

# III-Structured Capstone Projects in an Electronics and Instrumentation Advanced Lab



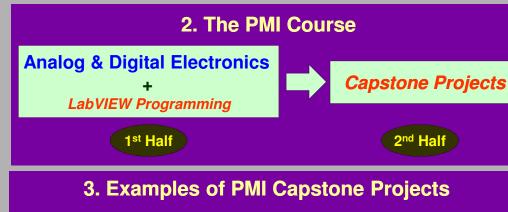
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#### 1. Introduction

- The *Physical Measurements and Instrumentation* (PMI) course covers analog & digital electronics and LabVIEW programming
- In the second half of PMI, students work on ill-structured capstone projects, where they apply their newly learned knowledge to automate experiments that were learned in previous advanced labs
- The PMI capstones provide a context in which to study how students solve ill-structured problems



- Measuring the Speed of Light
- Saturated Absorption Spectroscopy
- SQUID (Superconducting Quantum Interference Device)
- X-Ray Diffraction
- Chaotic Circuits

## 4. III-Structured Nature of the Capstone Projects

Characteristics of ill-structured problems <sup>1,2</sup>	Capstone Projects in PMI
⇒ One or more problem elements are unknown	Unclear which electronic components, measurement & analysis technique should be used
<ul> <li>Require integration of content domains</li> </ul>	Require integration of knowledge from electronics, instrumentation, programming and physics
Solutions not predictable or convergent	Several different solutions are possible depending on the electronic equipment and analysis technique used
<ul> <li>Typically encountered in professional settings</li> </ul>	For example, in research labs, we do experimental measurements, planning, debugging, etc.

#### 5. Students' Learning Outcomes

The capstone projects offer students excellent opportunities:

- To learn or re-learn physics concepts
- To write LabVIEW programs and build circuits on the NI ELVIS II prototyping board
- To see usefulness of electronics in physics experiments

### 6. Ongoing Work

Study to find out how students solve ill-structured problems

#### References

- 1. Jonassen, D. H. (2007). Learning to solve complex scientific problems. In Jonassen, D. H. (Editor), chapter 1.
- Jonassen, D. H. (1997). Instructional design model for well-structured and ill-structured problem-solving learning outcomes. Educational Technology Research and Development 45(1), 65–95.