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

REPLY TO ATTENTION OF
MADN-CLS

11 September 2018

BURPO.FRED.JOHN.1087644088 Digitally signed by BURPO.FRED.JOHN.1087644088 Date: 2018.09.15 21:02:44 -04'00'

MEMORANDUM THRU COL F. John Burpo, Department Head, Department of Chemistry and Life Science, United States Military Academy, West Point, NY 10996

FOR Dean of the Academic Board, United States Military Academy, West Point, NY 10996

SUBJECT: 2018 Executive Summary of Chemical Engineering (CEN0) Program Assessment

1. This memorandum is an executive summary, per *DPOM 5-07 Assessment of Student Learning in the Academic Program*, outlining the changes in the Chemical Engineering Program's assessment and assessment process, as well as curriculum changes, that have occurred since the last executive summary in September 2017.

a. The Chemical Engineering Program made no new recommendations for curricular changes during AY18. Of note, this is the last AY under the CEN0 program. Future years will have taken the CEN1 program.

(1) The last curricular change, from AY17, to add CH367 – Introduction to Automatic Process Control, to the Chemical Engineering major, was previously approved for implementation in AY19-2. Course development is ongoing.

(2) A curriculum change in the Department of Mathematical Sciences impacted the CEN1 curriculum. Based on external requests, the MA366 – Applied Engineering Math course was changed to reflect the needs of other departments. The Chemical Engineering faculty reviewed the proposed change and determined that the new course content no longer met the needs of the CEN1 major. As a result, the decision was made to change the CEN1 advanced math course to MA364 – Engineering Mathematics. This course is taken by numerous other engineering programs and includes the advanced math needed in the CEN1 major. A related change in the math department that impacted some members of CEN1 was the implementation of MA365 – Advanced Math for Engineers and Scientists. This course will be taken in lieu of MA364 for CEN1 cadets that take the advanced math track of MA153 – Math Modeling/Introduction to Differential Equations and MA255 – Advanced Multivariable Calculus.

(3) The new standard 8TAP that reflects these changes is shown in Appendix 1.

b. Course Student Outcomes (SO) Assessment:

(1) For AY18, the Chemical Engineering Program made the decision to implement assessment against the both the current and future Student Outcomes required by changes in ABET Accreditation Criteria for implementation no later than AY20. For AY19, these SOs have been updated in the Redbook and a comparison of the new outcomes (1-8) to the previous (1-12) is shown in Appendix 2. Future assessments will be conducted only against the new SOs.

(2) The analysis of AY18 SOs proceeds from the chemical engineering program assessment process, which includes analysis of an extensive data pack, discussions among faculty members, advisory board members, and students, as well as survey data capturing the opinions of each of these groups. Assessment data for embedded indicators is included in Appendix 3. Updated assessment data and evaluation results, to include survey and Advisory Board data, will be updated when complete. The performance of cadets on the Fundamentals of Engineering Exam (FEE) during AY18 was 17/21 (81%) cadets passing, above this year's national chemical engineering average pass rate of 74%. One cadet took the FEE twice. Overall, there were no major changes to the attainment of Student Outcomes compared to the previous year (AY17) and cadets reached at least the expected level of achievement for all Student Outcomes (per Appendix 3). Some trends and evaluations of note are as follows.

(3) Data for Student Outcome 12 (FE Exam data) show continued relative weak performance in process control (See Appendix 4 for FEE data comparison to previous years). Paragraph 1a details our ongoing attempt to correct this trend.

(4) AY18 was the third iteration of the CH365 Chemical Engineering Thermodynamics course. This course was introduced to address continual low performance in this topic area on the FEE. For AY18, for the first time the CEN1 average was above the national average. This closes the assessment loop on the introduction of this course. Continued assessment will occur in subsequent years as we also evaluate the internal structure of the course to improve scores further.

(5) There was a noticeable drop in the performance on the Chemistry topical area. No immediate action will be taken, pending review of chemistry performance in other engineering programs and subsequent data, to determine if there is a trend in response to changes in the chemistry program.

(6) There was a large positive change in the performance on both the Safety and Professional Ethics areas. There was a re-invigoration and emphasis on safety in CH459 which may have impacted this performance. We will continue to monitor and look for ways to incorporate these topics throughout the program.

c. Summary of results of Academic Program Goals and What Graduates Can Do (APG-WGCD) responsibility evaluations conducted during the year. The APG-WGCD

map was updated to reflect the changes to Student Outcomes described in Paragraph 1b and Appendix 2. Results of the new mapping are shown in Appendix 5.

d. Significant planned curricular changes. The Chemical Engineering program is not proposing any significant curricular changes moving into AY19. The program will be executing the new academic schedule, with one course, CH363 – Separation Processes, becoming a 30-lesson, 75-minute, course. The new CH367 – Introduction to Automatic Process Control will be taught for the first time.

e. During AY19, we will fully implement the changes to the Student Outcomes for the program reflected in the new ABET Criteria. These new Student Outcomes are already reflected in the Redbook.

f. Other than the stated change to the assessment process to reflect ABET accreditation criteria, there are no planned changes to the Chemical Engineering program's assessment process.

g. Current assessment schedule. Program assessment for AY18 will be complete by 1 Sep 2019 (following our next advisory board meeting, at which time the board will evaluate the program data of AY2018) and will be added as an Appendix to this Executive Summary. The planned Advisory Board meeting for AY18 will occur in May 2019. The next ABET record year will be AY19-20 with the onsite visit during the fall of 2020.

