Northampton Community College

Engineering, Associate in Science

Academic Program Review 2016 – 2021

March 2023

Authors:
William Doney, Professor, Engineering/Physics

Denise François-Seeney, Ph.D., Dean, School of Business & Industry

External Auditor:
Scott R. Hummel, Ph.D.
Professor of Mechanical Engineering
Lafayette College
Easton, PA

Table of Contents

I. Introduction

A. Provide the current purpose of the program.

The Engineering program at Northampton Community College's main purpose is to offer an Associate in Science (AS) degree designed to prepare students for transfer to four-year institutions. The Program's curriculum parallels the first two years of the baccalaureate programs into which many NCC students transition.

The secondary purpose is to provide students with a two-year Associate in Science degree, increasing their marketability in the years before they complete a Bachelor of Science program at a four-year school. Recognizing that employment opportunities are limited with an Associate's degree, students are strongly encouraged to work toward obtaining a BS degree at a four-year institution.

B. How does the program advance the mission or strategic focus areas (SFAs) of the college?

Enhancing Student Access:

- The Engineering Program continues to offer students quality, affordable education in preparation to transfer to a four-year institution.

Inspiring Academic Excellence:

- Students transferring must meet the academic standards set by the receiving schools. Therefore it is exceedingly important that NCC's engineering program teach and hold students to the highest academic standard, as their success or failure at the transfer school will impact future transfer students.

Fostering Diversity & Global Engagement:

- There is a requirement in the program to complete at least one course designated as Diversity & Global Awareness.

Engaging with our Communities:

- A highlight has always been the opportunities provided for students in the Engineering Club to participate in local events and student activities. One of note was the Bethlehem Green Energy days where students built human-powered lighting systems using bicycles.

Increasing Student Retention, Completion, and Transfer

- The college continues to pursue and formalize transfer articulation agreements with four-year institutions.
- Transfer presentations are scheduled each spring with local transfer school engineering departments to provide students with opportunities and contacts with four-year institutions within an hour's drive of NCC. Recent presentations have included: Temple, Wilkes, Penn State University – Hazelton, Minnesota State University (online program), & Widener University.

C. Comment on awards, honors, noteworthy accomplishments, or unique features related to the program during the review period.

Over the past five years, students of the program continue to transfer and receive financial support from transfer universities.

D. Catalog Description

1. The current program catalog description is included in Appendix A.

2. Does this description accurately describe the current program?

Yes **X** No _____

If No, what changes does the program review committee recommend? Explain reasons for any recommended changes.

E. Previous Program Review

1. Provide the date of the last program review: **March 31, 2017**

2. List the recommendations from that review and indicate the extent to which these recommendations have been implemented. Indicate "I" for recommendations implemented, "IP" for those in progress, and "NI" for those not implemented. For those recommendations not implemented, please explain the circumstances.

Table 1. Status of Recommendations from Last Program Review

Recommendation	Status
NCC Engineering AS program continues	I
NCC continues to seek out and sign articulation agreements with four-year institutions.	IP

II. Program Outcomes

A. Program-Level Student Learning Outcomes (see Appendix B)

1. Have the PLOs been updated or revised since the last program review?

Yes _____ No **X**

2. If yes, briefly explain the rationale for the changes (e.g., improving accessibility, conforming to best practices, etc.)

B. Program-Level Performance Indicators

The data provided in Appendix C provides key indicator used to assess the effectiveness of the program.

III. Environmental Scan

A. Identify current program-related local, regional and national trends.

The U.S. Bureau of Labor Statistics projects employment growth for engineers, with nearly 140,000 new jobs expected over the 2016–26 decade. In 2016, engineers had a median annual wage of $91,010—more than twice the median wage for all workers.

Nationally we're seeing a trend toward offering accelerated and non-traditional semester start course offerings, particularly in the online modality.

B. What has the program done to respond to these trends?

The field of engineering is broad, with many sub-disciplines within the four main area – mechanical, electrical, civil and chemical. There are also opportunities for interdisciplinary work in biology, medicine, environmental to name a few. With students and professionals having diverse interests, from airplane design to space travel to energy creation or environmental issues, students must be exposed to as many areas of application as possible. Although this is typically done once student select their engineering discipline focus at the four-year transfer school, faculty of the program continue to include real-world applications in both the physics and engineering courses at NCC.

The program also continues to monitor the disciplines pursued by students and adjusting what two engineering electives NCC offers to 2nd year students.

Recognizing the importance of flexibility in transferring the AS in Engineering, faculty have worked to develop advising FAQA files that guide our students in selecting courses to meet their needs. An example is presented below:

NCC ENGG ADVISING FAQA 2022

Version: 10/20/22

The Engineering major prepares students to transfer to a four-year institution to complete a Bachelor's degree ir Engineering. This program is an affordable step, as students will need to continue their education after earning t Associate's degree in order to pursue a career as an engineer as a Bachelor's degree is typically the minimum requirement for job placement. The Faculty Program Director for the Engineering major is William (Bill) Doney (bdoney@northampton.edu), x5556.

FULL-TIME vs PART-TIME: This program is best completed under full-time enrollment and can be started in either fall or spring semester. While it can be completed over a longer time frame as a part-time student, some courses a taken in a strict sequential order (e.g. Math, Engineering, Physics) and studying as a part-time student can make thi more difficult or take significantly longer to complete.

IN-PERSON vs. ONLINE: Students should be available and expect to complete a number of courses "in person", particularly in the areas of math, physics and engineering, as those courses are less likely to be offered online.

CHOOSING AN ENGINEERING DISCIPLINE: Students do not specialize in specific disciplines of engineering while at as this program provides the foundational courses common to all engineering disciplines (math, physics, chemistry, eds); preferred disciplines (chemical, mechanical, civil, electrical, etc) are typically chosen in the 3rd year of study or a transfer 4-year institution.

