Automation and Control Technology
Mississippi Curriculum Framework

Manufacturing Technology/ Technician - CIP: 15.0613 – (Manufacturing Engineering Technology/Technician)

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The Office of Curriculum and Instruction (OCI) was founded in 2013 under the Division of Workforce, Career, and Technical Education at the Mississippi Community College Board (MCCB). The office is funded through a partnership with The Mississippi Department of Education (MDE), who serves as Mississippi's fiscal agent for state and federal Career and Technical Education (CTE) Funds. The OCI is tasked with developing statewide CTE curriculum, programming, and professional development designed to meet the local and statewide economic demand.

For information, please contact curriculum@mccb.edu

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INDUSTRY CREDENTIALS, CERTIFICATIONS, AND PROFESSIONAL LICENSURE

See the "Industry Credentials, Certifications, and Professional Licensure"
https://www.mccb.edu/assessment

INDUSTRY JOB PROJECTION DATA

A summary of occupational data is available from the Mississippi Department of Employment Security.
https://mdes.ms.gov/information-center/labor-market-information/

ARTICULATION

Check with the local community college CTE administration for articulation agreements.

DUAL ENROLLMENT

See the "Procedures Manual for Dual Enrollment and Accelerated Programs"
http://www.mississippi.edu/cjc/dual_enrollment.asp

RESEARCH ABSTRACT

In the fall of 2022, the Office of Curriculum and Instruction (OCI) met with the different industry members who made up the advisory committees for the Automation and Control program. A discussion was held to gather feedback concerning the trends and needs, both current and future, of their field. Program faculty, administrators, and industry members were consulted regarding industry workforce needs and trends. Industry advisory team members from the college involved with this program were asked to give input related to changes to be made to the curriculum framework.

REVISION HISTORY:

2011 Research and Curriculum Unit, Mississippi State University
2018 Mississippi Community College Board
2022 Mississippi Community College Board

PROGRAM DESCRIPTION

Automation and Control Technology

Automation and Control Technology is an instructional program that provides the student with technical knowledge and skills necessary for gaining employment as an automated manufacturing systems technician in maintenance diagnostics, engineering, or production in an automated manufacturing environment. The focus of this program is on electricity/electronics, fluid power, motors and controllers, programmable controls, interfacing techniques, instrumentation, and automated processes.

This curriculum is designed as a two-year technical program. Students who graduate from the program will be better prepared to continue their education in advanced engineering related fields.

SUGGESTED COURSE SEQUENCE AUTOMATION AND CONTROL

Work Ready Certificate

			SCH Breakdown			Clock Hour Breakdown	
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab
IAT 1113	Introduction to Automation and Control I	3	2	2	60	30	30
IAT 1123	Electrical Wiring for Automation Control Technology	3	2	2	60	30	30
	All other electives approved by instructor per local community college policy	9					
	Total	15					

Career Certificate Required Courses Automation and Control

			SCH Breakdown			Clock Hour Breakdown	
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab
IAT 1113	Introduction to Automation and Control I	3	2	2	60	30	30
IAT 1123	Electrical Wiring for Automation Control Technology	3	2	2	60	30	30
IAT 1133	AC/DC Circuits for Automation and Control	3	2	2	60	30	30
IAT 1143	Fluid Power for Automation and Control	3	2	2	60	30	30
IAT 1153	Motor Controls for Automation and Control	3	2	2	60	30	30
IAT 1163	Manufacturing Skills for Automation and Control	3	2	2	60	30	30
IAT 1173	Controls System I for Automation and Control	3	2	2	60	30	30
	All other electives approved by instructor per local community college policy	9					
	TOTAL	**30**					

Technical Certificate Required Courses Automation and Control

			SCH Breakdown			Clock Hour Breakdown	
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab
IAT 2113	Programmable Logic Controllers for Automation and Control	3	2	2	60	30	30
IAT 2123	Control Systems II for Automation and Control	3	2	2	60	30	30
IAT 2133	Solid State Motor Controls for Automation and Control	3	2	2	60	30	30
	All other electives approved by instructor per local community college policy	6					
	TOTAL	15					

Electives

			SCH Breakdown			Clock Hour Breakdown	
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab
SBA 1123	Fluid Power						
SSP 100(2-3)	Smart Start 101	2-3					
WBL 191(1-3) WBL 192(1-3) WBL 193(1-3) WBL 291(1-3) WBL 292(1-3) WBL 293(1-3)	Work-Based Learning	1-3			3-9		
	All other electives approved by instructor per local community college policy						

General Education Core Courses

To receive the Associate of Applied Science degree, a student must complete all of the required coursework found in the Career Certificate option, Technical certificate option, and a minimum of 15 semester hours of General Education core. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester or provided primarily within the last semester. Each community college will specify the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science degree at their college. The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) Section 9 Standard 3 of the *Principles of Accreditation: Foundations for Quality Enhancement*[1] describes the general education core.

