



CHEG 4312-P01: Process Safety Engineering Fundamentals Syllabus  
Spring 2024

## General Course Information

Information Item	Information
<b>Instructor:</b>	Dr. Emmanuel Dada
<b>Section # and CRN:</b>	P01 CRN 23479
<b>Office Location:</b>	C.L. Wilson 201 B
<b>Office Phone:</b>	936-261-9968; cell Phone: 215-850-1883
<b>Email Address:</b>	<a href="mailto:eadada@pvamu.edu">eadada@pvamu.edu</a> ; emmanuel.dada@ymail.com
<b>Office Hours:</b>	TR : 11:00 A.M. – 12:30 P.M.
<b>Mode of Instruction:</b>	Lecture
<b>Course Location:</b>	C L Wilson Engineering Bldg 107A
<b>Class Days &amp; Times:</b>	T R 12:30 pm - 1:50 pm
<b>Catalog Description:</b>	<b>(3-0) Credit 3 semester hours.</b> This course addresses multiple aspects of Chemical Process Safety and Loss Prevention, but is concerned primarily with the identification of potential hazards and hazardous conditions associated with the processes and equipment involved in the chemical process industries. It includes methods of predicting the possible severity of the associated hazards and preventing, controlling or mitigating them. Course emphasizes quantitative engineering analysis, based on application of mass and energy balances, fluid mechanics of liquid, gas, and two-phase flow, heat transfer and the conservation of energy, mass transfer, diffusion and dispersion under highly variable conditions, reaction kinetics, process control, and statistics. Techniques for performing process hazard analysis, risk assessment, and accident investigations are introduced, including the review of several significant incidents in the chemical processing industry.
<b>Prerequisites:</b>	Senior standing in the Chemical Engineering major
<b>Co-requisites:</b>	None
<b>Required Text(s):</b>	A. Crowl and Joseph F. Louvar, ‘Chemical Process Safety: Fundamentals with Applications’, Prentice Hall 4th edition. Pearson Education, Inc.

	2019 or newer edition.
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<b>Recommended Text(s):</b>	<p>1. Trevor Kletz, "What Went Wrong? :Case Histories of Process Plant Disasters and How They Could Have Been Avoided", Fifth Edition, Elsevier Inc. 2009 ISBN: 978-1-85617-531-9</p> <p>2. Introduction to Process Safety for Undergraduates and Engineers; Center for Chemical Process Safety of the AIChE, Ny, NY, 2016:ISBN: 978-1-118-94950-4</p> <p>3. Access to Learning Resources:</p> <p>(i) Access to Center for Chemical Process Safety (CPS) , Chem On Demand; and Safety in Chemical Engineering Education (SACHE) : <a href="http://www.aiche.org">www.aiche.org</a></p> <p>(ii) Chemical Safety Board: <a href="http://www.csb.gov">http://www.csb.gov</a></p> <p>(iii) Mary Kay O'Connor Process Safety Center: <a href="http://psc.tamu.edu/symposia/2012-sym">http://psc.tamu.edu/symposia/2012-sym</a></p>
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### **REQUIRED SACHE CERTIFICATION PROGRAM:**

SACHE certificates are available at <http://www.aiche.org/academy/courses/sache/sache-certificate-program> (undergraduate students with aiche membership can access these course for free. Graduate students have to register as member of AIChE for free access. Membership dues for graduate student is \$50.00. To renew or become an AIChE student member, visit [www.aiche.org/students](http://www.aiche.org/students) to review status.

PVAMU Library:

phone: (936) 261-1500;

web: <http://www.tamu.edu/pvamu/library/>

University Bookstore:

phone: (936) 261-1990;

web: <https://www.bkstr.com/Home/10001-10734-1?demoKey=d>

#### **Course Goals or Overview:**

The goal of this course is to introduce students to principles of chemical process safety and quantitative methods for risk analysis and loss prevention.

