Process Operations Technology
Mississippi Curriculum Framework

Program CIP: 15.0699 – Industrial Production Technologies/Technicians
2021

Published by:
Mississippi Community College Board
Division of Workforce, Career, and Technical Education
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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.

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RESEARCH ABSTRACT

Process Operations Technology programs were established at the request of industries on the Mississippi Gulf Coast in response to a recognized critical need for process operations technicians in the petrochemical and power generation industries. The program was implemented in the fall semester of 2003 at the Perkinston Campus of Mississippi Gulf Coast Community College. Courses for the Mississippi Curriculum Framework for Process Operations Technology were reviewed and endorsed by representatives of major industries on the Gulf Coast. Chevron, BP, Shell, Mississippi Power, Entergy, and Southern Company have taken an active interest in the program by sponsoring scholarships, internships, and mentoring opportunities for students and by providing equipment and supplies. An Advisory Committee composed of industry representatives meets regularly to review the program and make comments and recommendations.

In the spring of 2015, the Office of Curriculum and Instruction (OCI) met with different industry members who made up the advisory committee. An industry questionnaire was used 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 members stated an AAS degree or two years industrial experience was needed for employment. Growth is projected over the next five years, in addition, replacing the retiring population will cause a need for new additional employees.

The following changes were made to the Process Operations Technology curriculum at this revision writing meeting:

- Chemical/Refining Process Technician Skill Standards were adopted.
- PPT 1713, Process Instrumentation I, was changed from a 4 semester credit hour course to a 3 semester credit hour course.
- PPT 1443, Process Operations, was changed from a 4 semester credit hour course to a 3 semester credit hour course, PPT 2443 Process Operations, and moved to the second year.
- PPT 2723, Process Instrumentation II, was changed from a 4 semester credit hour course to a 3 semester credit hour course.
- PPT 1433, Process Systems, was changed from a 3 semester credit hour course to a 4 semester credit hour course.
- PPT 291(1-3), Special Projects in Process Operations Technology, was changed to a PPT 291(1-5) course.
- PPT 2313, Quality Concepts, was moved to the first year and changed to PPT 1413.
- PPT 2733, Emerging Energy Technology, was added as an elective.

Revision History:

2003, Original curriculum framework, Research and Curriculum Unit, Mississippi State University

2008, Revised, Research and Curriculum Unit, Mississippi State University

2015, Revised, Office of Curriculum and Instruction, Mississippi Community College Board

2021, Revised, Office of Curriculum and Instruction, Mississippi Community College Board

ADOPTION OF NATIONAL CERTIFICATION STANDARDS

The following national standards were referenced in each course of the curriculum: **Chemical/Refining Process Technician Skill Standards.**

The Center for the Advancement of Process Technology (CAPT), along with its various alliance partners, including Alaska Process Industry Careers Consortium, California Chemical & Process Technology Alliance, and many others from around the nation, and working through a National Science Foundation grant, developed the Chemical/Refining Process Technician skill standards. The skill standards were submitted for recognition to the Texas Skills Standards Board (TSSB) in January, 2005, by the Gulf Coast Process Technology Alliance (GCPTA) on behalf of its industry partners in Texas. GCPTA is an industry-driven non-profit organization of community colleges and industry and an active member of CAPT. At its October 20, 2009 meeting the TSSB recognized updated Chemical/Refining Process Technician skill standards at the request of the GCPTA.

For more information related to implementing Chemical/Refining Process Technician Skill Standards at your local campus, please visit:

http://www.tssb.org/sites/default/files/wwwpages/repos/pdfiles/ChemRefProcessTechSSRevisedSep2009.pdf

INDUSTRY JOB PROJECTION DATA

Process Operation Technology occupations require an education level of a postsecondary career and technical certificate. A summary of occupational data from the Mississippi Occupational Employment Projections is displayed below:

Standard Occupational Classification (SOC)		2016 Employment	2026 Projected Employment	Projected Employment Growth 2016-2026		Total Projected Avg. Annual Job Openings
Code	Occupation			Number	Percent	
51-9199	Production Workers, All Other	1,100	1,190	90	8.2%	140

ARTICULATION

No articulated credit will be offered upon implementation of this curriculum. Local agreements and dual credit partnerships are encouraged.

