

# PCT - PROCESS CONTROL TECHNOLOGY

## PCT 100 Plant Equipment

This course provides an introduction to basic hand tools as well as a study of industrial plant equipment. Topics of study include equipment construction, principles of operation, care, maintenance, and utilization. Various pieces of equipment associated with process systems will be covered. Equipment being studied will include motor drive components, basic material handling equipment, pumps, compressors, valves, boilers, furnaces, turbines, heat exchangers and cooling towers, as well as relevant instrumentation.

*Upon successful completion of this course, students should be able to:*  
*Identify various types of plant equipment commonly found in processing plants.*

*List the various types valves, and discuss their basic operational characteristics, as well as their components.*

*Explain how pipe is sized, relate the differences between pipe and tubing, and describe how a seal is effected in each design.*

*Distinguish between the various types of pumps, compare and contrast their appropriate uses.*

*Describe the various types of compressors, compare and contrast their appropriate uses and operational procedures.*

*List the common types of motors; electric, air, and hydraulic and discuss their applications.*

*Recognize power transmission devices and describe, their use, care, and maintenance.*

*Describe the different types of turbines, compare and contrast their respective uses, their care, and maintenance.*

*Explain the principles of operation, care, and use of heat exchangers within a processing environment.*

*Discuss the differences between furnace types, their construction, principles of operation, components, care and maintenance.*

*Describe the various types of process equipment, comparing appropriate uses, maintenance, and relevant troubleshooting requirements.*

Prerequisite: PCT 101\* (\* May be taken concurrently.)

**3 Credits2 Weekly Lecture Hours**

**2 Weekly Lab Hours**

## PCT 101 Introduction to Process Technology

This course provides an overview of the concepts associated with Process Technology, as well as an introduction to the role of a Process Operators and Process Control Technicians as part of a team in the production environment. The course also provides a basic overview of issues and sciences associated with the refining and production of chemicals. In addition, the course will introduce the student to the real life environment, and the occupational responsibilities and duties of process operators/technicians.

*Upon successful completion of this course, students should be able to:*  
*Discuss the role and responsibilities of a process operators and process control technicians.*

*Investigate the basic sciences associated with processing industries.*

*Identify the need for quality control in a processing environment.*

*Demonstrate appropriate behavior within a diverse workplace.*

*Discuss the impact of job related work ethics (absenteeism, on-the-job habits, etc) as they relate to fellow workers, and the mission at hand.*

*Relate basic safety, health, and environmental issues associated with the processing industries technology.*

*Perform generalized introductory duties while observing acceptable practices for personal safety and health.*

*Prepare a potential career profile for a process technician.*

Prerequisite: NONE New students should complete Placement Testing prior to registration. Visiting students may submit college transcript.

**4 Credits2 Weekly Lecture Hours**

**4 Weekly Lab Hours**

## PCT 110 Safety, Health and the Environment

This course will provide students with an overview of the current petrochemical safety, health and environmental regulations, standards, and laws. The course will provide a survey of potential industry/product and facility hazards. Methods of protecting personnel through programs, procedures, and personnel protective equipment, including advanced personal safety and health measures will be addressed. In addition, the course will provide instruction in emergency response to spills, leaks and releases. Facility safety equipment, as well as warning and alarm systems will be covered.

*Upon successful completion of this course, students should be able to:*  
*Relate the need for knowledge of the various laws and regulations affecting the petrochemical industry.*

*State the role of Safety, Health and the Environment (SHE) regulations, standards and laws as they apply to the processing, storage, and distribution of petrochemicals.*

*Determine the individuals responsibility for, as well as their role in the implementation of a facilities safety, health, and environmental prevention and protection program.*

*Identify potential safety and health hazards associated with petrochemical processing facilities, and the outcomes these hazards can present for workers and the public at large.*

*Prescribe methods of abatement for various safety and health hazards.*

*Identify potential environmental hazards and discuss varied issues regarding their abatement.*

*Describe the individuals role in Emergency Response to spills, leaks, or releases of a facilities chemicals, intermediates, or products.*

*Specify the need and demonstrate the usage of basic personnel protective equipment.*

*Relate the use of typical facilities safety equipment, and its application, in specific instances.*

Prerequisite: PCT 100\* and PCT 101\* (\*Courses may be taken concurrently.)

