

Department of Chemistry and Life Science
United States Military Academy
West Point, New York 10996

MADN-CLS

25 May 2023

MEMORANDUM FOR RECORD

SUBJECT: Chemical Engineering Program Course and Program AARs AY23-2

1. The course assessment meeting for all AY23-2 chemical engineering courses was conducted on 23 May 2023. Attendees: COL Corey James, LTC Sam Cowart, Dr. Andrew Biaglow, LTC John Belanger, Dr. Simuck Yuk, and Dr. Enoch Nagelli. The courses discussed were CH362 Mass and Energy Balances, CH364 Chemical Reaction Engineering, CH367 Introduction/ Automatic Process Controls, CH400 Chemical Engineering Professional Practice, and CH402 Chemical Engineering Process Design.
2. Each course director presented topics and relevant assessment to their specific courses. These topics are outlined in more detail in the individual course assessments. The course director slides are provided as enclosures.
3. Some of the topics led to broader discussions relevant to the entire program. These included: 1) improving cadet acumen in analytical software to solve chemical engineering problems, 2) updating major graded events and capstone projects, 3) integrating more hands-on labs using the unit operations laboratory experiments to reinforce concepts across the curriculum, 4) and continued efforts to send major graded events course supervisors for review and feedback. In particular, the consensus was that the program needs to emphasize the relevance of the help function in Mathematica and other software tools to help develop individual acumen outside of the classroom.
4. POC is the undersigned.

Encl

Course and Program AAR Slides

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UNITED STATES MILITARY ACADEMY
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Chemical Engineering

Course and Program AAR

Dr. Enoch Nagelli and LTC Sam Cowart

23 May 2023



Agenda

- ☐ **CH362**
- ☐ **CH364**
- ☐ **CH367**
- ☐ **CH400**
- ☐ **CH402**
- ☐ **CH300**
- ☐ **CH450**
- ☐ **Chemical Engineering Program AAR
Comments**



Course assessment complete

- ❑ **Course average: 87.7%; TEE average 87.4%**
- ❑ **Maintain working example problems for each lesson (at/near 100%, with multiple problems per lesson)**
- ❑ **Maintain multiple concept single problem for ICPS**
- ❑ **Maintain lab scope – intro and build proficiency with ChemCAD**
 - **Maintain the flash distillation lab; struggled with Txy diagrams**
- ❑ **Maintain writing assignment (basic literature review)**
- ❑ **Maintain capstone project (time constrained with 32 cadets)**
- ❑ **Maintain 2-lesson sequence on VLE; good setup for CH363**
- ❑ **Continue with new Lesson 3 objectives; reinforce units (SI, US customary), dimensional analysis, process variables (mol vs. lb-mol, force, pressure, etc.)**
- ❑ **Spread out problem sets to a frequency of 1 per 3 lessons (~10 days).**
- ❑ **Develop new PS problems, with heavy reliance on MMA/MATLAB and multiple concepts.**
- ❑ **Shorten MB block by one lesson, add to EB block; get to MB/EB combo problems earlier.**
- ❑ **Reduce reliance on MMA/MATLAB/Excel for major graded events**



- ❑ **Course average: 88.6%**
- ❑ **Maintain in-class example problems for each lesson.**
 - **Can also introduce FEE-type questions, so cadets can be familiarized with FEE reference manual.**
- ❑ **Maintain block review/problem solving days before WPRs.**
 - **Can introduce the in-class PS to sharpen cadets' understanding on the key concepts.**
- ❑ **Capstone project**
 - **This year: reactor design on the conversion of ethanol to hydrocarbon.**
 - **Can design the project in a way so cadets can use the fundamental concepts learned in CH362 and/or CH364 into the MMA and ChemCad models.**
- ❑ **Major graded events (WPRs and TEE)**
 - **TEE is the mixture of FEE-typed questions and traditional ChemE problems.**
 - **To reduce the cadets' reliance on the previous year's documents, new types of problems were introduced for each graded event.**



Sustain:

- ✓ **Lesson 1: Introduce a series of examples to clearly articulate the “so what”. This was done in the sub-basement and had a great effect. Model the level in the absorption column on the spot.**
- ✓ **Continue use of SSI for describing/demonstrating dynamic behavior, stability, controller design, and tuning.**

Improve:

- ✓ **Potentially re-write the TEE.**
- ✓ **To facilitate a deeper understanding and engineering intuition, relate controllers and modeling to electrical circuits learned in EE301.**
- ✓ **Find even more ways to integrate SSI into the course. Feedback from Cadets is overwhelmingly positive.**



Sustain:

- ❑ 10/13* Cadets Passed the FEE Overall. **76.9% Pass Rate (1st time = 61.5%)**
 - ❑ **2/3 passed on 2nd attempt (Sawyer, Lucero, and Kim = 1 attempt)**
- ❑ CH400 serves to assess if cadets have mastery over program material and simultaneously prepare for FEE
- ❑ Lesson of probability and statistics review (Math department guest lecture)
- ❑ Kaplan/PPI2Pass for quizzes and problem sets
- ❑ Continue to maintain rigor of the subject area quizzes each week
- ❑ DIST Simulator
- ❑ General chemistry/gen bio review

Improve

- ❑ Cadets all take FE in early-mid MAR so re-test during the semester is an option
- ❑ Add additional SSI-Simulator & P&ID Controls Problems
- ❑ Cadets want more in class time to review quizzes and graded events
- ❑ Tremendous amounts of discomfort due to poor performance on quizzes/WPR
- ❑ For Failures, have cadets work on PPI2Pass/Diagnostics during dedicated CH400 class time until next attempt



Sustain:

Capstone project - Use research topics to supplement the design; incorporation of curricular content is good; good fit with curriculum.

