



**Industrial Systems Technology/Bio-maintenance
 Credential: Associate in Applied Science Degree
 in Industrial Systems Technology/
 Bio-maintenance A502400B**

The Industrial Systems Technology/Bio-maintenance - curriculum is designed to prepare or upgrade individuals to safely service, maintain, repair and install equipment in the bioprocess industry. Instruction includes theory and skill training needed for inspecting, testing, troubleshooting and diagnosing industrial systems.

Students will learn multi-craft technical skills in blueprint reading, mechanical systems maintenance, electricity, hydraulics/pneumatics, welding, machining or fabrication, and includes various diagnostic and repair procedures. Practical application in these industrial systems will be emphasized and additional advanced course work may be offered.

Upon completion of this curriculum, graduates should be able to individually, or with a team, safely install, inspect, diagnose, repair, and maintain industrial bioprocess equipment adhering to FDA regulations. Emphasis is given to providing proper documentation and following Standard Operating Procedures. Students will also be encouraged to develop their skills as life-long learners.

Program Length: 5 semesters

Career Pathway Options: Associate in Applied Science in Industrial Systems Technology/Bio-maintenance

Program Sites:

Lee Campus - Day Program

**Course Requirements for Industrial Systems
 Technology/Bio-maintenance**

A. General Education Courses (15/16 SHC) C-L-SHC

*ENG 111	Expository Writing	3-0-3
ENG 111A	Expository Writing Lab	0-2-1
	Humanities/Fine Arts Elective	3-0-3
MAT 115	Mathematical Models	2-2-3
	Or	
PHY 121	Applied Physics I	3-2-4
	Social/Behavioral Science Elective	3-0-3

Communications Elective (select 3 SHC)

ENG 112	Argument-Based Research	3-0-3
ENG 113	Literature-Based Research	3-0-3
ENG 114	Prof Research & Reporting	3-0-3
ENG 116	Technical Report Writing	3-0-3

B. Required Major Core Courses (18/19 SHC)

BPR 111	Blueprint Reading	1-2-2
ELC 112	DC/AC Electricity	3-6-5
HYD 110	Hydraulics/Pneumatics	2-3-3
ISC 110	Workplace Safety	1-0-1
	Or	
ISC 112	Industrial Safety	2-0-2
MEC 111	Machine Processes I	1-4-3

MNT 110	Introduction to Maintenance Procedures	1-3-2
WLD 112	Basic Welding Processes	1-3-2

C. Other Major Hours Required for Graduation (42 SHC)

AHR 120	HVACR Maintenance	1-3-2
BPM 110	Bioprocess Practices	3-4-5
BPR 115	Elc Fluid Power Diagrams	1-2-2
CIS 111	Basic PC Literacy	1-2-2
ELC 117	Motors and Controls	2-6-4
ELC 128	Introduction to PLC	2-3-3
ELC 228	PLC Applications	2-6-4
ELN 229	Industrial Electronics	3-3-4
ELN 231	Industrial Controls	2-3-3
ISC 278	cGMP Quality Systems	2-0-2
MNT 230	Pumps and Piping Systems	1-3-2
MNT 240	Industrial Equipment Troubleshooting	1-3-2
MNT 270	Bioprocess Equipment Maintenance	1-3-2
MNT 280	Bioprocess Operating Systems	1-3-2
	Technical Elective	3

Technical Electives (Choose 3 SHC)

COE 111	Co-op Work Experience I	0-10-1
COE 112	Co-op Work Experience I	0-20-2
COE 121	Co-op Work Experience II	0-10-1
MNT 111	Maintenance Practices	2-2-3

*Students may substitute ENG 110

Semester Hours Credit required for graduation: 75/77

**Semester Curriculum for Industrial Systems
 Technology/Bio-maintenance**

1st Semester (Fall)		C-L-SHC
BPR 111	Blueprint Reading	1-2-2
ELC 112	DC/AC Electricity	3-6-5
	Humanities/Fine Arts Elective	3-0-3
MEC 111	Machine Processes I	1-4-3
MNT 110	Introduction to Maintenance Procedures	1-3-2
WLD 112	Basic Welding Processes	1-3-2
		10-18-17

2nd Semester (Spring)		
BPM 110	Bioprocess Practices	3-4-5
CIS 111	Basic PC Literacy	1-2-2
ELN 229	Industrial Electronics	3-3-4
*ENG 111	Expository Writing	3-0-3
ENG 111A	Expository Writing Lab	0-2-1
MAT 115	Mathematical Models	2-2-3
	Or	
PHY 121	Applied Physics I	3-2-4
		12/13-13-18/19