TECHNICAL SKILLS ASSESSMENT

Colleges should report the following for students who complete the program with a career certificate, technical certificate, or an Associate of Applied Science Degrees for technical skills attainment. To use the approved Alternate Assessment for the following programs of study, colleges should provide a Letter of Notification to the Director of Career Technical Education at the MS Community College Board. Please see the following link for further instructions: http://www.mccb.edu/wkfEdu/CTDefault.aspx.

CIP Code	**Program of Study**	
15.0699	Industrial Production Technologies/Technicians	
Level	**Standard Assessment**	**Alternate Assessment**
Accelerated /15 Hour		
Level	**Standard Assessment**	**Alternate Assessment**
Career		
Level	**Standard Assessment**	**Alternate Assessment**
Technical/AAS	The Center for the Advancement of Process Technology (CAPT)	

PROGRAM DESCRIPTION

Process Operations Technology programs prepare technicians for employment in the diverse field of process operations in petroleum refineries, power generation facilities, pharmaceutical plants, chemical plants, waste water treatment plants, food and beverage process plants, offshore oil production facilities and a host of other industries. Individuals currently employed as process operations technicians will enhance their ability to perform their duties and increase opportunities to advance.

This curriculum offers an accelerated transition pathway at 15 hours, a career certificate at 30 hours, and a technical certificate at 45 hours, and an Associate of Applied Science degree in Process Operations Technology at 60 hours. Graduates are prepared for entry-level positions at any processing facility. They will have acquired the basic technical skills in equipment and systems and have a broadened vocabulary to make the job-specific learning less difficult. They will also possess team-building skills, safety awareness, environmental awareness, communication skills, and computer skills that are critical in the workplace. They will have a working knowledge of state and federal regulations on safety and the environment. Through an internship program, students have the opportunity to work in a position related to process technology during which they will receive work-related application of their classroom training.

SUGGESTED COURSE SEQUENCE

Accelerated Transition Pathway

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
PPT 1133	Introduction to Process Technology	3	3		45	45		
PHY 2244 PPT-1214	Physical Science I OR Process Chemistry	4	4	1	60			
	Electives	9	2	2	60	60		
	Total	15	15		225	225		

Career Certificate Required Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
PPT 1133	Introduction to Process Technology	3	3	0	45			
PPT 1424	Process Equipment	3	2	2	60			
PPT 1713	Process Instrumentation I	3	3	0	60			
PPT 1513	Safety, Health, and Environment	3	3	0	45			
PPT 1413	Quality Concepts	3	3	0	45			
PPT 1434	Process Systems	3	3	2	75			
PPT 1613	Technical Communication	3	3		45			
PPT 1214	Process Chemistry*	3	1	1	60			
PPT 2323	Troubleshooting I	3	1	4	60			
PPT 2733	Emerging Energy Technology	3	3	0	45			
	TOTAL	**30**	**24**	**6**	**495**			

*PHY 2244 Physical Science I may be taken in lieu of PPT 1214 Process Chemistry

Student are prepared with courses listed for the assessment

Technical Certificate Required Courses

			SCH Breakdown			Contact Hour Breakdown		Certification Information
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Total Contact Hours	Lecture	Lab	Certification Name
PPT 2443	Process Operations	3	3	0	45	45		
PPT 2723	Process Instrumentation II	3	2	2	60	30	30	
PPT 2823	Process Troubleshooting II	3	1	3	45	45		The Center for the Advancement of Process Technology (CAPT)
PPT 2113	Oil and Gas I	3	3	0	45			
PPT 2123	Oil and Gas II	3	3	0	45			
	TOTAL	**15**	**15**		**225**	**195**	**30**	

*It is recommended that students take The Center for the Advancement of Process Technology (CAPT) at the end of the course PPT 2823 Process Troubleshooting II.

