



UNITED STATES MILITARY ACADEMY  
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# *Chemical Engineering*



## Advisory Board Meeting

10 April 2020

**United States Military Academy  
Department of Chemistry and Life Science**



- 1. 100% surveys complete**
- 2. Discussions with chemical engineering faculty and cadets complete**
- 3. Tours of chemical engineering lab, work, classroom space complete**
- 3. Travel paperwork complete**



# Meeting Agenda

Date	Time	Event	Location	OIC	Task
9APR20	NLT1700	Pick up 15 PAX van	Motorpool	LTC Miller	pick up van
	1830 - UTC	Dinner	Barnstormer BBQ 1076 Route 9W Fort Montgomery, NY (845) 446 -0912	LTC Armstrong	Make reservation
10APR20	0730	Pick up	Holiday Inn Express 1106 Route 9W Fort Montgomery, NY (845) 446 - 4277	LTC Miller/ MAJ Corrigan	Drive van
	0745 - 0800	Arrival and lite breakfast	Bartlett Hall 465 (table side)	LTC Armstrong LTC James	Breakfast
	0800 - 0845	Session1: Introductions/ Introductory remarks and ABET orientation	BH465	COL Burpo LTC Armstrong	
	0845 - 0940	Session2: Program Assessment Student Outcomes Assessment Discussion of Program Objectives	BH465		
	0940 - 1000	Board Surveys	BH465	Dr. Biaglow	Survey Parts 1 & 2
	1000 - 1050	Career Panel (Cows)	BH465 (chair side)	MAJ Corrigan	
	1050 - 1115	Cadet Discussions (Fisties and Cows)	BH465 (chair side)		
	1130 - 1300	Lunch/Firstie Mock Interview Round Rob	BH465	Dr. Biaglow	
	1300 - 1330	Board backbrief on cadet interactions	BH465	LTC Armstrong	
				LTC James	
	1340 - 1430	Session 4: Future Challenges	BH465	LTC Miller/Dr. Nagelli	
	1430 - 1455	Admin and Unit Ops Lab Tour	SBBH	LTC Armstrong	
				LTC James	
	1500 - 1600	Wrap up	BH465		
	1600	Departure/ Drive back to Holiday Inn			



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# Lunch – Subs and Wraps



- Lunch:**
1. Cold cut Italian mix sandwiches and wraps
  2. Mixed salad
  3. Chips: regular/barbeque/sour cream & onion/Cheetos/Doritos
  4. Iced tea/soda/water/coffee
  5. **Cookie plate**



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# *Chemical Engineering*



## Advisory Board Meeting

10 April 2020

### 1. Introductory Remarks

**United States Military Academy  
Department of Chemistry and Life Science**



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# Thank You! Advisory Board

<p><b>Dr. Lynn Walker</b> Professor of Chemical Engineering Carnegie Mellon University Doherty Hall, 5000 Forbes Avenue Pittsburgh, PA 15213 (412) 268 - 3020 <a href="mailto:lwalker@andrew.cmu.edu">lwalker@andrew.cmu.edu</a></p>	<p><b>Kisondra Waters</b> Associate Global Energy and Power Bank of America, Merrill Lynch New York, NY 10036 (646)-743-2609 <a href="mailto:kisondra@gmail.com">kisondra@gmail.com</a></p>	<p><b>Donald C. Glaser</b> President, Simulation Solutions, Inc. 179 Avenue at the Common Shrewsbury, NJ 07702  (732)-389-5400 <a href="mailto:dglaser@simulation-solutions.com">dglaser@simulation-solutions.com</a></p>
<p><b>COL (Ret) Paul Dietrich</b> 3855 Victory Blvd Staten Island, NY 10314-6716  (718) 698-8526 <a href="mailto:paul@the-dietrichs.com">paul@the-dietrichs.com</a></p>	<p><b>Matt Garvey</b> Simulation Solutions, Inc. Shrewsbury, NJ  <a href="mailto:mgarvey@simulation-solutions.com">mgarvey@simulation-solutions.com</a></p>	<p><b>Dr. Patrick Underhill</b> Associate Professor, Chemical Eng. Rensselaer Polytechnic Institute Ricketts Building Troy, NY 12180 (518) 276-3032 <a href="mailto:underhill@rpi.edu">underhill@rpi.edu</a></p>
<p><b>Dr. Matthew Liberatore</b> Professor of Chemical Engineering University of Toledo 3055 Nitschke Hall, 2801 W Bancroft Toledo, OH 43606 (419) 530-8267 <a href="mailto:matthew.liberatore@utoledo.edu">matthew.liberatore@utoledo.edu</a></p>	<p><b>Dr. Kelly Schultz</b> Assistant Professor Lehigh University Iococca Hall, 111 Research Drive Bethlehem, PA 18015 (610) 758-2012 <a href="mailto:kes513@lehigh.edu">kes513@lehigh.edu</a></p>	<p><b>COL Aaron Hill</b> Academy Professor United States Military Academy Civil and Mechanical Engineering West Point, NY 10996 (845) 938 - 2478 <a href="mailto:aaron.hill@westpoint.edu">aaron.hill@westpoint.edu</a></p>
<p><b>Mike Deforest</b> USMA Class of '07, Chemical Enginee SMK Packaging  (619) 735 - 5300</p>	<p><b>Patrick Nonhof</b> Managing Partner Provenance Consulting</p>	



# Advisory Board Bench

<b>Kevin Shipe</b> Automation Innovation Engineer NALCO Champion 7705 Hwy 90A, Sugarland, TX 7749  281-263-7335 <a href="mailto:kevin.a.shipe@gmail.com">kevin.a.shipe@gmail.com</a>	<b>Lucy Hair</b> EleCent Team Leader CPOIS Program Lawrence Livermore National Lab  925-423-8545 <a href="mailto:hair1@llnl.gov">hair1@llnl.gov</a>	<b>Anthony Hatfield</b> Eli Lilly and Company Consultant Engineer Indianapolis Parenteral Man. Cartridge Fac  317-655-0429 <a href="mailto:hatfieldan@lilly.com">hatfieldan@lilly.com</a>
<b>COL (Ret) Vance P. (Phil) Visser</b> 2925 Thomas Smith Lane Williamsburg, VA 23185  757-254-3017 <a href="mailto:philvisser@yahoo.com">philvisser@yahoo.com</a>	<b>COL (Ret) Dwight Springer</b> Former Deputy Head Chemistry and Life Science US Military Academy  817-431-5331 <a href="mailto:dss5456@verizon.net">dss5456@verizon.net</a>	



# Thank you!

- For the opportunity to show you America's Military Academy
- For your service and insights to help our program improve
- For the time you have dedicated to this visit
- For your dedication to the profession





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# CDT Jesse Palmer, '19

## Chemical Engineering



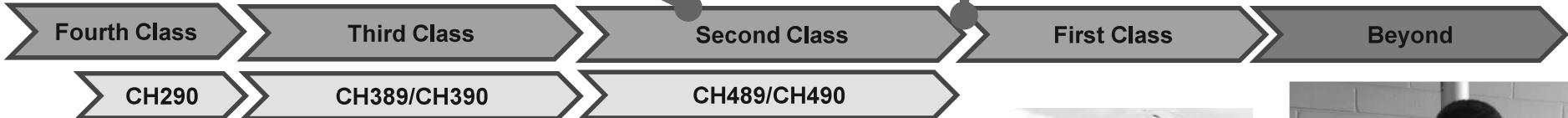
- Won Stamps Scholarship
- Won Goldwater Scholarship
- Tau Beta Pi Honor Society
- Phi Kappa Phi Honor Society
- Phi Sigma Iota Society
- Won Churchill Scholarship

### Co-Authored Publications

1. Cellulose Nanofiber Biotemplated Palladium Composite Aerogels. *Molecules*, 23(6)
2. Gelatin biotemplated platinum aerogels. *MRS Advances*, 1-6.
3. A Rapid Synthesis Method for Au, Pd, Aerogels Via direct Solution-Based Reduction. *Journal of visualized experiments: JoVE*, (136).
4. Direct solution-based reduction synthesis of Au, Pd, and Pt Aerogels. *Journal of Materials Research*, 32(22).

Australia; Renewable Energy Lab  
Sweden: Water NEXUS conference

Harvard AIAD; Disease  
biophysics groups



### USMA Independent Research

Jesse has collaborated with the Army Research Labs (ARL) in Adelphi, MD to produce biosensors and has developed novel Kevlar-cellulose composites with Harvard's Disease Biophysics group. As a recipient of Goldwater and Stamps Scholarships Jesse has used his academic funding to attend World Water Week in Stockholm, Sweden and visit the University of New South Wales in Sydney, Australia to pursue his interest in water desalination. Jesse is also completing a minor in Eurasian Studies. He plans on attending graduate school to develop batteries to enhance prosthetic limbs serving wounded veterans.



Field Artillery Officer

Future Faculty



# **USMA MISSION**

**To *educate, train, and inspire***  
**the Corps of Cadets so that each graduate**  
**is a commissioned *leader of character***  
**committed to the values of**  
**Duty, Honor, Country**  
**and prepared for a career of professional**  
**excellence and service to the Nation as**  
**an officer in the United States Army.**



**Within an Army in transition,  
West Point is the preeminent leader  
development and academic institution  
West Point is the preeminent leader  
whose graduates thrive in tomorrow's  
development institution in the world.  
complex security environments,  
and are inspired to a lifetime of service to  
our Army and the Nation as leaders of  
character.**

***“Inspired to serve.”***



## Program Vision

We envision an Army that is prepared for all dimensions of modern warfare, drawing upon disciplined, highly trained chemical engineers to develop solutions to the challenges facing the nation.



## Program Mission

The mission of the chemical engineering program is to prepare commissioned leaders of character who are proficient in applying chemical and engineering principles to solve problems in a complex operational environment.



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**Engineering  
Technology  
Accreditation  
Commission**



Accredited **1 October 2012** to present

Next Record Year: **AY2019-2020**

ABET Visit: **12-15 September 2020**



- An external certification of quality
- Keeps us in touch with the engineering profession
- Helps USMA (and ChemE) recruiting (2020 – 29; 2021 - 20; 2022 - 29; 2023 - ...so far 12 )
- Provides important opportunities for graduates
- Allows USMA engineering majors to take the Fundamentals of Engineering Examination
- It is required by Army Regulations (10-87).
- Almost everything that ABET expects us to do is something we should be doing anyway.



## Thoughts to Consider

- The ABET process is expensive in terms of faculty time
  - USMA is a small undergraduate college with limited human resources (faculty) and high faculty turnover
- The ABET accreditation is important to the institution and to the Army (so we tend to do it well)
- The only way we can be successful with ABET is to orient our program processes around the ABET criteria
  - By doubling up our efforts we obtain some efficiency
  - Much of what follows is oriented around the ABET processes and terminology
  - We need to be strategic in deciding on new initiatives