3rd Semester (Summer)		
AHR 120	HVACR Maintenance	1-3-2
BPR 115	Electric/Fluid Power Diagrams	1-2-2
HYD 110	Hydraulics/Pneumatics	2-3-3
ISC 110	Workplace Safety	1-0-1
	Or	
ISC 112	Industrial Safety	2-0-2
	Technical Elective	3
		5/6-8-11/12

4th Semester (Fall)		
ELC 117	Motors and Controls	2-6-4
ELC 128	Introduction to PLC	2-3-3
	Communications Elective	3-0-3
ISC 278	cGMP Quality Systems	2-0-2
MNT 230	Pumps and Piping Systems	1-3-2
		10-12-14

5th Semester (Spring)

ELC 228	PLC Applications	2-6-4
ELN 231	Industrial Controls	2-3-3
MNT 240	Industrial Equipment Troubleshooting	1-3-2
MNT 270	Bioprocess Equipment Maintenance	1-3-2
MNT 280	Bioprocess Operating Systems	1-3-2
	Social/Behavioral Science Elective	<u>3-0-3</u>
		10-18-16

Total Semester Hours Credit: 75/77

COURSE DESCRIPTIONS

AHR 120 HVACR Maintenance 1-3-2

This course introduces the basic principles of industrial air conditioning and heating systems. Emphasis is placed on preventive maintenance procedures for heating and cooling equipment and related components. Upon completion, students should be able to perform routine preventive maintenance tasks, maintain records, and assist in routine equipment repairs.

BPM 110 Bioprocess Practices 3-4-5

This course provides a study of plant operations including various plant utility systems and detailed study of the varied plant environments in a bioprocessing facility. Emphasis is placed on quality mindset and principles of validation through applications of monitoring procedures. Upon completion, students should be able to demonstrate the rigors of industry regulation and its necessity.

BPR 111 Blueprint Reading 1-2-2

This course introduces the basic principles of blueprint reading. Topics include line types, orthographic projections, dimensioning methods, and notes. Upon completion, students should be able to interpret basic blueprints and visualize the features of a part.

BPR 115 Elc/Fluid Power Diagrams 1-2-2

This course covers sketching of detail and assembly drawings and reading of hydraulic, pneumatic, electrical, mechanical, and piping schematics. Emphasis is placed on interpretation and communication skills utilizing sketches, symbols, diagrams, and other related topics. Upon completion, students should be able to read, demonstrate an understanding of, and draw sketches and schematics commonly used in industry.

CIS 111 Basic PC Literacy 1-2-2

This course provides an overview of computer concepts. Emphasis is placed on the use of personal computers and software applications for personal and fundamental workplace use. Upon completion, students should be able to demonstrate basic personal computer skills.

COE 111 Co-op Work Experience I 0-10-1

Prerequisite: Approval of Instructor or Department Chairperson
This course provides work experience with a college-approved employer in an area related to the student's program of study. Emphasis is placed on integrating classroom learning with related work experience. Upon completion, students should be able to evaluate career selection, demonstrate employability skills, and satisfactorily perform work-related competencies.

COE 112 Co-op Work Experience I 0-20-2

Prerequisite: Approval of Instructor or Department Chairperson
This course provides work experience with a college approved employer in an area related to the student's program of study. Emphasis is placed on integrating classroom learning with related work experience. Upon completion, students should be able to evaluate career selection, demonstrate employability skills, and satisfactorily perform work-related competencies.

COE 121 Co-op Work Experience II 0-10-1

Prerequisite: Approval of Instructor or Department Chairperson
This course provides work experience with a college-approved employer in an area related to the student's program of study. Emphasis is placed on integrating classroom learning with related work experience. Upon completion, students should be able to evaluate career selection, demonstrate employability skills, and satisfactorily perform work-related competencies.

ELC 112 DC/AC Electricity 3-6-5

This course introduces the fundamental concepts of and computations related to DC/AC electricity. Emphasis is placed on DC/AC circuits, components, operation of test equipment; and other related topics. Upon completion, students should be able to construct, verify, and analyze simple DC/AC circuits.

ELC 117 Motors and Controls 2-6-4

Prerequisites: ELC 111, ELC 112 or ELC 131
This course introduces the fundamental concepts of motors and motor controls. Topics include ladder diagrams, pilot devices, contactors, motor starters, motors, and other control devices. Upon completion, students should be able to properly select, connect, and troubleshoot motors and control circuits.

ELC 128 Introduction to PLC 2-3-3

This course introduces the programmable logic controller (PLC) and its associated applications. Topics include ladder logic diagrams, input/output modules, power supplies, surge protection, selection/installation of controllers, and interfacing of controllers with equipment. Upon completion, students should be able to install PLCs and create simple programs.

ELC 228 PLC Applications 2-6-4

Prerequisites: ELC 128
This course continues the study of the programming and applications of programmable logic controllers. Emphasis is placed on advanced programming, networking, advanced I/O modules, reading and interpreting error codes, and troubleshooting. Upon completion, students should be able to program and troubleshoot programmable logic controllers.

