

**COURSE NUMBER:** CI1110

**COURSE TITLE:** Signals & Measurements

**COURSE DESCRIPTION:**

This course will introduce the learner to the fundamental concepts of signals and measurements. Learners in the course will learn how to identify different types of signals, select the appropriate test equipment, take measurements, and interpret and report results.

**PREREQUISITES:** ET1101 - Electrotechnology

**CO-REQUISITES:** None

**CREDIT VALUE:** Three (3)

**COURSE HOURS PER WEEK:** Two (2)

**LAB HOURS PER WEEK:** Two (2)

**SUGGESTED TEXT:**

Witte, R.A. (2002). *Electronic test instruments: analog and digital instruments*, (2<sup>nd</sup> ed.).  
Prentice Hall. ISBN-10: 0130668303; ISBN-13: 978-0130668301

**LEARNING RESOURCES:** To be determined by instructor

**MAJOR TOPICS:**

- 1.0 Signal Fundamentals
- 2.0 Measurements
- 3.0 Amplification
- 4.0 Noise
- 5.0 Filtering
- 6.0 Modulation

**LEARNING OBJECTIVES:**

The expected learning outcomes are that the learner will be able to:

**1.0 Signal Fundamentals**

- 1.1 Define signal
- 1.2 Differentiate between a discrete and continuous signal

- 1.3 Differentiate between periodic and transient signals
- 1.4 Differentiate between voltage signals and current signals
- 1.5 Differentiate between time and frequency domain
- 1.6 Describe common periodic waveforms
- 1.7 Describe common non-periodic waveforms
- 1.8 Evaluate and report on signal characteristics

## **2.0 Measurements**

- 2.1 Effects of measurement on a signal
  - 2.1.1 Loading
    - 2.1.1.1 Define loading
    - 2.1.1.2 Describe the effect of loading on a signal
    - 2.1.1.3 Demonstrate loading effect
    - 2.1.1.4 Assess the effect of loading
  - 2.1.2 Impedance matching
    - 2.1.2.1 Define impedance matching
    - 2.1.2.2 State the importance of impedance matching on signals
  - 2.1.3 Interference
    - 2.1.3.1 Define interference
    - 2.1.3.2 Identify sources of interference
    - 2.1.3.3 Demonstrate the effects of shielding on mitigating interference
    - 2.1.3.4 Predict sources of interference on a specific application
- 2.2 Select appropriate measurement equipment for each of the following quantities:
  - 2.2.1 Voltage
  - 2.2.2 Current
  - 2.2.3 Frequency
  - 2.2.4 Phase
  - 2.2.5 Time
  - 2.2.6 Discrete
  - 2.2.7 Continuous
- 2.3 Compare measured values to calculated values
- 2.4 Choose appropriate measurements to quantify a signal
- 2.5 Evaluate differences between calculated and measured values

## **3.0 Amplification**

- 3.1 Amplification/gain
  - 3.1.1 Define amplification/gain
  - 3.1.2 Calculate the gain of a system
  - 3.1.3 Construct an amplifier system
  - 3.1.4 Measure the gain of a system

- 3.1.5 Compare the calculated versus measured gain of a system
  - 3.1.6 Assess the differences between calculated and measured values
- 3.2 Attenuation/loss
  - 3.2.1 Define attenuation/loss
  - 3.2.2 Calculate the loss of a system
  - 3.2.3 Measure the loss of a system
  - 3.2.4 Compare the calculated versus measured loss of a system
  - 3.2.5 Assess the differences between calculated and measured values
- 3.3 Decibel
  - 3.3.1 Decibel
  - 3.3.2 Calculate the loss and gain of a system using decibels
- 4.0 Noise**
  - 4.1 Noise
    - 4.1.1 Define noise
    - 4.1.2 Define noise floor
    - 4.1.3 Calculate noise floor
    - 4.1.4 Measure noise floor
    - 4.1.5 Discuss common types of noise
  - 4.2 Explain the effect of noise on signal
  - 4.3 Signal to Noise ratio
    - 4.3.1 Explain Signal to Noise ratio
    - 4.3.2 Measure Signal to Noise ratio
    - 4.3.3 Assess the outcome
  - 4.4 Identify methods to mitigate noise on a signal
- 5.0 Filtering**
  - 5.1 Define filtering
  - 5.2 Explain the purpose of filtering
  - 5.3 Describe the following classes of filters
    - 5.3.1 Low-Pass
    - 5.3.2 High-Pass
    - 5.3.3 Band-Pass
    - 5.3.4 Band-Stop
  - 5.4 Filter Construction
    - 5.4.1 Define Cutoff Frequency
    - 5.4.2 Define Rolloff
    - 5.4.3 Define Bode plot
    - 5.4.4 Measure the gain versus frequency response

- 5.4.5 Calculate the bandwidth
- 5.4.6 Measure the bandwidth
- 5.4.7 Compare the calculated against measured bandwidth

## **6.0 Modulation**

- 6.1 Bandwidth
  - 6.1.1 Define bandwidth
  - 6.1.2 Explain how bandwidth limits information transfer
- 6.2 Modulation
  - 6.2.1 Define modulation
  - 6.2.2 Explain how information is prepared for transmission
  - 6.2.3 Differentiate between analog and digital modulation
  - 6.2.4 Compare modulation methods including AM, FM, PM

### **EVALUATION:**

Laboratories:	15%
Assignments:	5%
Quizzes and/or Tests:	30%
Final Exam:	50%

**DATE DEVELOPED:** March 2012

**DATE REVIEWED:**

**REVISION NUMBER:** 1

**DATE REVISED:** June 2013

*Note to instructor: Check PIRS to ensure this outline is the most current version.*