2. Point of contact for this action is the AY18 Chemical Engineering Program Director, LTC Geoffrey Bull, at x2031.

5 Encls
1. Approved CEN1 8TAP
2. Comparison of Previous Student Outcomes to New
3. Program Assessment Data AY2017-2018
4. FEE Topical Outcomes Evaluation
5. Student Outcome to APG/WGCD Mapping

GEOFFREY R. BULL
LTC, FA52
Chemical Engineering Program Director (AY18)

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APPENDIX 1 to 2018 Executive Summary of Chemical Engineering Program Assessment. Approved CEN1 8TAP

CEN1 - Class of 2021

4th Class Year Fall Term	Spring Term	3rd Class Year Fall Term	Spring Term	2nd Class Year Fall Term	Spring Term	1st Class Year Fall Term	Spring Term
E **MA103** 4.0	*E* **MA104** 4.5	*E* **MA205** 4.5	*R* **CH362** 3.5	*R* **CH363** 3.5	*R* **CH364** 3.5	*D,R* **CH459** 3.5	**CH402** 3.0
EV203/ CH101 4.0	*R* **CH101/ PH205** 4.0	*R* **PH205/ PH206** 4.0	*R/* **EV203/ PH206** 4.0	*R* **EE301** 3.5	**CH367** 3.0	**CH365** 3.0	**CH400** 1.5
EN101 3.0	**EN102** 3.0	*R* **CH102** 4	**MA364/5** 3.0	*R* **CH383** 3.5	**MC312** 3.0	*R* **CH485** 3.5	**Engr Elective** 3.0
IT105 3.0	**PL100** 3.0	*E* **DFL1** 4.0	**PY201** 3.0	**MC311** 3.5	**MC300** 3.0	**Engr Elective** 3.0	**LW403** 3.5
HI105 3.0	**HI108** 3.0	*R* **SS201** 3.5	*E* **DFL2** 4.0	**PL300** 3.0	**SS307** 3.5	**Engr Elective** 3.0	*R* **HI302** 3.0
			R **SS202** 3.5	**MA206** 3.0			**MX400** 3.0

D = Double blocked course
R = RSTU lab course
E = Meet every day for 55 minutes

- Course should not be moved from that year or term
- Course may be scheduled in the fall or spring of that academic year
- Complementary Support Courses
- Core Engineering Sequence (not applicable)
- Course 3 Science Depth
- Course 9 STEM Depth
- other electives - most popular electives are templated

APPENDIX 2 TO 2018 Executive Summary of CEN0 Program Assessment: Comparison of Previous Student Outcomes (ABET a-k) to New (ABET 1-7)

Student Outcomes Prior to AY18 (ABET a-k)
On completion of the chemical engineering program, our graduates will be able to:
1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as analyze and interpret data.
3. Design a system, component, or process to meet desired needs within economic, environmental, social, political, ethical, health and safety, manufacturing, and sustainability constraints.
4. Function on multidisciplinary teams.
5. Identify, formulate, and solve engineering problems.
6. Understand professional and ethical responsibilities.
7. Communicate effectively.
8. Understand the impact of engineering solutions in a global economic, environmental, and societal context.
9. Recognize the need and develop the skills required for life-long learning.
10. Demonstrate knowledge of contemporary issues.
11. Demonstrate an ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Student Outcomes AY18 (ABET 1-7):
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.