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**						

Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from http://www.sacscoc.org/pdf/2012PrinciplesOfAcreditation.pdf

[1]

Southern Association of Colleges and Schools Commission on Colleges. (2012). *The principles of accreditation: Foundations for quality enhancement*. Retrieved from http://www.sacscoc.org/pdf/2012PrinciplesOfAcreditation.pdf

[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

Technical Electives

			SCH Breakdown				Contact Hour Breakdown		
Course Number	Course Name	Semester Credit Hours	Lecture	Lab	Externship	Total Contact Hours	Lecture	Lab	Externship
SSP 1002	Smart Start 102	2							
PPT 291(1-5)	Special Projects in Process Operations Technology	1-5		2-10		30-150		30-150	
PPT 292(1-6)	Supervised Work Experience in Process Operations Technology	1-6			3-18	45-270			45-270
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	1-6			3-18	45-270			45-270
	All other electives approved by instructor per local community college policy								
	TOTAL								

Courses

Course Number and Name: PPT 1133 Introduction to Process Technology

Description: This course is an introduction to the types of process operations within the process industry. Topics include technician duties, responsibilities, and expectations; plant organizations; the plant processes and utility systems; and the physical and mental requirements of the process technician.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3		45

Student Learning Outcomes:

1. Discuss the history and development of various types of process industries. OPT1-32
2. Identify and describe the duties, responsibilities, and expectations of a process technician. OPT10-11
3. Explore the concepts of health, safety, environmental, and quality concerns as related to the process industry. IPT12-31
4. Identify and describe the function of process equipment such as pumps, compressors, heat exchangers, cooling towers, furnaces and boilers. IPT 32
5. Identify fundamental process systems such as distillation, utilities and auxiliaries. IPT3-7-9
6. Investigate the relationship of math, physics, and chemistry to process technology.

Course Number and Name: PPT 1424 Process Equipment

Description: This course includes Instruction in the use of common process equipment including piping, valves, rotating equipment such as pumps, compressors, drivers, and fixed equipment such as exchangers, tanks, drums, and vessels.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Student Learning Outcomes:

1. Describe various types of piping equipment commonly found in process industries. PE-19
    a. Differentiate between pipes, tubing, hoses, and fittings, and explain the use of each. PE-2
    b. Define the role and purpose of valves in the overall operation of the plant. PE-3

2. Describe various types of rotating equipment commonly found in process industries. PE5-9
    a. Describe the importance and application of pumps and compressors
    b. Describe the importance and application of motors and engines.
    c. Explain the fundamental purpose and application of power transmission and lubrication.

3. Describe various types of fixed equipment commonly found in process industries. PE-19
    a. Describe the importance and application of heat exchangers and cooling towers.
    b. Describe the importance and application of furnaces and boilers.
    c. Describe the importance and application of vessels.

4. Use process and piping diagrams and drawings to explain process flows and identify equipment in a unit/system. PE-20

Course Number and Name: PPT 1713 Process Instrumentation I

Description: This course is a study of the instruments and instrument systems used in chemical processing industry including terminology, primary variables, symbols, and control loops

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	60

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Describe and apply the major elements of process technology. [PI1-13]
    a. Define pressure, and apply related measurements and processes used in the process industry.
    b. Define temperature, and apply related measurements and processes used in the process industry
    c. Define level, and apply related measurements and processes used in the process industry.
    d. Define flow, and apply related measurements and processes used in the process industry.
    e. Define analytical instrumentation, and apply related measurements and processes used in the process industry.

2. Describe and explain the functions and components of process control. [PI1-13]
    a. Identify and describe the various pieces of equipment used in instrumentation (transmitters; transducers; differential pressure cells; analog, pneumatic, and digital instruments; etc.)
    b. Describe valves used in instrumentation (globe, three-way, butterfly, etc.).
    c. Explain the functions and components of a control loop, and contrast the differences between open and closed controls.
    d. Describe the relationship between measurement instruments and their role in the overall control loop process.

3. Describe and interpret the types of process industry drawings. [PI1-18]
    a. Compare and contrast piping and instrument diagrams (P&IDs) and process flow drawings (PFDs).
    b. Describe the lettering and numbering standards based on ISA instrumentation symbols.
    c. Describe how to determine the instrument type from the symbol information.
    d. Describe the standards for line symbols.