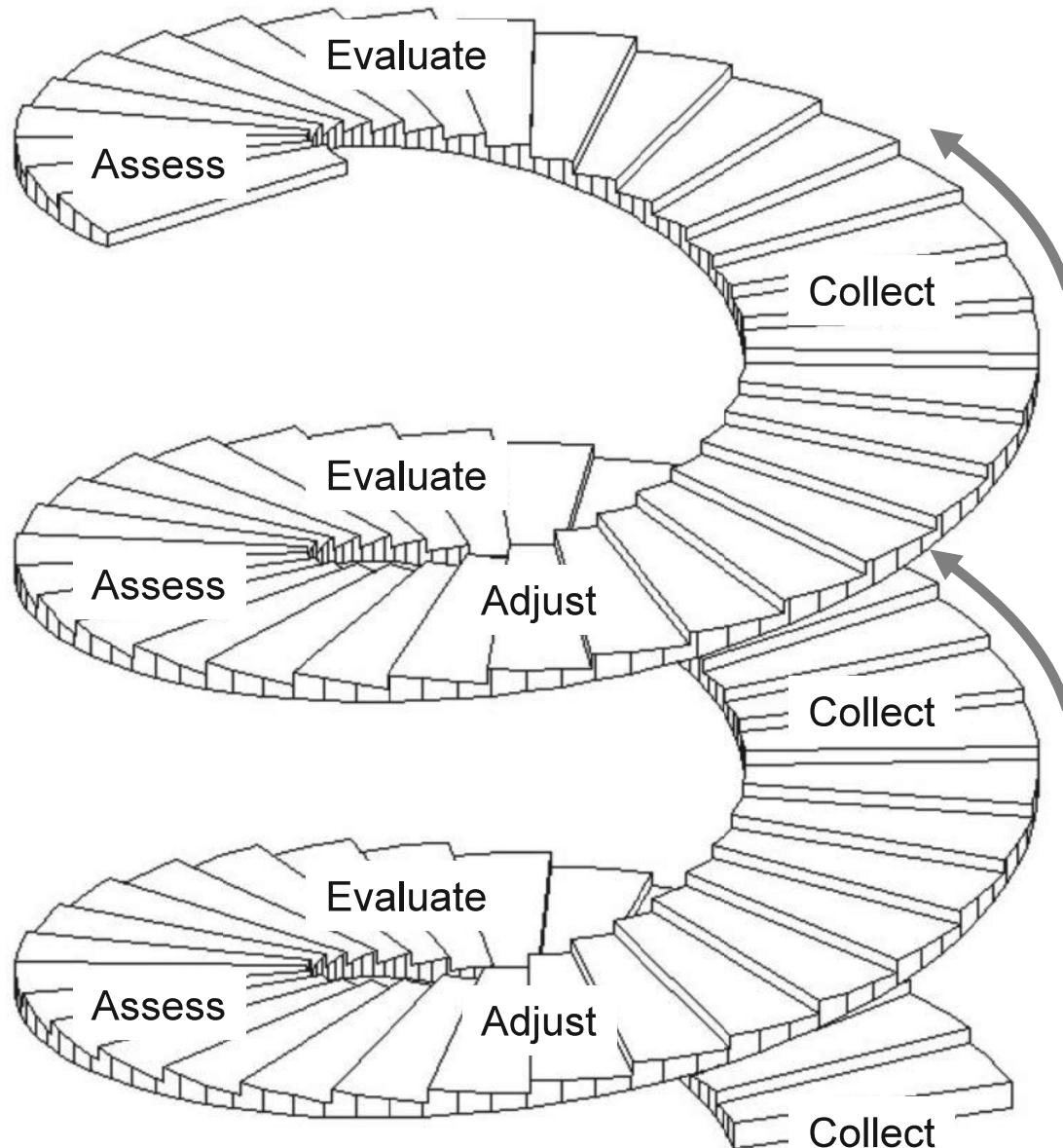


- **Program Educational Objectives (PEOs)**
  - Gleaned by asking *program constituents*
    - For us: Army, profession, graduate schools, other
  - **Our external Advisory Board a key resource**
  - Desired professional accomplishments of graduates **5-7 years after graduation**
  - Adjust every 3 years or so...
- **Student Outcomes**
  - What students should be able to do at graduation
  - Must be **measurable**
  - Designed to lead naturally to the PEOs
  - Assess/evaluate some fraction yearly.
- **Assessment → Continuous improvement**
  - Collect meaningful data to evaluate performance indicators (PIs)
  - Assess PIs for outcome attainment → information → COAs for change
  - Implement change
  - Assess its effects and level of success ("closing the loop")
  - Repeat all the above
  - Periodically check and adjust both Student Outcomes and PEOs





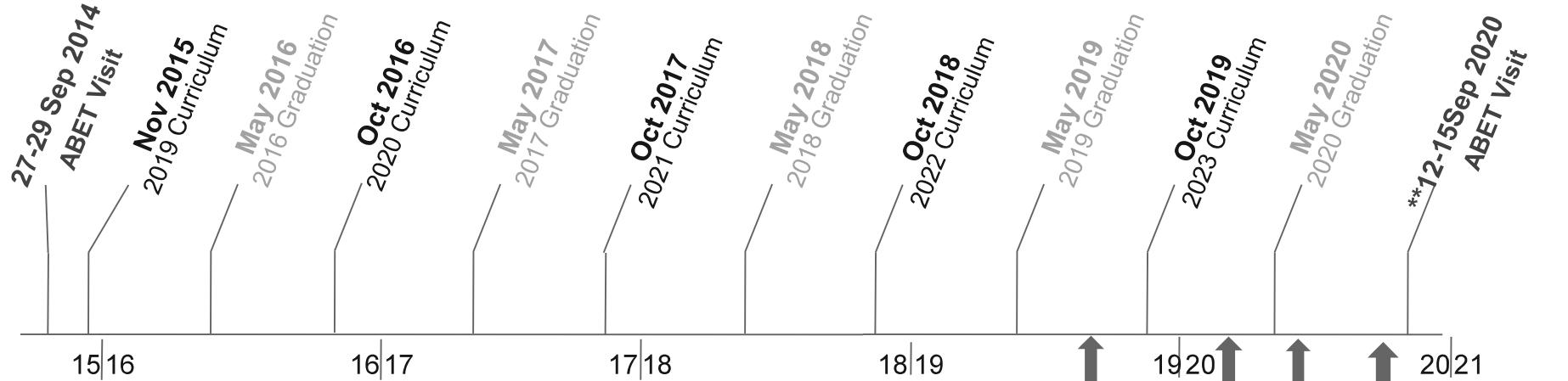
# Assessment Cycle





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# Timeline of Curricular Actions



Began record year Aug 2019

ABET Advisory

• Self-study due June 15, 2020

• Must include transcripts

• Must include periodic assessment

• Must include efforts at improvement

- ebooks-binder1
- ebooks-binder 2,3



## Excerpts from Minutes of 26 April 2019

- CH400 professional practice was discussed at length with cadet panel; and faculty; overall stay on current azimuth
- Desire for continued program improvement; program has good balance between theory and hands-on experience
- Some members of board would like to see more flexibility
- Cadets lamented about lack of chemical engineering electives
- Cadet feedback focused on various courses
- Cadets appreciate going to other departments for some courses (CME)
- General Chemistry discussion
- CH485 tough but useful and important to curriculum



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# End of Section 1



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# *Chemical Engineering*



## Advisory Board Meeting

10 April 2020

### 2. Program Assessment

**United States Military Academy  
Department of Chemistry and Life Science**



**Identical to ABET 1-7 plus one additional outcome (8)**

**On completion of the chemical engineering program, our graduates will be able to:**

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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. Communicate effectively with a range of audiences.
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.
8. Understand the chemical engineering curriculum, including chemistry, material and energy balances, safety and environmental factors, thermodynamics of physical and chemical equilibria, heat, mass, and momentum transfer, chemical reaction engineering, continuous and staged separation processes, process dynamics and control, modern experimental and computing techniques, and process design.



**Required Courses \***      **(for classes 2020 and beyond)**

MA364	Engineering Mathematics
CH362	Mass & Energy Balances
CH363	Separation Processes
CH364	Chemical Reaction Engineering
CH367	Introduction to Automatic Process Control (XE472 2019 and previous)
CH485	Heat & Mass Transfer
CH459	Chemical Engineering Laboratory
CH402	Chemical Engineering Process Design
CH400	Professional Practice
MC311	Thermal-Fluid Systems I
MC312	Thermal-Fluid Systems II
EE301	Fundamentals of Electrical Engineering
MC300	Fundamentals of Engineering Mechanics & Design (Statics & Dynamics)
CH365	Chemical Engineering Thermodynamics
CH383	Organic Chemistry 1



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# CDT Matthew Dibiase, '20

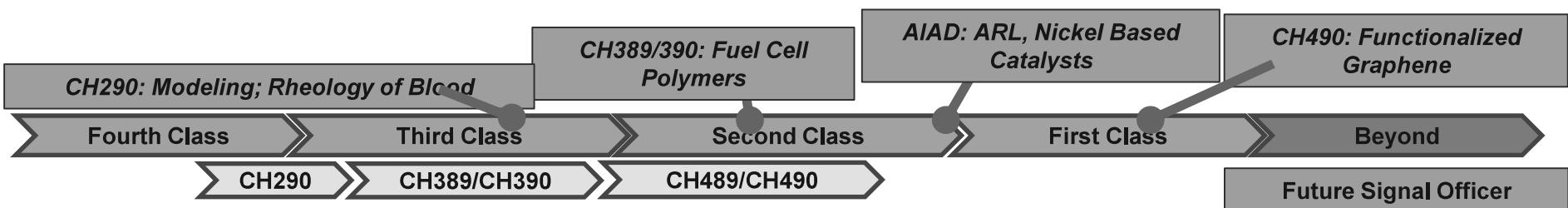
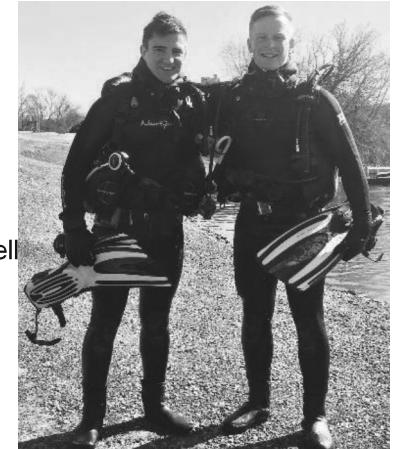
## Chemical Engineering



- Goldwater Scholarship Recipient
- Fullbright Scholarship Semifinalist
- Phi Kappa Phi Honor & Tau Beta Phi Honor Society

### Co-Authored Conference Proceedings and Publications

1. Army Research Lab (ARL) Technical Symposium "Catalysts for fuel cell electronics". (Poster)
2. 1<sup>st</sup> Place Catalysts and Reaction Engineering, Presentation: "Nickel catalysts and graphene for lithium ion batteries". American Institute of Chemical Engineering Annual Meeting, Orlando, FL, 10-15 NOV19.
2. Manuscript in progress, "Electroless deposition of Noble Metal Nanoparticles onto Silk Fibroin Films", (to be submitted, Spring 2020)



### USMA Independent Research

Cadet Dibiase has been working on a Proton Exchange Membrane (PEM) Fuel Cell project; a field of great interest for their efficiency advantages over combustion technology. However, conventional methods of electrolysis to produce H<sub>2</sub> and O<sub>2</sub> gas necessary for PEM fuel cells rely on expensive catalysts, Pt and IrO<sub>2</sub>. Despite exceptional efficiency of these catalysts, their high costs prevent industry scale up and production. We present alternative Ni-based catalysts to replace Pt and IrO<sub>2</sub>. Of the Ni catalysts characterized, NiS and NiFe LDH together provided the smallest total overpotentials of 1.7 V (vs SHE) for Hydrogen Evolution Reactions (HER) and Oxygen Evolution reactions (OER), respectively. However, Linear Sweep Voltammetry illustrated that NiFe LDH had the lowest overpotential of the two, contributing only 0.3 V to the total overpotential. Nevertheless, the total overpotential of 1.7 V is still only 0.2 V above the industry standard of 1.5 V from a combination of Pt and IrO<sub>2</sub>.



