Course Title: Introduction to Process Technology
Subject Area/Course Number: PTEC-010

New Course [ ] OR Existing Course [X]

Author(s): Michael J. Kean

Subject Area/Course No.: PTEC-010
Units: 3

Course Title: Introduction to Process Technology
Discipline(s): Manufacturing Technology, Industrial Technology, Sanitation and Public Health

Pre-Requisite(s): None
Co-Requisite(s): None

Advisories: Eligibility for ENGL-100

Catalog Description:
This introductory course will provide a clear overview of everyday life in the Process Technology industry. The student will learn about and experience first hand the variety of equipment used in typical processes and see how important safety and environmental considerations are in petrochemical operations. The class includes labs and field trips to typical chemical and petroleum manufacturing plants. The student is expected to climb ladders to the top of processing units, wear and carry safety equipment, and work in confined spaces.

Schedule Description:
Are you looking for a challenging and well paying career? Why not consider the opportunities in the petrochemical industry? This introductory course will provide a clear overview of everyday life in this progressive industry. You will learn about and experience first hand the variety of equipment used in typical processes and see how important safety and environmental considerations are in petrochemical operations. These classes are not just "classroom" encounters but include labs and field trips to typical plants where you will see the real world of chemical and petroleum manufacturing. You will be amazed at how exciting and rewarding a career in this field can be. Note: You will be expected to climb ladders to the top of processing units, wear and carry safety equipment, and work in confined spaces.

Hrs/Mode of Instruction: Lecture: ___54___ Scheduled Lab: ____ HBA Lab: ____ Composition: ____ Activity: ____ Total Hours 54

Credit [X] Credit Degree Applicable (DA) Grading [ ] Credit/Non-Credit (CR/NC) Repeatability [ ] 0
[ ] Credit Non-Degree (NDA)
[ ] Letter (LR)
[ ] Student Choice (SC)

(If Non-Credit desired, contact Dean.)

Credit Non-Degree (NDA) [300] Letter (LR) 1
[ ] Student Choice (SC) 2
[ ] 3

Last date of Assessment: ____SP2012______ Cohort #: __1___

Please apply for: LMC General Education Requirement(s): None
(Please list the proposed area(s) this course meets, or indicate "none")

Transfer to: [X] CSU [ ] UC [ ] IGETC Area [ ] CSU GE Area [ ] C-ID Number ______

Course is Baccalaureate Level: [X] Yes [ ] No
Course Outline of Record
Los Medanos College          2700 East Leland Road        Pittsburg CA 94565

Course Title: Introduction to Process Technology            Subject Area/Course Number: PTEC-010

Signatures:
Department Chair ___________________________ Date ____________
Librarian ___________________________ Date ____________
Dean (Technical Review) ___________________________ Date ____________
Curriculum Committee Chair ___________________________ Date ____________
President/Designee ___________________________ Date ____________
CCCD Approval Date (Board or Chancellor's Office) ___________________________ Date ____________

STAND ALONE COURSE: YES NO

Course approved by Curriculum Committee as Baccalaureate Level: YES NO

LMC GE Requirement Approved by the Curriculum Committee: ________________

FOR OFFICE OF INSTRUCTION ONLY. DO NOT WRITE IN THE SECTION BELOW.
Begin in Semester ________________ Catalog year 20____/20_____ Class Max: ________________
Dept. Code/Name: ________________ T.O.P.s Code: ________________ Crossover course 1/ 2: ________________
ESL Class: Yes / No DSPS Class: Yes / No Coop Work Exp: Yes / No

Class Code
A Liberal Arts & Sciences
B Developmental Preparatory
C Adult/Secondary Basic Education
D Personal Development/Survival
E For Substantially Handicapped
F Parenting/Family Support
G Community/Civic Development
H General and Cultural
I Career/Technical Education
J Workforce Preparation Enhanced
K Other non-credit enhanced
Not eligible for enhanced

SAM Code
A Apprenticeship
B Advanced Occupational
C Clearly Occupational
D Possibly Occupational
E* Non-Occupational
*Additional criteria needed

Remediation Level
B Basic Skills
NBS Not Basic Skills

1 One level below transfer
2 Two levels below transfer
3 Three levels below transfer

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Institutional Student Learning Outcomes:

☐ General Education SLOs:

At the completion of the LMC general education program, a student will:
1. read critically and communicate effectively as a writer and speaker.
2. understand connections among disciplines and apply interdisciplinary approaches to problem solving.
3. think critically and creatively.
4. consider the ethical implications inherent in knowledge, decision-making and action.
5. possess a worldview informed by diverse social, multicultural and global perspectives.