#### **Course Outcomes/Objectives**

**At the end of this course, the student will have achieved and demonstrated the following outcomes.**

1. Recognize professional and ethical elements of an outstanding safety program.
2. Evaluate ethical issues that may occur in professional engineering practice.
3. Recognize ethical standards and professional codes of conduct for engineers, e.g., NSPE Code of Ethics for Engineers.
4. Identify government agencies, regulatory bodies, codes, and standards that govern the global, societal, and environmental impact of plant design projects.
5. Be able to list examples of how unsound science or unethical behavior had a negative impact on society.
6. Identify and apply OSHA PSM and EPA RMP in the chemical process industries.
7. Describe and apply the principles and approach of inherently safer design to reduce and eliminate hazards and thereby lower the risk of new or currently operating chemical systems.

8. Describe the operation of chemical processes and equipment and apply engineering fundamentals to the analysis and prediction of performance under adverse circumstances.
9. Perform quantitative engineering analysis based upon the applications of mass and energy balance, fluid mechanics of liquid, gas, and two-phase flow, heat transfer and the conservation of energy, mass transfer, diffusion and dispersion under highly variable conditions, reaction kinetics, process control, and statistics.
10. Perform PHA analysis of targeted chemical process industries and evaluate the safety performance.
11. Identify the potential hazards and hazardous conditions associated with the processes and equipment involved in the chemical process industries.
12. Work effectively in teams and develop problem solving skills. Prepare and present a professional project report.

### **Course Requirements & Evaluation Methods**

This course will utilize the following instruments to determine student grades and proficiency of the learning outcomes for the course. The course has been designed to ensure that students acquire a solid grounding in ability to apply the knowledge of mathematics, science, and engineering and ability to identify, formulate, and solve engineering problems.

**Computer Assignments** – self-explanatory assignments, including web based training. Videos, and DVDs

**Homework Exercises** – written assignments, often in letter report format, designed to supplement and reinforce course material. The letter report format serves to develop and demonstrate an ability to communicate effectively in written mode.

**Quizzes** – announced or surprise in-class assignments to promote student accountability

**Partial Tests** – the objective is determining concept development and problem-solving skills. .

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**Final Examination and/or Project Reports & Presentations at the discretion of the instructor Grading Matrix**  
(*points will vary at the discretion of the instructor.*)

#### **Instrument Total**

Homework, Computer Assignments & Quizzes 30%

Partial Exams (Mid-term, etc) and/or Projects Reports&Presentation at the discretion of the instructor 40%

Final Exam and/or Project Reports & Presentation at the discretion of the instructor 30%

Penalty for lack of participation -10%

**Total 100%**

\*\*Extra credit may be assigned by instructor as optional but available to all.

#### **Grade Determination:**

A = 90 – 100pts;

B = 80 – 89pts;

C = 70 – 79pts;

D = 60 – 69pts;

F = 59pts or below

#### **Program Outcomes**

## Data Used to Show

### Student Proficiency in Measured Program Outcomes

1. Samples of student work in a Binder
2. Spreadsheet showing student performance and class average
3. End of Semester Course Assessment report

## Course Procedures

### Textbook Policy

Students must acquire the textbook if listed as “required” on the course syllabus. The textbook must be acquired by the 10<sup>th</sup> class day. Students are not allowed to share textbooks with other students who are currently registered in the same class. Failure to acquire (or show proof of purchase) the required textbook by the 10<sup>th</sup> class day will result in the student being administratively dropped from the course. The University will assess financial obligations for the course to the student as with any other dropped class according to the fee schedule. In addition, your financial aid may be affected by the subsequent registration action(s).

Go to <http://www.pvamu.edu/pages/195.asp> for the Roy G. Perry College of Engineering Textbook Policy.

