

## INDUSTRIAL TECHNICAL MAINTENANCE II

**Industrial Technical Maintenance II** builds on skills learned in Industrial Technical Maintenance I. This course includes classroom and practical experiences that prepare students to apply technical knowledge and skills to repair and maintain industrial machinery and equipment. Instructional activities are focused on electrical systems, electronic and process control systems, welding, and piping maintenance processes. Instruction includes in-depth training in diagnostic processes and problem-solving skills.

- DOE Code: 5688
- Recommended Grade Level: Grades 12
- Required Prerequisites: Industrial Technical Maintenance I
- Credits: 2 semester course, 2 semesters required, 2-3 credits per semester, maximum of 6 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas

### **Application of Content and Multiple Hour Offerings**

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

### **Career and Technical Student Organizations (CTSOs)**

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in SkillsUSA, the CTSO for this area.

## **Domain – Electrical Systems**

**Core Standard 1** Students analyze electrical systems to perform maintenance and repair processes

### **Standards**

- ITMII-1.1 Analyze and demonstrate adherence to safety, health and environmental rules and regulations for electrical power and control systems
- ITMII-1.2 Read and interpret electrical motor control and programmable controller system schematics, including identifying schematic symbols, signal flow and operation of the components and system
- ITMII-1.3 Adjust and test limit switches, pressure switches, float switches and electronic proximity sensors

- ITMII-1.4 Use a multimeter to measure voltage, current and resistance in an electrical circuit to verify system operation and power levels
- ITMII-1.5 Select, install and test fuses and circuit breakers
- ITMII-1.6 Install and test Direct Current (DC) electric motors in a manual motor control circuit
- ITMII-1.7 Install and test single and 3-phase Alternating Current (AC) electric motors in a manual motor control circuit
- ITMII-1.8 Install and test electrical relay control components in control system
- ITMII-1.9 Install and test electro-fluid power components and circuits
- ITMII-1.10 Test and repair machine electrical ground
- ITMII-1.11 Troubleshoot an electrical motor relay control circuit
- ITMII-1.12 Troubleshoot a solenoid-operated fluid power relay control circuit
- ITMII-1.13 Test and replace electrical control wiring using terminal attachment
- ITMII-1.14 Test and replace electrical control wiring using solder attachment
- ITMII-1.15 Test and replace transformers

### **Domain – Electronic Control Systems**

**Core Standard 2** Students analyze electronic control systems to perform maintenance and repair procedures.

#### **Standards**

- ITMI-2.1 Adhere to safety, health and environmental rules and regulations for electronic power and control systems
- ITMI-2.2 Connect and test linear and switching DC power supplies
- ITMI-2.3 Install and test solid-state AC and DC discrete and analog relays
- ITMI-2.4 Install, adjust and test analog sensors and signal conditioning equipment
- ITMI-2.5 Install and operate an AC variable frequency volts-to-hertz motor drive system
- ITMI-2.6 Connect and transfer programs to a Programmable Controller (PLC) using a PC
- ITMI-2.7 Create a basic PLC ladder-style program
- ITMI-2.8 Install and test basic PLC components
- ITMI-2.9 Troubleshoot PLC and controlled components

### **Domain – Process Control Systems**

**Core Standard 3** Students examine process control systems to maximize machine life and output.

#### **Standards**

- ITMI-3.1 Adhere to safety, health and environmental rules and regulations for process control systems
- ITMI-3.2 Read and interpret process control system documentation, including identifying components on a piping and Instrumentation diagram (P&ID), instrument tag and instrument index
- ITMI-3.3 Calibrate, adjust and test analog sensors and signal conditioning equipment
- ITMI-3.4 Calibrate, adjust and test pneumatic proportional valves and current to pneumatic (I/P) transmitters
- ITMI-3.5 Build a simple/basic process single loop system

## **Domain – Maintenance Welding**

**Core Standard 4** Students perform welding processes to maintain machine components.

### **Standards**

- ITMII-4.1 Adhere to safety, health and environmental rules and regulations for welding
- ITMII-4.2 Use an acetylene Torch to cut steel parts
- ITMII-4.3 Explain welding theory, equipment and selection process
- ITMII-4.4 Prepare metal parts to be welded including degreasing, cleaning, grinding and inspecting
- ITMII-4.5 Set up a Shielded Metal Arc Welder (SMAW) for operation and make basic welds
- ITMII-4.6 Use a Gas Metal Arc Welder (GMAW) to make basic welds on flat steel
- ITMII-4.7 Visually inspect welds identify defects
- ITMII-4.8 Use plasma cutter to cut flat stock

## **Domain – Maintenance Piping**

**Core Standard 5** Students perform appropriate procedures to maintain the working life of piping.

- ITMII-5.1 Adhere to safety, health and environmental rules and regulations for piping systems
- ITMII-5.2 Read and interpret piping schematics
- ITMII-5.3 Identify and select proper materials for installation and replacement
- ITMII-5.4 Prepare material for installation or repair of piping systems
- ITMII-5.5 Assemble and disassemble piping systems