4. Describe the role and function of advanced controls and controllers in process operations. [PI1-18]
    a. Identify the different advanced controls and controllers and their primary function.

Course Number and Name: PPT 1214 Process Chemistry

Description: This course will provide the student with an introduction to general and organic chemistry as applied to the process industry. Includes instruction on matter, energy, atoms, chemical reactions, and chemical bonding.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	1	75

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Demonstrate knowledge of general chemistry concepts. [PCI-9]
    a. Identify chemical symbols, compounds, and elements.
    b. Explore the use of concepts such as atom, proton, neutron, electron, atomic number, atomic weight, and molecules in calculations.
    c. Interpret and apply chemical formulas and equations.
    d. Discuss the concepts of acids, bases, and pH.
    e. Define covalent and ionic bonds.
    f. Describe the different types of chemical reactions (oxidation–reduction, equilibrium, combustion, sedimentation/precipitation, etc.).

2. Compare various forms of matter and their properties. [PCI-9]
    a. Compare and contrast the physical and chemical properties of the different forms of matter.
    b. Demonstrate knowledge of metric and English measurement systems and conversions between these systems.

3. Explore the principles of organic chemistry. [PCI-9]
    a. Identify the sources and structure of organic compounds.
    b. Identify the physical and chemical properties of hydrocarbons.
4.

Course Number and Name: PPT 1513 Safety, Health, and Environment

Description: This course is designed to provide a development of knowledge and skills to reinforce attitudes and behaviors required for safe and environmentally sound work habits. Emphasis is placed on safety, health, and environmental issues in the performance of all job tasks and regulatory compliance issues.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Student Learning Outcomes:

1. Describe various types of physical hazards commonly found in process industries. PSHE 1-18
2. Describe the chemical hazards in process industries. PSHE 1-3
3. Describe the biological, ergonomic and plant specific hazards associated with various processes. PSHE 1-18
4. Describe the environmental hazards in process industries. PSHE 1-18
5. Identify the various Engineering controls used to make process areas safe. PSHE 19-23
6. Discuss the various Administrative controls - Programs and Practices. PSHE 19-26
7. Describe the importance and application of PPE in process industries. PSHE 24
8. Describe the important role OSHA plays in the process industries. PSHE 24
9. Describe the important role EPA (state and federal) plays in process industries. PSHE 1-26
10. Describe the other regulatory agencies that impact the Process Industry. PSHE 1-26
11. Corrective action is taken as specified by company policies and procedures.

Course Number and Name: PPT 1413 Quality Concepts

Description: A course to provide an introduction to the field of quality in the process industry. Students are introduced to industry-related process concepts including operating consistency, continuous improvement, plant economics, team skills, and statistical process control (SPS).

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Student Learning Outcomes:

1. Discuss the history of the quality movement in the United States and the state of the movement in the process industry today. PQ 3
2. Describe the impact of quality on the organization's economic performance.
3. Understand and use effective system communication techniques to ensure operating consistency and reduce variability in the process. PQ 1-12
4. Understand and use effective system communication techniques to ensure operating consistency and reduce variability in the process. PQ 1-12
5. Discuss the principles associated with process orientation and systems thinking and theory.
6. Demonstrate how to follow procedures and policies in order to ensure operating consistency, reduce variability in the process, reduce waste and prevent safety incidents. PQ 1-12
7. Use continuous improvement methodology to optimize processes. PQ 1-12
8. Take preventive or corrective action to ensure operating consistency, reduce variability in the process, reduce waste and prevent safety incidents. PQ 1-12
9. Use statistical thinking in one's work as necessary. PQ 1-12
10. Use Quality Tools and team problem solving to resolve a real-world dilemma. PQ 1-12

Course Number and Name: PPT 1434 Process Systems

Description: This course involves the study of the interrelation of process equipment and process systems including related scientific principles.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	1	75