### Conduct:

1. Students will conduct themselves in a manner that is respectful to their fellow classmates and the instructor at all times.
2. **Cell phones, ipads and smart phones or similar electronic devices MUST** be turned off and stowed away during class time. Students are **NOT** allowed to leave class to answer cell phones or use these devices except for an emergency with the permission of the instructor. .
3. Students caught using ipads and smart phones or similar electronic devices during exams will receive **ZERO** for the exam and be subject to sanctions as stipulated under **Academic Misconduct**.
4. Students should be prepared to stay in the classroom for the duration of the exam. Students who have any condition that may require them to leave the exam room should make prior arrangements with the Instructor. Students who decide to leave the exam room for any other reason must handover their exam paper and consider the exam over for them.
5. Programmable calculators are **NOT** allowed in class.
6. Students should dress professionally and are **NOT** allowed to wear caps/hats in class.
7. Students are NOT allowed to bring food to the classroom or eat in class
8. Arrive to class prepared to discuss lesson with your project binder.
9. eBooks and/or Internet access are not allowed during class exams.

### Submission of Assignments:

All assignments are due by default one week after being given, unless otherwise stated.

*All homework assignments are due directly to the Instructor, prior to the start of class or the assignment will not be accepted. All homework assignments and exams should be written on one side of the page only, and should use the appropriate cover sheet, with the name, assignment title and date. All pages should be numbered. Failure to use the correct format will result in the assignment grade being reduced by 20%.*

## **Exam Policy**

Exams should be taken as scheduled. No makeup examinations will be allowed except under documented emergencies (See Student Handbook).

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## **LECTURE OUTLINE & SAMPLE TOPICS (subject to changes by the instructor.)**

### TOPIC (Hours)

#### Introduction - Process Safety Management (3)

Failure

Management Responsibility, Policy

Hazard Identification

Hazard Assessment

Hazard Control

Introduction to Process Safety Engineering, Loss Prevention

Application of Fundamental Engineering Principles

Teamwork 1

#### Toxic Materials - Introduction 2

Dose and Response Curves

Threshold Limit Values and Permissible Exposure Levels

Application of Engineering Principles - Problems

#### Introduction to Hygiene 3

MSDS's

Monitoring Volatile Toxicants, etc.

Liquid Vaporization Rates - Exposure during vessel filling

Ventilation

Applications - Problems

#### Source Models 3

Applications of Fluid Mechanics to Leakage of Liquid and Gas

Through Holes, Pipes, and Fittings

Evaporation, Flashing, and Boiling

Two Phase Flow

Applications - Problems

#### Toxic Release and Dispersion 3

Dispersion Models

Pasquill-Gifford Plume and Puff Models

Computer Applications

#### Fires and Explosions 3

Flammability of liquids and vapors

Minimum Oxygen Concentration, Ignition

Explosions - Detonations and Deflagrations

Blast Damage

Applications - Problems

#### Fire and Explosion Protection and Prevention 3

Inerting, Purging Static Electricity

Explosion Proof Equipment

Ventilation, Sprinklers

Applications - Problems

#### Reliefs 2

Location, Types, Systems

Knockout Drums

Flares

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Scrubbers, Condensers

Applications - Problems

Relief Sizing 3  
Spring Operated, Rupture Discs  
Design for Liquid, Vapor, Two-Phase Flow  
Venting for Dust and Vapor  
Thermal Expansion  
Applications - Problems  
Hazard Identification 2  
Checklists, DOW Fire and Explosion Index  
HAZOP  
Safety Reviews  
Application - Problems  
Risk Assessment 3  
Probability Theory  
Interactions between units  
Event Trees  
Fault Trees  
Accident Investigations 2  
Procedures  
Diagnosis  
Recommendations  
Term Project Presentations 6  
Examinations 3  
Total Hours: 42  
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### **University Rules and Procedures**

#### **Disability statement (See Student Handbook):**

Students with disabilities, including learning disabilities, who wish to request accommodations in class should register with the Services for Students with Disabilities (SSD) early in the semester so that appropriate arrangements may be made. In accordance with federal laws, a student requesting special accommodations must provide documentation of their disability to the SSD coordinator.

#### **Academic misconduct (See Student Handbook):**

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct. Students who engage in academic misconduct are subject to university disciplinary procedures.

#### **Forms of academic dishonesty:**

1. Cheating: deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.
2. Academic misconduct: tampering with grades or taking part in obtaining or distributing any part of a scheduled test.
3. Fabrication: use of invented information or falsified research.
4. Plagiarism: unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.