Future Faculty



CHEME Coursework Embedded Indicators

MECHE Coursework Embedded Indicators

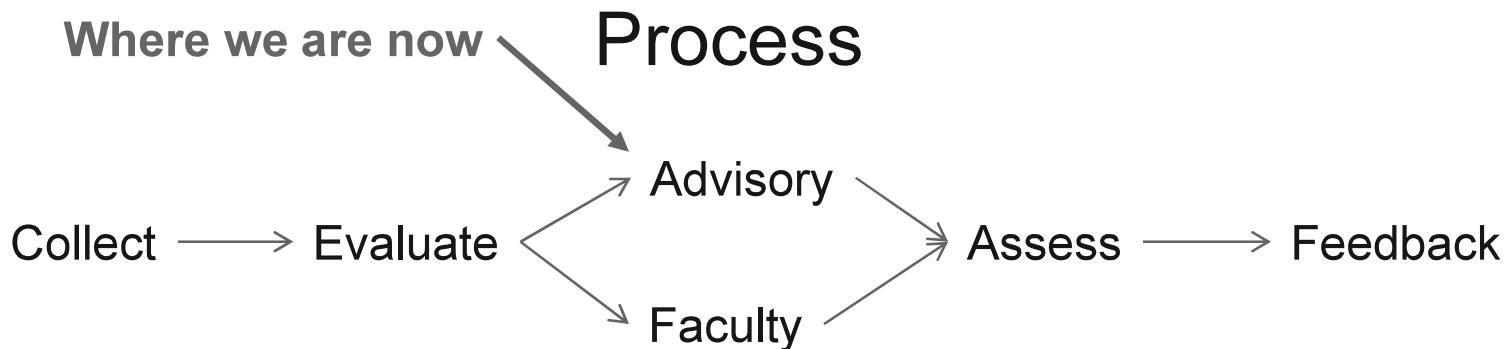
Fundamentals of Engineering Exam Topics

Participation in FE Exam (not pass rate)

Student end of semester surveys

Student CHEME Program Exit Surveys

Course Grades





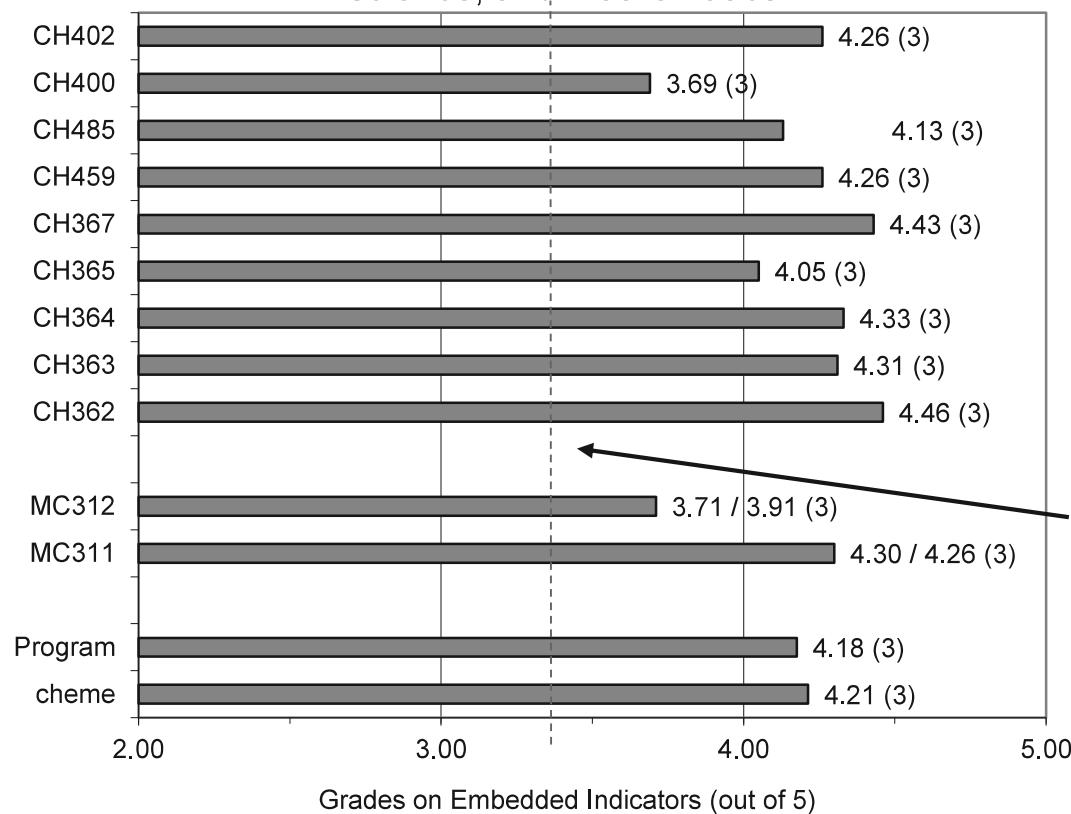
## Example Schedule for Chemical Engineering, Classes of 2021 and Beyond

Fall Term	Course	Credit Hours	Spring Term	Course	Credit Hours
<b>4th CLASS</b>					
MA103	Math. Modeling & Intro. Calculus	4.5	MA104	Calculus I	4.5
CH101	General Chemistry I	4.0	CH102	General Chemistry II	4.0
EN101	Composition	3.0	EN102	Literature	3.0
HI107	Western Civilization	3.0	HI108	Regional Studies in World History	3.0
IT105	Introduction to Computing & IT	3.0	PL100	General Psychology	3.0
PE11x	Combatives / Boxing / Movement	0.5	MS100	Introduction to Warfighting	1.5
			PE150	Fundamentals/Personal Fitness	1.5
<b>3rd CLASS</b>		<b>Total 18.0</b>			<b>Total 20.5</b>
MA205	Calculus II	4.0	CH362	<i>Mass and Energy Balances</i>	3.5
PH205	Physics I	4.0	MA364	<i>Applied Engineering Math</i>	3.0
Lx203	Foreign Language	4.0	PH206	<i>Physics II</i>	4.0
SS201	Economics	3.0	Lx204	<i>Foreign Language</i>	4.0
PY201	Philosophy	3.0	SS202	<i>American Politics</i>	3.0
MS200	Fundamentals: Army Operations	1.5	EV203	<i>Physical Geography</i>	3.0
			PE 2xx	<i>Lifetime Physical Activity</i>	0.5
<b>2nd CLASS</b>		<b>Total 19.5</b>			<b>Total 21.0</b>
CH363	<i>Separation Processes</i>	3.5	CH364	<i>Chemical Reaction Engineering</i>	3.5
EE301	<i>Fundamentals of Electrical Engineering</i>	3.5	CH367	<i>Introduction to Automatic Process Control</i>	3.0
CH383	<i>Organic Chemistry 1</i>	3.5	MC312	<i>Thermal-Fluid Systems 2</i>	3.0
MC311	<i>Thermal-Fluid Systems 1</i>	3.5	MC300	<i>Fundamentals of Eng. Mech. &amp; Design</i>	3.0
PL300	<i>Military Leadership</i>	3.0	SS307	<i>International Relations</i>	3.0
MA206	<i>Probability and Statistics</i>	3.0	MS300	<i>Platoon Operations</i>	1.5
PE32x	<i>Survival Swimming</i>	0.5	PE360	<i>Combat Applications</i>	1.5
<b>1st CLASS</b>		<b>Total 20.5</b>			<b>Total 18.5</b>
CH459	<i>Chemical Engineering Laboratory</i>	3.5	CH402	<i>Chemical Engineering Process Design</i>	3.5
CH365	<i>Chemical Engineering Thermodynamics</i>	3.0	CH400	<i>Chemical Engineering Prof. Practice</i>	1.5
CH485	<i>Heat &amp; Mass Transfer</i>	3.5	Elective	<i>Engineering Elective 3</i>	3.0
Elective	<i>Engineering Elective 1</i>	3.0	HI302	<i>History of the Military Art</i>	3.0
Elective	<i>Engineering Elective 2</i>	3.0	LW403	<i>Constitutional &amp; Military Law</i>	3.0
PE450	<i>Army Fitness Development</i>	1.5	MX400	<i>Officership</i>	3.0
		<b>Total 17.5</b>			<b>Total 17.0</b>



## Student Outcome 1

Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.



Values in parentheses are coverage ratings from Table 5-3 in the 2014 Self Study, page 5-9, updated for 2019.

Rubric::

3: Unique embedded indicator with clear rubric or cut scale.

2: Outcome was graded but grades are convoluted or part of the outcome is not covered.

1: Correlation to outcome but no assessment

0: No coverage or correlation

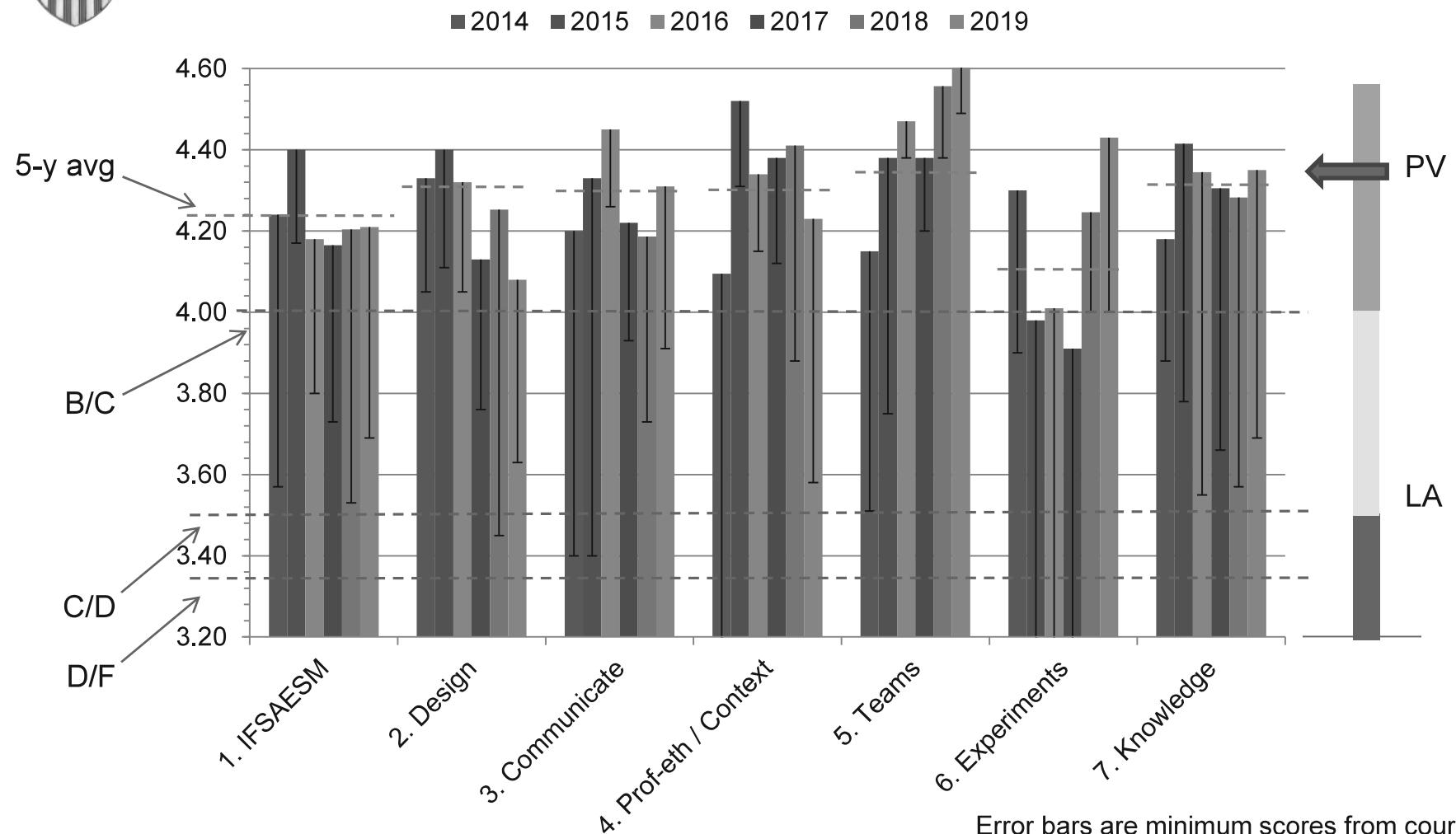
expected level of attainment = 67%

Similar data is collected for all 7 ABET outcomes  
Summary of all data is shown on next slide  
(AY19 is assessed using old outcomes)



