Spring 2019

CHE 312-102: Chemical Process Safety

Thomas Devine

1. **ChE 312 - Chemical Process Safety**

2. **Credits and contact hours**
   3-0-3 (3 lecture hr/wk – 0 lab hr/wk – 3 course credits)

3. **Course Coordinator or Instructor:** Thomas Devine, BS, MS Chemical Engineering
   Class Location and Time: CKB 217 6-9 PM
   Office Hours: Before class – Tiernan 160D

4. **Textbook**
   Daniel A. Crowl and J. F. Louvar, *Chemical Process Safety, Fundamentals with Applications,* 3rd ed., Prentice Hall, 2011. 723 pages. ISBN-13: 978-0-13-138226-8

5. **Specific course information**
   a. **Description:**
      A study of the technical fundamentals of chemical process safety: includes impact of chemical plant accidents and concepts of societal and individual risk; hazards associated with chemicals and other agents used in chemical plants, including toxic, flammable and reactive hazards: concepts of inherently safer design; control and mitigation of hazards to prevent accidents, including plant procedures and designs; major regulations that impact safety of chemical plants; consequences of chemical plant incidents due to acute and chronic chemical release and exposures; hazard identification procedures; introduction to risk assessment.
   b. **Prerequisites:** none (Junior Standing)
      Co-requisites: none
   c. **Required**

6. **Specific goals for the course**
   a. The student will be able to
      1. define major components of process safety and Process Safety Management (PSM)
      2. use online e-learning tools and obtain a SACHE certificate while recognizing the need for life-long learning in chemical process safety
      3. explain and apply OSHA PSM and it 14 elements when applicable
      4. identify the components of PSI and explain how it is obtained and utilized
      5. describe safety and differentiate inherently safe and safe
      6. describe risk in terms of frequency and consequences and use risk to define safety levels
      7. identify and explain most common process hazard analysis (PHA) and risk assessment techniques (LOPA)
      8. identify most of the basic toxicology terms and concepts that can impact workers in the chemical industry
      9. identify between compressible and incompressible fluids and calculate critical pressure and flows for compressible fluids
      10. describe the fire triangle and differentiate various types of fires

11. describe the explosion pentagon and differentiate various types of explosions
12. describe overpressure and calculate safe distance from overpressure development

b. This course explicitly addresses the following student outcomes: 1, 2, 4, 7. Also, this course mainly addresses the hazards associated with chemical, physical, and/or biological processes, which are stated in the Program Criteria.

GRADING and Grading scale:

Item	Number	Percent
Exams:	2	40%
Final:	1	25%
Homework	Weekly	20%
SACHE Certificates	3	10%
Attendance	1	5%
TOTAL:		**100%**

GRADING SCALE: $90 \leq A \leq 100$; $85 \leq B^{+} < 90$; $80 \leq B < 85$
$75 \leq C^{+} < 80$; $70 \leq C < 75$; $60 \leq D < 70$
$0 \leq F < 60$
This is approximate and may be adjusted.

7. Topics

1. *Course overview/Process Safety Overview; PSM/RBPS/OSHA PSM Acronyms*
2. *Toxicology/Industrial Hygiene/Regulatory Concerns*
3. *Source models/dispersion modeling/ Facility siting*
4. *PSI/PS laboratory/*
5. *Hazard and Risk Analysis*
6. *HIRA/Chemical reactivity hazards*
7. *Fires and Explosions*
8. *Mitigation/prevention of fire and explosion*
9. *Relief system concepts*
10. *Combustible dusts*
11. *Risk assessment concepts*
12. *Safe work Practices*

8. HOMEWORK: Homework assignments will be given and graded. Verbal collaboration on homework is encouraged, however, outright copying and submission of identical homework will not be accepted.

9. EXAMS: First exam will be around the 6th week of class and the 2nd exam around the 11th week – these exams will be delivered during the class period. The final exam will be during the scheduled finals period. Exams are comprehensive and will include all content up to the designated syllabus week – including all lecture content and classroom discussions, videos, and homework.

10. ONLINE LEARNING – Students will complete online learning courses developed for the Safety And Chemical Engineering Education (SAChE) program buy the AICHE. Three of the 4 Level 1 courses will be completed. The program is described and Level 1 courses accessed at http://sache.org/student_certificate_program.asp
Students need to be an AICHE member to enroll in the AICHE/SACHE certificate courses – membership in AICHE is provided free for all students but must be renewed annually. These video programs are free to student members.
The three SACHE certificates must be handed in by the 7th week of class to receive credit toward the course grade.

11. Chemical Safety Board (CSB) Videos: Videos to view will be assigned during the course**.** Go to www.csb.gov and then click on the video room tab near the top of the page.

12.ChE Student Outcomes (see 6b)

Students from the ChE program will attain (by the time of graduation):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.