#### **Nonacademic misconduct (See Student Handbook)**

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under nonacademic procedures.

#### **Sexual misconduct (See Student Handbook):**

Sexual harassment of students and employers at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action.

**Attendance Policy:**

Prairie View A&M University requires regular class attendance. Excessive absences will result in lowered grades.

Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in assignment of a grade of "F". Absences are accumulated beginning with the first day of class.

**Student Academic Appeals Process**

Authority and responsibility for assigning grades to students rests with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the Undergraduate Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

**Changes:**

Course evaluation, grading scales and outline can be changed by the instructor. Such changes shall be communicated to the students.

**Video Conferencing Etiquette**

When using Zoom, WebEx or other video conferencing tools, confirm the visible area is tidy, clear of background clutter, inappropriate or offensive posters, and other distractions. Ensure you dress appropriately and avoid using high traffic or noisy areas. Stay muted when you are not speaking and avoid eating/drinking during session. Before class session begins, test audio, video and lighting to alleviate technology issues. **Technical Support**

Students should go to the [Password Reset Tool](#) if they have password issues. The page will provide instructions for resetting passwords and contact information if login issues persist. For other technical questions regarding eCourses, call the Center for Instructional Innovation and Technology Services (CIITS) at 936-261-3283 or email [ciits@pvamu.edu](mailto:ciits@pvamu.edu).

**Communication Expectations and Standards**

Emails or discussion postings will receive a response from the instructor, usually in less than 48 hours. Urgent emails should be marked as such. Check regularly for responses.

**Discussion Requirement**

Online courses often require minimal to no face-to-face meetings. However, conversations about the readings, lectures, materials, and other aspects of the course can take place in a seminar fashion. This will be accomplished by the use of the discussion board. The exact use of discussion will be determined by the instructor.

**It is strongly suggested** that students type their discussion postings in a word processing application such as Word and save it to their PC or a removable drive before posting to the discussion board. This



is important for two reasons: 1) If for some reason your discussion responses are lost in your online course, you will have another copy; 2) Grammatical errors can be greatly minimized by the use of the spell-andgrammar check functions in word processing applications. Once the post(s) have been typed and corrected in the word processing application, copy and paste to the discussion board.

## COVID-19 Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the COVID-19 pandemic, Prairie View A&M University has adopted policies and practices for the Fall 2020 academic term to limit virus transmission. Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, help sessions, transitioning to and between classes, study spaces, academic services, etc.):

- **Self-monitoring** - Students should follow CDC recommendations for self-monitoring. Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.
- **Face Coverings** - Face coverings (cloth face covering, surgical mask, etc.) must be properly worn in all non-private spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain.
- **Physical Distancing** - Physical distancing must be maintained between students, instructors, and others in course and course-related activities.
- **Classroom Ingress/Egress** - Students must follow marked pathways for entering and exiting classrooms and other teaching spaces. Students should leave classrooms promptly after course activities have concluded, should not congregate in hallways and should maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.
- **Face-to-face Class** - To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student to leave and join the class remotely. If the student does not leave the class, the faculty member should report that student to the Office for Student Conduct for adjudication. Additionally, the faculty member may choose to teach that day's class remotely for all students.

- **COVID-19 Guidelines for Student Conduct Adjudication** - The mandatory COVID-19 Training/Certification taken by all students serves as the 1st Warning for violation of COVID-19 Guidelines.
  - 1<sup>st</sup> incident: upon review of Incident Report and finding of responsibility — Conduct Probation
  - 2<sup>nd</sup> incident: upon review of Incident Report and finding of responsibility — Suspension
  - Consult the Code of Student Conduct in the Student Planner or [Student Conduct website](#) for additional information on Conduct Probation and Suspension.
  
- **Personal Illness and Quarantine** - Students required to quarantine must participate in courses and course-related activities remotely and must not attend face-to-face course activities. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities. Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence. To receive an excused absence, students must provide appropriate documentation to the Office for Student Conduct, [studentconduct@pvamu.edu](mailto:studentconduct@pvamu.edu).