# Perf. on Embedded Indicators

## Program Averages AY2014 to AY2019



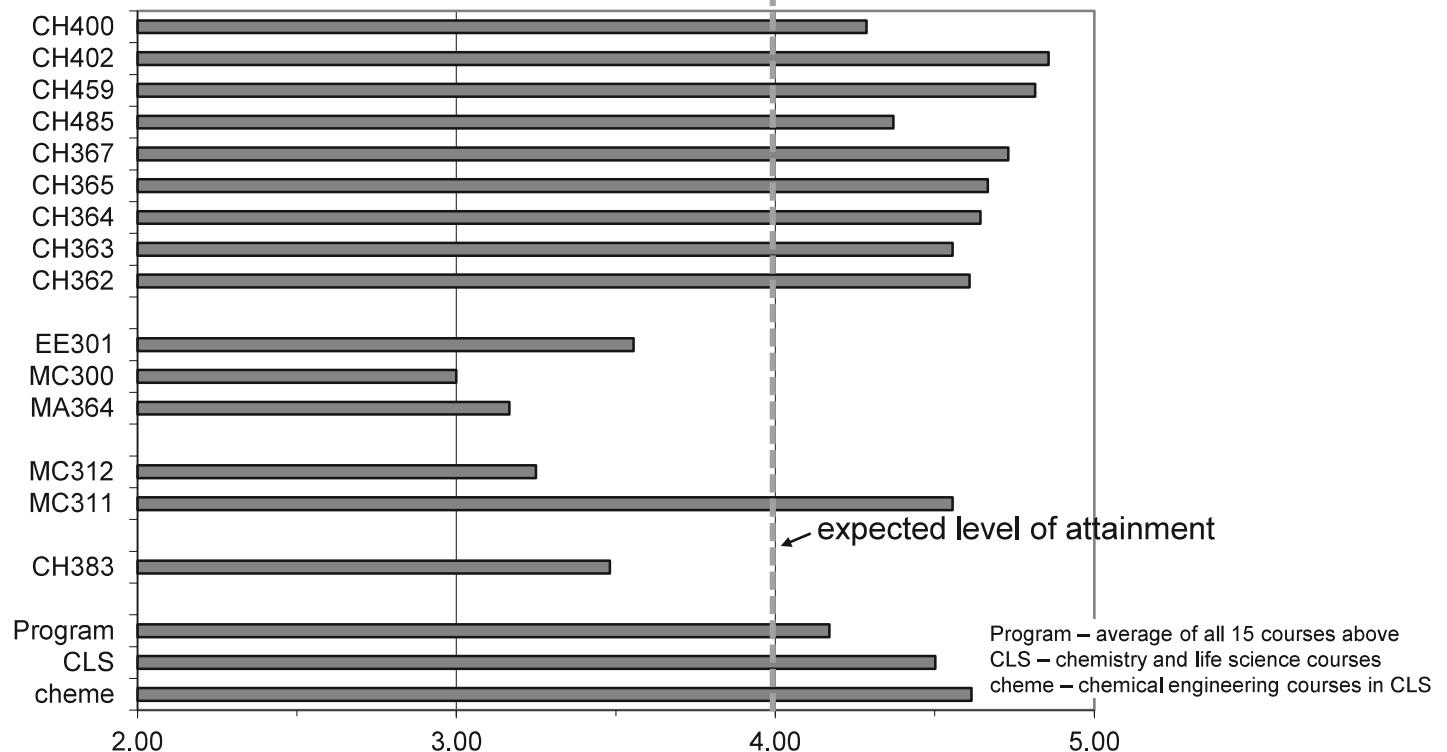
Expected level of attainment is the 5-year average



# Example Data: End-of-Semester Surveys

## Student Outcome 1

This course has improved my ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.



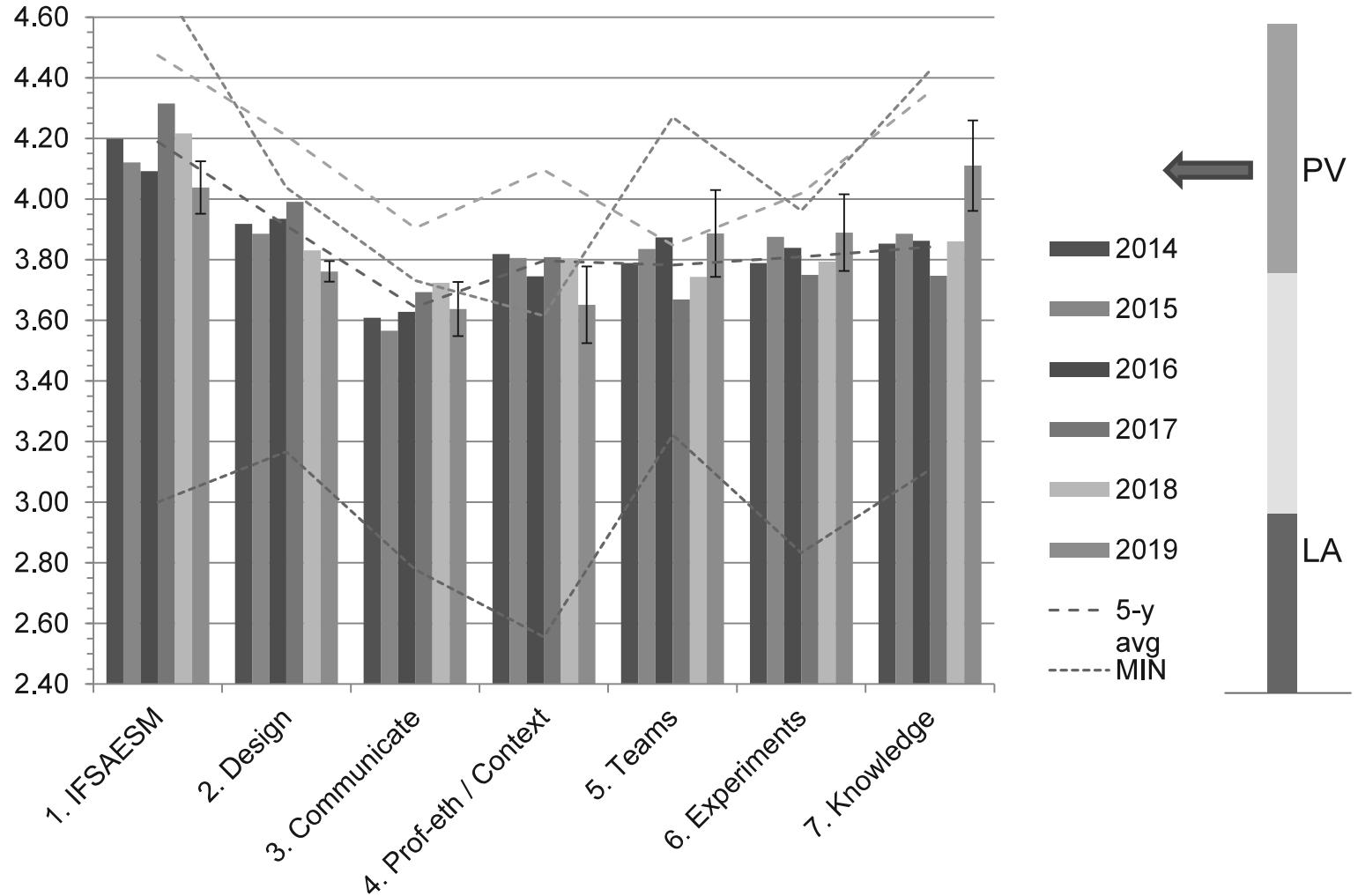
Data shown here is for Class of 2019  
Similar data is collected for all 7 ABET student outcomes  
Summary of all data is shown on next slide  
(AY19 is assessed using new outcomes)



## Program Averages from AY14-19

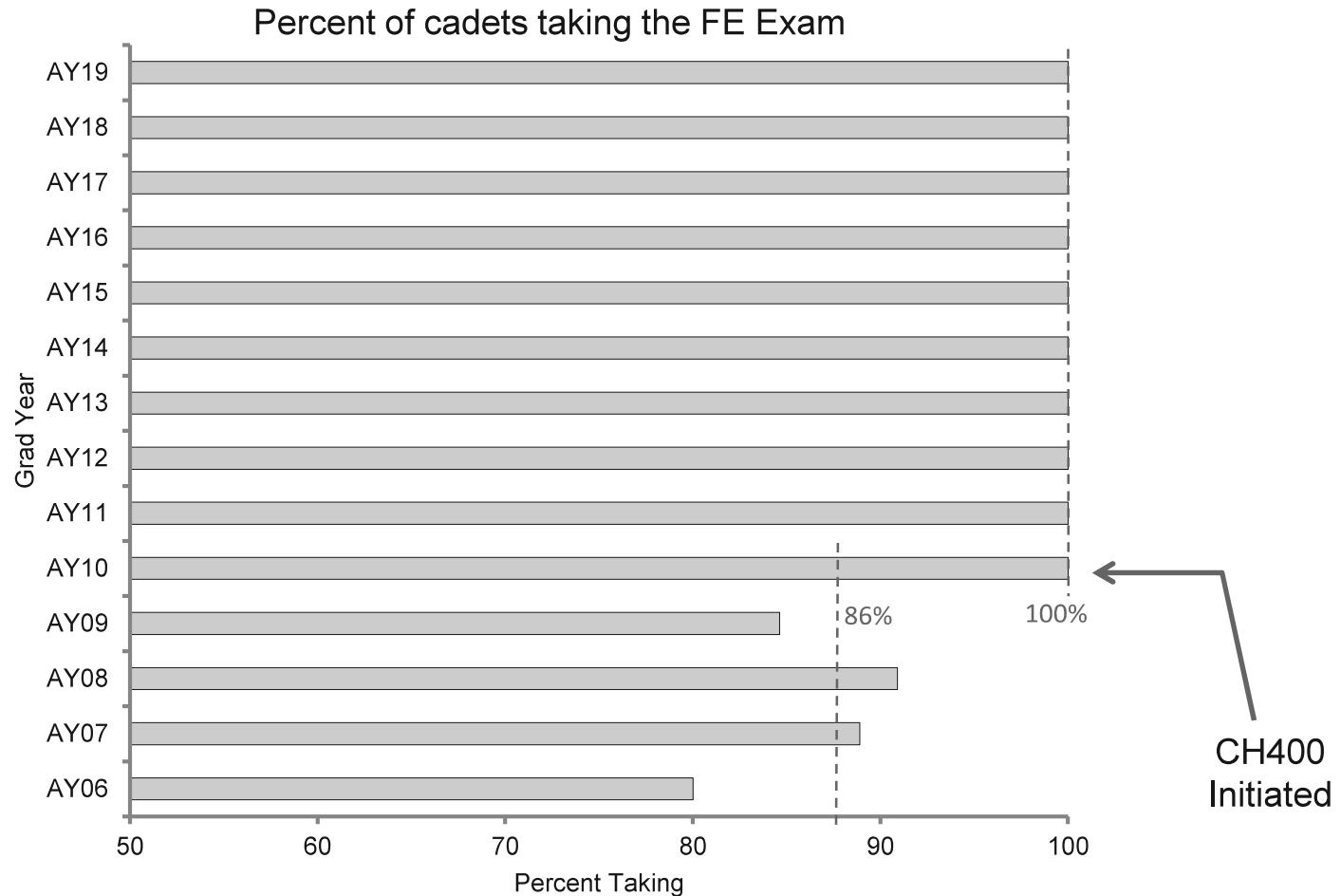
Error bars are standard deviations.

Expected level of attainment is the 5-y average





Student Outcome 7: Acquire and apply new knowledge as needed, using appropriate learning strategies