**3 Credits3 Weekly Lecture Hours**

**PCT 111 Process Control I**

This course is designed to provide operators/technicians with an introduction to the basic operating principles of process control systems. Topics of study will include control principles, the elements of process control systems, and process control signals and systems. The course also provides for an introductory study of various input and output devices used to control process variables in the petroleum, petrochemical, chemical, pharmaceutical, and food processing industries. Primary emphasis will be placed on processes that require the measurement of pressure, level, flow, and temperature.

*Upon successful completion of this course, students should be able to:*

*List the basic principles, characteristics and applications of process control systems.*

*Describe the various methods used to implement process control systems.*

*Explain the methods used to generate process control signals.*

*Define the basic concepts concerning transducers, as well as investigate the different types of output devices and signals used to control processes.*

*Describe the nature of fluids as well as the causes and effects of hydrostatic and dynamic pressure.*

*Describe fluid flow, characteristics of pressure, and pressure head, in regard to process control parameters.*

*Describe the instruments, methods and principles of operation used to measure pressure, level, and flow in fluids.*

*Determine the various operating conditions of pressure switches.*

*Relate the concepts of heat exchange.*

*Describe the physical changes heat produces in matter.*

*Determine the major differences between AC and DC motor operation, the fundamental methods of controlling each, and some of the problems associated with each type.*

*Explain closed loop control system theory relating to the purpose of closed loop control and the different modes of controller operation.*

*Discuss some of the more advanced aspects of automatic controllers, with relevance to safety and alarming of controllers.*

*Identify the real time limitations and implications and process characteristics required to transmit serial information between MTU and RTUs with regard to the limiting factors of a real time SCADA system.*

*Explain the primary purpose of process control and identify the four main processes variables associated with process control regulations.*

Prerequisites: PCT 100 and PCT 101 and (MAT 128 or MAT 150 or MAT 151 or MAT 160) and (PHY 107\* or PHY 110\* or PHY 131\*) (\*Courses may be taken concurrently.)

**4 Credits**

**PCT 112 Power Plant Processes**

In this course provides an introduction to the technical requirements associated with auxiliary equipment, as well as the safety, economics and maintenance required to meet the criteria for appropriate power plant operation. This course is designed to facilitate assimilation of knowledge and skills associated with various individual pieces of auxiliary plant equipment for the purpose of providing instruction in the function and process of performing daily operating responsibilities and functions. The interplay of business fundamentals and the importance of quality and systematic operations, along with energy management techniques will be studied. The principles and application of operations, maintenance, material handling and process trouble shooting techniques will be introduced.

*Upon successful completion of this course, students should be able to:*

*Identify the role and responsibilities of a production, and a process technician.*

*Relate the core values individuals need to demonstrate in order to meet management's goals and objectives.*

*Identify and discuss safety standards and hazards associated with processing plants.*

*Describe the use of permit systems developed for routine work and maintenance assignments as required by regulatory agencies such as Occupational Safety and Health Administration (OSHA).*

*Explain quality as it relates to importance as a competitive tool, expressing the importance of employer/employee commitment.*

*Cite the importance of good communication skills, and the effect of same on productivity, safety, and quality of a processing plant's operation.*

*Describe the physics, and the thermal properties, involved in the operation of a processing unit.*

*Discuss the energy characteristics associated with processing unit, such as; heat energy, kinetic energy (rotating equipment and flow), potential energy (vessels full of chemicals) and pressure (steam, bottled gases).*

*Describe the relevancy of process sampling, and analytical testing, as a means for enhancing the production of a safe and efficient product.*

*Explain the purpose of a processing unit, relating the process control assignments associated with the monitoring and data collection (as part of the normal operations of the unit).*

*Define the importance of routine and preventive maintenance assignments for assuring the efficiency, along with the reliability, of processing equipment.*

*Relate the operational procedures (in a macro manner) for unit shutdowns, turnarounds, and start-ups relating some of the cost issues, hazards, roles, and responsibilities for various support personnel during system startup.*

Prerequisite: PCT 100 and IST 105 and IST 200\* and PHY 107\* and (MAT 111 or MAT 120 or MAT 135 or MAT 151). (\*Courses may be taken concurrently.)

