DEPARTMENT OF THE ARMY
UNITED STATES MILITARY ACADEMY
West Point, New York 10996

MADN-CLS 13 December 2023

MEMORANDUM FOR RECORD

SUBJECT: Chemical Engineering Program Assessment and AAR (AY24-1)

1. The senior faculty of the chemical engineering program at the United States Military Academy met on 13 December 2023 to conduct a post-semester review of courses taught during Fall 2023 and current program assessment. The faculty members in attendance were Dr. Andrew Biaglow, COL Corey James, LTC Sam Cowart, Dr. Enoch Nagelli, Dr. Simuck Yuk, MAJ Galen Mandes, CPT Sam Lowell, CPT Louis Tobergte. Chemical engineering faculty members not in attendance were LTC John Belanger and MAJ Patrick Bowers.

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. These post-semester discussions serve as a tool to gauge effectiveness of course content and administration in meeting the ABET student outcomes specific to each course. Comments and questions from these discussions support the more formal content of the written course assessment packages that are completed at the end of each academic term. Ideas for course improvement and potential future changes are the focus of the discussions.

3. CH350 Bioprocess Engineering, CH363 Separations Processes, CH365 Chemical Engineering Thermodynamics, CH459 Chemical Engineering Laboratory, and CH485 Heat and Mass Transfer were reviewed and thoroughly discussed by all attendees. Some of the topics led to broader discussions relevant to the entire program. These included: 1) improving cadet acumen in dimensional analysis, fundamental general chemistry concepts, and process flow charts, 2) continuing to address course assessment from last time the course was taught, 3) translating chemical engineering skills attained through curriculum courses onto a resume, 4) and integrating general chemistry and general mathematical relationships as a standalone introduction problem set or other deliverable. In particular, the consensus was that the program continues to emphasize the relevance of general chemistry concepts to help develop chemical engineering acumen.

4. The point of contact for this document is the undersigned at enoch.nagelli@westpoint.edu or 845-938-3904.

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Chemical Engineering

Course and Program AAR, AY24-1

Dr. Enoch Nagelli & LTC Sam Cowart

13 December 2023

Agenda

- CH350
- CH363
- CH365
- CH459
- CH485
- Chemical Engineering Program AAR Comments

CH350 AAR

- **PS: A total # of PS is 6 in AY24-1**
  - **1-3 PS: MM kinetics, recombinant DNA technologies and fundamental biology concepts.**
  - **4-5 PS: reaction kinetics and fermenter design.**
  - **6 PS: process control in bioprocessing (new PS in AY24-1).**

- **WPR: Cadets performed similarly on the WPR #1 and #2.**
  - **WPR #1: more focused on fundamental; WPR #2: reactor design and bioprocess control**
  - **Interestingly, the most difficult question considered by cadets from WPR #1 and #2 is the concentration problem directly related to CH102 ICE table.**

- **TEE: comprehensive exam covering Block I to III in AY24-1**
  - **Mixture of MM kinetics, reaction design, and process control problems.**

- **Cadets relied heavily on the lesson slides to understand the LOs rather than the textbook. Most of all, cadets show a tendency to "jump on" the coding, instead of thinking about the mathematical concepts behind the problems.**

CH363 AAR

- Debate topic – Are NTUs critical to have in CH363 or can it wait until CH459?

- Sustain: Capstone
- Improve: Slides, Problem Sets

- Do we want to re-energize the Bayway trip (or similar)? Do we have the connections still?

CH365 AAR

- Response to AY23 course assessment: changed CDP to study activity coefficients, replaced CDP on fugacity.
- CDP: group assignment. Binary solution with given mole fraction. Measured boiling point on ebulliometer, modelled the system as ideal and nonideal in MMA and in CC, and performed bip regression in CC. Used collaborative spreadsheet on course Canvas page to encourage data sharing.
- Writing assignment (new) – 2-page report for CDP. Reports graded so far are very good with excellent plots.
- Writing assignment (sustain) – resumes, iterative. Provided format, so resumes look nice, but most cadets still cannot adequately identify skills learned in the program, so continuing to iterate this assignment.
- Performance on exams was strong. Averages on WPRs 89.2% ± 11% compared to 85.5% ± 10% in AY23).
- Course assessment incomplete as of 12-13-22. Blackboard surveys 100%. Tracking performance in FEE for thermo topic.
- Course is not complete. TEE and CDP still not graded as of 12-13-22.
- Sustain change from last year – rubric grading with resubmission. Forces cadets to examine homework to find mistakes.