ELN 229 Industrial Electronics 3-3-4

Prerequisites: ELC 112, ELC 131, or ELC 140
This course covers semiconductor devices used in industrial applications. Topics include the basic theory, application, and operating characteristics of semiconductor devices (filters, rectifiers, FET, SCR, Diac, Triac, Op-amps, etc). Upon completion, students should be able to install and/or troubleshoot these devices for proper operation in an industrial electronic circuit.

ELN 231 Industrial Controls 2-3-3

Prerequisites: ELC 112, ELC 131, or ELC 140
This course introduces the fundamental concepts of solid-state control of rotating machinery and associated peripheral devices. Topics include rotating machine theory, ladder logic, electromechanical and solid state relays, motor controls, pilot devices, three-phase power systems, and other related topics. Upon completion, students should be able to interpret ladder diagrams and demonstrate an understanding of electromechanical and electronic control of rotating machinery.

ENG 110 Freshman Composition 3-0-3

Prerequisites: RED 080 and ENG 090 or appropriate placement test scores

This course is the first course in a series of two designed to develop informative and business writing skills. Emphasis is placed on logical organization of writing, including effective introductions and conclusions, precise use of grammar, and appropriate selection and use of sources. Upon completion, students should be able to produce clear, concise, well-organized short papers.

ENG 111 Expository Writing 3-0-3

Prerequisites: RED 090 and ENG 090 or appropriate placement test scores

Corequisites: ENG 111A

This course is the required first course in a series of two designed to develop the ability to produce clear expository prose. Emphasis is placed on the writing process including audience analysis, topic selection, thesis support and development, editing, and revision. Upon completion, students should be able to produce unified, coherent, well-developed essays using standard written English. This course has been approved to satisfy the Comprehensive Articulation Agreement general education core requirement in English composition.

ENG 111A Expository Writing Lab 0-2-1

Prerequisites: RED 090 and ENG 090 or appropriate placement test scores

Corequisites: ENG 111

This writing laboratory is designed to apply the skills introduced in ENG 111. Emphasis is placed on the editing and revision components of the writing process. Upon completion, students should be able to apply those skills in the production of final drafts in ENG 111. The computer is used as a writing and design tool for this course.

ENG 112 Argument-Based Research 3-0-3

Prerequisites: ENG 111

This course, the second in a series of two, introduces research techniques, documentation styles, and argumentative strategies. Emphasis is placed on analyzing data and incorporating research findings into documented argumentative essays and research projects. Upon completion, students should be able to summarize, paraphrase, interpret, and synthesize information from primary and secondary sources using standard research format and style. *This course has been approved to satisfy the Comprehensive Articulation Agreement general education core requirement in English composition. This course is also available through the Virtual Learning Community (VLC).*

ENG 113 Literature-Based Research 3-0-3

Prerequisites: ENG 111

This course, the second in a series of two, expands the concepts developed in ENG 111 by focusing on writing that involves literature-based research and documentation. Emphasis is placed on critical reading and thinking and the analysis and interpretation of prose, poetry, and drama: plot, characterization, theme, cultural context, etc. Upon completion, students should be able to construct mechanically-sound, documented essays and research papers that analyze and respond to literary works. *This course has been approved to satisfy the Comprehensive Articulation Agreement general education core requirement in English composition. This course is also available through the Virtual Learning Community (VLC).*

ENG 114 Prof. Research and Reporting 3-0-3

Prerequisites: ENG 111

This course, the second in a series of two, is designed to teach professional communication skills. Emphasis is placed on research, listening, critical reading and thinking, analysis, interpretation, and design used in oral and written presentations. Upon completion, students should be able to work individually and collaboratively to produce well-designed business and professional written and oral presentations. The computer is used as a writing and design tool for this course. This course has been approved to satisfy the Comprehensive Articulation Agreement general education core requirement in English composition.

ENG 116 Technical Report Writing 3-0-3

Prerequisites: ENG 110 or ENG 111

This course, the second in a series of two, introduces layout and design of technical reports used in business and industry. Emphasis is placed on audience analysis, data collection and analysis, technical writing style and organization, oral presentation or technical data, and the appropriate use of graphics in written and oral presentations. Upon completion, students should be able to produce written and oral reports using a variety of technical communication models.

HYD 110 Hydraulics/Pneumatics I 2-3-3

This course introduces the basic components and functions of hydraulic and pneumatic systems. Topics include standard symbols, pumps, control valves, control assemblies, actuators, FRL, maintenance procedures, and switching and control devices. Upon completion, students should be able to understand the operation of a fluid power system, including design, application, and troubleshooting.