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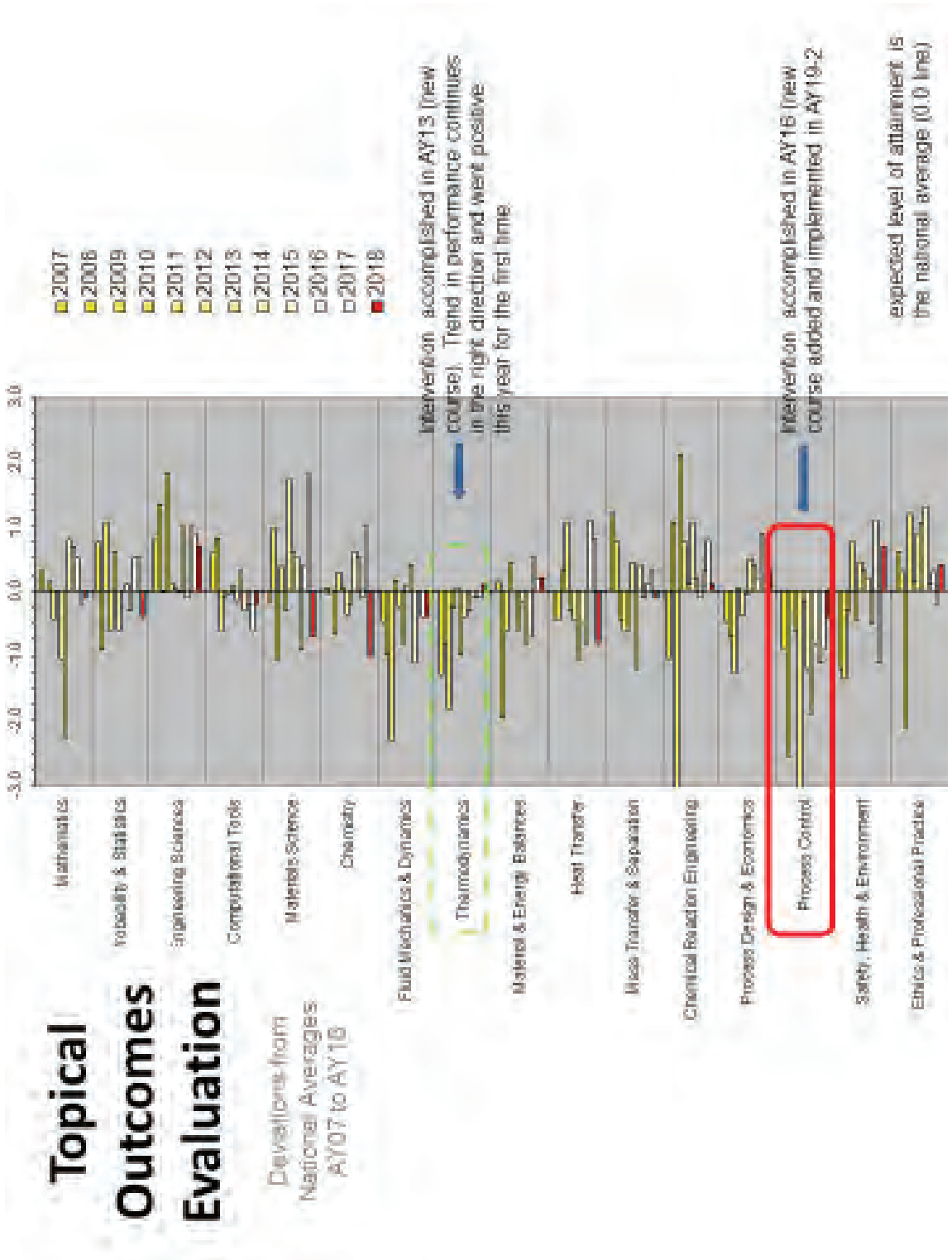
APPENDIX 3 TO 2018 Executive Summary of CEN0 Program Assessment: Program Assessment Data

Initial data published in separate file. Updated with Advisory Board input and survey data o/a 1 September 2019.

APPENDIX 4 TO 2018 Executive Summary of CEN0 Program Assessment: FEE Topical Outcomes Evaluation (also available in a separate file)



APPENDIX 5 TO 2018 Executive Summary of CEN0 Program Assessment: Student Outcome to APG/WGCD Mapping.

Student Outcome	Communication					Critical/Creative Thinking						Lifelong Learning				Disciplinary Depth				
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	7.1	7.2	7.3	7.4	7.5
a																XX	XX	XX	XX	
b						XX			X							XX		X		
c						XX				XX	X					XX		X	X	
d	X		X		X	XX	XX						X					XX	XX	XX
e					X	X										XX	X	X		
f										X						X		X		
g	XX	XX	XX													X			X	X
h			X		X						X				X			X	X	X
i												XX	XX					X		
j			XX		X							XX	X			XX	X			
k							XX			X		X	X			XX	XX	X		X
Total	XX	XX	XX		X	XX	XX		X	XX	X	XX	XX		X	XX	XX	XX	XX	XX

Student Outcome	Communication					Critical/Creative Thinking						Lifelong Learning				Disciplinary Depth				
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	7.1	7.2	7.3	7.4	7.5
1						XX										XX	XX	XX	XX	
2						XX	XX		X		X					XX		X		
3	XX	XX	XX													X			X	X
4						XX												X	X	
5	X		X		X	XX	XX						X			X	X	XX	XX	XX
6										XX					X	XX		X		
7			XX		X	XX				X		XX	XX			X			X	X
Total	XX	XX	XX		X	XX	XX		X	XX	X	XX	XX		X	XX	XX	XX	XX	XX

Note: A single “X” indicates that we assess that a particular Student Outcome supports the corresponding APG/WGCD, usually through strong emphasis in a single course of the program, or low-to-moderate emphasis in multiple courses. A double “XX” indicates that this Student Outcome strongly supports the corresponding APG/WGCD through strong emphasis in multiple courses.