# Fundamentals of Engineering Exam

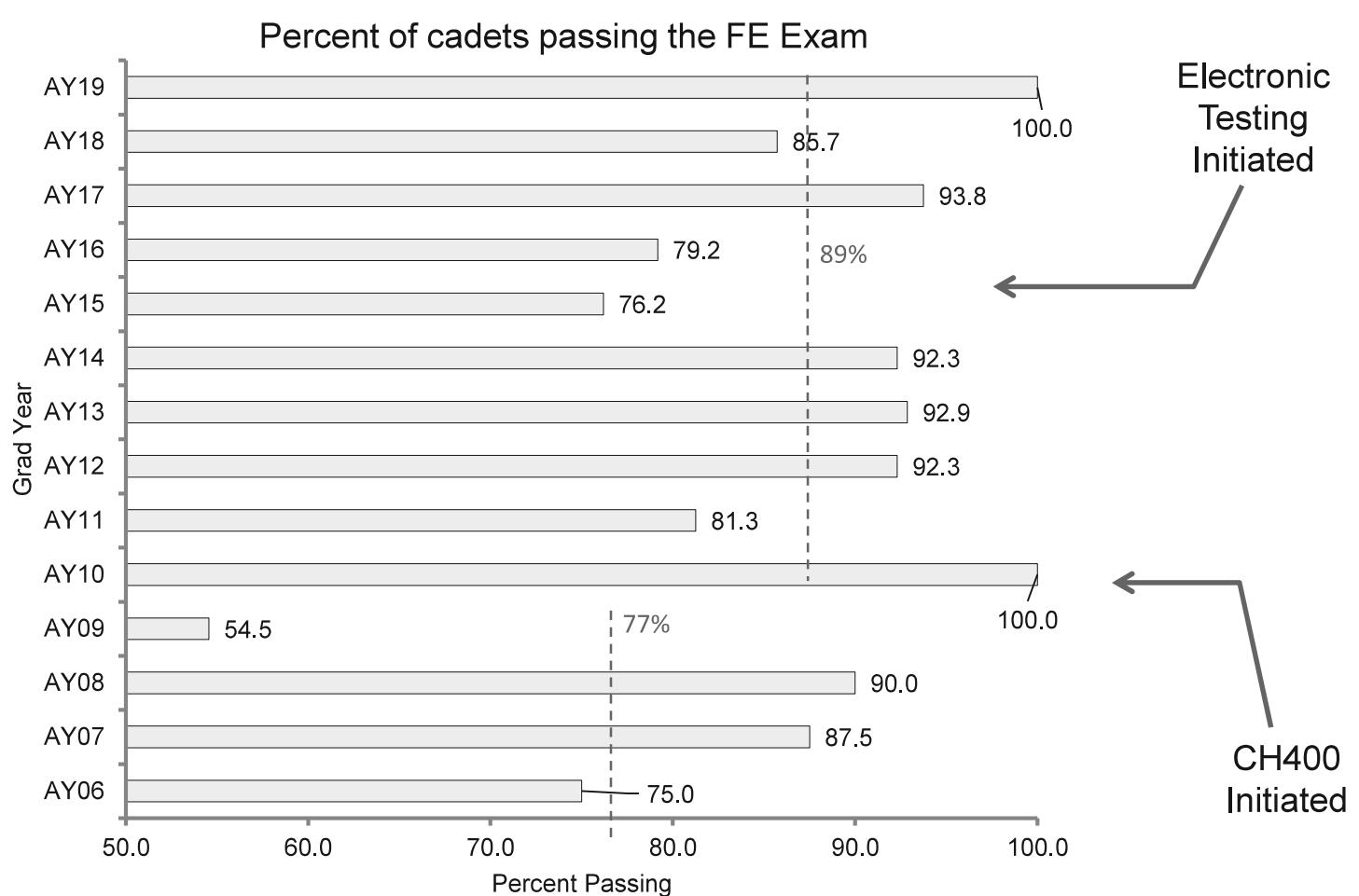
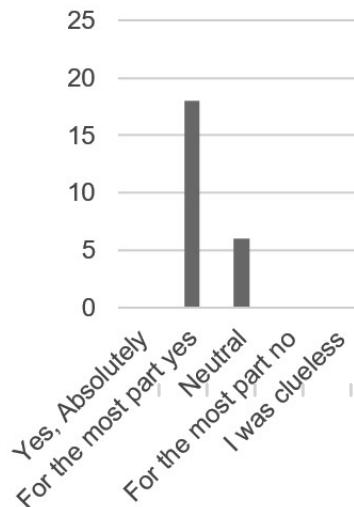
National, (+/- ~1%):

Student Outcome 7: Acquire and apply new knowledge as needed, using appropriate learning strategies

2019	77.0%
2018	75.0%
2017	74.0%
2016	79.0%
2015	77.4%

2014	89.0%
2013	86.3%
2012	85.1%
2011	87.0%
2010	87.0%
2009	84.0%
2008	87.0%
2007	87.0%

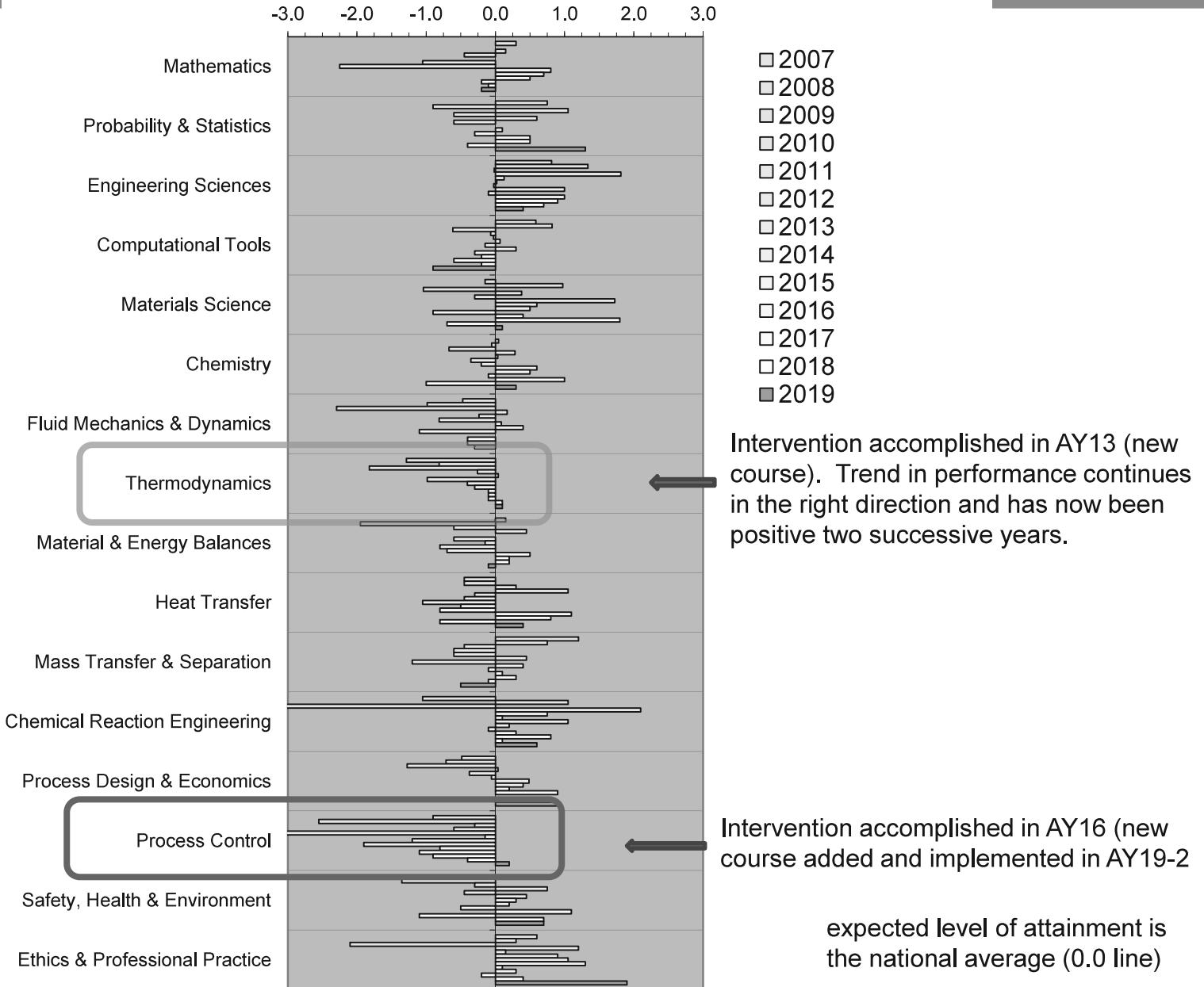
## Question 4



Question 4, Post FEE Survey: For the questions on the exam that seemed new to you, were you able to learn the material on the spot?

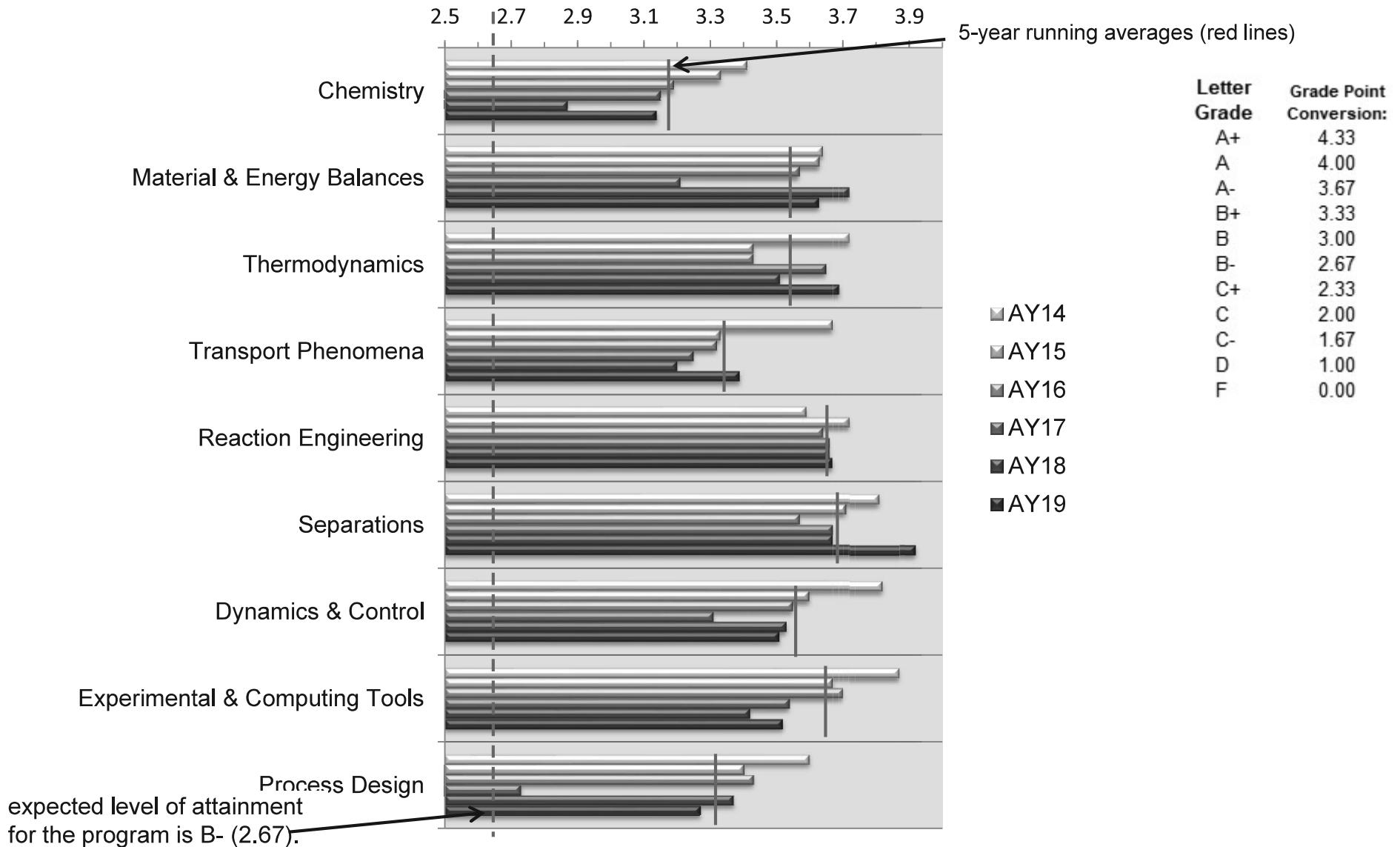


Deviations from  
National Averages  
AY07 to AY19





## Student Outcome 8: Understanding of the Chemical Engineering Curriculum Average GPA from Transcripts, AY2013 to AY2019