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Describe how process industry facilities are divided into systems. [PS 1-19]
2. Identify the types of systems used in the process industry: [PS 1-19]
    a. Water Systems.
    b. Relief and Flare Systems
    c. Electrical Power Generation and Distribution Systems
    d. Material Storage and Blending Systems
    e. Refrigeration System
    f. Steam Generation and Distribution Systems
    g. Reaction Systems
    h. Separation Systems
3. Describe typical process technician responsibilities for the following: [PS 1-19]
    a. operating systems
    b. monitoring systems
    c. troubleshooting systems
    d. completing rounds
    e. communication between inside and outside operator
    f. communication between process technician and other departments
4. List factors that can affect plant economics. [PS 1-19]

Course Number and Name: PPT 1613 Technical Communication

Description: This course includes an application of written, oral, and other forms of communication to the process technology industry. It includes instruction and practice in written communications (reports and presentations, procedures, resumes, documentation, training materials, etc.) and oral communications (presentations, directions/instructions, feedback, etc.).

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Organize and compose effective written communications.
    a. Identify direct, indirect, and persuasive approaches to writing.
    b. Develop skills to produce clear, concise, complete, accurate, and courteous messages.
    c. Compose effective correspondence (e-mail, memos, and letters).
    d. Compose a technical report illustrating proper organization and effective use of data tables, charts, and graphs.
    e. Compose written procedures and documentation for process technology operations.

2. Organize and compose effective oral communications.
    a. Compose and deliver oral instructions and reports.
    b. Receive and interpret oral instructions and directions.
    c. Develop and present an oral demonstration using graphics, tables, and equipment.
    d. Give and receive positive feedback from other individuals.
    e. Apply skills for oral interviews.

3. Prepare written communications involved in the job application process.
    a. Complete an application form.
    b. Complete a resume.
    c. Update a resume.
    d. Compose letters of application, follow-up, acceptance, and resignation.

Course Number and Name: PPT 2443 Process Operations

Classification: Technical Certificate Core

Description: This course is a course that combines equipment systems into operational units with an emphasis on instruction for start-up, normal operation, abnormal/emergency operations, and shutdown of an entire process.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	1	2	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Discuss the importance of this course and how the material learned here will prepare the student for work "on-the-job", including the role and responsibilities of a Process Technician. PO 1-26
2. Recall the key concepts from PT I and II, Equipment and Systems and understand how they build into an Operating Unit. PO 1-12
3. Discuss the importance of Equipment maintenance. PO 1-26
4. Use drawings and operating manual to learn about the basic elements of a specific operating unit. PO 1-26
5. Describe the conditions and activities related to the initial start-up or commissioning of the unit. PO 1-26
6. Describe the conditions and activities related to the Normal Operation of the unit. PO 1-26
7. Describe the conditions and activities related to the Abnormal Operation or Emergencies in the unit. PO 1-26
8. Describe the conditions and activities related to the Normal shutdowns of the unit. PO 1-26

Course Number and Name: PPT 2723 Process Instrumentation II

Classification: Technical Certificate Core

Description: This course is a study of the instruments and instrument systems used in processing and their application within the process industry including terminology, primary variables, symbols, and control loops.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Recall the types of instrumentation used in the petrochemical and refining industry to monitor and control the process. PI 1-13
2. Given a drawing, picture or actual device, identify and describe pressure regulators. PI 1-13
3. Define the function of a switch. PI 1-13
4. Explain how relays are used in the process industry. PI 1-13
5. Explain the purpose of annunciator systems. PI 1-13
6. Review the purpose and operation of transmitters. PI 1-13
7. Identify and describe types of control schemes. PI 1-13
8. Explain the purpose of digital control. PI 1-13
9. Define terms associated with Programmable Logic Control (PLC): PI 1-13
10. Explain the purpose of a DCS PI 1-13
11. Define terms associated with instrumentation power supply: PI 1-13
12. Define the terms associated with emergency shutdown systems, interlocks and alarms. PI 1-13
13. Describe the failure modes. PI 1-13
14. Explain how a control loop will respond to typical malfunctions PI 1-13