☐ None

Program-Level Student Learning Outcomes (PSLOs):

1. Be academically and experientially prepared to obtain an entry level position in the chemical, refining, oil, and gas production, water, waste management, food, and related manufacturing industries.
2. Apply critical thinking to research, evaluate, analyze and synthesize information to solve problems related to process equipment, instruments, systems, and operations within the chemical, refining, oil and gas production, water, waste management, food, and related industries.
3. Demonstrate excellent communication skills (oral and written) to ensure optimal communications with shift co-workers, first line supervisors, maintenance personnel, safety personnel, contractors, and other members of the manufacturing site team.
4. Demonstrate knowledge of the process technology and apply the technical skills necessary to operate complex process equipment and systems such as distillation, fired boilers, refrigeration, cooling tower, reactor, and similar unit operations.

Course-Level Student Learning Outcomes (CSLOs):

At the completion of this course, the student will be able to:

1. Identify and differentiate in the field typical petro/chemical and bulk manufacturing equipment such as pumps, valves, control loops, reactors, separation columns, mixers, driers, packagers, extruders, and heat exchangers. (PSLO 2,3,4)
2. Describe and illustrate the function and operation of each of the previous items. (PSLO 2,3,4)
3. Enumerate and describe the responsibilities of a typical petrochemical operating technician. (PSLO 3,4)

Assessments:

<table>
<thead>
<tr>
<th></th>
<th>Class Participation</th>
<th>Field Tour Summary</th>
<th>Homework</th>
<th>Quizzes and Tests</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSLO 1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CSLO 2</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CSLO 3</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

CSLO 1: Identify and differentiate in the field typical petro/chemical and bulk manufacturing equipment such as pumps, valves, control loops, reactors, separation columns, mixers, driers, packagers, extruders, and heat exchangers.
Class Participation: Students can participate in three ways: by answering questions, either when called on, or when the instructor asks an "open question (not directed at any one individual)"; by commenting on the subject at hand, i.e. enlarging, clarifying, or stating an example; or by asking a question; i.e. clarification of the subject at hand. Students will respond to instructor’s questions and comments about identifying and differentiating typical petro/chemical and bulk manufacturing equipment. Students will ask questions or make comments during class which demonstrate their ability in this area. Students will be expected to correctly answer questions, add comments, or ask questions for clarification on a regular basis. Students will be expected to participate as described above during team based activities (two to four in a group).

Field Tours: Optionally, there will be hands on field tours where each student will be required to identify and differentiate to the instructor the typical petrochemical and bulk manufacturing equipment such as pumps, valves, control loops, reactors, separation columns, mixers, driers, packagers, extruders, and heat exchangers.

Homework: On homework assignments, students will correctly identify and differentiate petrochemical manufacturing equipment. Examples of a homework assignment question that allows students to demonstrate their knowledge of being able to identify and differentiate petrochemical equipment:

Question: Which of these valves would not be used to block flow?
Answer:
A. Gate
B. Plug
C. Butterfly
D. Ball

Question: The two main categories of pumps are:
A. Centrifugal and Positive Displacement
B. Arm and Hammer
C. Fill and Empty
D. Gear and Lobe

Quizzes, Tests, and Final Exam: These types of test questions allow the students to identify and differentiate petrochemical equipment:

Question: Match the following control system components with their definition

<table>
<thead>
<tr>
<th>Match Question Items</th>
<th>Answer Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Transmitter</td>
<td>1. Records trends and prints a hard copy of process data</td>
</tr>
<tr>
<td>B. Recorder</td>
<td>2. Receives a signal from the transmitter and sends a signal to a device</td>
</tr>
<tr>
<td>C. Controller</td>
<td>3. Converts one type of signal to another</td>
</tr>
<tr>
<td>D. Transducer</td>
<td>4. Receives signal from measuring device and sends out a signal</td>
</tr>
</tbody>
</table>

Question: Using Sheet 2 (this sheet, provided to the student, contains drawings of typical symbols) match the equipment with the correct symbol

<table>
<thead>
<tr>
<th>Match Question Items</th>
<th>Answer Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing A</td>
<td>1. Pump</td>
</tr>
<tr>
<td>Drawing B</td>
<td>2. Tank</td>
</tr>
<tr>
<td>Drawing C</td>
<td>3. Pipe</td>
</tr>
<tr>
<td>Drawing D</td>
<td>4. Electronic Signal</td>
</tr>
<tr>
<td>Drawing E</td>
<td>5. Pneumatic Signal</td>
</tr>
<tr>
<td>Drawing F</td>
<td>6. Heat Exchanger</td>
</tr>
<tr>
<td>Drawing G</td>
<td>7. Distillation Column</td>
</tr>
</tbody>
</table>

