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

MADN-CHM-LS 22 May 2020

MEMORANDUM FOR RECORD

SUBJECT: Chemical Engineering Program Semester AARs AY20-2

1. The course assessment meeting for all AY20-2 chemical engineering courses was conducted 20 May 2020. Attendees: COL Geoffrey Bull, Dr. Andrew Biaglow, LTC Matthew Armstrong, LTC Corey James, LTC April Miller, Dr. Enoch Nagelli, and MAJ Trevor Corrigan. The courses discussed were CH400 Chemical Engineering Professional Practice, CH402 Chemical Engineering Process Design, CH362 Mass and Energy Balance, CH364 Chemical Reaction Engineering, and CH367 Chemical Engineering Process Controls.

2. Each course director presented topics relevant to their specific courses. These topics are outlined in more detail in the individual course assessments. The course director slides coming into the meeting are provided as enclosures.

3. Some of the topics led to broader discussions relevant to the entire program. These included: 1) general communication skills and technical writing abilities, 2) the use of capstone projects to unify a course, 3) problem sets within courses should be reviewed and changed routinely. In particular, the consensus was that the program needs to develop a unified way to improve communication ability within its major, beginning from the very first courses, 4) Remote learning was discussed and that AAR was rescheduled for 21MAY20, 5) adding FEE style questions to WPRs and TEE was uniformly agreed to be a best practice and way forward, and 6) Noted was a consistent weakness in our major (with respect to all class years) with written, technical communication.

4. POC is the undersigned.

Encl

CH400,CH402, CH362,CH364 and CH367 Course AAR Slides

MATTHEW J. ARMSTRONG
LTC, FA52
Chemical Engineering Program Director

# Agenda

- CH362
- CH364
- CH367
- CH400
- CH400

- Program discussion

- Remote teaching…rescheduled…later this week

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# Mass and Energy Balance
# CH362 AY20-2
## Course AAR
## MAJ Trevor Corrigan

# CH362 Course Schedule

**General Overview:**

- **Block 1 – Non-reactive Material Balances**
- **Block 2 – Reactive Material Balances**
- **Block 3 – Non-reactive Energy Balances**
- **Block 4 – Reactive Energy Balacnes**
- **Block 5 – Capstone/TEE prep (really only 2 lessons after shifting lessons around immediately after Spring Break)**

# CH362 AAR

## Sustain

- Sustain use of excel as an additional computational tool. The textbook utilizes excel as its sole computational tool, the FEE computational problems are largely spreadsheet based (after exploring FEE Study guide), and for many cadets it helped provide them exposure to a computational tool they will have easy access to beyond West Point.

- Sustain high percentage of individual graded events: ICPS, WPRs, Problem Sets, Labs, to assess ChemCad, MMA acumen

## Improve

- Remove computer projects: there are too many graded events in this course, resulting cadets rushing through all of them and not spending enough time wrestling with the problems.

- If we are not fulfilling an ABET Student outcome with the capstone, remove it and replace it with a dedicated block focused on chapter 6 – multiphase systems prior to the energy balance block. This will help cadets have a better understanding of Multiphase systems prior to Separations (CH363) and steam tables will make more sense after they've spent a few lessons going over multiphase systems.

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# Chemical Reaction Engineering
# CH364 AY20-2
## Course and Program AAR

Enoch A. Nagelli

# CH364 Course Schedule

## General Overview:

- **Topics covered in this course include ideal reactors including batch, CSTR and PFR, isothermal and non-isothermal. Other topics may include catalytic reactors, bioreactors, reactors, transient and steady state design, pressure drop in reactors, recycle, stability, and numerical methods.**

  - Mole Balances (Ch. 1)
  - Conversion and Reactor Sizing (Ch. 2)
  - Rate Laws (Ch. 3)
  - Stoichiometry (Ch. 4)
  - Isothermal Reactor Design (Ch. 5, 6)
  - Collection and Analysis of Rate Data (Ch. 7)
  - Multiple & Nonisothermal Reactions (Ch. 8, 9)
  - Catalysis & Catalytic Reactors (Ch. 10)

# CH364 AAR

- TEE (FEE MC questions and multi-step problems)
  - Part 1: FEE Multiple Choice Reaction Engineering Questions
    - 15 multiple choice with partial credit assessed
  - Part 2: Multi-step WPR Style Problems
    - 3 Multi-step problems
    - Bonus: numerical techniques to solve partial differential equations