Course Number and Name: PPT 2323 Process Troubleshooting I

Classification: Technical Certificate Core

Description: A course to apply knowledge of process variables, indicators and controllers, troubleshooting tools, and troubleshooting steps to solve problems in a simple process system

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	2	2	60

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Identify and describe the methods and tools of troubleshooting process systems. [PT 1-7]
    a. Identify and define the process variables to include naming an example of each variable, identifying the relationships between variables, and explain the meaning of the measured value of each variable.
    b. Identify and describe the function of instruments in operating and controlling a chemical process including indicators and controllers.
    c. Identify and define the troubleshooting tools and explain their use.
    d. Identify and define the troubleshooting steps and explain their use.
    e. Identify, verify, and analyze data on a process to draw conclusions and answer questions about the status of the process and the cause or causes.

2. Apply the troubleshooting steps and tools to solve simulated problems. [PT 1-7]
    a. Troubleshoot simple separation systems.
    b. Troubleshoot reaction systems.
    c. Troubleshoot steam generation systems.
    d. Troubleshoot distillation systems.
    e. Troubleshoot absorption and stripping systems.

Course Number and Name: PPT 2823 Process Troubleshooting II

Classification: Technical Certificate Core

Description: A course to apply knowledge of process variables, indicators and controllers, troubleshooting tools, and troubleshooting steps to solve problems in a simple process system

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	1	3	45

Prerequisite: Instructor Approved Process Troubleshooting I

Student Learning Outcomes:

1. Identify and perform mitigations of troubleshooting process systems. [PT 1-7]
    a. Identify and define the process upsets
    b. Identify, describe, and preform process troubleshooting steps
    a. Identify and define the troubleshooting steps and explain their use.
    b. Identify, verify, and analyze data to draw conclusions and answer questions about the status of the process and the cause or causes.
    c. Preform system line out after process upset

2. Apply the troubleshooting steps and tools to solve simulated problems. [PT 1-7]

Course Number and Name: PPT 2733 Emerging Energy Technologies

Classification: Technical Elective

Description: The purpose of this course is the introduce students to the latest technologies and possibilities in the world of energy. This is a fast paced, ever-changing industry and it will be helpful to them to know of the opportunities available to them in alternative energy as well as, the technologies that are keeping fossil fuels as viable choices.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Discuss the history of the United States energy industry. IPT 2-3, 24, 29-30, PS 15-6
2. Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear). IPT 2-3, 24, 29-30, PS 15-6
3. Identify various fuel sources and the cost/efficiency/environmental issues associated with each: IPT 2-3, 24, 29-30, PS 15-6
    a. Oil
    b. Coal
    c. Natural gas
    d. Uranium
4. Discuss emerging and alternative technologies, advantages and disadvantages for each of the following: IPT 2-3, 24, 29-30, PS 15-6
    a. Solar energy
    b. Wind energy
    c. Geothermal
    d. Ocean wave energy
    e. Biomass energy
5. Explain the fundamental concepts of natural gas. IPT 2-3, 24, 29-30, PS 15-6
6. Explain the fundamental concepts of Smart Grid and Time of Use technologies. IPT 2-3, 24, 29-30, PS 15-6
7. Discuss key energy regulatory topics such as cap and trade, efficiency, cost, etc. IPT 2-3, 24, 29-30, PS 15-6

Course Number and Name: PPT 2113 Oil and Gas Production I

Classification: Technical Elective

Description: This course includes an overview of the petroleum industry including exploration and geology, well drilling, wellhead operations, and product distribution. Emphasis is placed on oil and gas production.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor approved

Student Learning Outcomes:

1. Describe the process of oil exploration and associated geological principles. IPT 1-26
    a. Discuss the basic concepts of geology related to oil and gas exploration and production (reservoirs, fluid flow, and pressure).
    b. Discuss the basic concepts of oil and gas exploration including geographic and geophysical surveys, data sources, reservoir development tools, resource ownership, and so forth.

