Brazosport College

Syllabus for PTAC 2446 – Process Troubleshooting

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I. COURSE DESCRIPTION:

PTAC 2446 - Process Troubleshooting CIP 4103010003
Instruction in the different types of troubleshooting techniques, procedures, and methods used to solve process problems. Topics include application of data collection and analysis, cause-effect relationships, and reasoning. Laboratory instruction involves troubleshooting problems initiated by the instructor in an operating pilot plant. **Credit Hours:** 4 (3 lecture, 2 lab)

Chad Abney

Ron Colwell

Gregg Curry

Karl Grossman

Kenneth Resecker

Ed Smolen

Mark Stoltenberg

Gary Hicks

Jeff Detrick

August 2021

A. Prerequisite: Grade of "C" or better in **PTAC 2420**.
Required skill level: College-level reading, writing and math.

II. COURSE OBJECTIVES

TOPIC	OBJECTIVES
Overview	1. Discuss why we need to troubleshoot. • Murphy's Law 2. Brainstorm and identify things that could go wrong within a process. 3. Define proactive and reactive and give examples of each. 4. Discuss the consequences of proactive and reactive. • Safety and health • Process upset • Equipment damage • Environmental compliance issues • Downtime • Loss of production • Financial impact
Monitoring Instruments and Equipment	1. Discuss the importance of monitoring instruments and equipment as it relates to troubleshooting 2. Discuss ways monitoring instruments and equipment will aid in troubleshooting a process 3. Discuss instrument indicators when a process is operating abnormally • Process variables • Alarms • Controller output • Trends 4. Discuss equipment indicators when a process is operating abnormally • Pressures (pump suction/discharge) • Differential pressure (across filters) • Leaks • Abnormal sounds • Abnormal temperatures • Abnormal vibrations • Abnormal smells • Cavitation of a pump • Surging on a compressor, etc.
Relationships between Equipment and Instruments	1. Discuss the basic parts of a control loop and how they relay information 2. Discuss how failure of one instrument in a control loop would affect another 3. Discuss how a control loop will respond to change in set point 4. Discuss how a control loop will respond to an upset such as: • Loss of pump • Loss of instrument air

TOPIC	OBJECTIVES
Relationships between Equipment and Instruments (cont.)	• Plugged filter • Steam trap failure • Fouled exchanger • Power failure 5. Discuss how instrument or equipment failure may affect systems. a. Loss of a reflux pump on a distillation column b. Level indicator on a condensate pot c. Control valve failure on a feed line to a reactor d. Loss of temperature indication on a reactor
Relationships between Systems	1. Discuss the domino effect among interrelated systems (i.e., how one system affects another) a. Product of one system is feed stock for the next b. Thermal interconnectivity (i.e., hot fluid from one system used to preheat feed to another) 2. Given a scenario, explain how a problem in one system can affect other systems: • Reformer in a refinery provides hydrogen for other processes • Reactors producing a mixture of products that need to be separated by distillation (feed composition change) • Heat from reactor product stream used in a waste heat boiler to generate steam
Troubleshooting Tools	1. Given a process scenario, use tools provided to explain how each would be used in troubleshooting a problem • Process Flow diagrams • Process & Instrument Diagrams • Material balance • Statistical Process Control charts • Historical trends • Energy balance • Lab analysis / on-stream analyzers • How instruments, equipment and systems inter-relate • Field verification • Hand-held devices such as temperature sensors, vibration monitors, etc. • Baseline information • Operating procedures/training manuals • Engineering and equipment specifications • Cause and Effect diagram a. What is it supposed to do b. What is it doing c. What would cause it to do what it is doing
Troubleshooting Steps	1. Identify and document the symptoms of a problem: • Recognize normal conditions • Recognize abnormal conditions • Collect and document applicable data