- Recommend considering to reduce number of problem sets from ten to eight (can combine PSSH and catalysis topics)

- Recommend quizzes with FEE based multiple choice questions

- ChemCad walk through during synchronous distance learning labs online was helpful for cadets (based on cadet feedback)

- Individual technical writing capstone to build framework for technical writing skills (citations, technical writing "voice") was beneficial for cadets because conducted multiple IPRs via Teams with each individual cadet
  - First IPR "Constructing a technical abstract"
  - Second IPR "Figures with captions, Tables with titles"
  - Final IPR "Draft review"

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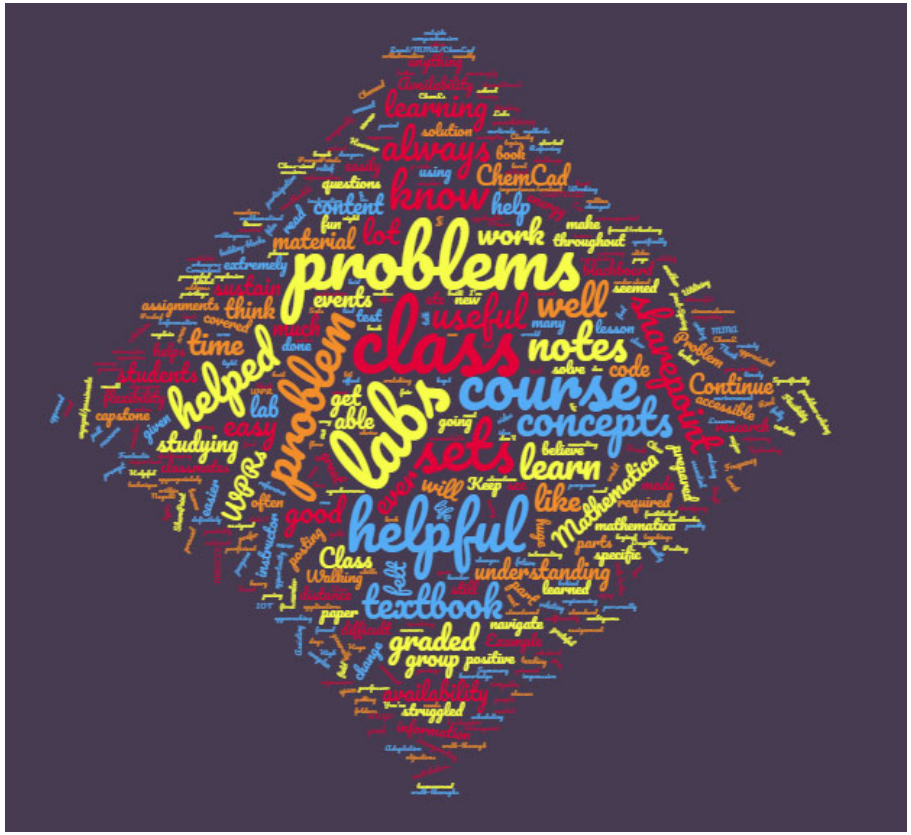
# Sustains & Improves

**Sustains:**




**Improves:**

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# Introduction to Automatic Process Control

# CH367 AY20-2

## Course and Program AAR

LTC Corey James

# CH367 AAR

- ✓ Lesson 1: Introduce a series of examples to clearly articulate the "so what".
- ✓ Spread capstone throughout semester; place key parts(linearization, controller design) and associated IPRs near those lessons in the sequence.
- ❑ Spend more time designing valves and relating that to controller action.
- ✓ Expand stability and tuning practical exercises.
- ❑ Continue use of SSI for describing/demonstrating dynamic behavior, stability, controller design, and tuning.
- ✓ More time on rigorous stability methods (root locus plots, bode plots)
- ❑ Simulink? Would provide an intuitive visual of a control loop that is trivial to build.
- ✓ Delete lesson 24 and expand coverage in chapter 8.(~lesson 12)
- ✓ For appropriate lessons, continue to use scaffolded fill-in slides to engage cadets.
- ❑ For the first requirement of the capstone, have the Cadets develop the system P&ID.