Section 9 Standard 3:

3. The institution requires the successful completion of a general education component at the undergraduate level that

   a) is based on a coherent rationale.

   b) is a substantial component of each undergraduate degree program. For degree completion in associate programs, the component constitutes a minimum of 15 semester hours of the equivalent; for baccalaureate programs, a minimum of 30 semester hours or the equivalent.

   c) ensures breadth of knowledge. These credit hours include at least one course from each of the following areas: humanities/fine arts, social/behavioral sciences, and natural science/mathematics. These courses do not narrowly focus on those skills, techniques, and procedures specific to a particular occupation or profession.

General Education Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
	Humanities/Fine Arts	3						
	Social/Behavioral Sciences	3						
	Math/Science	3						
	Academic electives	6						
	TOTAL	**15**						

[1] Southern Association of Colleges and Schools Commission on Colleges. (2017). *The Principles of Accreditation: Foundations for Quality Enhancement*. Retrieved from http://www.sacscoc.org/2017ProposedPrinc/Proposed%20Principles%20Adopted%20by%20BOT.pdf

AUTOMATION AND CONTROL TECHNOLOGY COURSES

Course Number and Name: **Error! Bookmark not defined.**IAT 1113 Introduction to Automation and Controls I

Description: This course is designed to introduce students to the fundamental skills associated with the automation and controls industry.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Explain and demonstrate safe work practices.
- **a** Explain OSHA's role in industry safety.
- **b** Recognize hazards and risks related to manufacturing industry.
- **c** Define safe work procedures to use around electrical hazards.
- **d** Explain proper procedures for managing hazardous materials.

2. Demonstrate proper use of test equipment.
- **a** Demonstrate the use of a digital multi-meter.
- **b** Demonstrate basic usage of oscilloscope.

3. Explain a working history of automation.
- **a** Explain the development of automation in industry.
- **b** Explain trends in current industrial automation.

4. Demonstrate usage of basic technical math.
- **a** Explain the metric system and how it is used in automation industry.
- **b** Convert base numbers into engineering notation.
- **c** Use a standard ruler to measure to 1/16 of an inch.
- **d** Manipulate equations.

5. Describe various components of robotics.
- **a** Explain the axes of movements of robotic systems.
- **b** Discuss power control systems used in robotics.
- **c** Identify the work envelope for robotic machinery.

Course Number and Name: IAT 1123 Electrical Wiring for Automation and Control

Description: Basic electrical wiring for automation and controls including safety practices; installation and maintenance of raceways, conduit, and fittings; and three-phase service entrances, metering devices main panels, raceways or ducts, subpanels, feeder circuits and branch circuits according to electrical codes.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Apply general safety rules.
   a. Explain and demonstrate safety rules and regulations for working near or on load centers and safety switches.
   b. Explain and demonstrate the ability of safe lifting and work habits.
2. Install and maintain raceways, conduit, and fittings.
   a. Identify types of raceways, conduit, and fittings.
   b. Apply usage of raceways, conduit, and fittings as required by electrical codes.
   c. Demonstrate the use of mechanical and hydraulic conduit benders to make specified bends to different sizes and types of conduit.
   d. Identify other types of raceways and their associated bodies.
3. Explain different types of three-phase service entrances, metering devices, main panels, raceways or ducts, subpanels, feeder circuits, and branch circuits according to electrical codes.
   a. Explain the codes (NEC and local) for the installation of a service entrance.
   b. Explain safety cautions to be used when installing a service entrance.
   c. Construct a sketch to install a service entrance.
   d. Explain terms associated with a service entrance.
   e. Identify components of a service entrance.