ENGINEERING EDUCATION PATHWAY: While there are some career options as technologists or similar math/scier career positions for students graduating from NCC's Associate's program, the most common path for an engineerir student would be to transfer to an accredited 4-year institution to earn a Bachelor's degree. Students are urged to begin conversations with transfer schools early as they tend to be highly competitive and rigorous institutions.

MATH: Competence and a solid foundation in math is a good indicator of a student's success in pursuing an engin degree. Math is also the primary reason students are delayed in completing the engineering program requirement Therefore, it is imperative that students stay on track with MATH courses. Students not eligible for Calculus 1 (MA 180) should make taking remedial math courses a priority. If possible, it is strongly recommended that students ta MATH over the summer to 'catch up' so they don't run out of courses in later semesters.

PRE-REQS: pre-reqs are in place to improve student success. although a student may think they can handle class Z the same time as class YYY, usually that is not the case, even if you took class VVV in high school. NCC understands this may delay graduating, transferring, etc, but it really is to improve your chances for successful completion. you NOT want to rush through Math, Physics, or the Engineering Electives

ENGINEERING ELECTIVES (2): ENGG electives must be 200-level, calculus-based courses, which is a requirement mandated by 4-year transfer engineering institutions. Courses considered for transfer *into* NCC must also meet the requirements. Currently NCC offers two approved engineering electives - ENGG 201 (Statics) and ENGG 251 (Stren Materials). 201 is the pre-req for 251, since 251 content starts with the last material covered in 201. If a student o needs 251 to graduate and it would require staying an additional semester, it is possible to request taking 201 and in the same semester, but it discouraged. ENGG 252 (Dynamics) may still be listed at NCC, but it hasn't been offere run) in almost 20 years, so at this time it is not an option. These two electives are perfect for students wishing to p Mechanical or Civil engineering at a 4 year school. For those pursuing other ENGG disciplines (electrical, chemical, etc), they should speak with a transfer advisor AT THE TRANSFER SCHOOL and ask what they should take before enrolling.

TECHNICAL ELECTIVE (1): Technical electives cannot be used for ENGG electives due to the 200-level, calculus-bas requirement mentioned above. NCC recommends CADM 100. If pursuing Chemical Engineering, CHEM II may be preferable. If pursuing Computer Engineering, a second Computer Science course may be preferable.

SPECIAL STUDIES / ENGG 19X (0): these courses, if still listed, are/were used as "credit-for-experience" situations. Since they don't transfer, it is better to have the student request a "challenge exam" for any courses they feel this apply to. An example may be for a CADM course where a student has previous AutoCAD or drafting experience. Th would be at the discretion of the program director for the course.

ADVISING THE LAST SEMESTER(s) / WHEN NEARING TRANSFER: When students are down to their last semester o before transfer, it is recommended that they contact their intended transfer school to see what they recommend t student complete while still at NCC. This is especially helpful for students pursuing Chemical / Electrical / Compute Engineering, as it may alter their engineering and technical elective choices to better suit their transfer school.

C. Does the program have any external transfer articulation or joint admissions agreements?

Yes _____ No **X**

Have any problems been encountered concerning the transferability of courses?

Yes _____ No **X**

D. Does the program have any inbound articulation agreements?

Yes _____ No **X**

Does the program have any community partnerships or other associations or memberships of note?

Yes _____ No **X**

If yes, describe the nature of these relationships

E. Does the program have an advisory committee?

Yes _____ No **X**

If yes, list the names and affiliations of the advisory committee members

F. How often does the advisory committee meet? N/A

IV. Curriculum

A. Curriculum Matrix

1. The program's most recent curriculum matrix for the program's learning outcomes can be found in Appendix E.

2. The key abilities matrix (see Appendix F) indicates how the program satisfies NCC's general education core requirements.

3. Based on the curriculum matrix review, are there any changes that need to be considered?

Yes _____ No **X**

If so, describe these changes.

B. Program and co-curricular maps are in Appendix G and Appendix H.

1. Based on the program map, validate the adequacy of the organized, intentional, sequential learning experiences.

Students enrolled in NCC's Engineering Program are immediately introduced to the foundational courses necessary to progress in a college science education. If mathematically prepared, the Calculus math sequence and general chemistry begin in the first semester of the program. This foundation is then built upon as students in their second semester of study continue with math and take the first of two calculus-based Physics courses for engineers & scientists. While establishing their knowledge and skills in math and physics, students will complete their second year of study by taking the engineering electives as well as other important course such as: Ethics & Moral Problems, Computer-Aided Design and Modeling, and Computer Science / Programming.

2. Based on the co-curricular map, discuss the relationship between student learning and co-curricular experiences.

Students are encouraged to explore the vast field of engineering disciplines by researching and exploring what engineers 'do' in all areas of life. Students are also encouraged to join the Engineering Club, which select projects to work on while at NCC. Since each person's interface with the natural world is unique, co-curricular experiences are meant to be encouraging rather than prescriptive. By the end of their studies at NCC, students should have been able to explore the opportunities within engineering, connect with like-minded students, and hone their interests in order to transfer into an appropriate engineering discipline at a four-year institution.

3. Are there any changes to the program map or co-curricular map that need to be considered?

Yes _____ No **X**

If so, describe these changes.

C. Discuss experiential opportunities for students within your program (e.g., internship, capstone, career research courses, service learning, etc.).

Students are notified through the internship and experiential learning manager, of local internship opportunities as they become available. Typically a student will not have the skills or background until their second year of studies, but they are still encouraged to apply. Capstone courses are completed at the four-year institutions after transferring.