If possible, use AIChE national student design contest.

Improve:

Communication – 1/4 poor reports, 1/4 excellent. Always room for improvement!

Control – Ability to draw P&IDs was good (95% course average in 1/0), but critical control points were missing (relief devices, level controllers in columns and vessels).

Research skills, background research on process design (91% average in 1/0). Cadet research on critical areas was mixed.

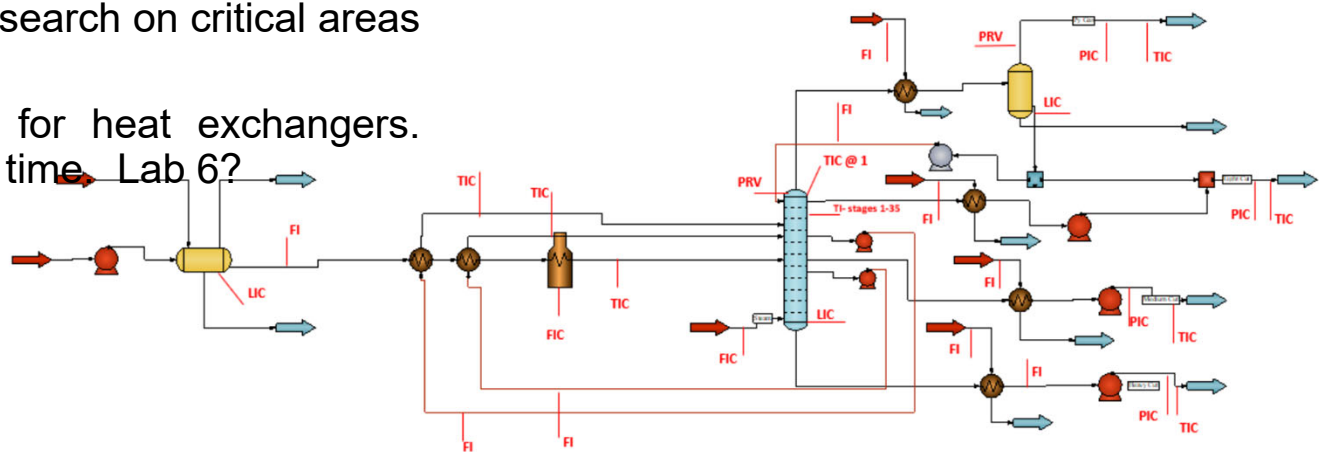
Recommend pinch zone analysis for heat exchangers. Problem is where to find lesson time. Lab 6?

Research:

Research requirement this year dictated by AIChE:

- (1) Removal of chlorides.
- (2) Constraints on water content.
- (3) General approaches to fractionation (of oil).
- (4) Context and social issues (Indonesia recycling).

Research on removal of chlorides (1) was generally poor. Knowledge of and research on water content (2) and fractionation COAs (3) was generally good. Research on context and social issues (4) was very good, but cadets did not make required (by AIChE) modifications to sorting facility.



Good example of flow diagram from Cadets Dawson, Komorowski, Hwang and Bomke, but copied at scale and difficult to read.



1. Course Directors Handbook for all administrative guidance and SOP

- ❑ EXSUM on Dept Sharepoint to include **Course AAR Slides**
- ❑ **Course Assessment Due 30 days** after semester completion

2. CD Duties

- ❑ Update graded event problems, problem sets, and capstone
- ❑ Integrate Unit Ops Lab (SB) into Labs for Core ChemE courses
- ❑ Continue to **send all major graded events** to Course Supervisors

3. Bioengineering ET Review

- ❑ Sharepoint Repository for all CH300 & CH350 Graded Events
- ❑ Contact Dr. Ken Allen (POC: LTC Cowart) \

4. FDW for CH459 (LTC Belanger with LTC Cowart and Dr. Nagelli)

- ❑ Labs run **24MAY-02JUN** (Mr. Mathew and ChemE Team)
- ❑ Discussion/Collab on Calculations and Due outs for Cadets

5. Conferences and Collaborative Manuscripts

- ❑ AIChE Fall 2023 in Orlando, FL – Undergrad poster competition for cadets to compete: **AUG23 (POC: MAJ Mandes for OIC)**
- ❑ Abstracts Submitted: Dr. Yuk, MAJ Mandes, and Dr. Nagelli



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Extra Slides