Certification

NCCER Level I Instrumentation

Module 12116-14-Electrical Systems for Instrumentation
Module 12117-14-Steel piping practices

NCCER Level II Instrumentation

Module 12214-15-Raceways for Instrumentation

Course Number and Name: IAT 1133 AC/DC Circuits for Automation and Control

Description: Principles and theories with DC and AC circuits used in the automation trade. Includes the study of electronic circuits, laws and formulas, and the use of test equipment to analyze AC and DC circuits.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Explain and apply basic safety regulations which must be followed.
    a. Discuss required safety regulations for the lab and industrial settings.
    b. Discuss and apply safe working habits
    c. Demonstrate and practice general safety procedures
2. Define basic electronics terms
    a. Define terms as they apply to DC circuits, voltage, current, resistance, power, etc.
    b. Define terms as they apply to AC circuits, peak voltage, peak-to-peak voltage, Vrms, frequency, period, cycle, etc.
3. Measure values in DC and AC Circuits
    a. Apply knowledge to measure voltage, resistance, and current in DC and AC circuits
    b. Demonstrate ability to select and use various metering devices (DMM, Oscilloscope, etc.)
4. Demonstrate and apply understanding of a basic DC and AC electronic circuit
    a. Identify and determine values of resistors, capacitors, and inductors
    b. Calculate and solve for resistance, voltage, current, and power
    c. Demonstrate knowledge of schematic symbols in DC and AC
5. Analyze and evaluate parameters of series, parallel, and series parallel circuits
    a. Compute values of voltage, current, resistance, and power
    b. Measure values of voltage, current, and resistance
    c. Define and calculate voltage divider network
    d. Construct voltage divider network to achieve a desired output voltage
6. Analyze inductance and capacitance in DC and AC series and parallel circuits
    a. Calculate inductive reactance and solve for circuit values in AC circuits
    b. Calculate capacitive reactance and solve for circuit values in AC circuits
    c. Calculate values in RLC circuits
    d. Define RLC resonant and non-resonant circuits

Certification

Basic Systems Technician

Course Number and Name: IAT 1143 Fluid Power for Automation and Control

Description: This basic course provides instruction in hydraulics and pneumatics. This course covers actuators, accumulators, valves, pumps, motors, coolers, compression of air, control devices, and circuit diagrams. Emphasis is placed on the development of control circuits and troubleshooting techniques.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Define and describe basic laws governing fluids.
   a. Describe the concept of force, flow, and pressure.
   b. Analyze the relationship of force and pressure in a circuit.
   c. Explain what causes flow in a circuit.
   d. Calculate area, pressure, velocity, and rate of flow.
   e. Explain and apply the ideal gas laws, Boyle's Law and Charles' Law, in fluid systems.
2. Identify and draw symbols for hydraulics and pneumatics.
   a. Explain the logic for drawing symbols for hydraulic components.
   b. Draw individual hydraulic and pneumatic components.
3. Describe operation and nomenclature of various pumps and compressors.
   a. Analyze the operation of vane, gear, and piston pumps in hydraulics.
   b. Analyze the operation of air compressors.
4. Explain fluids as pertaining to the transmission of energy.
   a. Describe various types of hydraulic fluids.
   b. Explain the purpose of the fluid reservoir, the filtration system, and the heat exchanger in hydraulics.
   c. Explain the purpose of the receiver in pneumatics.)
   d. Explain the purpose of trio units in compressed air.
5. Describe the operation of flow, pressure, and directional control valves.
   a. Explain basic design features used in each type of control valve.
   b. Demonstrate how flow, pressure, and directional valves are used in hydraulics and pneumatics.
6. Explain the types of actuators used in pneumatics and hydraulics.
   a. List important cylinder design features.
   b. Explain basic design features of hydraulic motors and other rotary actuators.
   c. Identify common types of air motors.
7. Explain, construct, and troubleshoot various hydraulic and pneumatic circuits.
   a. Explain the purpose of a sequence circuit.
   b. Construct and troubleshoot a sequence circuit.
8. Demonstrate the use of electro-mechanical controls in hydraulic and pneumatic circuits.
   a. Explain the construction and use of solenoids in directional controls.
   b. Construct a hydraulic or pneumatic circuit that is controlled electrically.