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# Chemical Engineering Professional Practice

# CH400 AY20-2

## Course and Program AAR

LTC Matthew Armstrong

# CH400 AAR

- CH400 serves to assess if cadets have mastery over program material and simultaneously prepare for FEE
- Cadets appreciated entire lesson of probability and statistics review; want that for every block
- Continue to maintain rigor of the subject area quizzes each week
- Add new questions to quizzes via "Little Yellow Chem. E. Book"
- Re-invigorate DIST simulator…add another PE
- Tremendous amounts of discomfort due to poor performance on quizzes
- Some cadets wanted to pass FEE…start test taking in late February
- Do not apply and Extra Credit or Bonus until after the FEE…this will promote better preparation
- Front load the bottom 1/2 of students to take FEE first; opportunity to retest
- A lot of AI…before each FEE date review the WPRs
- Conducted remote AI
- Several cadets took FEE at Pearson Vue near house
- Get SSI installed on cadet laptops in first week of class

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# CH402 AY20-2

## Course and Program AAR

## Dr. Biaglow

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# CH402 AAR

Sustain:

Use of writing examples to show what right looks like.

Capstone project - Use of research topics to supplement the design; incorporate more curricular content; good fit with curriculum

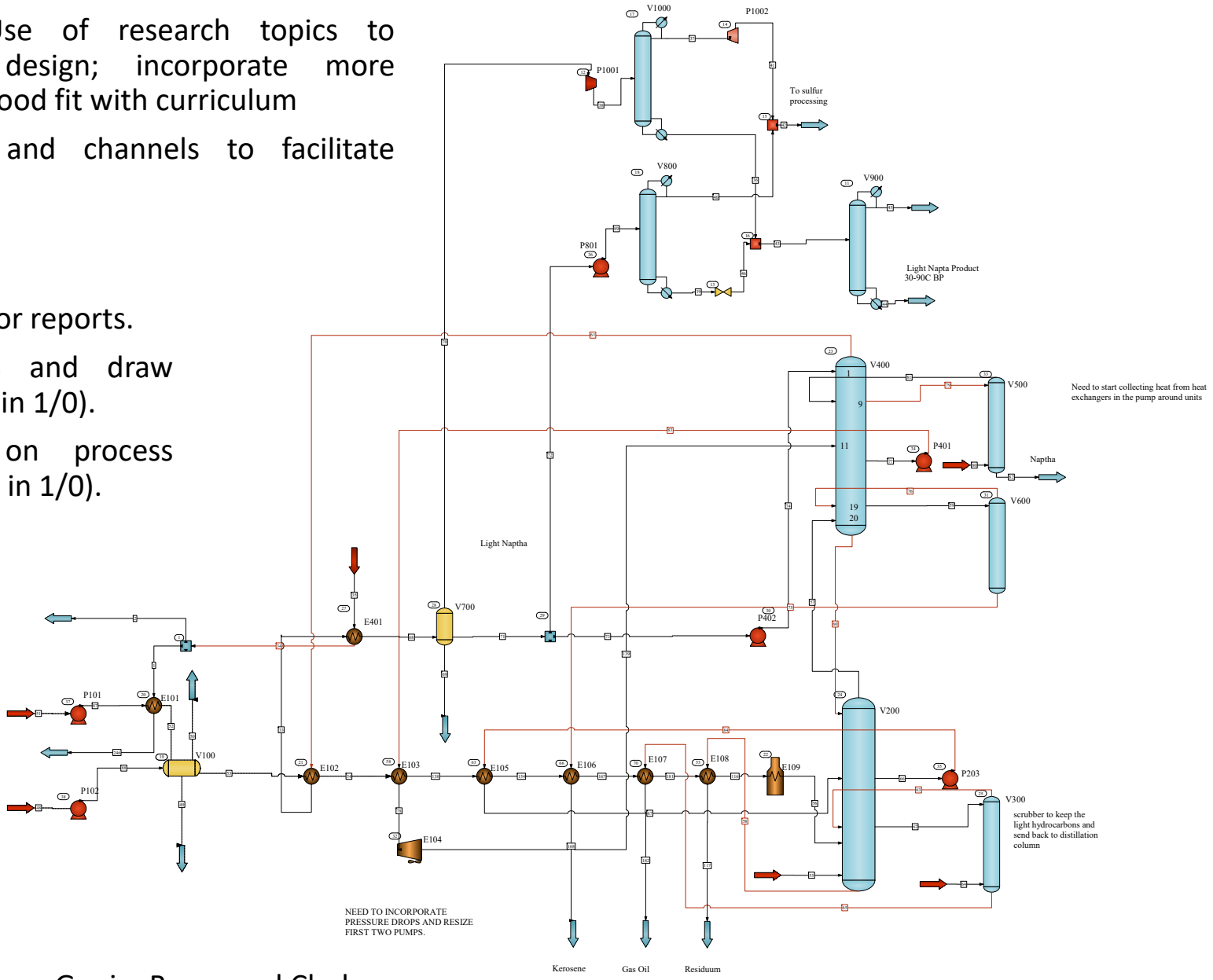
Use of MS Teams and channels to facilitate collaboration.

