PTE #

Automated Manufacturing Guide

Idaho Division of Professional Technical Education

650 West State Street

Boise Idaho 83720

2008

Automated Manufacturing Level I

TI 1004 - Automated Manufacturing Level I
Introductory course in a three course program leading to industry certification in automated manufacturing. Course includes measurement, safety, and circuit diagrams as they relate to automated manufacturing controls. Course includes theory and laboratory practice in CNC milling, Computer Aided Design (CAD), and Computer Aided Manufacturing (CAM) concepts. Introduction to laser and plasma manufacturing devices.

Min Length - 180 hrs.

Outcomes

Given the proper tools, the student will demonstrate understanding and skill related to measurement and quality control.

Objectives:

- Demonstrate understanding of accuracy, precision, and measurement tools.
- Demonstrate an understanding of units of measurement and metric conversion.
- Demonstrate an understanding of fractions, decimals, and the effect of rounding.
- Demonstrate the ability to properly use scaled measurement tools.
- Demonstrate the ability to properly use vernier, dial, and digital calipers.
- Demonstrate the ability to properly use micrometers.
- Demonstrate the ability to properly use height gages and dial indicators.
- Demonstrate the ability to properly use fixed gages.
- Demonstrate the ability to properly use transfer measurement tools.
- Demonstrate an understanding of statistical analysis.
- Demonstrate an understanding of nominal dimensions and tolerance.
- Demonstrate an understanding of statistical process control.
- Demonstrate the ability to properly conduct parts inspection and to complete inspection reports.

The student will demonstrate a thorough understanding of the principles of mechanisms.

Objectives:

- Demonstrate an understanding of levers.
- Demonstrate an understanding of inclined planes.
- Demonstrate an understanding of screws.
- Demonstrate an understanding of wheels and axles.
- Demonstrate an understanding of pulleys.
- Demonstrate an understanding of gears.
- Demonstrate an understanding of gear trains.
- Demonstrate an understanding of chain and sprocket drives.
- Demonstrate an understanding of stepped pulleys and belts.
- Demonstrate an understanding of black and tackle systems.
- Demonstrate an understanding of cams.
- Demonstrate an understanding of linkages.
- Demonstrate an understanding of friction.
- Demonstrate an understanding of kinetic and potential energy.
- Demonstrate an understanding of drive train speed ratios.

Given the proper tools the student will demonstrate the knowledge and ability to skillfully operate the Computer Numeric Controlled (CNC) Mill.

Objectives:

- Demonstrate an understanding of the control program.
- Demonstrate knowledge and the ability to properly mount stock.

- Demonstrate a thorough understanding of tooling.
- Demonstrate an understanding of home positions.
- Demonstrate the ability to properly select an NC (numeric code) program.
- Demonstrate the ability to verify and dry run the program.
- Demonstrate the ability to run the NC program.
- Demonstrate an understanding of NC programming.
- Demonstrate an understanding of coordinate systems.
- Demonstrate the ability to develop an NC program.
- Demonstrate the ability to edit an NC program.
- Demonstrate the ability to verify and run an NC program.

Automated Manufacturing Level II

TI 1005 - Automated Manufacturing Level II
Second course in a three course program leading to industry certification in automated manufacturing. Continued work in measurement, safety, circuit diagrams, and CNC milling. Overview of electronics as it relates to sensors, servos, solenoids, and other automated manufacturing controls. Overview of automated manufacturing using 3-D pick and place technology, articulated arm robotics, conveyors, and materials handling. Course will emphasize limits of precision and accuracy, stepper motor control, and connectivity with other computerized manufacturing operations. Overview of pneumatics and hydraulics used to control

manufacturing processes. Includes air theory, hydraulic theory, pneumatic/hydraulic circuit diagrams and components, PLC control, and circuit simulation.

Min Length - 180 hrs.

Outcomes

Given the proper tools and test equipment the student will demonstrate an understanding of sensors and their applications.

Objectives:

- Demonstrate an understanding of contact sensors.
- Demonstrate an understanding of digital light sensors.
- Demonstrate an understanding of analog light sensors.
- Demonstrate an understanding of reed switch sensors.
- Demonstrate a knowledge of logic AND circuits.
- Demonstrate a knowledge of logic OR circuits.
- Demonstrate an understanding of relays: logic NOT circuits.
- Demonstrate an understanding of inductive proximity sensors.
- Demonstrate an understanding of pressure sensors.
- Demonstrate an understanding of on-off control systems.
- Demonstrate knowledge of how optic fiber is used as a conductor.
- Demonstrate an understanding of control circuit design.