**3 Credits2 Weekly Lecture Hours**

**2 Weekly Lab Hours**

**PCT 115 Process Control II**

This course presents additional theory and application of process control. Integrated topics such as drawings, symbols, control loops, measurements and variable measurements will be presented. Additionally, topics to be studied will include, but not be limited to: conductivity, pH, ORP, various optical measurements, products of combustion, chromatography, and control systems. Process control computers, DCS, and system integration will also be discussed in detail.

*Upon successful completion of this course, students should be able to:*

*Interpret and use the various types of process control drawings, to include the use of process control symbols and their application.*

*Describe the operational characteristics of a typical control loop.*

*Compare the different modes of operation of control loops.*

*Investigate the four common advanced control methods, the advantages of each, and their applications in an industrial facility.*

*Describe how control loops perform in the time domain and how compensation is affected for time lags in the system response.*

*Determine the methods used to protect control loops.*

*Explain various types of process control instrumentation used to measure conductivity, pH, ORP, products of combustion and chromatography.*

*Discuss the optical analyzer, and how frequency of infrared, ultraviolet and visible light are measured.*

*List the products of combustion, and identify the instrumentation used to measure and control it in a process control system.*

*List the various types of process control devices including instruments used to measure conductivity, pH, ORP, optical parameters.*

*Discuss microprocessors, specifically their application in process control systems.*

*Describe the workings of a SCADA system Identify the advantages of automatic process control as well as PLC's (or DCS's) in industrial automation and relate the types of processes control.*

Prerequisite: PCT 111 and CHE 101 and PHY 107\*. (\*Courses may be taken concurrently.)

**4 Credits3 Weekly Lecture Hours**

**2 Weekly Lab Hours**

**PCT 120 Unit Operations**

This course provides for a study of the basic principles and operation of the main units associated with the production of product in the processing industries. The primary emphasis of study will focus on processing units operation. Processes involving the principles of fluid mechanics heat transfer including evaporation, mass transfer including distillation, and mechanical separation will be explored. The basic processes being facilitated within the various units will be examined. The interactions and the transactional phoneme occurring during operation of these units will be addressed. The commonalties, results, and effects, associated with various processes will be related to various allied chemical-manufacturing operations. Instructional emphasis will be limited to the relevant theoretical and practical aspects of the subject matter.

*Upon successful completion of this course, students should be able to:*

*Determine how to analyze a complex process in order to identify sub-processes, as they relate to a unit and its operation.*

*Describe a unit's operation and relate whether its processing characteristics entail a chemical or a physical reaction.*

*Assist an engineer in solving problems associated with each operation and in some instances; with direction, apply solutions to problems.*

*Identify the differences among similar pieces of equipment, their varied operational characteristics, and the safety practices associated with each.*

*Troubleshoot basic problems with mechanical equipment and identify and/or recommend necessary corrective action for proper unit operation.*

*Identify and correct blockage in fluid lines.*

*Recognize problems associated with pumps and identify correct action.*

Prerequisites: CHE 101 and PHY 107\* and PCT 115\* and (MAT 120 or MAT 135 or MAT 151 or MAT 152 or MAT 160). (\*Courses may be taken concurrently.)