Improve:

Communication – 2/8 poor reports.

Identify control points and draw P&IDs (61% average in 1/0).

Background research on process design (78% average in 1/0).




PFD from Cadets DiBiase, Gouin, Berry, and Clark

# Chem E Prog AAR

- Junior Rotator integration to research groups needs to be more structured.
- Junior Rotator's as DAC's
- Sustain FEE style problems in every Chem E course…MAJ Corrigan
- Improvements in creating figures from data with formatting axes, captions, units etc
- More practice setting up mathematical problems and then using numerical methods (MMA, Matlab, Chemcad)
- Balancing course work with other classes
- Connecting analytical rigor with fundamentals …Dr. Nagelli
- Balancing between pattern recognition and thinking out of the box with concepts

# Chem E Prog AAR

- Special Topics course memorandum: go hot with Numerical Methods in Chem E…Summer '21;
- Writing is a continued weakness across all classes; 8/20 MC312 NCs
- Dr. Yuk onboard…start admin. Of bio-engineering courses?
- To greatest extent possible only instruct/Course Direct one distinct course per semester
- Continue working the 5th Pillar of scholarship…push Faculty Development and Associate Professor…collaborate
- CH485 FDW with LTC Cowart; Maintain FDW for our electives during summer
- Maintain CH459 bootcamp during summer…Dr. Nagelli is CD now
- What is standard on number of research cadets per faculty (5)
- Stick to the Course Directors Handbook for all administrative guidance
- Continue preparation of ABET…after 1NOV? LTC Armstrong

# Chem E Prog AAR

- Treat all faculty the same regardless if they are first time rotators or not.
  - Specific layout of courses taught – uniform over the 3 years
  - Can be different for junior and senior rotators
- Continue joint research. Try to do more joint scientific research
- Continue research with the AICHE club (beer, chocolate, and coffee)
- Keep AICHE club – it is a source of funding for future conferences. Assign new faculty with no research plans as OIC. Best to assign 2 or 3, one for each subarea. The sub-clubs are a great source of recruiting.
- Maintain Cadet involvement in planning of department tailgates
- Maintain football tailgates when environment allows
- Maintain faculty socials **LTC April Miller**

# Remote Teaching AAR

- Maintain use of digitizers and recorded classes to assist cadet study efforts. This could also improve our ability to conduct classes for cadets who want to go abroad. MAJ Corrigan

- Purchase WACOM for all faculty members
- Recommend class structure be a blend of asynchronous and synchronous. I don't recommend forcing Cadets to stay on for the entire time.
- Recommend USMA policy to force all Cadets to show their video (if possible) LTC Miller

# Remote Teaching AAR

- Synchronous classes on MS Teams with Elmo projected to work out problems worked great
- Time needed for grading impacted with all digital submissions
- Emailed graded events to cadets and had them submit all documents to me via email
  - Admin time required for uploading/scanning/converting pictures into pdfs for cadets after cease work
- AI was effective with shared screen options (especially with Chemcad workshops) **Dr. Nagelli**

# Remote Teaching AAR

- Transition to remote teaching o/a 20MAR20
- Used Microsoft Teams/ Elmo/ Wacom
- QA/QC of graded events: quizzes/ WPRs/ TEEs
- AI on Teams
- Some anomalies were noticed
- All future syllabi must include language/plan for remote learning:
  - Cadets must have CHEMCAD/ SSI
  - Not sure what AY21-1 will look like **LTC Armstrong**