1. Based on a review of these opportunities, are there any changes that need to be considered?

Yes _____ No **X**

If so, describe these changes.

D. Modality Awareness

1. If courses are being offered in online or hybrid formats, discuss the assessment of the effectiveness of these formats.

The policy of the Engineering program is to prioritize face-to-face laboratories for its program Physics courses. As a result, the majority of upper, 200-level courses are offered as face-to-face or in a hybrid format. Hybrid courses follow similar assessment schemes to face-to-face courses.

2. Are there any changes to these formats that need to be considered?

Yes **X** No _____

If so, describe these changes.

Consider "Rolling Admissions" – where student can start and finish a course on their schedule and not be forced into the traditional fall/spring/summer start/end dates. This would work best for courses that can be offered online in an asynchronous modality, allowing students to begin a course when they are educationally and financially ready, and when their schedule allows. NCC already offers traditional 14-week courses, 7-week courses, 10-week summer courses, even 4-week winter courses, so the precedence for non-traditional length courses is there. I've discussed this but am told that at this time is not possible with how the current financial aid works.

V. Assessment

A. Append the current version of the program's Assessment Plan (Appendix I).

B. Using Table 4, provide a summary of the assessment activity that has occurred since the last program review.

The program has embraced the College's "culture of assessment." To focus our assessment efforts the program is working on a chart (still in draft form) to show which assessment techniques, in which courses, are addressing program learning outcomes. Not all courses address each program outcome, but each outcome was structured to be assessed concretely within a specific course. The chart is not exhaustive but provides examples of relevant courses with corresponding assessments of the outcomes.

Table 2. PLO Assessment

Program Learning Outcomes	Relevant Course(s)	Assessment Examples
Transfer to a four-year engineering program in any engineering discipline.	All Program Courses	Successful completion of assignments and courses
Move directly into industry in a position requiring math, science, and computing skills.	All Program Courses	Successful completion of assignments and courses
Demonstrate an ability to work independently and collaboratively as a team.	PHYS 215 PHYS 225 ENGG 201 ENGG 251 CHEM 120	Lab assignments, Group Projects
Demonstrate observational, integrative, and synthetic skills.	All Program Courses	Hands-on lab assignments & experiments
Demonstrate basic skills common to all engineering specialties.	All Program Courses	Successful completion of assignments and courses
Demonstrate competent speaking skills when working with diverse groups.	All Program Courses	Presentations, Lab Exercises
Effectively research and collect data using various published resources and the Internet.	PHYS 215 PHYS 225	Lab assignments, Group Projects, Exams
Analyze and present data in an acceptable, methodical, and standardized manner.	PHYS 215 PHYS 225 ENGG 201 ENGG 251 CHEM 120	Lab assignments, Group Projects, Exams
Demonstrate competent technical knowledge in engineering-related areas.	All Program Courses	Successful completion of assignments and courses

Demonstrate a basic framework of technical vocabulary and graphical interpretation skills.	All Program Courses	Successful completion of assignments and courses
Successfully apply mathematics (algebra, trigonometry, geometry and calculus) to solving engineering problems	PHYS 215 PHYS 225 ENGG 201 ENGG 251	Homework, Quizzes, Exams

C. What programmatic changes have been implemented as a result of recent programmatic assessment activities?

- Continually updating lab exercises and manuals for all physics courses.
- Review and adoption of Open Educational Resource (OER) textbooks.
- Updating the technology in the Physics Lab (Penn 129) to provide livestream lecture and capture capabilities to support hybrid/online classes.

D. Identify desired changes as a result of programmatic assessment that have yet to take place.

Investigate offering non-traditional scheduled course offerings.

VI. Students

A. Describe full-time and part-time enrollment trends since the last program review or the past five years.

Table 3. Student Enrollment Data

Academic Year	2020-21	2019-20	2018-19	2017-18	2016-17
FALL					
Full-Time	87	121	102	104	138
Part-Time	69	70	83	80	81
Total Fall	156	191	185	184	219
SPRING					
Full-Time	56	80	87	88	110
Part-Time	62	85	72	65	84
Total Spring	118	165	159	153	194

B. Describe enrollment trends regarding student age, gender, and race since the last program review or the past five years.

Table 4. Student Demographic Data

Academic Year (FALL)	2020	2019	2018	2017	2016
RACE/Ethnicity*					
Asian	8	9	5	10	7
Black or African American	17	23	20	15	21
Hispanic	41	43	43	53	48
Non-resident Alien	3	5	6	5	15
Two or more Races	5	6	4	8	9
White	79	101	101	90	115
Sex					
Male	130	167	158	157	193
Female	26	24	27	27	26

*Unreported races or ethnicities had less than 2 during all reporting periods.

C. Describe any concerns the program review committee has regarding: (1) any enrollment trends mentioned above or (2) other enrollment-related issues.

The Covid pandemic saw a drop in overall enrollment numbers when classes were move exclusively remotely. In the current school year we are cautiously hopeful that the enrollment is beginning to return, as course section enrollment has increased.

D. Has the program instituted any methods or materials to encourage and increase applications by <u>new</u> students since the last program review or the past five years?

Yes **X** No _____

If yes, please describe any initiatives.

In collaboration with the NCC advising office, we continue to participate in Bethlehem and Monroe Campus Open-Houses each semester. Over the summer there are at least two days for students (and their parents) interested or enrolled in engineering to attend "meet the faculty" presentations. The engineering club periodically does high school and community outreach events and participates in the Science Olympics and high school STEM student visits. Efforts to engage with the college feeding high schools are ongoing.

E. Has the program instituted any methods or materials to encourage and increase the recruiting of <u>continuing</u> students to choose this program major or emphasis?