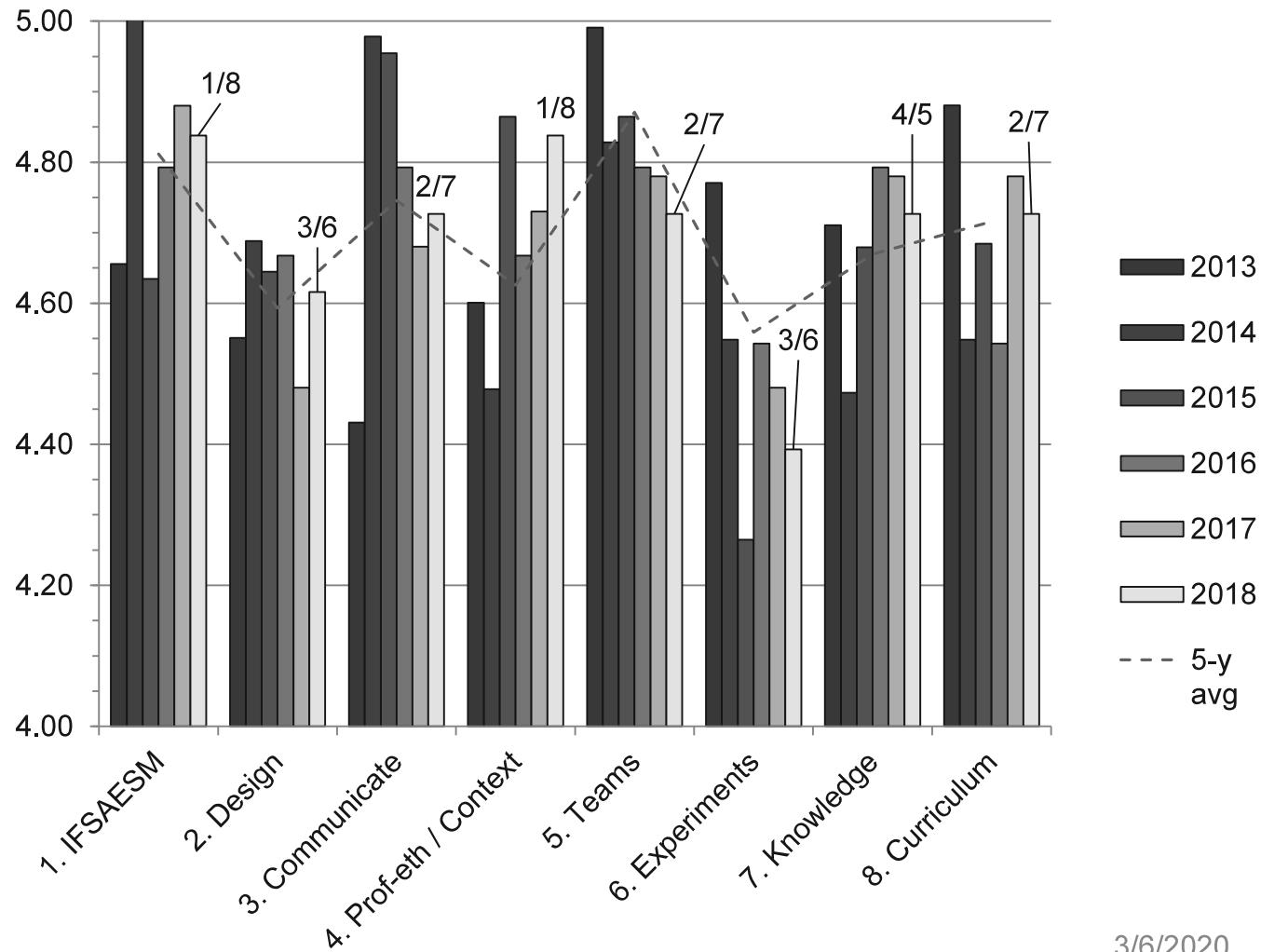
# Advisory Board Student Outcomes Surveys

## Student Outcomes 1-8

Program Averages from AY13-18

Data labels are response frequencies for 4 or 5 (# of 4s / # of 5s) on the 1-5 Survey Likert Scale

Standard deviations range from .33 to .73

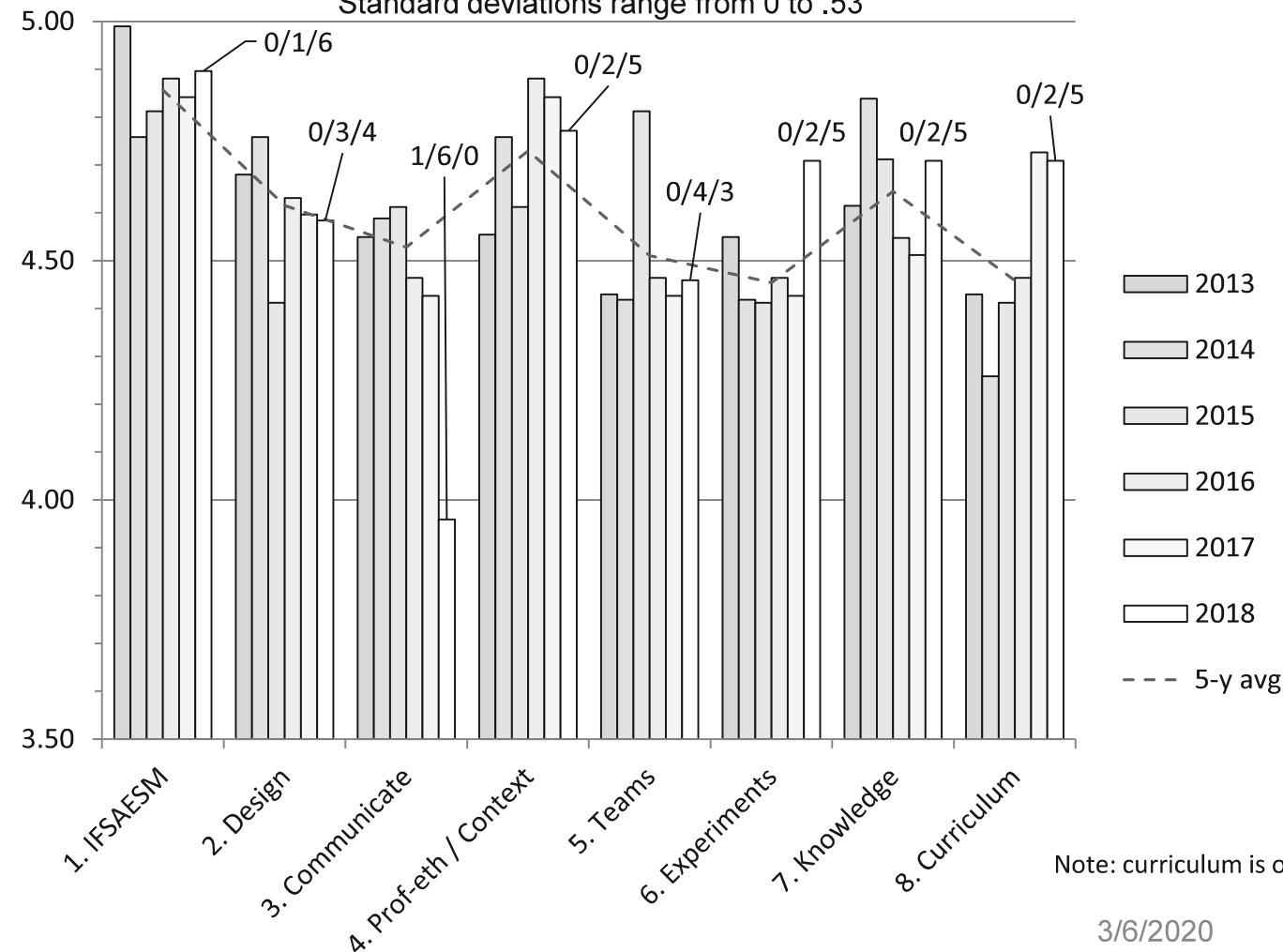




## Student Outcomes 1-8

Program Averages from AY13-18

Data labels are response frequencies for 3, 4 or 5 (# of 3s / # of 4s / # of 5s) on the 1-5 Survey Likert Scale  
Standard deviations range from 0 to .53





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# **Advisory Board Completes Survey**

## **Part 1**



The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria.

There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program's constituents' needs, and these criteria.



During a career as commissioned officers in the United States Army and beyond, program graduates:

1. Demonstrate effective leadership and chemical engineering expertise.
2. Contribute to the solution of infrastructure and operational problems in a complex operational environment.
3. Succeed in graduate school or advanced study programs.
4. Advance their careers through clear and precise technical communication.

Advisory Board Recommended: October 2012

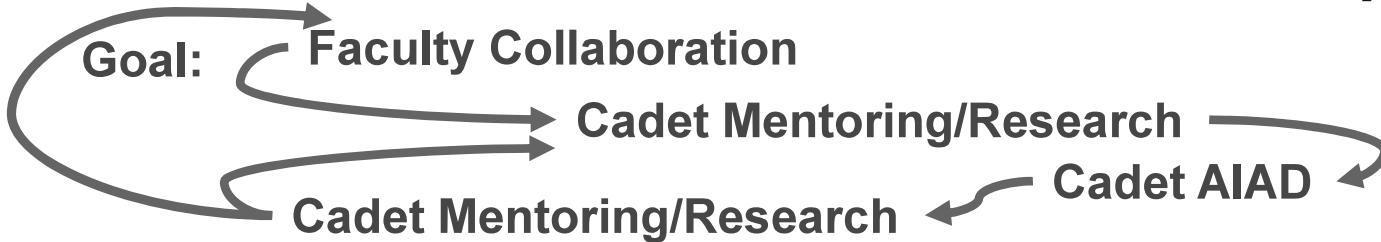


## Program Surveys

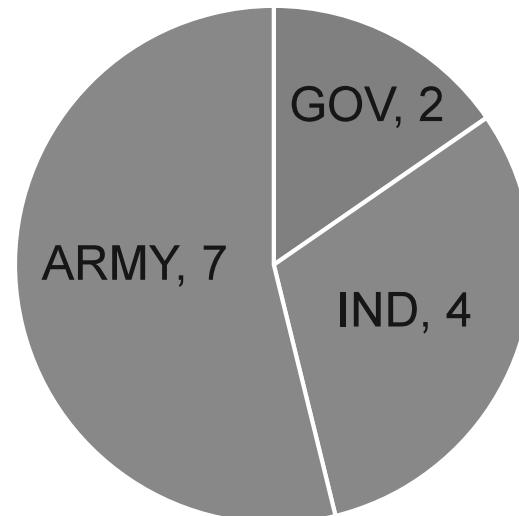
Program Advisory Board Surveys  
Program Faculty Surveys  
Program Cadet Surveys



## Advanced Individual Academic Development (AIAD)



- Lawrence Livermore National Lab
- Sandia National Lab
- Army Research Labs
- Picatinny Arsenal
- BAE Systems – Radford AAP
- BAE Systems – Holston AAP
- Southern Polymer
- Uniform Color Company
- Renewable Energy Group





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# **Advisory Board Completes Survey**

## **Part 2**



Concept (flexible) of discussions

- ~ 1000-1045 Board ask questions of cadets
  - Any courses in curriculum cadets are unhappy with?
  - Any general issues with the program they would like to discuss?
- ~ 1045-1115 Cadets ask questions of board



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# Lunch – Subs and Wraps



- Lunch:**
1. Cold cut Italian mix sandwiches and wraps
  2. Mixed salad
  3. Chips: regular/barbeque/sour cream & onion/Cheetos/Doritos
  4. Iced tea/soda/water/coffee
  5. Cookie plate



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# *Chemical Engineering*



## Advisory Board Meeting

10 April 2020

### 4. Future Challenges

**United States Military Academy  
Department of Chemistry and Life Science**



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## Academic Excellence



- #1 Most Accessible Professors
- #2 Best College Library



- #1 Public College in the country
- #6 Liberal Arts Universities
- #11 In the Northeast
- #14 Overall College in the country

## Academic Excellence



- #2 Top Public Schools (Liberal Arts)
- #3 Best Undergrad Engineering Program
- #4 Civil Engineering Program
- #7 Mechanical Engineering Program
- #19 National Liberal Arts College



# Strategic Influence

Governmental Strategic Guidance

- President
- Congress
- Department of Defense
- Government Agencies (e.g., NSA, FBI, CIA, ...)

