

Loyola Jesuit Seismic Observatory Service for the Advanced Physics Laboratory Education

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Levels

- ▶ 100
 - ▶ General Physics I – Mechanics, waves, heat
 - ▶ General Physics II – Electromagnetism, optics
- ▶ 200
 - ▶ Modern Physics
- ▶ 300
 - ▶ Optics
 - ▶ Electronics
 - ▶ Nuclear
 - ▶ Digital Electronics
 - ▶ Solid State

Introductory and Advanced Labs Concept

Primarily concerned with the study of effects in a prepared experiment environment using direct measurements and error assessment.

Advanced labs increase the sophistication of the study and experiment.

Intermediate Lab Concept

Experimental output signal processing to mirror contemporary experimentation.

Scope:

- ▶ Produce signals from the effect studied
- ▶ Adjust, transform and convert signals
- ▶ Condition, record and study signals

Prerequisites:

- ▶ Introductory Electronics 1 (mandatory)
- ▶ Digital Electronics Course/Lab (desired)

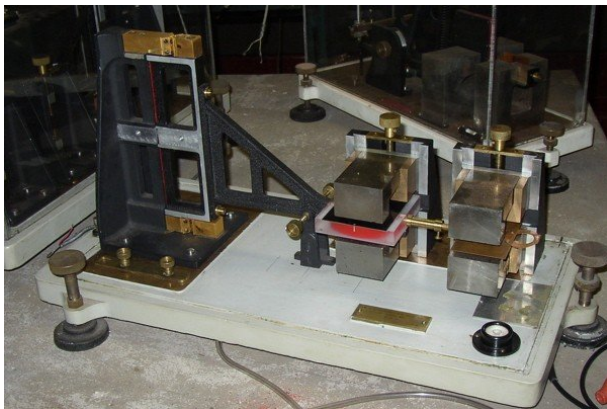
Intermediate Lab Elements

Intermediate Lab Elements:

- ▶ Signal Providing
 - ▶ Sensors
- ▶ Signal Processing
 - ▶ Adjusting (amplification, coordination)
 - ▶ Transforming (M/E or Th/E transducers)
 - ▶ Conversion (A/D, D/A)
- ▶ Signal Conditioning
 - ▶ Filtering (analog and digital)
 - ▶ Time/frequency domain (Fourier Transform)

Case study: Seismic Laboratory

Historic Loyola Seismic Observatory and Cudahy Science Hall,
established in 1912:



Case study: Seismic Laboratory

Study mechanical oscillators (pendulums) to determine:

- ▶ Natural Frequency
- ▶ Damping Constant

Students view the analog signal directly through the oscilloscope, and use analog filters to condition the signal. Students then view the signal on a computer via an A/D converter.

Digital signals from all three seismometers are processed by digital filtration to be analyzed. Students can use digital filters and Fourier transforms.

Case Study: Thermal Radiation Laboratory

Cenco Equipment:

- ▶ Temperature/Electrical, thermistor, thermocouple
- ▶ Radiation Flux/Electrical Transducers