Yes **X** No _____

If yes, please describe any initiatives.

Continuous faculty advising of enrolled and in-coming students, as well as conversations with the Technology Department Heads at NCC and the local high schools.

F. Comment on graduation rates since the last program review or the past five years.

We have found that the majority of students transfer before completing their AS degree at NCC. This is not a bad thing, as the program serves as a bridge program for students pursuing a bachelor's degree at a four-year institution. Although low, graduation rates have remained consistent over the past five years.

G. Discuss your program's engagement with and impact of new student orientation, advising, tutoring support, library services, disability support, student life, and career services.

The program leads continues to attend new student orientations, open house events at both campuses, advising opportunities and engage with the career office and the internship and experiential learning manager.

VII. Physical and Financial Resources

A. Comment on the availability, adequacy, and use of learning tools, such as computer software, instructional media, laboratories, studios, etc.

The physics lab (Penn 129) where the engineering classes (phys 215, phys 225, and engg 201) are taught is equipped with computers, a smartboard, and live-streaming capabilities using the latest technology.

B. Discuss the adequacy of (1) instructional space, (2) office space, (3) instructional supplies, and (4) equipment for the program.

The program has sufficient instructional space, office space, supplies and equipment.

C. Discuss library resources.

The library houses educational subscriptions and materials available for students and faculty

D. Comment on the role of marketing and public relations in supporting the program.

The program continues to look into marketing opportunities, but being a smaller program a NCC, we typically do our own outreach and marketing.

E. Program costs and income.

Table 5. Financial Data

Academic Year	FY2022	FY2021	FY2020	FY2019	FY2018
Program Income					
Tuition	545,929	630,792	856,691	774,714	777,439
Local Reimbursement	111,472	118,468	144,833	131,646	129,013
Operating Reimb.	262,785	289,962	351,263	307,957	294,576
Total Income	920,186	1,039,222	1,352,787	1,214,317	1,201,028
Program Costs					
Direct Costs	456,315	473,276	582,772	549,927	549,795
Indirect Costs	488,376	506,696	642,401	601,162	554,590
Total Costs	944,691	979,972	1,225,173	1,151,089	1,104,385
FTE	100.09	119.78	168.44	156.68	160.74
Income per FTE	9,193	8,676	8,031	7,751	7,472
Cost per FTE	9,438	8,181	7,274	7,347	6,871
Inst. Avg. Cost per FTE	10,058	8,901	7,820	7,933	7,075
Rank	79 of 126	96 of 138	80 of 135	82 of 133	66 of 126

1. **Describe how the program is financed, including college budget (if any) as well as any grants that have been received over the past five years, and outline any major expenses over the past five years.**

   The program is financed by tuition, local, and operating reimbursement and hovers around budget neutral.

2. **If possible, analyze the program's cost-effectiveness (i.e., does current/projected student enrollment cover the cost of faculty, supplies, etc. and/or are the faculty staff, space and/or facilities appropriate for the current/projected enrollment).**

   NCC already possesses the equipment necessary to support the program courses. Any new courses will require minimal funds for equipment or other. The program curriculum includes the foundational courses in math, English, communications, chemistry and general education that are currently available each semester at the college. Any costs associated with hiring additional adjunct faculty are offset by additional tuition revenue of offering those courses. There are no additional space needs for this program as courses are accommodated within the current room – Penn 129.

VIII. Human Resources

A. Briefly describe Program Leadership and oversight.

Program is led by and consists of one full-time faculty member. Oversight is provided by the Dean, as well as input from the math cluster.

Courses within the program are stewarded by individual part-time adjunct faculty in coordination with the full-time faculty member. The full-time faculty member serves as the course coordinator to: research and recommend text(s) for the course; develop innovative labs; communicate concerns about and successes in the course to the Dean; maintain and manage up-to-date course outlines and syllabi; and; communicate with adjunct faculty teaching those course to ensure consistency between sections and across the campuses.

B. Report the numbers of full-time and part-time faculty, professional staff, and clerical staff currently associated with the program.

Table 6. Instructor Demographic Data

Academic Year	Position	Name
2022-2023	Full-time faculty	Doney, William (Bill)
2022-2023	Adjunct Instructor	Miller, Fritz
2022-2023	Adjunct Instructor	Tarretto, David
As needed	Adjunct Instructor	Barlow, William (Tom)
As needed	Online Adjunct Instructor	Cuvo, Tony
As needed	Adjunct Instructor	Sanchez, Katerina

1. **Note any changes that have occurred in staffing since the last program review or previous five years.**

   Adjunct instructor staffing varies semester by semester, depending on enrollment.

2. **Briefly explain how these changes have affected the program.**

   This has had little effect on the program, as our adjuncts remain committed to NCC.

C. What is the ratio of full-time to part-time faculty? What percentage of (1) day sections, (2) traditional evening/weekend sections, (3) distance education/hybrid sections, and total sections are taught by full-time faculty. Comment on the levels of full-time, part-time faculty, and professional or clerical staff.

The sole full-time faculty member teaches all the daytime on-campus sections, as well as some online sections.

The adjunct faculty teach the evening on-campus sections, as well as online sections as needed.

D. Faculty Expertise/Experience

1. **Northampton hires faculty members who are well-credentialed (see Appendix J) and understand and embrace the open-access mission of the community college.**

   Please refer to Table 6 in the previous section, as well as Appendix J.

2. **How do faculty in this program promote academic excellence through professional development, scholarship, and service?**

   The center for teaching and learning with technology provides weekly webinars and trainings to faculty.