Certification

Level 1 NCCER Instrumentation

Module 12111-14 Tubing
Module 12113-14 Hoses

Course Number and Name: IAT 1153 Motor Control for Automation and Control

Description: This course includes the installation of different motor control circuits and devices. Emphasis is placed on developing the student's ability to diagram, wire, and troubleshoot the different circuits and mechanical control devices.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Install different control circuits and devices.
   a. Diagram and wire a two-wire and three-wire motor control circuit with indicating pilot lights.
   b. Diagram, wire, and troubleshoot an on-delay and off-delay timer circuit.
   c. Diagram and wire multi-control manual station.
   d. Diagram and wire a "hands-off-automatic" control station.
   e. Diagram and wire a jog-forward/jog-reverse control.
2. Troubleshoot different control circuits and devices.
   a. Troubleshoot a two-wire and three-wire motor control circuit with indicating pilot lights.
   b. Troubleshoot an on-delay and off-delay timer circuit.
   c. Troubleshoot a multi-control manual station.
   d. Troubleshoot a "hands-off-automatic" control station.
   e. Troubleshoot a jog-forward/jog-reverse control.

Certification

Basic Systems Technician

Course Number and Name: IAT 1163 Manufacturing Skills for Automation and Control

Course Description: Manufacturing skills is the initial course designed to provide the student with the basic skills needed to be successful in a high-performance manufacturing environment. The course covers 5 major areas of knowledge that are considered critical for employment in a high-performance manufacturing company. The topics covered include: Basic Computer Literacy, Blueprint Reading, Precision Measurement, and an introduction to manufacturing improvement methods that covers Lean Manufacturing, Quick Changeover, 5S, Teamwork and Problem solving.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Apply precision measurement skills.
   a. Recognize precision measuring instruments.
   b. Demonstrate the proper use and care of precision measuring instruments.
   c. Demonstrate the ability to measure accurately with English measurement scales.
   d. Demonstrate the ability to measure accurately with metric measurement scales.
   e. Apply precision measurement devices in simulated job tasks.
2. Apply skills needed to read industrial blueprints.
   a. Read an orthographic drawing.
   b. Read various different types of drawings used in manufacturing such as isometric, auxiliary and sectional views.
   c. Determine dimensions from various mechanical drawings.
   d. Demonstrate the ability to recognize symbols used in different types of drawings.
3. Explain techniques used in high-performance manufacturing.
   a. Describe High-Performance manufacturing procedures to include:
      i. Lean manufacturing
      ii. 5S
      iii. SMED
      iv. Identifying customers and their needs
      v. Quality control
      vi. Understanding of ISO
      vii. Value stream mapping
   b. Research and present a manufacturing topic.
4. Demonstrate basic communication skills.
   a. Communicate effectively using verbal and written skills.
   b. Demonstrate teamwork and problem-solving skills.
5. Create and practice job-seeking skills.
   a. Create a resume and cover letter.
   b. Perform interviewing skills.
6. Perform basic computer literacy skills.
   a. Demonstrate how to create and save a word processing file.
   b. Create and save a spreadsheet file.
   c. Demonstrate send, receive, save and open an attachment using a personal email account.

Certification

Level 1 NCCER Instrumentation

Module 12108-14 Gaskets O-Rings and Packing
Module 12106-14 Fasteners
Module 12109-14 Lubricants, Sealants, and Cleaners
Module 12304-14 Inspect handle and store instrumentation materials

Course Number and Name: IAT 1173 Control Systems I for Automation and Control

Course Description: This is an introductory course to provide information on various instrumentation components and processes. Topics include analyzing pressure processes, temperatures, flow, and level.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Explain and apply basic safety regulations which must be followed.
    a. Discuss required safety regulations for the lab and industrial settings.
    b. Discuss and apply safe working habits.
2. Describe and interpret block diagrams, instrument tags, loop drawings, and piping and instrument diagrams (P&ID).
    a. Identify symbols associated with block diagrams, instrument tags, loop drawings, and piping and instrument diagrams (P&ID).
    b. Interpret function blocks and describe their relationship to the overall process.
3. Describe and discuss temperature measurement devices.
    a. Discuss heat transfer.
    b. Discuss temperature measurement principles.
    c. Identify devices used to measure and control temperature.
    d. Analyze and calibrate signals from temperature measurement devices.
4. Describe and discuss pressure measurement devices and their use.
    a. Identify and describe a manometer and its use.
    b. Identify and describe pressure elements and their use.
    c. Identify and describe measuring devices and their use.
    d. Analyze and calibrate pressure measurement devices.
5. Describe and discuss level measurement devices and their use.
    a. Identify and describe direct level measurement devices and their use.
    b. Identify and describe indirect level measurement devices and their use.
    c. Analyze and calibrate level measurement devices.
6. Describe flow measurement devices and their use.
    a. Identify and describe flow rate meters.
    b. Identify and describe total flow meters.
    c. Analyze and calibrate flow measurement devices.
7. Describe sensors used in process analysis.
    a. Discuss analyzers used in instrumentation.
    b. Describe and discuss analytical measurement fundamentals.
    c. Troubleshoot the various sensors.
8. Describe information transmission pertaining to process control.
    a. Discuss and describe pneumatic transmission characteristics.
    b. Explain electrical transmission characteristics.

