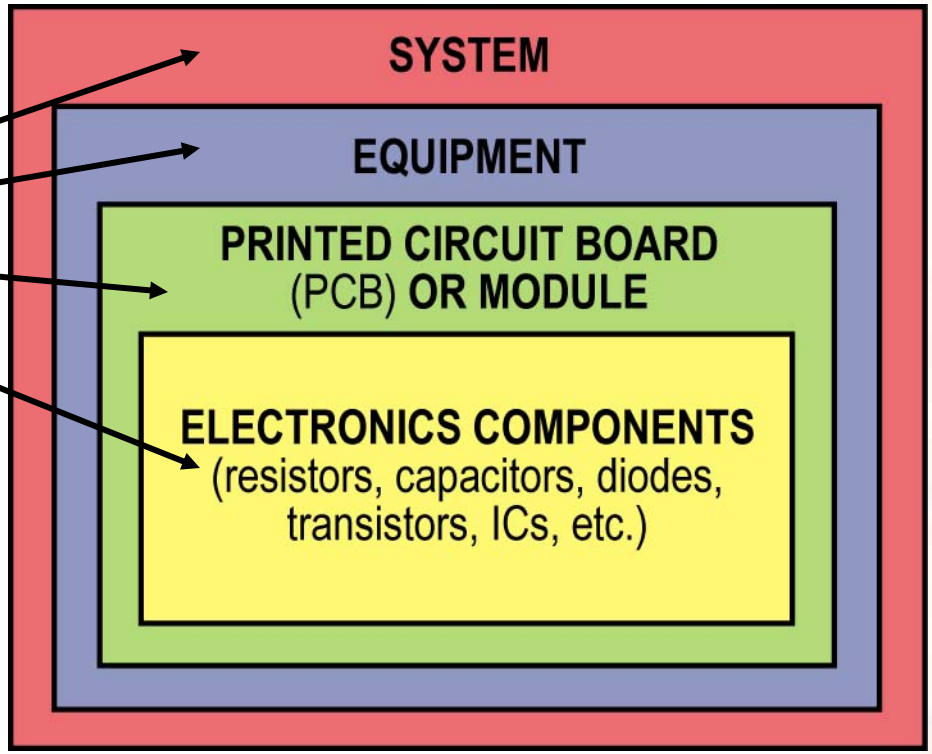
"Figure 2C is the correct answer as specified by the “large, but not infinite” time constant. In Figure 2A, the misconception is to ignore the RC time constant and see only the half-wave rectifier. In Figure 2B the misconception is to confuse a large with a small time constant. In Figure 2D, the misconception is to confuse a large with an infinite time constant. Figure 2E is an example of a poor choice for a possible answer because it contains two concepts" (Simoni, Herniter, & Ferguson, 2004).



Applications to Systems Electronics

Electronics Technician

Where do I start trouble shooting?



Courses to be Systemized:

1. DC and AC Circuits
2. Solid State Devices
3. Digital Fundamentals
4. Microprocessors
5. Data Acquisition and Measurements
6. Electronics Communications

Student Learning Outcomes:

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

Questions for Discussion/Q&A

- Do faculty understand the thought processes by which students learn?
- Is there disparity between what faculty desire students to learn and what students are actually learning?
- Is there a tool/method that faculty can depend on to answer the above questions?

Attendees Question Ideas/Submissions

References

Foundation coalition (n.d.) Foundation coalition: An agent of change. Retrieved October 12, 2007 from http://www.foundationcoalition.org/home/keycomponents/concept/presentations/concept.pdf

Richardson, J. (2004). Concept Inventories: Tools For Uncovering STEM Students' Misconceptions. In Cunningham, S. (NSF) and George, Y.S. (AAAS) (Eds.) Invention and Impact: Building Excellence in Undergraduate Science, Technology, Engineering and Mathematics (STEM) Education Assessment and Education Research (p. 19-25). American Association for the Advancement of Science. Retrieved September 15, 2007 from http://www.aaas.org/publications/books_reports/CCLI/PDFs/02_AER_Richardson.pdf

M.F. Simoni, M.E Herniter, and B.A. Ferguson (2004). Concepts to Questions: Creating an Electronics Concept Inventory Exam. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition: American Society for Engineering Education. Retrieved October 12, 2007 from http://www.foundationcoalition.org/events/news/conferencepapers/2004asee/simoni.pdf