

Vincennes University

Indiana Center for Applied Technology (ICAT) – Industrial Maintenance Training

Advanced Manufacturing Machinery Technician NOW (AMMT NOW)

Goals:

1. To provide high quality training on state-of-the-art equipment to help bridge the Advanced Manufacturing “skills gap”.
2. To provide well-rounded entry-level skilled Industrial Maintenance Technicians to the advanced manufacturing and machinery service industry in the U.S.
3. To improve the technical skills of incumbent workers.
4. To prepare Veterans and Civilian adult learners for gainful employment as Industrial Maintenance and Machine Service Technicians.
5. To provide a solid foundation for life-long learning in the field of advanced manufacturing.
6. To develop a flexible system to allow HAAS Factory Outlets to pick and choose the training and length of training for their specific needs for that class.

Description:

The Vincennes University Advanced Manufacturing Machinery Technician NOW program is an accelerated training program up to 16 weeks in length (HFO group can modify if desired) to prepare trainees for employment in industrial maintenance or machine service with emphasis on machine tool, robotics and automation maintenance. The training provides hands on experience in AC/DC electrical components, electric motor controls, PLC’s, servo, vector and frequency drives, mechanical drive systems, schematic print reading, industrial safety, robotics, along with hydraulics, pneumatics, mechatronics, and basic CNC machine setup, programming and operation. Those completing this program will be prepared to troubleshoot industrial equipment such as robots, CNC machine tools and other automated equipment; install, repair and replace mechanical, electrical, hydraulic and pneumatic parts; and create basic programs for automated equipment.

Eligibility:

This program is designed for Veteran and Civilian adult learners. Recent high school graduates are referred to Vincennes University’s two year Computer Integrated Manufacturing program. Students must pass a general mechanical knowledge assessment to show a minimum aptitude for industrial maintenance training.

Certificate:

Upon successful completion of the program, the trainee will be awarded with a Vincennes University Certificate of Completion of the Advanced Manufacturing Machinery Technician NOW program.

Facility:

VU will provide all the training at the ABB Robotics and Industrial Maintenance Lab which is located on Vincennes University’s main campus in the Indiana Center of Applied Technology building (ICAT). The lab consists of 20 Industrial sized ABB robots, 3 full size HAAS CNC machines, 4 AC/DC Electrical Systems trainers, 4 Electric Motor Control trainers, 4 PLC trainers (digital, analog, DeviceNet, EtherNet), 4 Electronic Sensor trainers, 4 AC Electronic Drive trainers, 4 Mechatronics trainers, 4 Hydraulic and Pneumatic trainers, 1 HVAC trainer, and 4 Mechanical Drives trainers.

Tuition and Fees:

The tuition cost of the 16 week program is \$8,000. Book fees will be an additional \$975. (longer or shorter programs as dictated by HFO’s would be adjusted accordingly, roughly \$500 per week)

Industrial Maintenance Lecture/Lab 7:30AM - 4:00PM M-F (includes 1 hr. break for lunch)

Project/Programming/Study Lab 37.5 hrs/week

Total Training hours

16 weeks X 5 days/week X 7.5 hours/day = 600 hours, minus 4 holidays (30 hrs.) = 570 hours

Implementation

The first Advanced Manufacturing Machinery Technician NOW program began October 27, 2014 and will run 2-3 times per year based on student volume. Contact the Director or Instructor below for the dates of the next class. Class size will be limited to 8 students per class to allow no more than two students per trainer. A minimum class size of 4 students is required to hold a class.

Placement:

Vincennes University will use its own resources along with Save Our Veterans, Operation: Job Ready Veterans, WorkOne in Indiana, and its counterpart one-stop employment centers in other states, and through industry partners, along with multimedia contact. Ideally, companies will be involved in the candidate selection process from the beginning.