Certification

Level 1 NCCER Instrumentation

Module 12119-14 Craft Related Mathematics
Module 12115-14 Instrumentation Safety Practices

Course Number and Name: IAT 2113 Programmable Logic Controller for Automation and Control

Course Description: This course provides instruction in the use of programmable logic controllers (PLCs) in modern industrial settings. The operating principles, installation and basic programming of PLCs will be covered.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Explain principles of PLCs.
   a. Identify components and operational principles of PLCs.
   b. Differentiate between a PLC and a computer.
2. Identify different types of PLC hardware.
   a. Identify and wire different types of input and output modules.
   b. Identify different types of PLC processor modules, memory capabilities, and programming devices.
3. Explain numbering systems, encoding/decoding, and logical operations.
   a. Convert numbers from one system to another.
   b. Explain logical operations using truth tables and ladder logic diagrams.
4. Program internal and discrete instructions.
   a. Program examine on and off instructions.
   b. Program on-delay and off-delay instructions.
   c. Program up-counter and down-counter instructions.
   d. Program sequencer instructions for real-world output devices.
   e. Program latch and unlatch instructions.
5. Troubleshoot and maintain different programmable controller systems.
   a. Identify and troubleshoot the power supply.
   b. Identify and troubleshoot the inputs and outputs (I/O) cards.
   c. Identify and troubleshoot real-world inputs and outputs.
6. Identify and demonstrate communication protocols.
   a. Serial USB and ethernet

Certification

Basic Systems Technician

Course Number and Name: IAT 2123 Control Systems II for Automation and Control

Course Description: This course is a continuation of Control Systems I with special emphasis on application of applied skills along with new skills to develop instrument process controls. The student will be given a process to develop the appropriate instruments and needed diagrams, utilizing various controlling processes and demonstrating loop troubleshooting techniques.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Identify and describe parameters and variables of an operational process control system.
   a. Discuss and explain terms associated with process control instrumentation.
   b. Explain how the terms relate to the controlled process and diagrams.
   c. Describe and demonstrate different control configurations, feed forward, and cascade.
2. Describe control valve characteristics.
   a. Explain and demonstrate fast-opening, equal-percentage, and proportional control valves.
   b. Explain control valve positioners.
   c. Discuss and demonstrate signal conversions techniques.
   d. Apply maintenance techniques involving control valves.
3. Describe various modes of process control.
   a. Discuss and demonstrate on-off control.
   b. Explain and describe proportional, integral, and derivate modes of operation.
   c. Describe and demonstrate methods for tuning different control modes.
   d. Describe characteristics of each mode of operation.
   e. Connect, tune, operate, and troubleshoot various process control configurations.
4. Describe advanced control methods.
   a. Explain a digital control system.
   b. Discuss different levels of digital control.
   c. Describe and explain the computer's role in process control.
   d. Develop sketches of various control systems.
5. Troubleshoot process control loops.
   a. Perform standard troubleshooting techniques on process control loops.
   b. Apply safe troubleshooting techniques.
   c. Demonstrate and explain integration of system drawings.

Certification

Level 1 NCCER Instrumentation

Module 12114-14 Hand and Power tool for instrumentation

Course Number and Name: IAT 2133 Solid State Motor Controls for Automation and Control

Course Description: This course provides knowledge of the principles and operation of solid state motor control, and variable frequency drives. The design, installation, and maintenance of different solid state devices for motor control will be introduced.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Apply general safety and safety requirements for working on and around electrical motors.
   a. Apply principles of safety in the use of electrical motors.
   b. Describe safety procedures to utilize during connecting and operating electric motors.
2. Troubleshoot solid state motor controls.
   a. Identify electronic and industrial symbols used to represent logic gates in solid state schematics.
   b. Describe the operation of the different types of industrial and electronic logic gates.
   c. Draw a solid state logic circuit to replace a manual control station.
   d. Troubleshoot and repair/replace solid state devices to include memory devices, flip/flops, adjustable time delays, starting and stopping sequences, and looping.
3. Operate AC and DC variable speed drives.
   a. Discuss the operation of a DC variable speed drive.
   b. Discuss the operation of an AC variable speed drive.
   c. Connect and operate a DC and AC variable speed drive.