IX. Analysis of Findings

A. Based upon the data collected in this document, discuss the strengths and weaknesses of your program.

The engineering career is a highly valued profession and in great demand. A good quality engineering program that provides low cost, first- & second-year course work for transfer continues to be of great value. NCC's program has been successful in providing that value and continues to strive toward excellence. It continues to serve as a "bridge" program to colleges and universities. Students' leaving before finishing the program fulfills a major purpose for students needing strong math and science skills prior to entering a four-year program.

B. Based on the data collected in this document, discuss the opportunities for improvement available to your program and the internal and external challenges your program faces.

The program must continue to seek areas for improvement, to increase enrollment levels, to maintain partnerships and connections with transfer schools, and pursue a partnership with a 4-year engineering program to offer a Bachelor's degree here on campus.

X. External Review Report

Refer to Appendix K for the external/accreditor review report.

XI. Action Plan

A. Identify 2-3 program goals for the future.

1. Goal – **provide "rolling admissions" courses**
    i. Timeframe: **on-going**
    ii. Responsible Party(ies): **Faculty, Dean(s), Financial Aid, Advising, Non-Credit**
    iii. Resource Implications: **May require a non-traditional financial aid approach.**
2. Goal - **pursue a partnership with a 4-year engineering program to offer a bachelor's degree here on campus**
    i. Timeframe: **on-going**
    ii. Responsible Party(ies): **Faculty, Dean**
    iii. Resource Implications: **Time and connections**
3. Goal - **pursue and formalize engineering degree transfer articulation agreements with 4-year schools.**
    i. Timeframe: **on-going**
    ii. Responsible Party(ies): **Faculty, Dean, outreach**
    iii. Resource Implications: **Time and connections**

Appendix A: Program Description

Narrative

Northampton's Engineering program is designed primarily for transfer to a baccalaureate degree program in engineering. If your goal is to earn a bachelor's degree in engineering, our program can be an affordable and convenient way to get started. Many of our students transfer and complete degrees at Lehigh and Drexel Universities, Lafayette College, Penn State, Rutgers, Northeastern and many other engineering schools. By beginning your studies at Northampton, you could save thousands of dollars.

If you plan to transfer to a four-year institution, we encourage you to check with that institution to see what its requirements are. Then carefully select your courses here with the help of an advisor to be sure that they will meet your transfer school's requirements. Historically, our transfer students generally perform as well or better in their transfer school as they did when they were enrolled at Northampton.

As a graduate of our program, you may also choose to transfer into engineering technologies or go directly into industry in a position that requires math, science, and computing skills.

Features

Engineering students at Northampton take courses designed to develop skills common to all engineering specialties - chemical, civil, electrical, mechanical, and more. Our curriculum parallels that of the first two years in typical engineering schools.

Your professors are full-time and will conduct both the lecture and lab segments of your studies. You can also look forward to small class sizes, which ensures personal attention when you need it. As part of our program, you will have access to a full range of student services, including career and personal counseling, transfer counseling, tutoring, and job placement.

More importantly, you may study full-time or part-time. Courses in this program are offered primarily during the day; however, many have evening sections.

Requirements

Engineering is one of the most demanding and challenging of all college majors. Most students pursuing an engineering degree have strong background in math (algebra, geometry, trigonometry, pre-calculus), physics, and chemistry. If you feel you need help or haven't had classes in these areas, NCC advisors can help you schedule specific courses to prepare you for engineering study.

Appendix B: Program-Level Learning Outcomes

Graduates of the program will:

- Transfer to a four-year engineering program in any engineering discipline.
- Move directly into industry in a position requiring math, science, and computing skills.
- Demonstrate an ability to work independently and collaboratively as a team.
- Demonstrate basic skills common to all engineering specialties.
- Effectively research and collect data using various published resources and the Internet.
- Analyze and present data in an acceptable, methodical, and standardized manner.
- Demonstrate competent technical knowledge in engineering-related areas.
- Demonstrate competent speaking skills when working with diverse groups.
- Demonstrate observational, integrative, and synthetic skills.
- Demonstrate a basic framework of technical vocabulary and graphical interpretation skills.
- Successfully apply mathematics (algebra, trigonometry, geometry, and calculus) to solving engineering problems.

Appendix C: Program-Level Performance Indicator Data

Year	Total Students[a]	Withdrew[b]	Withdrew and transferred[c]	Retained in new major[d]	Retained in same major[e]	Graduated[f]	Graduated and Transferred[g]	% retention[h]
2019	190	62	9	22	80	9	8	62.6%
2018	185	48	17	31	76	5	8	64.9%
2017	184	53	27	21	72	3	8	56.5%
2016	219	66	29	37	76	3	8	56.6%
2015	219	62	14	31	85	13	14	65.3%

a. Enrollment as of Fall census date
b. Withdrew prior to following year census.
c. Withdrew and transferred prior to following year census.
d. Stayed at NCC but was in a different major the following year census.
e. Stayed at NCC and was still in the same major the following year census (these students will be part of the following year total enrollment number)
f. Graduated prior to following year census.
g. Graduated and transferred to another institution prior to following year census.
h. Percent of total students either graduated or still at NCC.

Additional Information

Top transfer schools for 2015-2019

- Pennsylvania State University (26)
- Temple University (18)
- Lehigh University (11)
- Drexel University (9)
- Lehigh Carbon Community College (8)
- East Stroudsburg University (7)
- Moravian College (7)
- Wilkes University (7)
- University Of Pittsburgh (5)
- There were 38 other institutions that had 1 or 2 transfer students.

Majors most frequently changed into:

- General Studies
- Business Administration
- Computer Science
- Business Management
- Automotive Technology

Appendix D: Curriculum Matrix

List all of the program learning outcomes for the program of study in the first column. List the program courses across the top row. Then make "**I**" for a learning outcome that is introduced (*addressed for the first time*), "**R**" for a learning outcome that is reinforced (*addressed again, but not emphasized in a major way*), and/or "**M**" for a learning outcome that emphasized (*addressed in a major way, emphasis toward mastery*) under each specific course.