Department of the Army

- Army Goals and Priorities
- Army Regulations
- Army Doctrine

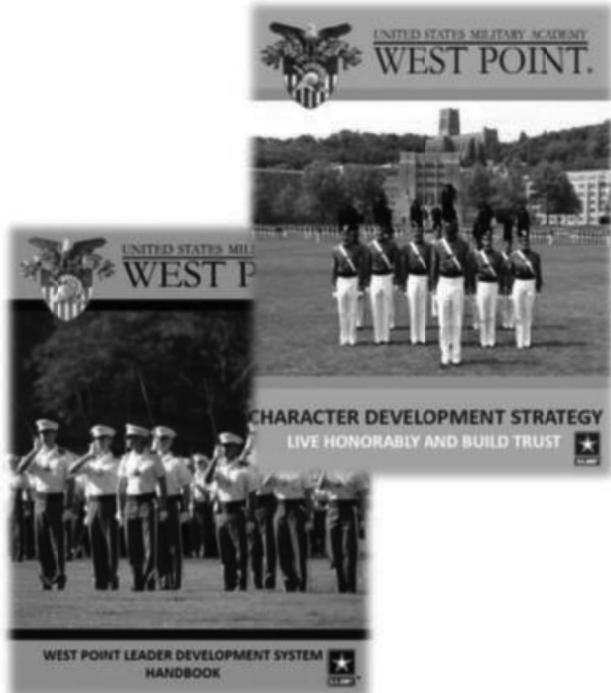
Higher Education Communities

- Professional Societies
- Accreditation Agencies
- Best Practices
- Peer Institutions

West Point Mission and Strategic Plan

Academic Program Vision and Strategic Plan

**Academic Program Goals**



Core Courses

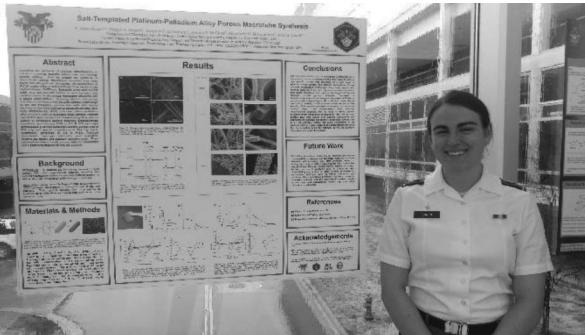
Academic Majors

Enrichment Experiences <sup>49</sup>



# CDT Anchor Losch, '20

## Chemical Engineering



- Fullbright Scholarship Semifinalist
- Anna Sobol Levy Scholarship
- Rotary Scholarship – Semifinalist
- Tau Beta Phi Honor Society

### Co-Authored Conference Proceedings and Publications

- F. John Burpo\*, **Anchor R. Losch**, Enoch A. Nagelli, Stephen J. Winter, Stephen F. Bartolucci, Joshua P. McClure, David R. Baker, Jack Bui, Alvin R. Burns, Sean F. O'Brien, Brittany Aikin, Kelsey Healy, Alexander N. Mitropoulos, J. Kenneth Wickiser, Greg Forcherio, and Deryn D. Chu "Salt-Templated Synthesis Method for Porous Noble Metal Platinum-based Macrobeams and Macrotubes." *J. Vis Exp.* (Invited Paper)
- Burpo, F., Nagelli, E., **Losch, A.**, Bui, J., Forcherio, G., Baker, D., McClure, P., Bartolucci, S., Chu, D. "Salt-templated Cu-Pt Alloy Macrobeams for Ethanol Oxidation." *Catalysts*, 2019, 9(8), 662.
- Burpo, F., Nagelli, E., Bartolucci, S., Mitropoulos, A., McClure, J., Baker, D., **Losch, A.**, Chu, D. "Salt-Templated Platinum-Palladium Porous Macrobeam Synthesis." *MRS Communications*, 2019, 9(1), 280-287.

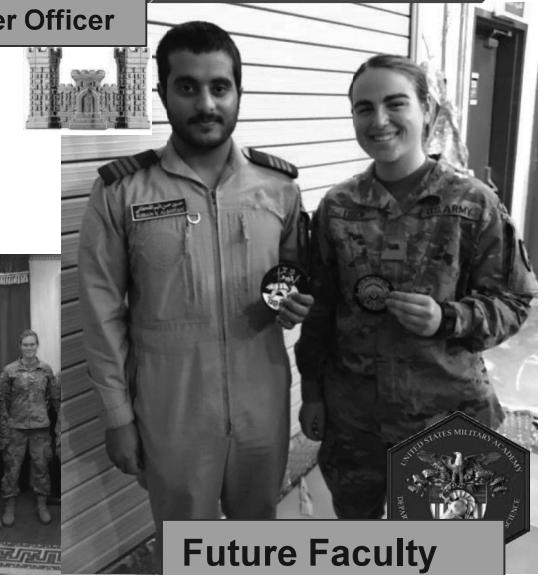
**CH289/CH290: Multi-Functional Materials**

**CH489: Multi-Functional Materials**



### USMA Independent Research and Activities

Cadet Losch researches in the Multi-Functional Materials Laboratory. She has completed synthesis work on Salt-Templated Platinum-Palladium and Copper-Platinum Alloy Porous Macrotubes, and presented at the Inter-Academy Chemistry Symposium and Projects Day. Outside of class and research, Anchor is a conductor in the Cadet Spirit Band, and President of the Model Arab League and American Institute of Chemical Engineers. As a part of the Peace and Dialogue Leadership Initiative, she has traveled to Israel and Palestinian territories to participate in a nuanced conversation about the US role in the Middle East, with a focus on Israeli-Palestinian relations, society, and culture. She studied Arabic abroad in Morocco, where she taught English at a local NGO. She travelled to Qatar with the National Council on U.S.-Arab Relations on a cultural exchange program between U.S. and Qatari servicemembers. She also has completed service work in Viet Nam, Mongolia, Papua New Guinea, and the Galapagos Islands.



**Future Faculty**



- ABET Criteria changed this year, officially
  - Critical change is the reduction of dedicated engineering credit hours from 48.0 to 45.0
- Also, the Student Outcomes, what graduates of programs are expected to be able to do upon graduation, have changed
  - Fundamentally the same, but some consolidation, wording changes, and enhancements that may impact the collection of some assessment data
  - We already leaned forward to include the new SOs in our AY19 assessments, and are currently utilizing during AY20 record year.



# Chemical Engineering Faculty

	AY20	AY21	AY22	AY23	AY24	AY25	AY26
Burpo	X	X	X	X	X	X	X
Biaglow	X	X	X	X	X	X	X
Lachance	a	a	?	?	?	?	?
Bull	X						
Armstrong	X	X					
Nagelli	X	X	X	X	X	X	X
James	X	X	X	X	X	X	X
Miller, A.	X						
Corrigan	X	X					
Cowart		X	X	X			
Chin		X	X	X			
Yi		X	X	X			
Bowers			X	X	X		
Mandes			X	X	X		
Belanger				X	X	X	
Rogers						X	X
<b>Totals</b>	<b>8+</b>	<b>9+</b>	<b>9+</b>	<b>10+</b>	<b>7+</b>	<b>6+</b>	<b>5+</b>

a – available to teach; currently in registrar's office

? – uncertain availability



- Since AY19 the Academy's 1-day/2-day schedule has changed
  - Now 40x 1-days and 30x 2-days
  - **Some courses have shifted to a 30-lesson sequence (CH363; CH485), IOT deconflict cadet schedules**
- The additional 10 2-days are now 'Study Days'
- Biggest impact on Chemical Engineering is CH459 (ChemE Laboratory)
  - Back-to-back sections: experiment reset time?
- Major impacts to core classes, CH101/102
  - Full impact on base knowledge and understanding uncertain



# Chemical Engineering Program 10+ year vision

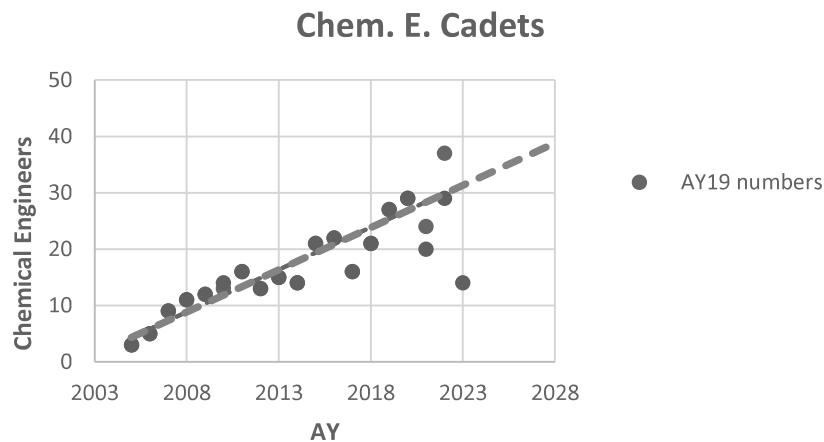
1. **Stabilized at ~40 +/- (1-5) cadets per class year; if >40 establish OML; Recommended GPA: ~2.3**
2. **Chemical engineering faculty:**
  - a. Senior faculty: AP; 2<sup>nd</sup> time rotators; Associate Professors; Title 10s; PhDs. Teach chemical engineering course 3-6 years in a row.
  - b. Junior faculty: 1<sup>st</sup> time rotators. Teach CH101/102 (not both); collaborate with Senior Faculty on research. No CH102 without CH101.
  - c. Minimize churn; “Do less better.” ... Stability; efficiency; optimization; transparency
3. Curriculum:

<b>Bioengineering</b> <ol style="list-style-type: none"><li>a. 3x Bio.-Eng. track: CH300, CH350, CH4; validate the ET credit</li><li>b. Stand up bioengineering sequence</li><li>c. Stand up bioengineering major</li><li>d. Currently: Bio.-Eng. AP search; Ongoing Title10 hiring action</li></ol>	<b>Chemical Engineering:</b> <ol style="list-style-type: none"><li>a. Expand CH400 to 3.0 credits</li><li>b. Expand CH459 to 4.0 credits – cadet feedback</li><li>c. Expand CH402 to 7.0 credits (2 sem.)</li><li>d. Other Chem E. electives: (Numerical methods; explosives)</li></ol>
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4. Pedagogy:
  - a. Intensive problem solving with instructors as coaches and role models
  - b. classroom/lab workshop experience (theory + demo + practice)
  - c. faculty demonstrate proficiency at problem solving as well as depth of knowledge; multi-year faculty development
5. Ranked undergraduate program
  - a. ABET recertifications (12-15 SEP 20); maintain ABET efforts; assessment
  - b. Establish “footprint” at National level conferences: AIChE; SOR; ACS & communicate USMA Chem. E. vision to other Universities
  - c. Get more Chemical Engineers PEV training here (James, Nagelli)
  - d. **Maintain** BH331 computer room; chemical engineering work/research space (Applications Rm.; BH136); Network
6. AIChE Club stability...and consistency of student involvement; strength of last ABET certification in 2014



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AY	# Chem E.
2005	3
2006	5
2007	9
2008	11
2009	12
2010	14
2011	16
2012	13
2013	15
2014	14
2015	21
2016	22
2017	16
2018	21
2019	27
2020	29
2021	20
2022	29
2023	14





## Electives Proposals

- Cadets have expressed ongoing interest in more chemical engineering electives
- Currently have 3 engineering electives in our major (to meet ABET requirements; 9 credit hours)
- ABET change lowered the required number of strictly engineering credit hours to 45
  - Options: retain engineering elective (at least in short term, will do so)? Chemistry elective? MSE at large? Others?



- **CH450** Bioengineering Modeling and Analysis added to Redbook (*more details next slide*)
- Numerical Methods for Chemical Engineering Problems
  - Enhance cadet experience with computational tools (MMA, Matlab)
  - Ready to execute
  - FEE data seems to support this
- Chemical Explosives
  - Taught before, ready to execute with instructor prep



# CH450, Bioengineering Modeling and Analysis

## CH450 (Version: 2019 2) COURSE DETAILS

COURSE	TITLE	EFF YEAR	EFF TERM	DEPARTMENT	CREDIT HOURS
CH450	BIOENGINEERING MDLING & ANLSIS	2019	2	Chemistry & Life Science	3.0 (BS=0.0, ET=0.0, MA=0.0)

### SCOPE

This course provides a broad understanding of bioengineering disciplines to include biomechanics, biomaterials, tissue engineering, biocatalysis, biochemical engineering, and biosensors. Fundamental concepts of molecular kinetics, thermodynamics, and mass transport are applied in problem sets in each bioengineering sub-discipline and capstone design project providing students the opportunity for modeling, analysis, and design from the biomolecular to physiological length scale and across multiple time scales. Modeling software such as MATLAB and Mathematica is extensively used.