Textbook(s):

78 Amatrol Learning Activity Packets
ABB IRC5 Robot Manuals

For more information, contact:

Jerry Ruble

**Director, Industrial Maintenance and ABB Robotics Training
Indiana Center for Applied Technology (ICAT), Room 105
Vincennes University**

Email: jruble@vinu.edu

phone: 812-888-4346

cell: 812-890-6702

Hubie Holland

**Instructor, Industrial Maintenance Training
Indiana Center for Applied Technology (ICAT), Room 105
Vincennes University**

Email: hholland@vinu.edu

phone: 812-888-4413

cell: 812-259-1148

COURSE OVERVIEW:

SECTION 1 – (7.5 clock hours total)
Introduction to Industrial Maintenance/Technician

SECTION 2 – (included in section 3 - 14)
Workplace safety, measuring and math (to be incorporated into each section as needed)

SECTION 3* – (30 clock hours total)
AC and DC Electricity

SECTION 4* – (45 clock hours total)
Electric Motor Control

SECTION 5* – (7.5 clock hours total)
Electronic Sensors

SECTION 6* – (60 clock hours total)
Mastering Programmable Logic Controllers (PLC's)

SECTION 7* – (18.75 clock hours total)
PLC Analog Application

SECTION 8* – (15 clock hours total)
PanelView Operator Interface

SECTION 9* – (15 clock hours total)
DeviceNet – ControlLogix

SECTION 10* – (37.5 clock hours total)
AC Electronic Drives

SECTION 11* – (48.75 clock hours total)
Mechanical Drives

SECTION 12* – (48.75 clock hours total)
Hydraulics

SECTION 13* – (45 clock hours total)
Pneumatics

SECTION 14* – (___ clock hours total)
HAAS Specific Training- hours dependent on subjects)

SECTION 15* – (45 clock hours total)
Robotic Training

SECTION 16 – (37.5 clock hours total)
Review, Projects, Testing

COURSE OUTLINE:

Basic Industrial Maintenance Practices

Introduction to maintenance, repair and troubleshooting industrial equipment as well as safety, careers, workplace skills, technical math, measuring and monitoring systems.

Exploration of the basic electrical components using AC and DC electricity, designs for motor control systems, PLC programming, fluid power and mechanical systems.

Introductions to lathes, mills, robots and machine control systems. Hands-on learning and practical application will account for 50% of training time. Safety, schematic print reading, troubleshooting skills and problem solving are heavily emphasized throughout the training.

SECTION 1 – (7.5 clock hours total)

Introduction to Industrial Maintenance/Technician

Unit 1 – Introduction to Industrial Maintenance (3 hours)

Introduction

Industrial Maintenance Defined

The role of maintenance

Common manufacturing machines

Unit 2 – Careers in Industrial Maintenance/Technician (1 hours)

Introduction

Modern maintenance and technician careers

Unit 3 – Workplace Skills – (3.5 hours)

Introduction

Personal Skills

Technical Skills

Training opportunities

Job Seeking

SECTION 2 – (included in sections 3 - 14)

Workplace safety, measuring and math

General safety guidelines

Clothing in a manufacturing/industrial environment

Personal Protective Equipment (PPE)

Housekeeping (5S)

Guards and barriers

Handling and lifting

Compressed air/hydraulic pressure safety

Lock out Tag out (LOTO)

Hazardous Materials

Fire Safety

Safety documentation

Measurement Systems and Math

Introduction

Measurement systems for maintenance and technicians

Math for maintenance and technicians

Measurement

Rules
Tape measures
Straight edges
Scales
Calipers
Micrometers
Dial Indicators
Pin gauges

Quality Systems

Quality systems
Quality control
Role of maintenance/technicians in quality

SECTION 3 – (30 clock hours total)

AC and DC Electricity

Unit 1 – Basic Electrical Circuits - (4.5 hours)

Fundamentals of Electricity
Electrical Circuit Components
Manual Input Devices
Output Device

Unit 2 – Electrical Measurements - (5 hours)

Voltage Measurements
Introduction to Series and Parallel Circuits
Current Measurements
Resistance Measurements

Unit 3 – Circuit Analysis – (5 hours)

Power in Series Circuits
Power in Parallel Circuits
Circuit Protection Devices

Unit 4 – Inductance and Capacitance – (5.5 hours)

Electromagnetism
Inductance
Capacitance
Characteristics of Capacitance
Inductor and Capacitance Applications

Unit 5 – Combination Circuits – (5.5 hours)

Characteristics
Lighting Circuits
Voltage Dividers
Troubleshooting

Unit 6 – Transformers – (4.5 hours)