Given the proper tools and test equipment the student will demonstrate an understanding of pneumatics.

Objectives:

- Demonstrate an understanding of atmospheric pressure and vacuum.
- Demonstrate an understanding of how atmospheric pressure and vacuum are related to mechanical work.
- Demonstrate an understanding of the double-acting cylinder and pneumatic system design.
- Demonstrate an understanding of the operation of push button valves.
- Demonstrate the ability to control a piston with push button valves.
- Demonstrate the ability to operate the 5/2 air-operated, air-returned valve.
- Demonstrate knowledge of the operation of the 5/2 valve.
- Demonstrate knowledge of the law of gases.
- Demonstrate the ability to operate the air-operated, spring-returned valve.
- Demonstrate knowledge of the operation of the 3/2 roller valve.

Given the proper tools and test equipment the student will demonstrate an understanding of the principles of electricity and electronics.

Objectives:

- Demonstrate an understanding of the theory of magnetism.

- Demonstrate an understanding of the theory of electromagnetism.
- Demonstrate an understanding of electrical power supplies.
- Demonstrate an understanding of electrical instrumentation.
- Demonstrate an understanding of output devices.
- Demonstrate an understanding of control devices.
- Demonstrate an understanding of circuit protection.
- Demonstrate an understanding of electrical conditioners.
- Demonstrate knowledge and the ability to find specific circuit values in series circuits.
- Demonstrate knowledge and the ability to find specific circuit values in parallel circuits.
- Understand the operation and application of logic gates.
- Demonstrate to apply Ohm's Law to circuit behavior.
- Demonstrate an understanding of capacitance.
- Demonstrate an understanding of reactance.
- Demonstrate an understanding of the relationship between force, work, and power.

Given the proper tools and test equipment the student will demonstrate an understanding of hydraulics.

Objectives:

- Demonstrate an understanding of pressure and force.
- Demonstrate an understanding of hydraulic power transmission and circuits.
- Demonstrate an understanding of hydraulic power sources.
- Demonstrate the ability to determine hydraulic component characteristics.
- Demonstrate knowledge and the ability to control the hydraulic flow rate.
- Demonstrate knowledge of the operation of the flow control valve.
- Demonstrate knowledge of the construction and function of the 4/3 closed center valve.
- Demonstrate knowledge of power transformation using a double-acting cylinder.
- Demonstrate the ability to control the piston location.

Automated Manufacturing Level III

TI 1006 - Automated Manufacturing Level III
Third course in a three course program leading to industry certification in automated manufacturing. Continued work in measurement, safety, circuit diagrams, CNC milling, pneumatics, and hydraulics. Course includes theory and laboratory practice in CNC lathe and robotic welding. A senior project that combines all automated manufacturing processes learned to-date will be undertaken.

Min Length - 180 hrs.

Outcomes

Given the proper tools the student will demonstrate the knowledge and ability to skillfully operate robotics and materials handling equipment.

Objectives:

- Demonstrate an understanding of homing and moving the robot.
- Demonstrate an understanding of recording robot positions.
- Demonstrate the ability to write and run robot programs.
- Demonstrate the ability to write pick and place programs.
- Demonstrate an understanding of inputs and program jumps.
- Demonstrate an understanding of program outputs.
- Demonstrate an understanding of XYZ coordinate systems.
- Demonstrate an understanding of relative positions.
- Demonstrate an understanding of program loops.
- Demonstrate an understanding of program subroutines.
- Demonstrate an understanding of contact and non-contact sensors.
- Demonstrate the ability to properly and safely operate the conveyor.

Given the proper tools the student will demonstrate the knowledge and ability to skillfully operate the Computer Numeric Controlled (CNC) Lathe.

Objectives:

- Demonstrate an understanding of the control program.
- Demonstrate the ability to properly mount CNC Lathe tools.
- Demonstrate the ability to properly initialize the tool turret.
- Demonstrate an understanding of reference positions.
- Demonstrate the ability to properly select the NC (numeric code) program.
- Demonstrate the ability to run the NC program.
- Demonstrate the ability to properly write NC programming.
- Demonstrate an understanding of coordinate systems.
- Demonstrate the ability to develop NC programs.
- Demonstrate the ability to edit NC programs.
- Demonstrate the ability to verify and run NC programs.

Given the proper tools the student will demonstrate the knowledge and ability to skillfully operate the Robotic Welder.