2. Describe the oil and gas drilling process and wellhead development procedures, such as well construction, well completion, and well work-over and servicing. IPT 1-26

3. Describe wellhead operations and production. IPT 1-26
    a. Identify and describe the functions of the major components of a wellhead.
    b. Compare and contrast the differences in wellhead construction for onshore and offshore facilities.
    c. Identify and discuss safety, health, and environmental factors associated with wellhead production.
    d. Describe the activities associated with monitoring and regulating the wellhead, including typical malfunctions, and maintenance activities.

4. Describe the separation and treatment of emulsions. IPT 1-26
    a. Describe the process and equipment used to separate and treat the emulsion and the products obtained from the separation.
    b. Compare and contrast emulsion separation and treatment processes in onshore and offshore facilities.

Course Number and Name: PPT 2123 Oil and Gas Production II

Classification: Technical Elective

Description: This course includes a continuation of Oil and Gas Production I with emphasis on oil and natural gas production and processing.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
3	3	0	45

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Provide an overview of the role and importance of gas in the oil and gas industry. [IPT 1-26]
2. Explain the importance of Gas Dehydration. [IPT 1-26]
3. Explain the formation of hydrates and how hydrates affect natural gas. [IPT 1-26]
4. Discuss the importance of Gas Compression. [IPT 1-26]
5. Discuss the purpose of produced water treatment systems. [IPT 1-26]
6. Discuss the Auxiliary Systems associated with production. [IPT 1-26]
7. Explain the purpose of artificial lift and enhanced recovery techniques. [IPT 1-26]
8. Identify the early methods used to transport crude oil, natural gas and petroleum products. [IPT 1-26]
9. Discuss the Federal, state and regional environmental regulations that govern oil and gas production operations. [IPT 1-26]
10. Discuss the safety regulations dealing with oil and gas production. [IPT 1-26]

Course Number and Name: PPT 291(1-5) Special Projects in Process Operations Technology

Classification: Technical Elective

Description: A course designed to provide the student with practical application of skills and knowledge gained in other vocational–technical courses. The instructor works closely with the student to ensure that the selection of a project will enhance the student's learning experience.

Hour Breakdown:

Semester Credit Hours	Lecture	Lab	Contact Hours
1		2	30
2		4	60
3		6	90
4		8	120
5		10	150

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 the 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 of activities performed and objectives accomplished to the instructor.

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: PPT 292(1-6) Supervised Work Experience in Process OperationsTechnology

Classification: Technical Elective

Description: A course that is a cooperative program between industry and education designed 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		3	45
2		6	90
3		9	135
4		12	180
5		15	225
6		18	270

Prerequisite: Instructor Approved

Student Learning Outcomes:

1. Prepare a written agreement.
    a. Compile a written training agreement in cooperation with the instructor and student that details a work schedule and specific tasks/skills to be mastered in the program.

2. Prepare a written report of activities.
    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 work experience programs.
    a. Complete all required activities in the training agreement.
    b. Adhere to all written and oral instructions for the supervised experience.

Appendix A: Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Acrylic cooling tower—Actual working model (1 per program)
2. Distillation training tower (1 per program)
3. Pump demonstrator—working model (1 per program)
4. Distillation Training Unit (table size) (1 per program)
5. Chiller unit for distillation training unit (table size) (1 per program)
6. Static kettle reboiler and shell and tube reboiler (1 per program)
7. Static Vertical Thermosiphon Reboiler (1 per program)
8. Acrylic boiler—Actual working model (1 per program)
9. Crude oil desalter (1 per program)
10. FCCU (fluid catalytic cracker unit)—Working model (1 per program)
11. DTU-1 Working glass distillation training unit (1 per program)
12. Educational process trainer pressure, level, flow, temperature (1 per program)
13. pH skid for EPT (1 per program)
14. PVC valves, ball, check, gate, globe, safety (1 each per program)
15. Simulator software and site licenses (1 software per program with licenses for all lab computers
16. Tool and toolbox (for process operation technicians)
17. Windows-compatible computers with standard accessories and Internet access (1 per student)
18. Integrated office software (word processing, spreadsheet, presentations, and database) (1 license per computer)
19. Laser printer
20. Color printer (inkjet or laser)