Please note: Not every course will address every program-learning outcome.

I = Introduce; R = Reinforce; M = Emphasize Mastery

Program Learning Outcomes	**PHYS 215**	**PHYS 225**	**ENGG 201**	**ENGG 251**
1. Transfer to a four-year engineering program in any engineering discipline.	-	-	-	-
2. Move directly into industry in a position requiring math, science, and computing skills.	-	-	-	-
3. Demonstrate an ability to work independently and collaboratively as a team.	M	M	-	-
4. Demonstrate basic skills common to all engineering specialties.	M	M	M	M
5. Effectively research and collect data using various published resources and the Internet.	I	I	-	-
6. Analyze and present data in an acceptable, methodical, and standardized manner.	M	M	-	-
7. Demonstrate competent technical knowledge in engineering-related areas.	M	M	M	M
8. Demonstrate competent speaking skills when working with diverse groups.	I	I	-	-
9. Demonstrate observational, integrative, and synthetic skills.	R	R	-	-
10. Demonstrate a basic framework of technical vocabulary and graphical interpretation skills.	R	R	I	i
11. Successfully apply mathematics (algebra, trigonometry, geometry and calculus) to solving engineering problems.	M	M	M	M

Appendix E: Key Abilities Program Matrix

The five Gen Ed Key Abilities help students navigate the world. In each class they take, they should expect to be challenged to develop and deepen their key abilities. After they graduate, these abilities will help them continue learning, adapt to change, and become citizens who can make wise choices and contribute to their communities.

1. ***Communicate***
   - *Students can share their ideas powerfully and clearly.*
     - *Uses appropriate, relevant, and compelling content and sources that illustrate knowledge and understanding of the topic.*
     - *Assignment is organized and understandable. Distinct intro, body, and conclusion, as appropriate for the discipline.*
     - *Language is clear and understandable. Executes assignment within conventions of a specific discipline, including source citation.*
2. ***Analyze and Solve Problems***
   - *Students are able see and solve the problems around them, using solid data to draw and communicate reasonable conclusions.*
     - *Identify and understand an issue, concept, or problem, any data needs, and constraints that must be considered in order to analyze an issue or solve a problem. Students recognize multiple perspectives.*
     - *Use various tools, representations, notation, etc. to help them organize data and see relationships or identify assumptions related to the issue, concept or problem.*
     - *Evaluate any conclusions drawn, implications made, or plans for solving a problem, including evaluating any assumptions and any evidence gathered.*
3. ***Use Technology***
   - *Students can select and ethically use appropriate technology to create, communicate and discover.*
     - *Effectively select and use the appropriate technology applications or resources to accomplish specific goals.*
     - *Be an active and responsible participant in online communities.*
     - *Understand the legal and ethical facets of technology in a global society.*
4. ***Understand Diversity***
   - *Students can understand how each individual's experiences shape our society, and how societies, in turn, shape the way local and global resources are used.*
     - *Explain how the range of human differences shape the historical and current formation of artistic, economic, social, scientific, cultural or political institutions.*
     - *Explain how individuals experience equality and inequality with a society, its institutions or its cultures.*
     - *Analyze how individuals and institutions have addressed persistent global challenges, including physical resources and social values.*
5. ***Engage in Ethical Questions***
   - *Students can identify ethical choices, consider alternatives and consequences, and choose actions and choose actions keeping in mind everyone affected.*

Indicate in the table below the program courses in which a key ability is assessed ("**A**"-Assessed) – if possible, identify the specific assignment/activity in which the key ability is assessed. Focus on the required courses and designated program electives.

Key Abilities	**PHYS 215**	**PHYS 225**	**ENGG201**	**ENGG 251**
1. Communicate	A	A	A	A
2. Analyze and Solve Problems	A	A	A	A
3. Use Technology				
4. Understand Diversity				
5. Engage w/ Ethical Questions	A	A	A	A

Appendix F: Program Map

Engineering- Associate in Science (2022-23 Catalog)

Developmental Education Courses *(if required)*			☐	MATH020	Pre-Algebra
☐	ACLS050	Introduction to Academic Literacy	☐	MATH022	Elementary Algebra
☐	ENGL027	Writing Skills Workshop	☐	MATH026	Intermediate Algebra

SEMESTER-BY-SEMESTER PROGRAM MAP FOR FULL-TIME STUDENTS

Courses are listed in preferred order of completion.

Plans can be modified to fit student needs by adding more semesters.