Objectives:

- Demonstrate an understanding and ability to control and program the robot.
- Demonstrate the ability to properly mount the stock.
- Demonstrate knowledge and ability to adjust and control the Gas Metal Arc Welder (GMAW).
- Demonstrate an understanding of operation of the robot as a welder.

TI 9810 - Occupational & Career Experience for Automated Man

A school district, community, or industry (preferred) based work experience/internship activity organized and planned to develop advanced skills necessary to gain and maintain employment. This course may encompass a broad range of paid/unpaid work experiences related to the career objective of the student. The experience must be supervised and monitored by the teacher.

Min Length - 90 hrs.
Ibed Code - 2497

Outcomes
Given the information resources of a library, obtain and compile the information needed to seek a job.
Objectives:

- Identify the requirements for a job.
- Investigate educational opportunities.
- Investigate occupational opportunities.
- Locate resources for finding employment.
- Confer with prospective employers.
- Identify job trends.

Given appropriate information, locate a job opportunity, prepare and take an interview for it, complete the required tests, forms, and applications, and evaluate your response to the job opportunity.
Objectives:

- Locate a job opening.
- Complete a resume.
- Prepare for an interview.
- Participate in an interview.
- Complete tests required.
- Complete forms required.
- Complete an application letter.
- Complete a follow-up letter.
- Complete an acceptance letter.
- Evaluate a job offer.
- Evaluate a job rejection.

Given the assignment to explain how your capabilities make you employable, demonstrate how to match your skills and experience to a job you seek.
Objectives:

- Match your interest to job area.
- Match your aptitudes to job area.
- Verify your abilities.
- Identify your immediate work goal.

- Develop your career plan.

Given the responsibility of an employee in a new job, demonstrate your knowledge of appropriate behavior in the work place.
Objectives:

- Exhibit dependability.
- Demonstrate punctuality.
- Follow rules and regulations.
- Explain the consequences of dishonesty.
- Complete assignments accurately and on time.
- Control your emotions.
- Take responsibility for your decisions and actions.
- Take pride in your work and be a loyal worker.
- Learn to handle pressures and tensions.
- Demonstrate ability to set priorities.
- Demonstrate problem-solving skills.

Given the responsibility of an employee in a new job, demonstrate your knowledge of safety in the workplace.
Objectives:

- Comply with safety and health rules.
- Select correct tools and equipment.
- Utilize equipment correctly.
- Use appropriate action during emergencies.
- Maintain clean and orderly work area.
- Demonstrate personal hygiene and cleanliness.
- Identify and locate Material Safety Data Sheets (MSDS).

Given the responsibility to perform the duties of a new job, with a new employer, demonstrate a knowledge of the actions and behaviors which will project a business-like image.
Objectives:

- Participate in company or agency orientation.
- Demonstrate knowledge of company or agency products and services.
- Exhibit positive behavior.
- Read current job-related publications.
- Support and promote employer's company image and purpose.
- Maintain appearance to comply with company standards.

Given the responsibility to perform the duties of a new job, with a new employer, demonstrate a knowledge of how to successfully work with others.
Objectives:

- Work productively with others.

- Show empathy, respect, and support for others.
- Demonstrate procedures and assist others when necessary.
- Recognize problems and work toward their solution.
- Minimize the occurrence of problems.
- Channel your emotional reactions in positive ways.

Given the responsibility to perform the duties of a new job, with a new employer, demonstrate a knowledge of how to successfully communicate with others.
Objectives:

- Read and comprehend written communications and information.
- Use correct grammar.
- Speak effectively with others.
- Use job-related terminology.
- Listen attentively.
- Write legibly.
- Use proper telephone etiquette.
- Follow written and oral directions.
- Ask questions.
- Locate information in order to accomplish task.
- Prepare written communication.
- Utilize proper keyboarding skills.
- Utilize appropriate computer skills.

Given the responsibility to perform the duties of a new job, with a new employer, demonstrate a knowledge of how to adapt to change.
Objectives:

- Recognize the need to change.
- Demonstrate a willingness to learn.
- Demonstrate flexibility.
- Participate in continuing education.
- Seek challenge in the work place.
- Adjust goals and plans when necessary.

Given the responsibility to perform the duties of a new job, with a new employer, demonstrate a knowledge of the role of that business, its employees, and the free enterprise system.

Objectives:

- Explain the role of business in the free enterprise system.
- List the responsibilities of employees.
- Identify the responsibilities of managers and employers.
- Discuss the opportunities for business ownership or management.
- Describe the planning required to start a business.
- Discuss the importance of business meetings.