CH459 AAR

- Same groups as originally for the course:
  - No emphasis or prescribed roles as past AY
  - Two cadets were consistently paired up with each other in both round robins
- WPR1 tests round robin 1 material & WPR2 tests round robin 2 material.
  - WPR1 Average = 86.2%
  - WPR2 Average = 84.3%
- SWE Executed for First time as EXSUM on DIST
  - Improve: Create schedule for each cadet to run own trial to collect individual data? (assessing this as an option and include as part of the rubric)
  - Sustain: Overall figures and tables. IPRs from instructor is key
- Emphasis in the Labs
  - P&IDs on Lucid Chart with automatic control loops and transfer of units by connecting to Laplace block
  - Developing and Labeling flow charts with process variables and units
  - Note: Cadets automatically revert to Excel for calculations.
- Overall stronger C1D1 section compared to E1F1.
  - Lower performing cadets were relying on teammates for calculations and ChemCad

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CH485 AAR

Previous changes maintained
Changes made 24-1
Recommended changes 25-1

- Course average: 85.4% (prior to TEE), AY23-1: 83.6%
- Maintained high number of example problems for each lesson
  - FEE practice problems
  - Problems from other transport texts useful as new PS problems
- Maintained problem solving days before WPRs/ICPS
- Maintaineded formal discussion of radiation heat transfer
  - Included new ICPS, PS, and Lab problems that involved radiation
- Increased number of problem sets to 9 (50 points each)
  - PS1 new; focused on fundamental transport relationships and solving basic differential equations; set the stage for the course
  - Added several problems to shorter problem sets (now at 3-5 problems per PS).
- Increased throughput on in-person lab for Lab 6 (Arnold Cell)
  - 2 different Arnold Cells with acetone diffusion at 50 ℃ and 45 ℃
  - Cadet understanding of the situation/problem was increased
  - "Better" than sitting in class and watching video of acetone diffusion
- Changed Lab 7 to Convective & Radiative Heat Transfer (in-person)
  - Gave cadets previously collected data due to equipment maintenance issues
  - Re-start wetted wall column for back-up/primary lab

Chem E Prog AAR

End of Semester Close Out for CDs: Course Assessments / File Dump

- Assessment package due NLT 20 Jan 24
- Assistance on outcomes assessment worksheets (1/0)
- Submit to Dr. Biaglow upon completion
- All course materials into SharePoint; Graded events into GE folder

Advisory Board on 12APR24

- Meeting is on 1-Day (Coordinate for support from ChemEs in CH101)
- COL Hill, Prof. Liberatore, Prof. Krishnamoorthy, Kisondra Waters, COL(R) Dietrich, Mike Deforest confirmed (6/11 confirmed)
- MAJ Mandes/CPT Lowell (Primary) and CPT Tobergte (Assistant)

Bioengineering Update

- Redbook updated after ET Review of CH300 and CH350 by ABET committee and approved by COL Burpo and COL James

Faculty Observation to Continue in AY24-2!

Access for Cadets to use BH331 as ChemE dedicated space for collaboration?

Chem E Prog AAR

CH459 Transition Plan to Prepare for AY26-1 for Dr. Yuk as CD

- Spring Training Schedule – Run Instruments with Dr. Yuk to get one set of Data around teaching schedules
- Dr. Yuk to be present during C1D1 section for the semester as schedule permits in AY25-1

AIChE Club (OIC: CPT Lowell and CIC: CDT Williams)

- Trip Section events for AY24-2 for cadets in Club: Brewery Trip/Tour? Bayway Refinery?
- Bioengineering Focused Trip Section? – Dr. George Kennedy as Product Development R&D for BD in Franklin Lakes, NJ

ABET Accreditation

- Record Year AY25
- Self-Study Submitted 01JULY2026
- Program Evaluator Feedback from Visits
  - Appropriate engineering standards
  - Constituents of PEOs
  - Document waivers (irregularities for graduation)
  - Criterion 4: need to use direct indicators and algin indicators with outcomes
  - Address all "words" or "aspects of all student outcomes

AY24-2 Highlights – Dr. Yuk CH300 & CH450 CD, MAJ Bowers CH101 CD, MAJ Mandes CH362 CD.