**LESSONS:** 30 @ 75 min (2.000 Att/wk) **LABS:** 0 @ 0 min

### SPECIAL REQUIREMENTS:

None

Prerequisites: CH102, MA205, PH206



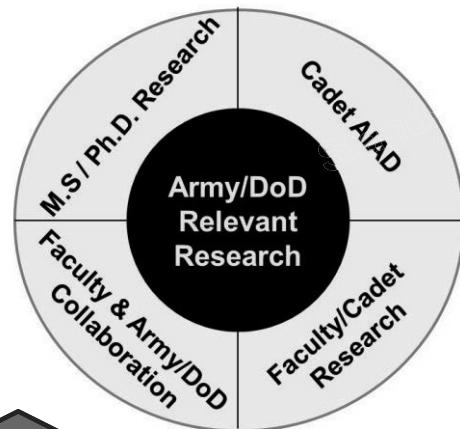
- **Bio-Engineer Title 10 Ph.D. Spring 2020**
- **Bioengineer Academy Professor Spring 2020**
- **Stand up bioengineering track (1-2 years)**
  - CH300
  - CH350
- **Bioengineering sequence (2-5 years)**
- **Bioengineering major (7 – 10 years)**



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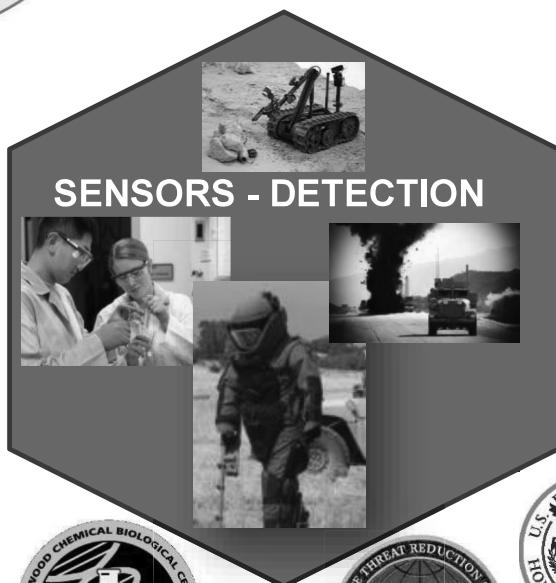
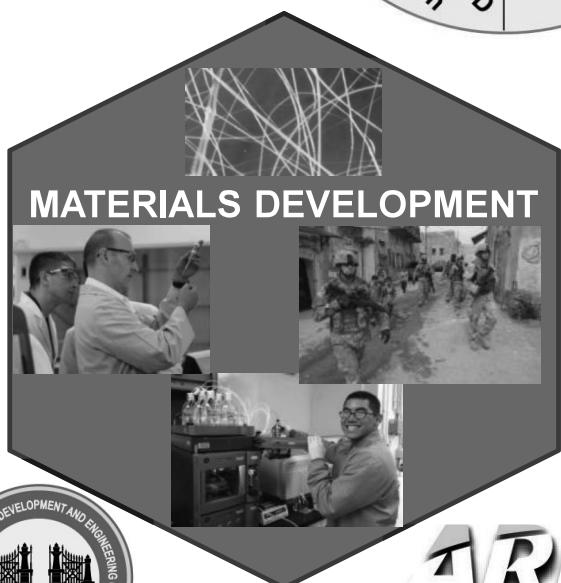
# Undergraduate Research

*Securing external resources through collaborations*



## Funded Collaborations:

UC Santa Barbara  
Florida Institute of Technology  
Cornell  
University of Michigan

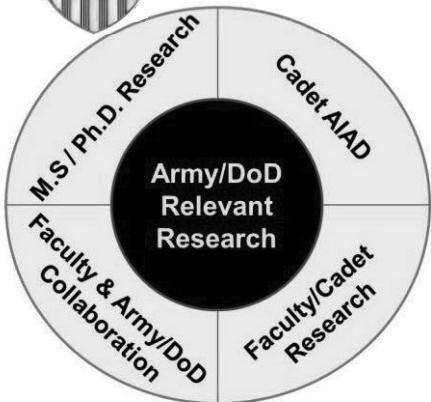


**ARL**  
**DARPA**



**USU**  
Uniformed Services University  
**NCAA-DOD**  
Grand Alliance  
CARE Consortium





# Promoting Cadet Development in Chem. E.

## Faculty and Cadet Developmental Model

Principal investigators with DoD supporting projects, funding, and collaborators facilitate cadet research through a progressive series of courses – **CH290** (1 CR), **CH389/390** (1.5 CR), **CH489-492** (3 CR). This course progression allows cadets to begin research as early as their first year and participate in a multi-year project. Every effort is made to link research AIAD's with the collaborating DoD labs.

### \*Promoting Research and Scholarship

- 10 Cadet co-authored papers in AY20
- 24 Cadet conference proceedings AY20
  - AIChE; SOR; ACS
  - 200/300/400 level research

### \*Modeling Institutional Values:

- Department Character development strategy
- 3 Leadership Challenge Facilitators
- 3 PL300 Mentors (25 cadets)
- 3 SLDP Developmental Coaches

### \*Instituting research-based instructional practices to support APGs and WPLDS outcomes

*Every interaction is a developmental event*

### \*Engaging with Cadets:

- Club Affiliations: 3 Faculty/2 Clubs (1 OIC)
- USMA Chapters: AIChE and ACS
- ODIA Sport: 4 Faculty/ 4 Teams
  - 1 Head OR- Men's Hockey
  - 3 Asst. OR-Swimming & Diving
  - Rifle
  - Men's Basketball
- First-year Sponsorship Program: ~53 Cadets
- Unofficial Sponsor: >25



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# CDT Matthew Dibiase, '20

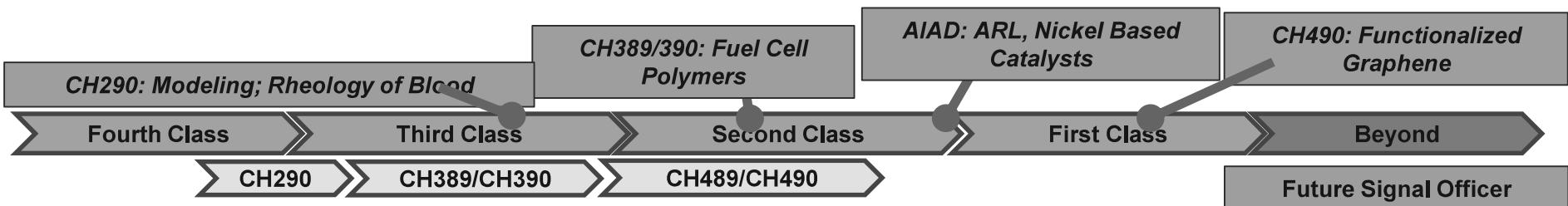
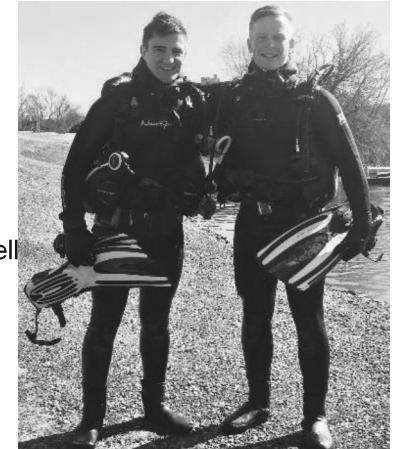
## Chemical Engineering



- Goldwater Scholarship Recipient
- Fullbright Scholarship Semifinalist
- Phi Kappa Phi Honor & Tau Beta Phi Honor Society

### Co-Authored Conference Proceedings and Publications

1. Army Research Lab (ARL) Technical Symposium "Catalysts for fuel cell electronics". (Poster)
2. 1<sup>st</sup> Place Catalysts and Reaction Engineering, Presentation: "Nickel catalysts and graphene for lithium ion batteries". American Institute of Chemical Engineering Annual Meeting, Orlando, FL, 10-15 NOV19.
2. Manuscript in progress, "Electroless deposition of Noble Metal Nanoparticles onto Silk Fibroin Films", (to be submitted, Spring 2020)



### USMA Independent Research

Cadet Dibiase has been working on a Proton Exchange Membrane (PEM) Fuel Cell project; a field of great interest for their efficiency advantages over combustion technology. However, conventional methods of electrolysis to produce H<sub>2</sub> and O<sub>2</sub> gas necessary for PEM fuel cells rely on expensive catalysts, Pt and IrO<sub>2</sub>. Despite exceptional efficiency of these catalysts, their high costs prevent industry scale up and production. We present alternative Ni-based catalysts to replace Pt and IrO<sub>2</sub>. Of the Ni catalysts characterized, NiS and NiFe LDH together provided the smallest total overpotentials of 1.7 V (vs SHE) for Hydrogen Evolution Reactions (HER) and Oxygen Evolution reactions (OER), respectively. However, Linear Sweep Voltammetry illustrated that NiFe LDH had the lowest overpotential of the two, contributing only 0.3 V to the total overpotential. Nevertheless, the total overpotential of 1.7 V is still only 0.2 V above the industry standard of 1.5 V from a combination of Pt and IrO<sub>2</sub>.



Future Faculty



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# CDT Jesse Palmer, '19

## Chemical Engineering



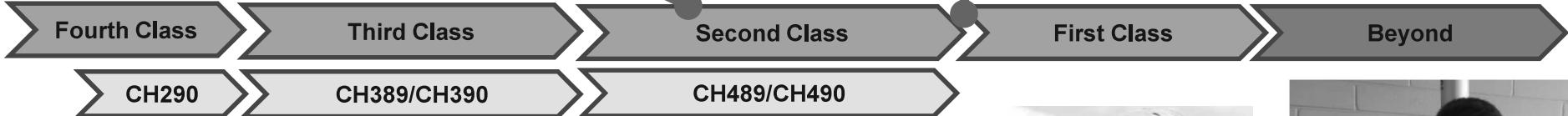
- Won Stamps Scholarship
- Won Goldwater Scholarship
- Tau Beta Pi Honor Society
- Phi Kappa Phi Honor Society
- Phi Sigma Iota Society
- Won Churchill Scholarship

### Co-Authored Publications

1. Cellulose Nanofiber Biotemplated Palladium Composite Aerogels. *Molecules*, 23(6)
2. Gelatin biotemplated platinum aerogels. *MRS Advances*, 1-6.
3. A Rapid Synthesis Method for Au, Pd, Aerogels Via direct Solution-Based Reduction. *Journal of visualized experiments: JoVE*, (136).
4. Direct solution-based reduction synthesis of Au, Pd, and Pt Aerogels. *Journal of Materials Research*, 32(22).

Australia; Renewable Energy Lab  
Sweden: Water NEXUS conference

Harvard AIAD; Disease  
biophysics groups



### USMA Independent Research

Jesse has collaborated with the Army Research Labs (ARL) in Adelphi, MD to produce biosensors and has developed novel Kevlar-cellulose composites with Harvard's Disease Biophysics group. As a recipient of Goldwater and Stamps Scholarships Jesse has used his academic funding to attend World Water Week in Stockholm, Sweden and visit the University of New South Wales in Sydney, Australia to pursue his interest in water desalination. Jesse is also completing a minor in Eurasian Studies. He plans on attending graduate school to develop batteries to enhance prosthetic limbs serving wounded veterans.



Field Artillery Officer

Future Faculty



**Pre-approved elective sequences,  
but ultimately cadet choice (can choose any 3)**

## **Materials Engineering**

- MC364 Mechanics of Materials
- MC380 Engineering Materials
- Open Elective

## **Nuclear Engineering**

- NE300 Nuclear Reactor Analysis
- NE350 Nuclear Reactor Design
- NE450 Nuclear Systems Design

## **Decision Analysis**

- SE301 Foundations of Engineering Design & Systems Management

SE 481 Systems Simulation

EM484 Dynamic Systems Analysis

## **Advanced Control Systems**

- EE360 Digital Computer Logic
- EM484 Dynamic Systems Analysis
- XE475 Mechatronics

## **Energy Conversion Systems**

- EE377 Electrical Power Generation
- ME472 Energy Conversion Systems
- ME480 Heat Transfer

## **Power Systems**

- ME306 Dynamics
- ME491 Mechanical Power Plants
- EE377 Electrical Power Generation
- XE442 Alternative Energy Engineering

## **Industrial Engineering**

- SE301 Foundations of Engineering Design & Systems Management

EM411 Project Management

EM420 Production Operations Management

## **Other Advanced Engineering Electives**

Satisfy prerequisites

Engineering Science or design = 3.0 credits

Program director approval



## Some Administrative

- Next Advisory Board on-site
  - Late April/Early May 2021...close out Class of '20
- Travel Paperwork/Dinner settle
- Tour of Unit Operations Lab...UTC



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## End of Section 4



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# *Chemical Engineering*



## Advisory Board Meeting

10 April 2020

# Thank you!

United States Military Academy  
Department of Chemistry and Life Science



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# Back Up Slides



## Historical Data:

AY	# Chem E.
2005	3
2006	5
2007	9
2008	11
2009	12
2010	14
2011	16
2012	13
2013	15
2014	14
2015	21
2016	22
2017	16
2018	21
2019	27
2020	29
2021	20
2022	29
2023	16