Introduction
Sizing a transformer
Transformer types

SECTION 4 – (45 clock hours total)

Electric Motor Control

Unit 1 – Introduction to Electric Motor Control - (4.5 hours)

Electrical Safety
Three phase power
Disconnects and Protective Devices
Three Phase Motors

Unit 2 – Manual Motor Control and Overload Protection – (4.5 hours)

Manual Motor Control
Manual Motor Starter Operation
Overload Protection

Unit 3 – Control Transformers – (4.5 hours)

Introduction
Control Transformer Operation
Control Transformer Applications in Machine Control

Unit 4 – Control Ladder Logic – (4.5 hours)

Electrical Control System Basics
Ladder Diagram Basics
Logic Elements 1
Logic Elements 2

Unit 5 – Control Relays and Motor Starters – (4.5 hours)

Control Relays
Magnetic Motor Starters
Two-wire Control
Three-wire Start/stop Control

Unit 6 – Introduction to Troubleshooting - (4.5 hours)

Introduction to Troubleshooting
Control Component Troubleshooting
Motor Starter Troubleshooting
Power Component Troubleshooting

Unit 7 – Systems Troubleshooting - (4.5 hours)

Test Equipment for Troubleshooting
Introduction to Systems Troubleshooting
Systems Troubleshooting Methods
Troubleshooting Applications

Unit 8 – Reversing Motor Control - (4.5 hours)

Manual Motor Reversing
Reversing Magnetic Motor Starter
Interlocking for Reversing Motor Control
Modes of Operation
Hand-Off-Auto Control

Unit 9 – Automatic Input Devices - (4.5 hours)

Limit Switches
Float Switches
Pressure Switches
Sequence Control

Unit 10 – Basic Timer Control - (4.5 hours)

On-Delay Timers
Off-Delay Timers
Troubleshooting

SECTION 5 – (7.5 clock hours total)

Electronic Sensors

Unit 1 – Introduction to Electronic Sensors - (3.5 hours)

Introduction to Electronic Sensors
Inductive Sensors
Capacitive Sensors

Unit 2 – Electronic Sensor Applications - (4 hours)

Magnetic Reed Sensors
Hall Effect Sensors
Photoelectric Sensors
Sensor Applications

SECTION 6 – (60 clock hours total)

Mastering Programmable Logic Controllers

Unit 1 – Introduction to Programmable Controllers - (5 hours)

PLC Orientation
PLC Operation
PLC Programming Languages

Unit 2 – Basic PLC Programming - (5 hours)

PLC Program Instructions
Numbering Systems
Project Creation and Organization
Programming Software

Unit 3 – PLC Motor Control - (5 hours)

PLC Program Analysis
Motor Control Basics
Seal-In Program Logic
Data Types and User Defined Tags
Interlock Functions

Unit 4 – Discrete I/O Interfacing - (5 hours)

Basic Input Interfacing
Basic Output Interfacing
Electronic Device Interfacing

Unit 5 – PLC Timer Instructions - (5 hours)

Retentive Timer Instructions
Non Retentive Timer Instructions
Time Driven Sequencing and Applications

Unit 6 – PLC Counter Instructions - (5 hours)

Count Up Instruction
Count Down Instruction
BCD Thumbwheel Switches
LED Displays

Unit 7 – Introduction to PLC Troubleshooting - (5 hours)

PLC Troubleshooting
Power Supply Troubleshooting
Input Troubleshooting
Output Troubleshooting

Unit 8 – PLC Systems Troubleshooting - (5 hours)

Processor Troubleshooting
Systems Troubleshooting Techniques
Program Documentation

Unit 9 – Event Sequencing - (5 hours)

Introduction to Event Sequencing
Continuous Cycle Logic
Multiple Actuator Event Sequencing

Unit 10 – Application Development - (5 hours)

Program Development
Modes of Operation
Stop Functions
Timers and Counters Applications

Unit 11 – Process Control Instructions - (5 hours)

Program Initialization
Master Control Reset
Subroutines
Jump and Label Instructions

Unit 12 – Math and Database Instructions - (5 hours)

Add Instruction
Subtract Instruction
Multiply and Divide Instructions
Move Instructions

SECTION 7 – (18.75 clock hours total)