TOPIC	OBJECTIVES
Troubleshooting Steps (cont.)	• Identify potential problems and the magnitude and urgency of the problem based on the data collected 2. Communicate the problem • Determine what communication is needed • Discuss with team members to help troubleshoot the problem and identify the possible causes 3. Identify the most likely cause: • Eliminate causes that do not fit the data • Evaluate and prioritize remaining possible causes • Determine the most likely causes(s) 4. Collect additional data to confirm most likely cause 5. Develop a plan to take corrective action(s) based on priorities • Short-term solution (compensating action to keep plant/unit running) • Intermediate term solution (temporary action to prevent extended downtime) • Long-term solution (action to eliminate problem(s)) 6. Document incident • Upset • Troubleshooting steps • Corrective action(s) • Cause
Troubleshooting Exercises or Scenarios (Guidelines)	1. Apply troubleshooting steps to an everyday problem (for example, car engine failure, washing machine runs over, car brake failure, remote for VCR fails, etc.) 2. Given a scenario, preferably that reflects an industry within your area, use troubleshooting steps to identify symptom(s), identify cause(s) and develop corrective action(s) for a process upset. Note to Instructor: The following list suggests potential problems. a) Equipment problems • Pump cavitation • Filter plugging • Loss of heat transfer • Tube failure • Agitator failure • Power failure to equipment • Coupling failure • Loss of cooling • Etc. b) Instrument problems • Loss of instrument air • Plugged air filter • Wet instrument air supply • Computer failure

TOPIC	OBJECTIVES
Troubleshooting Exercises or Scenarios (Guidelines) (cont.)	• Loss of power to transmitter • Calibration problems with transmitter • Break in thermocouple • Short in thermocouple • Incorrect valve position • I/P calibration and/or failure • Blocked in transmitter • Etc. c) Process problems • Composition change • Contamination • Inhibitor present or absent • Change in feed ratio • Bad or spent catalyst • Loss of feed • Weather-related changes • Incorrect valve alignment • Etc.

Students will troubleshoot problems in pilot a plant located in the unit operations lab and on computer simulation both on initial startup and after the plant is at steady state. Some examples of problems are shown below. The lab will also be used to reinforce lecture objectives.

Troubleshoot various startup problems either by simulation or actual event to include, but not limited to:

1. Loss of instrument air
2. Loss of electrical power
3. Transmitter blocked in
4. Plugged line
5. Open control circuit
6. Incorrect controller action
7. Vacuum leak
8. Open bypass
9. Fouled heat exchanger
10. Loss of chilled water
11. Bad pH probe

Troubleshoot various instrument and process upsets after steady operations to include, but not limited to:

1. Loss of output from controller
2. Loss of instrument air to a valve or I/P
3. Open bypass valve
4. Open thermocouple circuit
5. False transmitter signal
6. Loss of instrument air to entire plant

7. Pump failure
8. Heat exchanger failure
9. Loss of transmitter signal
10. Loss of steam
11. Loss of cooling water
12. Electrical failure
13. Plugged steam trap

III. STUDENT LEARNING OUTCOMES

OUTCOME	METHOD OF ASSESSMENT
1. Discuss how equipment and/or instrument malfunctions may affect a system	Students will successfully solve equipment of instrument problem(s) on a decanter process on exam 1.
2. Discuss the domino affect between inter-related systems (how a malfunction in one system affects another system).	Students will successfully solve a problem(s) on using a combination of two or more of the following: reactor/boiler, distillation, or absorption/stripping process on the final exam given a scenario.
3. Demonstrate the ability to identify a problem through monitoring instruments and equipment (collecting data) and communicate effectively.	Student will successfully solve problems in the unit operations lab on individual hands-on tests using a six step process and recording the data in the lab book.
4. Demonstrate the ability to use troubleshooting steps and tools to identify the most likely cause(s) and take corrective action(s).	Student will successfully solve problems in the unit operations lab on individual hands-on tests, once the source of the problem is identified the problem will be corrected.
5. Given a scenario (paper, simulator, trainer, etc.) with a problem, demonstrate the ability to utilize troubleshooting tools and steps to identify most likely cause(s) and take corrective action(s).	Students will successfully solve a problem(s) on a reactor/boiler, distillation, or absorption/stripping process on the final exam given a scenario.

