

Course Overview for: IND223 Motors & Motor Control, 3 Credit Hour, 4/11/17

Course Description:

This course is an application of common electrical concepts and relay ladder logic/motor control circuits used in industry to maintain and troubleshoot electrical power and control systems, including variable frequency drive systems. Students will learn how to install, operate, maintain, and troubleshoot single-phase transformers, NEMA and IEC contactors & motor starters, motor branch circuits, and reversing circuits (power & control). A heavy focus of the course will be on variable frequency drives. Students will learn to install, maintain, program and troubleshoot industrial programmable VFDs. The course will focus on 3 types of VFD: Automation Direct's GS2, Allen Bradley PowerFlex 70 and Allen Bradley PowerFlex 525. The topics presented will be learned through online instructional material, and hands-on labs.

This course will consist of 9 competencies:

1. Install and troubleshoot single phase transformers.
2. Explain, calculate and measure power distribution voltages
3. Explain and troubleshoot NEMA and IEC contactors and motor starters
4. Install and troubleshoot three phase motor branch circuit.
5. Install and troubleshoot three phase motor reversing circuits.
6. Explain the basic operation of a programmable variable frequency drive
7. Wire and configure a programmable variable frequency drive
8. Program and troubleshoot a variable frequency drive
9. Configure and interface a VFD to be controlled by an analog signal or Ethernet from a PLC

This course will consist of the following 8 Modules:

Module #1: Three Phase Power and Transformers

Module #2: Wire and Troubleshooting Motor Branch Circuits

Module #3: Wire and Troubleshooting Motor Reversing Circuits

Module #4: Basic VFD Operation (PF525)

Module #5: VFD Wiring and Programming I (GS2 Drive)

Module #6: VFD Wiring and Programming II (GS2 Drive)

Module #7: VFD Programming & Troubleshooting I (PF70)

Module #8: VFD Ethernet & Analog Control (PF525)

Module 1: Three Phase Power and Transformers: Hands-On Assessment Tasks:

1. Measure AC voltages on a 208V, 5-wire system: phase to phase, phase to N, phase to ground on a motor training unit.
2. Measure AC voltages on a 208V, 5-wire system: phase to phase, phase to N, phase to ground on a three phase plug.
3. Ring out, measure the resistance, (ohmmeter) and explain the wires on a three phase cord/outlet.
4. Wire a Demo Transformers for the following configurations: *120V to 208V, 120V to 104 (full KVA capability), and 208V to 120V, Calculate the maximum current on the primary and secondary on each configurations.
5. Wire an enclosed industrial transformers (rated pri. 240/480, sec. 120/240), Wire for high & low voltage on each side.
6. Wire and power to an enclosed transformer that is wired for 120V to 240V. Measure the primary and secondary voltage.

Module 2: Wire and Troubleshooting Motor Branch Circuits: Hands-On Assessment Tasks:

1. Interpret all the information on the nameplate of a three phase motor.
2. Wire and power a 9 lead, dual voltage rated, three phase motor for high or low voltage.
3. Identify the different components on a NEMA, and an IEC motor starter, and correlate to the symbols on a print.
4. Explain how the IEC and NEMA motor starter overload relays sense overload current. Size the overloads.
5. Wire the power and control circuits of a single motor branch circuit, based on an electrical print.
6. Wire a Demo transformer in for the control circuit power. 208V on primary and 120V on the secondary.

Course Overview for: IND223 Motors & Motor Control, 3 Credit Hour, 4/11/17

7. Troubleshoot the motor branch circuit once an instructor puts a fault in the system.

Module 3: Wire and Troubleshooting Motor Reversing Circuits: Hands-On Assessment Tasks:

1. Identify the different components on an IEC reversing contactor.
2. Correlate the components on an IEC reversing contactor to the symbols on an electrical print.
3. Identify the different components on a NEMA reversing magnetic motor starter.
4. Correlate the components on a NEMA reversing motor starter to the symbols on an electrical print.
5. Wire the power and control control circuits for an IEC reversing starter circuit.
6. Troubleshoot the reversing power and control circuit, after the instructor puts a bug into the branch circuit.

Module 4: Basic VFD Operation (PF525): Hands-On Assessment Tasks:

1. Remove the Control Module from the Power Module on a PF525 VFD.
2. Explain all the objects on the PF525, as well as the power and control connections.
3. Reset the PF525 on the NSCC PF525 Training Unit to factory default settings.
4. Reset a fault on the PF525 unit and start the drive up.
5. Display the output frequency and output voltage on the display of the PF525.
6. Change the Acceleration time to 3 seconds, and the Deceleration time to 6 seconds.
7. Disable the reverse direction pushbutton on the PF525 drive.
8. Test voltages for the control inputs on the PF525 module, and validate the signal on the PF525 display

Module 5: VFD Wiring and Programming I (GS2 Drive): Hands-On Assessment Tasks:

1. Remove the Control Module from the Power Module on a PF525 VFD.
2. Explain all the objects on the PF525, as well as the power and control connections.
3. Reset the PF525 on the NSCC PF525 Training Unit to factory default settings.
4. Reset a fault on the PF525 unit and start the drive up.
5. Display the output frequency and output voltage on the display of the PF525.
6. Change the Acceleration time to 3 seconds, and the Deceleration time to 6 seconds.
7. Disable the reverse direction pushbutton on the PF525 drive.

Module 6: VFD Wiring and Programming II (GS2 Drive): Hands-On Assessment Tasks:

1. Wire a GS2 based on an electrical print, with 6 discrete input devices and an external potentiometer
2. Configure the GS2 for external IO, 3-wire control, and 0-10V input with a potentiometer
3. Set the acceleration and deceleration times on the GS2
4. Configure and test the job speed on the GS2 VFD
5. Disable the reverse option on the GS2 VFD
6. Configure the GS2 speed reference for the up/down arrows on the VFD, and the external DI
7. Fault the GS2 VFD, and discover/recover from the fault

Module 7: VFD Programming & Troubleshooting I (PF70): Hands-On Assessment Tasks:

1. Explain all the objects on the PF70, as well as the power and control connections
2. Reset the PF70 on the NSCC PF70 Training Unit to factory default settings
3. Determine what caused a fault on the PF70 VFD
4. Reset a fault on the PF70 unit and start the drive up
5. Display the output frequency and output voltage on the display of the PF70
6. Setup a PF70 unit using the SMART menus on the HIM unit
7. Backup/restore a PF70 program to the HIM unit

Module 8: VFD Ethernet & Analog Control (PF525): Hands-On Assessment Tasks:

1. Configure the PF525 to be controlled by a 4-20mA signal for the speed control
2. Configure the PF525 for remote I/O control with external pushbuttons/selector switches
3. Connect the PF525 to a CompactLogix unit for speed control and run the drive
4. Explain the signal flow and how to troubleshoot the system
5. Configure the PF525 to be controlled by Ethernet for the speed control, and discrete I/O control
6. Connect the PF525 to the AB CompactLogix unit for speed and discrete I/O control
7. Explain how the CompactLogix controls the drive and how to troubleshoot the system