PLC Analog Application

Unit 1 – Analog Input Modules - (5 hours)

Sensors
Module Installation
Module Operation
Editing Analog Input Configuration

Unit 2 – Analog Input Configuration and Troubleshooting - (4.5 hours)

Comparison Instructions
ON/OFF Control Using Analog Inputs
Analog Input Alarms and Status
Troubleshooting Analog Input Modules

Unit 3 – Analog Output Modules - (4.75 hours)

Analog Output Devices
Module Installation
Module Operation
Output Tag Structure

Unit 4 – Analog Output Configuration and Troubleshooting - (4.5 hours)

Module Configuration
Wireoff Fault Bits
Troubleshooting Analog Output Modules

SECTION 8 – (15 clock hours total)

PanelView Operator Interface

Unit 1 – Introduction to PanelView Plus - (5 hours)

PanelView Plus Construction
PanelView Plus Configuration
FactoryTalk View Studio – Machine Edition
PanelView Plus Application Transfer

Unit 2 – PanelView Plus Application Editing I - (5 hours)

Tags and Communications
Studio-Me Software Operation
Application Displays
Input and Output Objects

Unit 3 – PanelView Plus Application Editing II - (5 hours)

Numeric Input and Output
Editing Studio-Me Displays
Local Messages
Alarms, Diagnostic and Information Messages

SECTION 9 – (15 clock hours total)

DeviceNet - ControlLogix

Unit 1 – Industrial Communications Networks - (5 hours)

Network Operation
Installation
Module Configuration
Ethernet/IP Configuration

Unit 2 – DeviceNet I/O - (5 hours)

RSNetWorx for DeviceNet
Downloading and the EDS Wizard
Node Commissioning and Online Configuration

Unit 3 – DeviceNet Troubleshooting - (5 hours)

DeviceNet Tags
Introduction to DeviceNet Troubleshooting
Intermittent and Multi-node Troubleshooting

SECTION 10 – (37.5 clock hours total)

AC Electronic Drives

Unit 1 – Introduction to AC Drives - (5 hours)

Variable Frequency Drives
Drive Categories and Levels
The Allen-Bradley PowerFlex 70 Drive
PowerFlex 70 Drive Configuration

Unit 2 – Configuring A-B PowerFlex 70 Drives - (5 hours)

PowerFlex 70 Drive Parameter Organization
Configuring and Tuning PowerFlex 70 Drive
Monitoring Drive Parameters

Unit 3 – A-B PowerFlex 70 Control Parameters - (5 hours)

PowerFlex 70 Motor Control Parameters
PowerFlex 70 Speed Command Parameters
PowerFlex 70 Dynamic Control Parameters
PowerFlex 70 Input and Output Parameters

Unit 4 – Communications and Diagnostics for A-B PowerFlex 70 Drives - (4.5 hours)

Utility Parameters
PowerFlex 70 Communications
Power and Diagnostic Parameters

Unit 5 – Troubleshooting A-B PowerFlex 70 Drives- (4.5 hours)

Drive Faults
VFD Troubleshooting
Troubleshooting Inputs

Unit 6 – Configuring and Troubleshooting A-B PowerFlex 40 Drive- (4.5 hours)

General Purpose AC Drive Fundamentals
Acceleration and Deceleration Control
Torque Control
Stop Modes
General Purpose AC Drives Troubleshooting

Unit 7 – Configuring and Troubleshooting Servo Drives- (4.5 hours)

Basic AC Servo Drive Components
AC Servo Feedback
AC Drive Tuning
AC Servo Drive Troubleshooting

SECTION 11 – (48.75 clock hours total)

Mechanical Drives

Unit 1 – Introduction to Mechanical Drive Systems - (4.5 hours)

Mechanical Power Transmission Safety
Machine Installation
Motor Mounting
Shaft Speed Measurement

Unit 2 – Key Fasteners - (4.5 hours)

Keyseat Fasteners
Key Assembly
Torque and Power Measurement
Mechanical Efficiency

Unit 3 – Power Transmission Systems - (4.5 hours)

Introduction to Shafts
Introduction to Bearings
Introduction to Couplings
Shaft Alignment

Unit 4 – Introduction to V Belt Drives - (4.5 hours)