SKILL STANDARDS LEARNING OUTCOMES

The following list of learning outcomes are Key Activities from the Chemical/Refining Process Technician skill standards, developed by the North American Process Technology Alliance (NAPTA), and recognized by the Texas Skill Standards Board (TSSB). These outcomes have been integrated into PTAC 2446, Process Troubleshooting.

1. **Diagnose Malfunction or Abnormality.**
2. **Remedy Equipment/Process Malfunction.**

IV. TEXTBOOK OR COURSE MATERIAL INFORMATION

A. Textbook

1. Troubleshooting for Process Technicians, Kukuk, Publisher, 2009. ISBN: 281-8-5600492-9-6 (required)
2. Troubleshooting Lab Manual, Hicks, BC Custom Publisher, November 2016 (required)
3. Visorgogs Safety Glasses (required)

Required course materials are available at the Brazosport College bookstore, on campus or online at http://brazosport.edu/bookstore/home.html. Students are not under any obligation to purchase a textbook from the college bookstore. The same textbook is/may also be available from an independent retailer, including an online retailer.

For Distance Education Courses include the following: Contact the Brazosport College Bookstore with a credit card for course materials. Phone: 979-230-3651. Fax: 979-230-3653. Email: bookstore@brazosport.edu. Website: http://www.brazosport.edu/bookstore

Process Troubleshooting is one of the core courses in the Process Technology Degree. The two-year program has been created to train students for careers as Process Technicians in the chemical and refining process industries.

Process Troubleshooting provides instruction in the different types of troubleshooting techniques, procedures, and methods used to solve process problems. Topics include application of data collection and analysis, cause-effect relationships, and reasoning. Laboratory instruction involves troubleshooting problems initiated by the instructor in an operating pilot plant. This course is considered a capstone course in the Process Technology Degree Plan.

B. Course Outline

This is a sample outline which may vary with individual instructors. It will also vary based on whether the course is a summer course or a fall/spring course. Students should contact their instructor for the outline of the course they are taking.

WEEK	LECTURE	LAB
1	Introduction Chapter 1	
2	Finish Chapter 1	Simulations
3	Chapter 2	Simulations
4	Chapter 2 Finish and Review, Start Chapter 3	Plant Descriptions - Plant A-1 - E Exercise
5	Exam 1 (Plant A-1, Process Control, Chapters 1 & 2), Finish Chapter 3	Plant Descriptions - Plant A-1 - E Exercise
6	Chapter 4	Plant Startup
7	Finish Chapter 4	Plant 1
8	Exam 2, Start Chapter 5	Plant 1
9	Review Exam 2, Continue Chapter 5	Plant 2
10	Finish Chapter 5	Plant 2

11	Start Chapter 6	Plant 3
WEEK	**LECTURE**	**LAB**
12	Finish Chapter 6	Plant 3
13	Exam 3 Chapters 5 & 6	
14	Review Exam 3, Draw Plants	
15	Review for final	Makeup
16	Final Exam	

Important Semester Dates:
Last Day to Withdraw from Classes– Check BC Academic Calendar at http://catalog.brazosport.edu/index.php

V. LAB REQUIREMENTS

YOU MUST MAKE AT LEAST A "D" IN THE LABORATORY PORTION OF THIS COURSE IN ORDER TO PASS THE COURSE.

VI. STUDENTS WITH DISABILITIES

Brazosport College is committed to providing equal education opportunities to every student. BC offers services for individuals with special needs and capabilities including counseling, tutoring, equipment, and software to assist students with special needs. For student to receive any accommodation, documentation must be completed in the Office of Disability Services. Please contact Phil Robertson, Special Populations Counselor at 979-230-3236 for further information.

