INTRODUCTION

This lab covers the fundamentals of Circuit analysis, which can be separated into three broad categories: resistive – circuit analysis, time-domain analysis, and frequency-domain analysis. The students will have a perfect opportunity to acquire a practical understanding of the powerful engineering circuit analysis techniques, such as nodal analysis, mesh analysis, voltage and current division, linearity, superposition, Thévenin’s theorem, transient response of capacitors and inductors, and the phenomenon of resonance.

This lab exposes the students to a new piece of equipment, NI ELVIS, wherein all the conventional equipment such as, Oscilloscope, Function Generator, Variable Power Supply, Digital Multi meter are integrated into one single unit. All the operations are controlled by the software installed on the computer to which NI ELVIS is connected. This will expose the students to a new level of understanding with the latest in software and hardware.

NI ELVIS Overview
NI ELVIS combines hardware and software into one complete laboratory suite. This document provides an overview of the hardware and software components of the NI ELVIS.

NI ELVIS Hardware
The following sections briefly describe the hardware components of the NI ELVIS.

NI ELVIS Bench top Workstation:
The bench top workstation and the DAQ (Digital Acquisition) device together create a complete laboratory system. The workstation provides connectivity and functionality. The control panel on the workstation provides easy-to-operate knobs for the function generator and variable power supplies, and it offers convenient connectivity in the form of BNC and banana-style connectors to the NI ELVIS - Scope SFP (the software panel) and NI ELVIS – DMM (Digital Multi-meter) SFP. The bench top workstation also contains a protection board that protects the DAQ device from possible damage resulting from laboratory errors.
The bench top workstation has the following controls and indicators:

- **System Power LED**: Indicates whether the NI ELVIS is powered.
- **Prototyping Board Power Switch**: Controls the power to prototyping board.
- **Communications Switch**: Requests disabling software control of the NI ELVIS. This setting provides direct access to the DAQ device DIO lines.
- **Variable Power Supplies Controls**

**Note:** You can control the variable power supplies through either the hardware controls on the bench top workstation (Manual mode) or the controls on the NI ELVIS - Variable Power Supplies SFP (Software mode). You can only use the controls described in the following section when the variable power supplies are in Manual mode.

**Supply – Control:**

- **Manual Switch**: Controls whether the negative supply is in Manual mode or Software mode.
- **Voltage Adjust Knob**: Controls the output of the negative supply. The negative supply can output between –12 and 0 V.

**Supply + Control:**

- **Manual Switch**: Controls whether the positive supply is in Manual mode or Software mode.
- **Voltage Adjust Knob**: Controls the output of the positive supply. The positive supply can output between 0 and +12 V.

**Note:** You can control the function generator through either the hardware controls on the Bench top workstation (Manual mode) or the controls on the NI ELVIS - FGEN SFP (Software mode). You can only use the controls described in the following section when the function generator is in Manual mode.
• **Manual Switch:** Controls whether the Function Generator is in Manual mode or Software mode.
• **Function Selector:** Selects what type of waveform is generated. NI ELVIS can generate sine, square, or triangle waves.
• **Amplitude Knob:** Adjusts the peak amplitude of the generated waveform.
• **Coarse Frequency Knob:** Sets the range of frequencies the Function Generator can output.
• **Fine Frequency Knob:** Adjusts the output frequency of the Function Generator.

**DMM Connectors:**
(Caution: By connecting different signals to both the DMM terminals on the prototyping board and the DMM connectors on the control panel, you are shorting them together, potentially damaging the circuit on the prototyping board.)

• **CURRENT Banana Jacks**
  • **HI:** The positive input to all the DMM functionality, except measuring voltage.
  • **LO:** The negative input to all the DMM functionality, except measuring voltage.

• **VOLTAGE Banana Jacks**
  • **HI:** The positive input for voltage measurements.
  • **LO:** The negative input for voltage measurements.

**Oscilloscope (Scope) Connectors:**
(Caution: By connecting different signals to the Scope terminals on the prototyping board and the Scope connectors on the control panel, you are shorting them together, potentially damaging the circuit on the prototyping board.)

• **CH A BNC Connector:** The input for channel A of the Oscilloscope.
• **CH B BNC Connector:** The input for channel B of the Oscilloscope.
• **Trigger BNC Connector:** The input to the trigger of the Oscilloscope.

**NI ELVIS Prototyping Board:**
The NI ELVIS Prototyping Board connects to the bench top workstation. The prototyping board provides an area for building electronic circuitry and allows the connections necessary to access signals for common applications. The figure below shows the layout of the interconnections inside the board.
NI ELVIS Software
The NI ELVIS software, created in LabVIEW, takes advantage of the capabilities of virtual instrumentation. The NI ELVIS provide the functionality of the following instruments in software:

- Arbitrary Waveform Generator (ARB)
- Bode Analyzer
- Digital Bus Reader
- Digital Bus Writer
- Digital Multi-meter (DMM)
- Dynamic Signal Analyzer (DSA)
- Function Generator (FGEN)
- Impedance Analyzer
- Oscilloscope (Scope)
- Two-Wire Current Voltage Analyzer
- Three-Wire Current Voltage Analyzer
- Variable Power Supplies

Safety Information:
The following section contains important safety information that you must follow when using the product.

1. Do not operate the product in a manner not specified in this document. Misuse of the product can result in a hazard.
2. You must insulate signal connections for the maximum voltage for which the product is rated. Do not exceed the maximum ratings for the product.
3. Do not install wiring while the product is live with electrical signals. Do not remove or add connector blocks when power is connected to the system.
4. Avoid contact between your body and the connector block signal when hot swapping modules.