Belt Drive Concepts
V-Belt Operation
Belt Tensioning
Belt Tension Measurement

Unit 5 – Introduction to Chain Drives - (4.5 hours)

Chain Drive Concepts
Chain Drive Operation
Chain Tensioning
Chain Tension Measurement
Fixed Center Chain Installation

Unit 6 – Spur Gear Drives - (4.5 hours)

Spur Gear Concepts
Gear Drive Designs
Spur Gear Operation
Spur Gear Installation
Spur Gear Analysis

Unit 7 – Multiple Shaft Drives - (4.5 hours)

Multiple Shaft Gear Analysis
Multiple Shaft Drive Installation
Sleeve Couplings

Unit 8 – Brakes and Clutches - (4.5 hours)

Brake and Clutch Concepts
Brakes
Friction Clutches
Cam Clutches

Unit 9 – Brake/Clutch Selection and Maintenance - (4.25 hours)

Brake/Clutch Combinations
Brake and Clutch Selection
Brake and Clutch Maintenance

Unit 10 – Linear Ball Bushings - (4.25 hours)

Linear Drives
Linear Ball Bushing Applications
Linear Ball Bushing Maintenance and Selection

Unit 11 – Ball Screw Drives - (4.25 hours)

Ball Screw Operation
Ball Screw Applications
Ball Screw Identification
Ball Screw Selection and Maintenance

SECTION 12 – (48.75 clock hours total)

Hydraulics

Unit 1 – Hydraulic Power Systems - (4.5 hours)

Introduction to Hydraulics
Power Unit Operation
Circuit Connections
Basic Cylinder Circuits

Unit 2 – Basic Hydraulic Circuits - (4.5 hours)

Pumps
Needle Valves
Basic Motor Circuits
Hydraulic Schematics

Unit 3 – Principles of Hydraulic Pressure and Flow - (4.75 hours)

Pressure VS. Cylinder Force
Hydraulic Leverage
Fluid Friction
Absolute VS. Gauge Pressure

Unit 4 – Hydraulic Speed Control - (5 hours)

Relief Valves
Check Valves
Flow Control Valves
Meter-In and Meter-Out Circuits
Flow Control Circuit Design
Flow Rate VS. Cylinder Speed

Unit 5 – Pressure Control Circuits - (5 hours)

Sequence Valves
Sequence Valve Application
Pressure Reducing Valves
Pressure Reducing Valves Applications

Unit 6 – Hydraulic DCV Applications - (5 hours)

Overview of the DCV
Two-Position DCV's
Pilot Operated DCV's
Cam Operated DCV's

Unit 7 – Hydraulic Cylinder Applications - (5 hours)

Cylinder Types
Regeneration Circuits
Pressure Compensated Flow Control Valves
Synchronization Circuits

Unit 8 – Hydraulic Relief Valve Operation - (5 hours)

Pilot Operated Relief Valve Operation
Pump Unloading Applications
Remote Pressure Control

Unit 9 – Hydraulic Check Valve Applications - (5 hours)

Pressure Port Check Valve Circuit
Pilot Operated Check Valves
Pilot Operated Check Valve Applications
Pilot Operated Check Valve Circuit Design

Unit 10 – Accumulator Applications - (5 hours)

Accumulator Operation
Accumulator Circuits
Accumulator Applications
Accumulator Sizing

SECTION 13 – (45 clock hours total)

Pneumatics

Unit 1 – Pneumatic Power Systems - (4.5 hours)

Introduction to Pneumatics

Pneumatics Power

Circuit Connections

Basic Cylinder Circuits

Unit 2 – Basic Pneumatic Circuits - (4.5 hours)

Single Acting Cylinder Circuits

Basic Motor Circuits

Pneumatic Schematics

Unit 3 – Principles of Pneumatic Pressure and Flow - (4.5 hours)

Pressure VS. Cylinder Force

Pneumatic Leverage

Pressure and Volume

Air Flow and Resistance

Unit 4 – Pneumatic Speed Control Circuits- (4.5 hours)

Air Flow Control and Measurement

Flow Control Valves

Speed Control

Unit 5 – Pneumatic DCV Operations - (4.5 hours)

Cam Valves

Cam Valve Applications

Two Way Valves

Unit 6 – Air Logic - (4.5 hours)