**4 Credits3 Weekly Lecture Hours**

**2 Weekly Lab Hours**

**PCT 190 Process Control Internship (1 credit)**

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 60 hour internship will earn 1 college credit for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

*Upon successful completion of this course, students should be able to:*  
*Explain three program-related concepts that have been applied during the work experience.*

*Describe the ways that technology is utilized in the work experience.*

*Analyze the culture of the host organization.*

*Analyze an operational process within the work experience.*

*Demonstrate how assigned tasks depend on successful communication.*

*Describe how time and activity are managed to meet work-imposed deadlines.*

*Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.*

*Demonstrate specifically how job-related competence has improved.*

*Formulate a self-assessment for career growth and personal satisfaction.*

*Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).*

*Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.*

**1 Credit**

**PCT 194 Process Control Internship (2 credits)**

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 120 hour internship will earn 2 college credits for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

*Upon successful completion of this course, students should be able to:*  
*Explain three program-related concepts that have been applied during the work experience.*

*Describe the ways that technology is utilized in the work experience.*

*Analyze the culture of the host organization.*

*Analyze an operational process within the work experience.*

*Demonstrate how assigned tasks depend on successful communication.*

*Describe how time and activity are managed to meet work-imposed deadlines.*

*Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.*

*Demonstrate specifically how job-related competence has improved.*

*Formulate a self-assessment for career growth and personal satisfaction.*

*Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).*

*Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.*

**2 Credits**

**PCT 199 Process Control Internship (3 credits)**

College-Sponsored Experiential Learning (CSEL) is designed to integrate on-the-job learning experiences with classroom studies. These experiences are structured either to explore career options or to prepare for a specific occupation. Students participating in the Cooperative Education and Internship Program gain college credit and are graded for their learning/work experience by the appropriate faculty. Students participating in this 180 hour internship will earn 3 college credits for this experience. Upon successful completion of this hands-on work experience, the student should be able to satisfy instructionally selected competencies from those below according to the number of credits to be awarded. NOTE To be eligible for an internship, students must: Have completed a minimum of 18 or more credits within the last 5 years. Have begun course work in their major (at least 9 credits). Have an overall grade point average (GPA) of 2.5. Obtain a written recommendation by a DCCC faculty within the discipline of the internship. Submit a current resume to the Office of Student Employment Services.

*Upon successful completion of this course, students should be able to:*

*Explain three program-related concepts that have been applied during the work experience.*

*Describe the ways that technology is utilized in the work experience.*

*Analyze the culture of the host organization.*

*Analyze an operational process within the work experience.*

*Demonstrate how assigned tasks depend on successful communication.*

*Describe how time and activity are managed to meet work-imposed deadlines.*

*Describe an instance where problem-solving skills were needed to analyze a situation in the work experience.*

*Demonstrate specifically how job-related competence has improved.*

*Formulate a self-assessment for career growth and personal satisfaction.*

*Satisfy the competencies of the chosen CSEL placement (to be developed in consultation with the CSEL instructor).*

*Work closely with a faculty mentor in the student's program/major to complete a project which articulates how the experience helps the student achieve program outcomes.*

**3 Credits****PCT 240 Wastewater I**

This course is designed to prepare students to sit for the Department of Environmental Protection (DEP) certification for Wastewater Treatment Operator Level I.

*Upon successful completion of this course, students should be able to:*

*Understand the role of the treatment plan operation.*

*Understand basic wastewater treatment process.*

*Understand state and federal regulations for Wastewater management.*

*Demonstrate safe and clean work environment.*

Prerequisite: NONE New students should complete Placement Testing prior to registration. Visiting students may submit college transcript.

**4 Credits2 Weekly Lecture Hours****4 Weekly Lab Hours****PCT 241 Wastewater II**

This course provides Level II Industry Certification for students who want to become a Water Management Technician. Topics of study include Wastewater treatment types, Wastewater Land application, Wastewater activated sludge basics, and Wastewater advanced topics.

*Upon successful completion of this course, students should be able to:*

*Understand the types of wastewater treatment - ponds & lagoons, trickling filters, rotating biological contact.*

*Understand solids handling and disposal.*

*Understand activated sludge.*

*Demonstrate a safe and clean work environment.*

Prerequisite: PCT 240.

**4 Credits2 Weekly Lecture Hours****4 Weekly Lab Hours**