CHEG 4103 –P16 Special Topics –Introduction to Process Safety in Engineering

Spring 2020

PRAIRIE VIEW A & M UNIVERSITY

COLLEGE OF ENGINEERING

Roy G. Perry College of Engineering

Department of Chemical Engineering

COURSE SYLLABUS

Course Title: SPECIAL TOPICS: Introduction to Process Safety in Engineering
Course Prefix: CHEG Course No.: 4103 Section No.: P16
Department of Chemical Engineering College of Engineering
Instructor Name: Dr. Emmanuel A. Dada
Office Location: WILS 201B
Office Phone: 936-261-9968, cell: 215-850-1883 (preferred)
Fax: 936-261-9419
Email Address: eadada@pvamu.edu; emmanuel.dada@ymail.com (preferred)
U.S. Postal Service Address: Prairie View A&M University
P.O. Box 519
Mail Stop 2505
Prairie View, TX 77446-0519
Office Hours: T 2:00 – 3:00 P.M.; R 2:00 – 3:00 P.M. & 5:00 – 6:00 p.m.

Virtual Office: By Phone (215-850-1883) and Skype by appointment (appointment must be scheduled via
e-mail to emmanuel.dada@ymail.com); skype name: emmanuel.dada1

Course Location: Wilson Bldg Room 202

Class Meeting Days &Times: Wednesdays 5:30 p.m. to 8:20 p.m.

Catalog Data and Course Description:
(3-0) Credit 3 semester hours. This special topic 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.

Prerequisite: Senior standing in the Chemical Engineering major.

Co-requisites: No applicable.

Required Text:

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. Note that AIChE Student Membership is available at no cost to undergraduate students registered for at least one chemical engineering course. To renew or become an AIChE student member, visit www.aiche.org/students to review status. You can also check with PVAMU Student Chapter of AIChE.)

Recommended Text/Readings:
ISBN: 978-1-85617-531-9

2. Access to Learning

Resources:

(i) Access to Center for Chemical Process Safety (CPS) , Chem On Demand; and Safety in Chemical Engineering Education (SACHE) : www.aiche.org

(ii) Chemical Safety Board: http://www.csb.gov

(iii) Mary Kay O'Connor Process Safety Center: http://psc.tamu.edu/symposia/2012-sym

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 senior chemical engineering 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 ABET 2000 outcomes a: Ability to apply the knowledge of mathematics, science, and engineering and e: 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**

(Points will vary at the discretion of the instructor.)

**Grading Matrix**

<table>
<thead>
<tr>
<th>Instrument Total</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework, Computer Assignments &amp; Quizzes</td>
<td>30%</td>
</tr>
<tr>
<td>Partial Exams (Mid-term, etc) and/or Projects Reports &amp; Presentation at the discretion of the instructor</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam and/or Project Reports &amp; Presentation at the discretion of the instructor</td>
<td>30%</td>
</tr>
<tr>
<td>Penalty for lack of participation</td>
<td>-10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

**Grade Determination:**

A = 90 – 100pts;  
B = 80 – 89pts;  
C = 70 – 79pts;  
D = 60 – 69pts;  
F = 59pts or below

**Program Outcomes**
| Measured by Course | Program ABET outcomes (f) and (j) assessed using course assignments. |
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 10th 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 10th 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).


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
5
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

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):

Dr. Emmanuel A. Dada
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.