Externally Piloted Valves

Introduction to Air Logic

Air Logic Design

Unit 7 – Pneumatic Maintenance - (4.5 hours)

Air Filtration

Water Removal

Lubrication

Servicing Pneumatic Components

Unit 8 – Moving Loads Pneumatically - (4.5 hours)

Pneumatic Cylinder Loads

Cylinder Applications

Component Sizing

Pneumatic Motor Loads

Air Bearings

Unit 9 – Vacuum Systems - (4.5 hours)

Vacuum Gauges

Manometers

Vacuum Generators

Vacuum Applications

Unit 10 – Air Compressors - (4.5 hours)

Compressor Types
Reciprocating Compressor Systems
Compressor Flow Concepts
Compressor Performance

SECTION 14 – (___ clock hours total)

HAAS Specific Training

Unit 1 – Introduction to CNC Machines - (3 hours)

Introduction to CNC Machines
Vertical Machines
Horizontal Machines
Lathes

Unit 2 – HAAS Control System Overview - (4.5 hours)

DC Bus
Printed Circuit Boards
Control Panel
Drive Systems

Unit 3 – Installation and Setup - (15 hours)

Leveling
Squaring Table
Column Alignment
Spindle Sweep

Unit 4 – Basic Mill Programming and Operation - (18.75 hours)

Job Planning, Bench work and Layout
CNC Basics
CNC Programming
CNC Setup and Operation
CAD/CAM

Unit 5 – Basic Lathe Programming and Operation - (18.75 hours)

Job Planning, Bench work and Layout
CNC Basics
CNC Programming
CNC Setup and Operation
CAD/CAM

Unit 7 – Introduction to Ballbar Testing - (8 hours)

Introduction to BallBar
360 degree Testing
220 degree Partial Arc Testing
Data Analysis

Unit 8 – Maintenance and Troubleshooting- (7.5 hours)

Coolant
Automatic Tool Changers and Turrets
ESD and PCB's
Transformers
DC Bus
Machine Grounding
Hydraulic and Pneumatic Systems

Automatic Lubrication System
Daily, Weekly, Monthly PM's

Unit 8 – HAAS proprietary training - (___ hours)

HFO can request trainer from HAAS to teach this portion of class in Vincennes or ask HAAS to send training information to Vincennes University for specific training.

SECTION 15 – (45 clock hours total)

Robotic Training

Unit 1 – Work Cell and Robot Safety - (2 hours)

Work Cell Safety
Emergency Stops
Safeguard Stops
Limiting the Workspace
Electrical Safety

Unit 2 – Robot Components - (2 hours)

What is a Robot?
Manipulator
Controller
Human Machine Interface
Cables

Unit 3 – Software Menus - (8 hours)

QuickSet Menu
ABB Menu
Status Bar
Operator View
Memory

Unit 4 – Coordinate Systems - (4 hours)

Introduction to Coordinate Systems
Base Coordinate System
World Coordinate System
Tool Coordinate System
Work Object Coordinate System

Unit 5 – Faults and Recovery - (4 hours)

Event Logs
Recovery
Backup and Restore
Creating Systems
Revolution Counter
Calibration

Unit 6 – Robot Control Electrical System - (8 hours)

Computer
Power Supplies
Panel (Safety) Board
Contact Board
Axis Computer
Serial Measurement Board
Drive System
Motors/Resolvers

Unit 7 – Programming - (12 hours)

Loading, Editing and Creating Programs
Move Commands
Input/Output Commands
Decision Making Instructions
Program Flow

SECTION 16 – (37.5 clock hours total)

Review, Projects, Testing

Unit 1 – Projects/Mechatronics - (15 hours)

Designing, Wiring, Troubleshooting Motor Control Systems
Designing, Plumbing, Troubleshooting Fluid Power Systems
Designing, Tuning, Troubleshooting Robotic Cell Systems

Unit 2 – Review - (15 hours)

Electrical
Electrical Motor Control
Electronic Sensors
PLC's
Fluid Power
Robotics
CNC Machines

Unit 3 – Testing - (7.5 hours)

Electrical
Electrical Motor Control
Electronic Sensors
PLC's
Fluid Power
Robotics
CNC Machines