Location: B= BETH, M= MROE, S=SBTH, E= ESTN, D= DIST *subject to change

	complete	Course #	Course Title	Credits	Gen Ed	Fall	Winter	Spring	Summer	Pre-requisites / Co-requisites
Semester 1	☐	COLS101	College Success	1		B, M, D	----	B, M, D	D	
	☐	ENGL101	English I	3	Comm.	B, M, D, E	----	B, M, D, E	B, M, D	PRE: ENGL Placement Policy
	☐	CMTH102	Introduction to Communication	3	Comm.	B, M, D	----	B, M, D	B, M, D	
	☐	MATH180	Calculus I	4	QL	B, M, D	----	B, M, D	B, M, D	PRE: MATH145 or MATH160 or Placement Policy
	☐	CHEM120	General Chemistry I	4	Science	B,M	----	B,M	M	PRE: MATH022 or Placement Policy, 1yr HS Chemistry or CHEM011; ENGL101 eligibility
			Total Semester Credits:	15						
Semester 2	☐	MATH181	Calculus II	4	QL	B,M	----	B,M	B,M	PRE: MATH176 or MATH180 with a C or better or score of 4 or 5 on APCalculus AB test or 3, 4, or 5 on AP Calc BC test
	☐	PHYS215	Physics for Science & Engineering I	5		B,M	----	B,M	----	PRE or CO: MATH181
	☐	CISC115	Computer Science	4		B,M	----	B,M	----	PRE: MATH026 or Placement Policy
	☐	ENGL151L	English II (Literature) (D)	3	Comm.	B, M, D	----	B, M, D	B, M, D	PRE: ENGL101
			Total Semester Credits:	16						
Semester 3	☐	MATH210	Calculus III	4	QL	B,M	----	B,M	M	PRE: MATH181
	☐	PHYS225	Physics for Science & Engineering II	5		B,M	----	B,M	----	PRE: PHYS215 with a C or better
	☐		Engineering Elective+	3/4		Depends on course selected				Depends on course selected
	☐		Technical Elective**	3/4		Depends on course selected				Depends on course selected
			Total Semester Credits:	15-17						
Semester 4	☐	MATH211	Differential Equations	4		B,M	----	B,M	----	PRE: MATH210
	☐		Engineering Elective+	3/4		Depends on course selected				Depends on course selected
	☐		AH General Education Elective	3	AH	B, M, D	D	B, M, D	B, M, D	Depends on course selected
	☐		SSHB General Education Elective	3	SSHB	B, M, D	D	B, M, D	B, M, D	Depends on course selected
	☐		SIT General Education Elective	3	SIT	B, M, D	D	B, M, D	B, M, D	Depends on course selected
			Total Semester Credits:	16/17						
			Total Degree Credits	62-65						

General Education Requirements		
☐	ENGL151L	Diversity
☐	PHYS215 &PHYS225	Combined Fulfill 1 Writing Intensive Requirement
☐		Writing Intensive (AH, SIT, or SSHB)

Notes:

Must earn a C or better in the mathematic courses to advance to the next one.

Students should contact potential transfer institutions at least TWO SEMESTERS prior to their desired semester oftransfer to ask for suggested courses to complete in the remaining semesters at NCC. Elective selections may be dependent on the student's desired Engineering discipline (Mechanical, Electrical, Computer, Civil, etc..).

***It is the student's responsibility to be knowledgeable of NCC graduation requirements and to verify transfer requirements with the 4-year institution. Courses listed on the programmap are based upon the assumption that prerequisites and courses taken in previous semesters will be successfully completed**

Appendix G: Co-curricular Map

PROGRAM NAME: **ENGINEERING Program**

ver: 4/4/19

AY 18-19

	0 - 15 credits	16 – 30 credits	31 – 45 credits	46+ credits
Get the Courses You Need	Take the following courses:	Take the following courses:	Take the following courses:	Take the following courses:
	COLS 101 College Success CHEM 120 General Chemistry I ENGL 101 English I **MATH 180 Calculus I** CMTH 102 Speech Communication, Technical Elective (*ENGG100 Recommended*)	CISC 115 Computer Science I ENGL 151L English II (Literature) **MATH 181 Calculus II** **PHYS 215 Physics for Science & Engineering I**	**MATH 210 Calculus III** **PHYS 225 Physics for Science & Engineering II** Engineering Elective (*ENGG 201 Recommended*) Arts & Humanities (AH)	MATH 211 Differential Equations Engineering Elective (*ENGG 251 Recommended*) Scientific Study of Human Behavior (SSHB) Societies & Institutions over Time (SIT)
	For details on course requirements, see the Program Map.	*For details on course requirements, see the Program Map.*	*For details on course requirements, see the Program Map.*	*For details on course requirements, see the Program Map.*
Engage with the Spartan Experience	- Join Engineering club - Create Academic Plan - Attend at least one campus recreation event	- stay active in the ENGG Club	- Pursue an elected officer position (ENGG Club) - remain active in the ENGG Club	- investigate scholarship opportunities - remain active in the ENGG Club
Get Ready for Life after Completion – Career Readiness		- look for summer Engineering internship - consider taking a class over summer to catch-up (MATH) or reduce course load in following semester	- consider tutoring in Math	- look for summer Engineering internship
Get Ready for Life after Completion – Transfer Readiness		- Talk with advisor about transfer - Create list of potential transfer schools	- Attend college fairs/visits - View list of Program to Program transfer agreements - visit potential transfer schools - talk to transfer school transfer office & select ENGG electives	- Apply to transfer institution(s) - Apply for graduation - Begin matching elective choices to target programs

Appendix H: Assessment Plan

	Program Learning Outcomes (PLOs) (list the PLO # and the corresponding course # where PLO will be assessed)	Gen Ed / Key Ability Outcomes (list the Gen Ed Outcome and the corresponding course # where it will be assessed)
AY 2022-2023	3, 4, 5, 6	Analyze & Solve Problems (**ENGG201**), Technology
AY 2023- 2024	7, 8	Diversity (ENGL151L), Ethical Q (PHIL202G)
AY 2024-2025	9, 10, 11	Communicate (PHYS225), Analyze & Solve Problem (ENGG201)
AY 2025-2026		Technology, Diversity (ENGL151L)
AY 2026-2027		Ethical Q (PHIL202G), Communicate

Appendix I: Teaching Faculty Credentials

Full-time Faculty in Physics and Engineering Demographic Data

Faculty Member	Date Hired	Credentials
Doney, William	Fall 2005	MS, Bucknell University

Appendix J: External Review Report

LAFAYETTE COLLEGE
Department of Mechanical Engineering

Easton, Pennsylvania 18042 TEL 610-330-5403 FAX 610-330-5059 http://engineering.lafayette.edu

To: William Doney, Professor of Engineering and Physics
Northampton Community College
3835 Green Pond Rd
Bethlehem, PA 18020

From: Scott Hummel, Professor of Mechanical Engineering
Lafayette College
Easton, PA 18040

Date: October 12, 2023

Re: External Audit of NCC Engineering Program

Background

At your request, I have reviewed and evaluated Northampton Community College's (NCC) Engineering Program through a visit to the NCC campus and through examination of the most recent Engineering Program Audit document and supporting materials. I reviewed documents related to the curriculum, enrollment, program costs, faculty, student information and program outcomes.