Certification

Basic Systems Technician

Course Number and Name: IAT 291 (1-3) Special Project in Automation and Control Technology

Course Description: A course to provide students with an opportunity to utilize skills and knowledge gained in other Automation and Control Technology courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1	0	2	75
2	0	4	60
3	0	6	90

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Develop a written plan for the special project.
   a. Compile a written plan for the special project in cooperation with the instructor which details the work to be accomplished, a schedule for delivery, and specific skills/tasks to be mastered.
2. Prepare a written report of activities and accomplishments.
   a. Compile a daily log of activities and tasks.
   b. Submit weekly reports to the instructor summarizing activities and tasks completed.
   c. Submit a final report of activities and experiences.
3. Follow written guidelines for the special project.
   a. Complete all required activities in the training program.
   b. Adhere to all written and oral instructions for the special project.

Course Number and Name: IAT 292 (1-6) Supervised Work Experience in Automation and Control

Course Description: A course which is a cooperative program between industry and education and is designated to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours.

Hour Breakdown:

Semester Credit Hours	Lecture	Externship	Contact Hours
1	0	3	45
2	0	6	90
3	0	9	135
4	0	12	180
5	0	15	225
6	0	18	270

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Apply technical skills needed to be a viable member of the workforce.
   a. Prepare a description of technical skills to be developed in the supervised work experience.
   b. Develop technical skills needed to be a viable member of the workforce.
2. Apply skills developed in other program area courses.
   a. Perform skills developed in other program area courses.
3. Apply human relationship skills.
   a. Use proactive human relationship skills in the supervised work experience.
4. Apply and practice positive work habits and responsibilities.
   a. Perform assignments to develop work habits and responsibilities.
5. Work with instructor and employer to develop written occupational objectives to be accomplished.
   a. Perform written occupational objectives in the supervised work experience.
6. Assess accomplishment of objectives.
   a. Prepare daily written assessment of accomplishment of objectives.
   b. Present weekly written reports to instructor in activities performed and objectives accomplished.
7. Utilize a set of written guidelines for the supervised work experience.
   a. Develop and follow a set of written guidelines for the supervised work experience

Course Number and Name: WBL 191(1-3), WBL 192(1-3), Work-Based Learning I, II, III, IV, V, and VI , WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)

Course Description: A structured work-site learning experience in which the student, program area teacher, Work-Based Learning Coordinator, and worksite supervisor/mentor develop and implement an educational training agreement. Designed to integrate the student's academic and technical skills into a work environment. Includes regular meetings and seminars with school personnel for supplemental instruction and progress reviews. (1-3 sch: 3-9 hours externship)

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
4	2	4	90

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
   a. Apply technical skills needed to be a viable member of the workforce.
   b. Apply skills developed in other related courses in a work-based setting.
   c. Perform tasks detailed in an educational training agreement at the work setting.
2. Apply general workplace skills to include positive work habits and responsibilities necessary for successful employment.
   a. Demonstrate pro-active human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
   b. Demonstrate time, materials, and resource management skills.
   c. Demonstrate critical thinking skills such as problem solving, decision making, and reasoning.
   d. Demonstrate acquiring, evaluating, organizing, maintaining, interpreting, and communicating information.
   e. Demonstrate positive work habits and acceptance of responsibilities necessary for successful employment.