VII. TITLE IX STATEMENT

Brazosport College faculty and staff are committed to supporting students and upholding the College District's non-discrimination policy. Under Title IX and Brazosport College's policy FFDA (Local), discrimination based on sex, gender, sexual orientation, gender identity, and gender expression is prohibited. If you experience an incident of discrimination, we encourage you to report it. While you may talk to a faculty or staff member at BC, please understand that they are "Responsible Employees" and must report what you tell them to college officials. You can also contact the Title IX Coordinators directly by using the contact information below. Additional information is found on the Sexual Misconduct webpage at www.brazosport.edu/sexualmisconduct.

VIII. ACADEMIC HONESTY

Brazosport College assumes that students eligible to perform on the college level are familiar with the ordinary rules governing proper conduct including academic honesty. The principle of academic honesty is that all work presented by you is yours alone. Academic dishonesty including, but not limited to, cheating, plagiarism, and collusion shall be treated appropriately.

Academic dishonesty violates both the policies of this course and the Student Code of Conduct. In this class, any occurrence of academic dishonesty will be referred to the Dean of Student Services for prompt adjudication, and may, at a minimum, result in F, in this course. Sanctions may be imposed beyond your grade in this course by the Dean of Student Services. Please refer to the Brazosport College Student Guide for more information. This is available online at http://brazosport.edu/students/for-students/student-services/.

IX. ATTENDANCE AND WITHDRAWAL POLICIES

Class attendance contributes to your final grade, but you must attend class to successfully complete the course. If you are unable to complete this course, you must complete and submit a withdrawal form with the registrar's office. If the student decides to drop out of the class, it is the responsibility of the student to initiate a withdrawal before the withdrawal deadline in order to get a "W" on their transcript. If this is not done the student will receive a grade based on test grades and class grades earned during their attendance and absence (i.e., zeros on all missed materials, exams, skills tests, and final exam).

X. COURSE REQUIREMENTS AND GRADING POLICY TESTING MAKE-UP POLICY

Major tests
Cross Disciplinary Skills (work ethic, safety, teamwork, housekeeping, and attitude)
Final Examination

A. Grading

The final grade will be based on the following:

Class Participation	0% - 15%
Class Projects	0% - 20%
Lab*	20% - 50%
Lecture Exams	50% - 80%
Final	10% - 25%
Total	100%

Grades are assigned as follows:

Grade	Final Average
A	90-100
B	80-89
C	70-79
D	60-69
F	Below 60

XI. STUDENT CONDUCT STATEMENT

Students are expected to be aware of and follow the Brazosport College Student Code of Conduct. Students have violated the Code if they "fail to comply with any lawful directions, verbal or written, of any official at BC." Lawful directions include precautions and requirements taken to prevent the spread of COVID-19 at Brazosport College. Students who do not follow safety requirements, including the wearing of a mask, may be removed from class by their instructor and referred to the Dean of Student Services.

XII. COVID-19 STATEMENT

At Brazosport College, all of us, including faculty, staff, and students, share a common goal this fall semester, to keep our classes running in the safest manner possible and avoid any disruption to your progress in achieving your educational and career goals. To that end, we ask and encourage you to conduct yourself in the following manner while on campus this semester:

- Every day, perform a self-health check prior to coming to campus and stay home if sick.
- To the greatest extent possible, maintain your distance between you and other students, faculty, and staff while on campus.
- Wear a properly fitted face covering over your mouth and nose while indoors on campus. If you do not have a mask, they will be available to you in all classrooms this fall.
- Practice good hygiene, washing your hands regularly and/or using hand sanitizer.
- The most effective way to protect yourself from Covid-19 is through vaccination. The vaccine is readily available and at no cost to you. Vaccine information and availability can be found at https://brazosport.edu/coronavirus/vaccine/.