Northampton Community College's Engineering Program is primarily designed for students who wish to complete their first two years of undergraduate study in the Lehigh Valley and at a relatively low cost. Students who have completed the program have gone on to prestigious schools including Lehigh University, Lafayette College, Drexel University, Rutgers University, and Penn State University, among others. This speaks highly of the NCC program as these are all prestigious ABET accredited engineering programs. In the sections that follow I will discuss some observations and suggestions.

Observations

◊ Purpose of the program within the context of engineering education:

The Engineering program at NCC offers a high-quality engineering education to its students without many of the barriers of a 4-year institution. The program serves as an important bridge for students to study engineering locally and affordably up to the first two years of a typical engineering program before transferring to a Bachelor of Science engineering program.

◊ Curriculum
- It is clear that the faculty and administration at NCC continuously assess and modify the program to keep it current with engineering practice and engineering education pedagogies.
- The foundational physics, chemistry and math courses are appropriate for students transferring to B.S. programs. Specifically, the physics courses are calculus based, the math sequence extends from calculus I through differential equations, and the chemistry courses mirrors those of a typical offered at 4- year colleges.
- The physics and chemistry courses have required laboratories. This element is very important because ABET requires that some basic science classes contain a lab for BS engineering programs. I encourage NCC to continue offering labs with these courses.
- Engineering graphics is the recommended for most engineering students. This is appropriate as most engineers need some experience in engineering graphics. Excluding Chemical Engineering students from graphics enables them to take an additional chemistry elective which in turn puts them in a stronger position for transferring to a four-year program.
- NCC does not currently offer an introduction to engineering course. I consider this to be preferable to NCC offering their own version as there are many introductory engineering course models throughout academia. If NCC were to offer one, it more than likely would not be accepted as transfer credit at any of NCC's target engineering schools. I suggest that NCC stay abreast of the ongoing efforts by the College Board to offer an AP Introduction to Engineering course, but no action is suggested at this time.
- The course offerings at NCC are generally geared towards students interested in mechanical engineering and civil engineering. These are two of the largest areas of engineering nationally. By combining the engineering course offerings with courses offered in the sciences at NCC, a student could also be prepared to pursue a 4-year degree in other fields of engineering including chemical engineering, bioengineering, and environmental engineering.
- Transferring from NCC into an electrical engineering program would be more challenging for students since NCC does not typically offer the foundational electrical engineering courses. It is important to note however that the number of students pursuing electrical engineering nationally has decreased significantly over the past three decades. In this sense, I believe that NCC is appropriately following the needs and wants of their students. No change is suggested at this time.
- The transferability of engineering courses from NCC is excellent. Lafayette College for example accepts NCC's courses without the need for students to have individual courses signed off by department heads. NCC has done an excellent job in meeting the curricular needs of 4-year B.S. granting engineering institutions.

◊ Students and Enrollment
- It is immediately clear when speaking to Prof. Doney that the faculty are dedicated to the institution and the success of the students.
- During the period examined, the enrollment variations were consistent with those seen at 4-year B.S. engineering programs. The impact of the Covid-19 pandemic caused a

decrease in engineering enrollments in 2020-21. I would expect this to lessen in future years as national college enrollments rebound to pre-Covid levels. Engineering employment after graduation continues to be strong as compared to other majors of study. For this reason, it is expected that engineering enrollments will remain high for at least the next decade.

- The impacts of the Covid-19 pandemic are being seen across higher-ed where students are not performing as well in math as their counterparts' pre-2019. I expect this "Covid-Tail" to last for several years or even longer. This will likely continue to impact community colleges such as NCC where a higher percentage of students will need remedial courses prior to entering the calculus sequence as compared to pre-2019.
- Attrition in NCC's engineering program is an ongoing concern when one looks at graduation rates, however, one needs to recognize that many high performing students go on to four-year programs before completing their degree at NCC. The data in Appendix C for the number of students who "Withdrew and transferred" bolster this case. The number of transfers to other institutions is generally two to three times higher than the number of students graduating. This trend should be viewed as success of the engineering program, as the primary goal is to have students transfer to a 4-year B.S. granting institution, not necessarily to earn a degree from NCC.

◊ Conclusions and Recommendations

- NCC is providing a vital service in the Lehigh Valley region in delivering affordable and high-quality engineering education. The program serves as a steppingstone for students who wish to obtain a four-year degree at a fraction of the cost, but without any decrease in the academic rigor.
- I highly recommend that the program be continued.
- Affiliation with four-year engineering schools in which students attend after NCC would be a positive step in creating a seamless transition and integration of the NCC program with the four-year institutions. To this end, I recommend that NCC continue to seek out and sign articulation agreements with these institutions.
- The Engineering programs at NCC should in no way view their programs in a negative light when students leave NCC to pursue engineering programs at four-year schools. In fact, quite the contrary is true. When students leave the program before graduation to pursue a four-year degree at an ABET accredited school, NCC should consider this success!
- In my experience of working with students at Lafayette who came through the NCC program, I can state that these students perform as least as well as those who started at Lafayette.

Scott Hummel, PhD

10/12/2023
Date