ISC 110 Workplace Safety 1-0-1

This course introduces the basic concepts of workplace safety. Topics include fire, ladders, lifting, lock-out/tag-out, personal protective devices, and other workplace safety issues related to OSHA compliance. Upon completion, students should be able to demonstrate an understanding of the components of a safe workplace.

ISC 112 Industrial Safety 2-0-2

This course introduces the principles of industrial safety. Emphasis is placed on industrial safety, OSHA, and environmental regulations. Upon completion, students should be able to demonstrate knowledge of a safe working environment and OSHA compliance.

ISC 278 cGMP Quality Systems 2-0-2

This course focuses on the development, implementation, and on-going maintenance of a quality system in a cGMP environment. Topics include the cGMP standard, components of cGMP quality systems, quality function roles and training, development of documentation such as SOPs, and system review procedures. Upon completion, the student should be able to identify the components of a quality system and develop a quality system manual utilizing the cGMP standard.

MAT 115 Mathematical Models 2-2-3

Prerequisites: MAT 070, MAT 080, MAT 120, MAT 121, MAT 161, MAT 171, or MAT 175 or appropriate placement test scores

This course develops the ability to utilize mathematical skills and technology to solve problems at a level found in non-mathematics-intensive programs. Topics include applications to percent, ratio and proportion, formulas, statistics, functional notation, linear functions and their groups, probability, sampling techniques, scatter plots, and modeling. Upon completion, students should be able to solve practical problems, reason and communicate with mathematics, and work confidently, collaboratively, and independently.

MEC 111 Machine Processes I 1-4-3

This course introduces shop safety, hand tools, machine processes, measuring instruments, and the operation of machine shop equipment. Topics include use and care of tools, safety, measuring tools, and the basic setup and operation of common machine tools. Upon completion, students should be able to safely machine simple parts to specified tolerances.

MNT 110 Introduction to Maint Procedures 1-3-2

This course covers basic maintenance fundamentals for power transmission equipment. Topics include equipment inspection, lubrication, alignment, and other scheduled maintenance procedures. Upon completion, students should be able to demonstrate knowledge of accepted maintenance procedures and practices according to current industry standards.

MNT 111 Maintenance Practices 2-2-3

This course provides in-depth theory and practical applications relating to predictive and preventive maintenance programs. Emphasis is placed on equipment failure, maintenance management software, and techniques such as vibration and infrared analysis. Upon completion, students should be able to demonstrate an understanding of modern analytical and documentation methods.

MNT 230 Pumps and Piping Systems 1-3-2

This course covers pump installation and maintenance and related valves and piping systems. Topics include various types of pump systems and their associated valves, piping requirements, and other related topics. Upon completion, students should be able to select and install pump and piping systems and demonstrate proper maintenance and troubleshooting procedures.

MNT 240 Indust Equip Troubleshoot 1-3-2

Prerequisites: ELC 112 or ELC 131

This course covers the various service procedures, tools, instruments, and equipment necessary to analyze and repair typical industrial equipment. Emphasis is placed on electro-mechanical and fluid power equipment troubleshooting and repair, including common techniques and procedures. Upon completion, students should be able to troubleshoot and repair industrial equipment.

MNT 270 Bioprocess Equip Maint 1-3-2

Prerequisites: MNT 110

This course covers the equipment used in a bioprocess manufacturing facility and the techniques used to maintain and troubleshoot it. Topics include types of equipment, the role of equipment in the bioprocess manufacturing facility, troubleshooting bioprocess equipment, and the role of a bioprocess maintenance technician. Upon completion, students should be able to maintain and troubleshoot bioprocess equipment in a biotechnology manufacturing facility using work techniques appropriate for the biotechnology industry.

MNT 280 Bioprocess Operating Sys 1-3-2

Prerequisites: ELC 128

This course covers the specific SCADA (Supervisory Control and Data Acquisition) software used to operate bioprocess equipment in a modern biotechnology manufacturing facility. Topics include the operation, configuration, applications, and problem solving of standard bioprocess control software. Upon completion, students should be able to safely utilize bioprocess control software when required in the maintenance and operation of bioprocess equipment.

PHY 121 Applied Physics I 3-2-4

Prerequisites: MAT 060

This algebra-based course introduces fundamental physical concepts as applied to industrial and service technology fields. Topics include systems of units, problem-solving methods, graphical analyses, vectors, motion, forces, Newton's laws of motion, work, energy, power, momentum, and properties of matter. Upon completion, students should be able to demonstrate an understanding of the principles studied as applied in industrial and service fields

WLD 112 Basic Welding Processes 1-3-2

This course introduces basic welding and cutting. Emphasis is placed on beads applied with gases, mild steel fillers, and electrodes and the capillary action of solder. Upon completion, students should be able to set up welding and oxy-fuel equipment and perform welding, brazing, and soldering processes.