If at any time this semester you begin to experience Covid symptoms, or if you are exposed to someone who has tested positive for Covid-19, please take the following steps:

- Stay home if you're feeling sick and minimize your contact with others.
- Alert the College by completing the Covid-19 Exposure Report Form online at https://brazosport.edu/coronavirus/report/. Be sure to provide accurate contact information, including a working phone number that you will answer.
- After submitting the report, you will be promptly contacted by a member of our Rapid Response Team, who will ask you some specific questions about your situation and provide you with guidance moving forward.
- If it is determined that you should not come to class, your instructor will be notified. **Please know that your instructor will consider course adjustments and potential make-up work only if your case has been reported to Brazosport College, and they've been notified by our response team.** Your instructor will work with you to determine how to manage any make-up work.

The Community Health Network (CHN) Clinic at Brazosport College (located in BC Central B-Wing) is scheduled to be open from 8 AM to 6 PM Tuesday through Thursday during the Fall 2021 semester. While walk-ins are available, your visit will be easier if you pre-register by creating an account at www.mychn.org. In addition to providing health and behavioral services, CHN also provides COVID vaccinations and testing. All insurance is accepted, and healthcare is provided on a sliding scale including no cost for those who need it.

Throughout the semester, please regularly check the College's Covid-19 information page at https://brazosport.edu/coronavirus/, where the latest updates and guidelines will be posted. As members of the BC community, all of us share a responsibility to each other to be as safe as possible.

XIII. CAMPUS CLOSURE STATEMENT

Brazosport College is committed to the health and safety of all students, staff, and faculty and adheres to all federal and state guidelines. The College intends to stay open for the duration of the semester and provide access to classes and support services on campus in the safest way possible. The College will also comply with lawful orders given by applicable authorities, including the Governor of Texas, up to and including campus closure. It is possible that on campus activities may be moved online and/or postpone if such orders are given.

XIV. STUDENT RESPONSIBILITIES

Students are expected to fully participate in this course. The following criteria are intended to assist you in being successful in this course:

1. Understand the syllabus requirements
2. Use appropriate time management skills
3. Communicate with the instructor
4. Complete course work on time, and
5. Utilize online components (such as Desire2Learn) as required.

a. Class Attendance

Much of the learning occurs in the classroom setting and cannot be made up by reading the textbook. Therefore, class participation is essential to your learning and attendance will be taken.

b. Class Participation

Your participation grade is based on the quality (not frequency) of your contribution. Those receiving high grades in class participation will be those who:

- Are prepared for class
- Arrive to class on time
- Have excellent attendance
- Make comments and ask questions that significantly contribute to the learning environment of the class
- Are willing to volunteer for role plays and other in-class demonstrations and exercises.

XV. OTHER STUDENT SERVICES INFORMATION

Information about the Library is available at http://brazosport.edu/students/for-students/places-services/library/about-the-library/ or by calling 979-230-3310.

For assistance with online courses, an open computer lab, online and make-up testing, audio/visual services, and study skills, visit Learning Services next to the Library, call 979-230-3253, or visit http://brazosport.edu/students/for-students/places-services/learning-services/

For drop-in math tutoring, the writing center, supplemental instruction and other tutoring including e-tutoring, visit the Student Success Center, call 979-230-3527, or visit http://brazosport.edu/students/for-students/student-success-center/math-center/

To contact the Physical Sciences and Process Technologies Department call 979-230-3618.

The Student Services provides assistance in the following:

Counseling and Advising	979-2303040
Financial Aid	979-230-3294
Student Life	979-230-3355

To reach the Information Technology Department for computer, email, or other technical assistance call the Helpdesk at 979-230-3266.

Get the information you need – when you need it. Click http://geni.us/BRAZO to install **BC Connect** on your mobile device to receive reminders, explore careers, map your educational plan, be in the know about events, find out about scholarships, achieve your goals and much more.