CSLO 2: Describe and illustrate the function and operation of typical petrochemical and bulk manufacturing equipment.
Class Participation: Students can participate in three ways: by answering questions, either when called on, or when the instructor asks an "open question (not directed at any one individual)"; by commenting on the subject at hand, i.e. enlarging, clarifying, or stating an example; or by asking a question; i.e. clarification of the subject at hand. Students will respond to instructor’s questions and comments about describing and illustrating the function and operation of typical petrochemical and bulk manufacturing equipment. Students will ask questions or make comments during class which demonstrate their ability in this area. Students will be expected to correctly answer questions, add comments, or ask questions for clarification on a regular basis. Students will be expected to participate as described above during team based activities (two to four in a group).

Field Tours: During optional field tours at area petrochemical plants and the PTEC field lab, students will identify and describe the function and operation of typical petrochemical plant equipment.

Homework: In independent assigned homework the student will describe and illustrate the function and operation of typical petrochemical and bulk manufacturing equipment such as pumps, valves, control loops, reactors, separation columns, mixers, driers, packagers, extruders, and heat exchangers. These are examples of homework questions that allow the students to demonstrate their knowledge of the function and operation of typical petrochemical and bulk manufacturing equipment.

Question: The distillation process consists of but is not limited to:

Answer: A. Hot vapor passes up the column
       B. Product is heated
       C. Heat vaporizes all volatile components
       D. All of these

Question: In a refrigeration system, the heat exchange occurs with what part of the process?

Answer: A. Receiver
       B. Evaporator
       C. Tower
       D. Pilot

Quizzes, Tests, and Final Exam: These type of test questions allows the students to demonstrate their knowledge of the function and operation of typical petrochemical and bulk manufacturing equipment.

Question: Some of the issues associated with the improper operation of a shell and tube heat exchanger

Answer: All of these
       Exposure to chemicals or steam
       Rupture tubes fro thermal shock
       Downtime due to repair

Question: The function of a cooling tower is:

Answer: To remove heat from process cooling water
       A place to chemically treat cooling water
       A place to refill supply of water
       Produce steam

CSLO 3: Enumerate and describe the responsibilities of a typical petrochemical operating technician.

Class Participation: Students can participate in three ways: by answering questions, either when called on, or when the instructor asks an "open question (not directed at any one individual)"; by commenting on the subject at hand, i.e. enlarging, clarifying, or stating an example; or by asking a question; i.e. clarification of the subject at hand. Students will respond to instructor’s questions and comments about enumerating and describing the responsibilities of a typical petrochemical operating technician. Students will ask questions or make comments during class which demonstrate their ability in this area. Students will be expected to correctly answer questions, add comments, or ask questions for...
clarification on a regular basis. Students will be expected to participate as described above during team based activities (two to four in a group).

**Homework:** On homework assignments, students will correctly describe responsibilities of a typical petrochemical operating technician. These types of sample homework questions allow the students to demonstrate their knowledge of the responsibilities of a typical petrochemical operating technician.

**Question:** During studies of highly effective teams, researchers found:

**Answer:**
A. There was no synergy  
B. Team members often argued  
C. Team members responded constructively to the views of others  
D. There were “free riders”

**Question:** A process technician should perform their activities with a focus on:

**Answer:**
A. Safety and Health  
B. Production  
C. Environment  
D. All of the above

**Quizzes, Tests, and Final Exam:** These types of sample questions allow the students to demonstrate their knowledge of the responsibilities of a typical petrochemical operating technician.

**Question:** Describe the role of the Process Technician in achieving successful compliance with regulations.

**Question:** Describe the personal attitudes and behaviors that can help to prevent workplace accidents and incidents.

**Question:** The Process Technician needs to have an understanding of physics because:

**Answer:**
It allows you to trouble shoot the process.  
It explains the chemical reactions in the process.  
It maps the direction of the process flow through the pipes.  
It allows you to impress your boss with your knowledge.