NON-CAPITALIZED ITEMS

1. Molecular model kits
2. Basic chemistry lab kit (beakers, flasks, tubing, hydrometers, thermometers, etc.)
3. pH meter
4. Hot plates
5. Bunsen burner

It is recommended that instructors have access to the following items:

1. LCD monitor/television
2. Smart board
3. Windows notebook computer
4. LCD projector
5. Digital camera
6. Optical scanner
7. Copy machine

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:

a. Career Certificate Required Course – A required course for all students completing a career certificate.
b. Technical Certificate Required Course – A required course for all students completing a technical certificate.
c. 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

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: Textbook List

Recommended Process Operations Textbook Lists CIP 15.0699 Industrial Production Technologies/Technicians		
Title	**Author**	**ISBN**
Introduction to Process Technology	North American Process Technology Alliance (NAPTA)	ISBN 10: 0-13-480824-X ISBN:13:978-0-13-480824-6
Process Technology Equipment	North American Process Technology Alliance (NAPTA)	ISBN 10: 0-13-489126-0 ISBN:13:978-0-13-489126-2
Process Instrumentation	North American Process Technology Alliance (NAPTA)	ISBN 10: 0-13-521392-4 ISBN:13:978-0-13-521392-6
Safety, Health, and Environment	North American Process Technology Alliance (NAPTA)	ISBN 10: 0-13-557249-5 ISBN:13:978-0-13-557249-8
Process Quality	North American Process Technology Alliance (NAPTA)	ISBN 10: 0-13-646470-8 ISBN:13:978-0-13-646470-3
Process Technology Systems	Michael Speegle	ISBN-10: 1-4180-3999-3 ISBN-13: 978-1-4180-3999-3
Technical Communication	Kirk Polking	WorkBook
Basic Chemistry	Timberlake & Timberlake	ISBN-10: 0-13-413804-x ISBN-13: 978-134-13804-6
Troubleshooting Resources	Michael KuKuk	WorkBook
Renewable Energy Systems	D. Buchla; T. L. Floyd; T. Kissell	ISBN: 9780132622516, 0132622513 ISBN: 978133756630, 0133756637
Process Operations	North American Process Technology Alliance (NAPTA) Pearson	ISBN 10: 0-13-700410-9 ISBN 13: 978-0-13-700410-2
Petroleum Geology, Exploration, Drilling, and Production	Norman J. Hyne Ph.D..	ISBN 0-87814-823-X ISBN 13 9148-0-87814-823-3

Appendix D: Crosswalk

Course Crosswalk

Process Operations

CIP 15.0699 Industrial Production Technologies/Technicians

Note: Courses that have been added or changed in the 2021 curriculum are highlighted.

Existing 2015 MS Curriculum Framework			Revised 2021 MS Curriculum Framework		
Course Number	**Course Title**	**Hours**	**Course Number**	**Course Title**	**Hours**
PPT 1133	Introduction to Process Technology	3	PPT 1133	Introduction to Process Technology	3
PPT 1424	Process Equipment	3	PPT 1424	Process Equipment	3
PPT 1713	Process Instrumentation I	3	PPT 1713	Process Instrumentation I	3
PPT 1513	Safety, Health, and Environment	3	PPT 1513	Safety, Health, and Environment	3
PPT 1413	Quality Concepts	3	PPT 1413	Quality Concepts	3
PPT 1434	Process Systems	3	PPT 1434	Process Systems	3
PPT 1613	Technical Communication	3	PPT 1613	Technical Communication	3
PPT 1214	Process Chemistry	3	PPT 1214	Process Chemistry	3
PPT 2323	Troubleshooting I	3	PPT 2323	Troubleshooting I	3
PPT 2733	Emerging Energy Technology	3	PPT 2733	Emerging Energy Technology	3
PPT 2443	Process Operations	3	PPT 2443	Process Operations	3
PPT 2723	Process Instrumentation II	3	PPT 2723	Process Instrumentation II	3
			PPT 28233	Process Troubleshooting II	3
PPT 2113	Oil and Gas I	3	PPT 2113	Oil and Gas I	3
PPT 2123	Oil and Gas II	3	PPT 2123	Oil and Gas II	3