APPENDIX A: RECOMMENDED TOOLS AND EQUIPMENT

CAPITALIZED ITEMS

1. Analysis trainer (1)
2. Calibration stations (1 per 2 students)
3. Camera, video, with accessories (2)
4. Computer, notebook (for programming controls) (1)
5. Computer process control hardware (1)
6. Computer systems (1 per 2 students)
7. Conveyor system (1)
8. Dead weight tester (1)
9. Drill press, pedestal (1)
10. Educational grade robots , with end effectors (1)
11. Electromechanical trainers (1 per 3 students)
12. Flow process trainer (1)
13. Fluid power training lab trainer (1)
14. Hydraulic test kit (1)
15. Megohmmeter (1 per 3 students)
16. Mechanical training lab trainer (1)
17. Meter, noise dosimeter (1)
18. Oscilloscopes (50 Mhz dual trace) (1 per 2 students)
19. Portable calibrators (2)
20. Programmable logic controller trainers with software licenses (1 per 2 students)
21. PLC simulation software
22. Robotic arm with computer software (1)
23. Robot system (SCARA type) (1)
24. Robot arm (fully articulated with computer software and programming station) (1)
25. Robot (welding with 4-9 axes) (1)
26. Special end effectors of robots (1 per robot)
27. Temperature process trainer (1)
28. Industrial grade robots, with end effectors (1)
29. Industrial pneumatics training system (1)
30. Motor Control Station

*Other equipment items can be added when deemed appropriate by the community college industry craft committee or by industry/business training requirements.

NON-CAPITALIZED ITEMS

1. Air compressor (5 hp) (1)
2. Automatic tool change system (1)
3. Automatic storage and retrieval system (1)
4. Basic hand tools: Pliers, wire strippers, wrenches, screwdrivers, needle-nose pliers, ruler, safety glasses (20 each)
5. Caliper, digital electronic (2)
6. Current measuring devices (1 per 2 students)
7. Digital volt-ohm-meters (1)
8. Gage, electric readout force with cable (1)
9. Gage, digametic height (1)
10. Gage, set radius (1)
11. Gauging, sets (1)

12. Networked laser printers (1)
13. Level process trainer (1)
14. Meter, air velocity (1)
15. Meter, sound octave bans analyzer (1)
16. Meter, sound level calibration (1)
17. Power tools (1/2" and 3/8" drill motors) (1 each)
18. Pressure gage repair kits (1)
19. Pressure process trainer (1)
20. Rotary actuators with powered slides systems (1)
21. Safety goggles
22. Safety devices, i.e., light curtain safety mats (1 per work station)
23. Tachometers (3)
24. Temperature meters (3)
25. Tester, datacom (1)
26. Tester, checker precision cable LE (1)
27. Vacuum, shop cleaner (1)
28. Vision system (1)
29. Vision system for CIM cell (1)
30. Variable Frequency Drive (Soft start)
31. Routers
32. Switches
33. Calibers
34. Micrometers

*Other equipment items can be added when deemed appropriate by the community college industry craft committee or by industry/business training requirements.

APPENDIX B: CURRICULUM DEFINITIONS AND TERMS

- Course Name – A common name that will be used by all community colleges in reporting students

- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students

- Classification – Courses may be classified as the following:
  - Career Certificate Required Course – A required course for all students completing a career certificate.
  - Technical Certificate Required Course – A required course for all students completing a technical certificate.
  - Technical Elective – Elective courses that are available for colleges to offer to students.

- Description – A short narrative that includes the major purpose(s) of the course

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course

- Corequisites – A listing of courses that may be taken while enrolled in the course

- Student Learning Outcomes – A listing of the student outcomes (major concepts and performances) that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
-
  - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
  - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  - Activities that include integration of academic and career–technical skills and course work, school to-work transition activities, and articulation of secondary and postsecondary career–technical programs
  - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas

- Sequencing of the course within a program is left to the discretion of the local college. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors. Programs that offer an Associate of Applied Science Degree must include all of the required Career Certificate courses, Technical Certificate courses **AND** a minimum of 15 semester hours of General Education Core Courses. The courses in the General Education Core may be spaced out over the entire length of the program so that students complete some academic and Career Technical courses each semester. Each community college specifies the actual courses that are required to meet the General Education Core Requirements for the Associate of Applied Science Degree at their college.
- In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new student learning outcomes to complement the existing competencies and suggested objectives in the program framework
- Revising or extending the student learning outcomes
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

APPENDIX C: RECOMMENDED TEXTBOOK LIST

Recommended Textbook List		
Book Title	**Author(s)**	**ISBN**
Industrial Maintenance and Mechatronics	Ballee & Shearer	9781635634273
Programmable Logic Controllers	Max Rabiee	9781649259868
Fluid Power Systems 3rd edition	Patrick J. Klette	9780826933670
AC/DC Principles and Applications	Paul T. Shultz	9780826913579