**Method of Evaluation/Grading**

A level student work is characterized by participating in class and team activities on a routine basis (50% of the time); leading the discussion during team activities; correctly answering questions asked by the instructor; asking meaningful questions for clarification of class materials; or by contributing to discussions of class subjects. A level student work is characterized by completing all homework assignments and providing detailed answers to homework questions that are at least 90% accurate; being able to identify typical petrochemical equipment such as pumps, valve types, heat exchangers, control loops, and cooling towers in the field; being able to describe the function and operation of this equipment in detail. (For example, on a field trip or in the classroom, the student’s work would include identifying a heat exchanger and stating that the function of the heat exchanger is typically to cool liquids, heat liquids, condense a gas to a liquid, or vaporize a liquid to a gas; stating that whenever a liquid is heated, typically another liquid is cooled; being able to identify the “shell” side and “tube” side of a shell and tube heat exchanger and knowing that vapors are usually on the shell side in a condenser or evaporator; being able to define terms connected with heat transfer such as latent heat, sensible heat, baffle, and U-tube.). A level student work is characterized by a 90% or greater accuracy on quizzes, tests, and the final exam.

C level student work is characterized by participating in classroom discussions 10% of the time, either by answering questions, commenting on the subject at hand, or asking pertinent questions. During team activities, a C Level work will not typically include leading the discussion. C level students’ homework assignments will include answers that are 70% to 79% accurate. C level student work is characterized by being able to identify most typical petrochemical equipment such as pumps, heat exchangers, valve types, control loops, and cooling towers; describing the general function and operation of petrochemical equipment but not giving all of the details. (For example, on a field trip or in
the classroom, students would be able to identify a heat exchanger and be able to state that the function of the heat exchanger is typically to cool liquids, heat liquids, condense a gas to a liquid, or vaporize a liquid to a gas but might not be able to tell which part of the heat exchange is the shell side and which side is the tube side nor know that gases are typically on the shell side of the exchanger. Students would be able to define some of the terms associated with heat exchangers. They would know that liquids have a gaseous state but may not know the terms “sensible heat” or “latent heat” nor would they be able to identify a U-tube heat exchanger and describe its function.) C level student work is characterized by a 70% to 79% accuracy on quizzes, tests, and exams.

The relative weighting of the CSLOs are:
CSLO 1, will account for approximately 40%
CSLO 2, will account for approximately 30%
CSLO 3, will account for approximately 30%

Class participation & Field Tours    approximately 15%, ranging from 5% to 30%
Homework assignments    approximately 10%, ranging from 5% to 30%
Quizzes    approximately 15%, ranging from 5% to 30%
Exams (4 Total)    approximately 60%, ranging from 30% to 75%

This course will be a Student Choice course. The grading policy will be:
A = 100 - 90
B = 89 - 80
C = 79 - 70
D = 69 - 60
F = 59 - 0

Course Content:
History of the process industry
A career as a process technician
Roles and responsibilities
Shift work
  Union and non-union operations
  Work environment and physical requirements
Working with others as a team
Basic physics
  Mass, density, elasticity, viscosity, buoyancy, specific gravity, flow, evaporation, pressure, velocity,
  friction, temperature, and heat
  Relation between pressure, temperature, and volume
  Bernoulli’s law and liquid and gas flow
Basic chemistry
  Organic/inorganic chemistry, reactions, exothermic and endothermic, compounds, mixtures, solutions,
  chemical equilibrium, catalyst, acids and bases, and pH
Piping and valves
  Valve and pipe materials
  Types of piping
  Piping and valve connection types
  Valve types – ball, butterfly, check, diaphragm, gate, globe, plug, and relief
  Line labeling
Tanks, drums, and vessels
  Purpose and function of each
  Vessel and tank design
Pumps
  Positive displacement, centrifugal, metering, and diaphragm
Centrifugal pump parts
Typical pump curve
Head, flow, NPSH, speed, impeller size

Compressors
Centrifugal and positive displacement

Steam turbines

Electrical motors

Heat exchangers, cooling towers, furnaces, and boilers
Heat transfer coefficient
Tube and shell sides
Fouling
Co-current and countercurrent flow

Distillation
Trays, packing, condenser, reflux, re-boiler, thermal siphon, bottoms and overhead

Process control instrumentation overview
Process utilities

Instructional Methods:
- Lecture
- Lab
- Activity
- Problem-based Learning/Case Studies
- Collaborative Learning/Peer Review
- Demonstration/Modeling
- Role-Playing
- Discussion
- Computer Assisted Instruction
- Other (explain) Field trips

Textbooks:

PTAC *Introduction to Process Technology* Student Workbook, Author/Publisher: The Center for the Advancement of Process Technology (CAPT), 1999