Self-Study Report

for the

Electronic Engineering Technology

Program

at

Nashua, NH

July 1, 2022

CONFIDENTIAL

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Program Self-Study Report
for
ETAC of ABET
Accreditation or Reaccreditation

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INTRODUCTORY STATEMENT

Institutional Overview

Nashua Community College (NCC) is a two-year institution located in southern New Hampshire and is one of the seven community colleges that make up the Community College System of New Hampshire (CCSNH). The school was founded as a vocational college in 1970 but has since transitioned into an institution with far more comprehensive programs and areas of academic study. Though NCC continues offering a number of vocational degrees, the college also emphasizes programs that prepare students for transfer into four-year institutions.

In the fall of 2021, the student headcount was 1,271, and an additional 736 students enrolled in NCC courses through dual enrollment programs at area high schools. Approximately one-third of the students at the college were non-traditional learners, and about 30 percent attended full-time. The college currently offers 34 associate degree programs and 21 certificate options for students. The institution is accredited by the New England Commission of Higher Education
(NECHE) and also has 11 programs that hold program-specific accreditations. At NCC, the following 11 programs have specialized accreditation:

1. Accounting (ACBSP)
2. Aviation Technology (FAA Approval)
3. Automotive Technology (ASE)
4. Collision Repair Technology (ASE)
5. Electronic Engineering Technology (ABET)
6. Honda Automotive Technology (ASE)
7. Management (ACBSP
8. Marketing (ACBSP)
9. Nursing (ACEN)
10. Precision Manufacturing (NIMS)
11. Small Business Entrepreneurship (ACBSP)

The college takes pride in these programmatic accreditations and greatly values the oversight these accrediting bodies provide in ensuring NCC programs meet the highest possible standards of content and delivery. More precisely, the institution recognizes the importance of ABET accreditation and acknowledges the high regard in which ABET-accredited programs are held. Moreover, the college holds the fundamental belief that the relationship between the NCC Engineering Technology Program and ABET is essential for the continued success of our EET program and graduates.

Overview of NCC Electronic Engineering Technology Program

NCC first introduced the Electronic Engineering Technology Program in 1994, and the program received its initial accreditation in 2009. The last comprehensive ABET review took place in 2016, and at that time, the visiting team recognized two areas of weakness. The first area of weakness was related to the number of full-time faculty in the program. At that time, the

program employed only one-full time instructor, and this individual also served as the EET program coordinator. This matter was resolved the following year when a second full-time professor was hired, and the program has maintained two full-time faculty members since that time.

The second area of weakness is related to the assessment and evaluation of student attainment of learning outcomes. At that time, the EET was performing little meaningful assessment work and did not complete a significant analysis of student learning. Over the following two years, the program faculty devoted themselves to resolving this matter and worked diligently to collect, analyze, and evaluate student learning. In 2018, the program submitted an interim report detailing the extent of this work, and shortly thereafter, ABET responded and stated the weakness had been resolved. The program faculty continue to remain committed to this important endeavor.

Currently, the program is in the midst of two significant changes. Due to two recent retirements, the program is currently operating with two new full-time faculty members. Though changes such as these are seldom ideal, the two new professors are both excellent matches for the program and capable of meeting the needs of students. Both instructors have considerable experience teaching in the field, and the newly-hired program coordinator previously worked as an electronic engineering technology instructor at one of CCSNH's sister colleges. As a result, she is quite familiar with the NCC program and the operations of New Hampshire's Community College System.

The second major institutional change impacting the program pertains to the program's physical learning environment. College leadership recognizes the importance that a robust educational atmosphere plays in student learning and seeks to expose students to a setting that meets the needs of students and resembles an industry working environment. As a result, in 2019, college leadership secured funding to entirely remodel the second floor of the school's Streeter Hall building for the purpose of creating a STEM technology wing. This new area will house classrooms and laboratories for various STEM programs, including Mathematics, Computer Science, Computer Networking, and Electronic Engineering. The Electronic Engineering Technology area will include separate Capstone and EET labs, dedicated storage spaces, adjacent faculty offices, and a conference room. The construction of this new wing is underway and expected to be completed by the upcoming spring semester; the college is anticipating opening the area to students in fall 2023. A detailed description is included in Criterion 8, Section B.

The ABET Self-Study Process

The Electronic Engineering Technology program at NCC recognizes the importance of self-reflection and the need to maintain practices of ongoing self-evaluation and continuous improvement. As such, the program appreciates ABET's participation in the accreditation process and fully embraces this opportunity for self-evaluation and deliberation. Program leadership took great care to ensure that this document accurately depicts the state of the program and that the information contained in this report is elucidatory, complete, and accurate.

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BACKGROUND INFORMATION

A. Contact Information

List name, mailing address, telephone number, and e-mail address for the primary pre-visit contact person for the program.

Susan Hughes
Program Coordinator - Electronic Engineering Technology
Nashua Community College
505 Amherst Street
Nashua, New Hampshire 03063
Office: 603-578-8900 X 1582
shughes@ccsnh.edu

B. Program History

Include the year implemented and the date of the last general review. Summarize major program changes with an emphasis on changes occurring since the last general review.

Nashua Community College first offered the Electronic Engineering Technology Program in 1994, and the program received its initial accreditation on October 1, 2009. The last general ABET review took place in 2016, and at that time, ABET noted two areas of weakness; the first of which pertained to the limited number of full-time faculty, and the second pertained to program assessment and commitment to continuous improvement. As a result of those findings, the college took immediate steps to rectify both of these matters. In 2017, in order to address the faculty staffing issue, the college hired a second full-time instructor, and at that same time, EET faculty developed a formalized system for the assessment of student learning. Moreover, the EET faculty fully committed to a process of continually collecting, assessing, and evaluating data pertaining to key points of learning and student outcomes. The program submitted an interim report in 2018 which detailed the extent of these efforts, and upon completion of this report, ABET responded and stated the weakness was resolved. The assessment work remains ongoing at this time.

Due to two recent retirements, the EET faculty has undergone a significant transformation in the past year, as the program is currently operating with two newly hired instructors. Despite the natural challenges usually caused in situations such as this, the college feels the recently hired faculty are capable, talented, and well-prepared to meet the needs of the institution and deliver quality educational experiences to students. Each of the instructors is highly qualified, and each has extensive experience in both academic and industry settings. In addition, the program coordinator previously served as an EET instructor at one of CCSNH's sister colleges, and as such, she has familiarity with the program curriculum and college operations.

C. Options

List and describe any options, tracks, concentrations, etc. included in the program.

Each student in the NCC Electronics Engineering major completes the same core curriculum. Electives vary by student.

D. Program Delivery Modes

Describe the delivery modes used by this program, e.g., days, evenings, weekends, cooperative education, traditional lecture/laboratory, off-campus, distance education, or web-based.

The primary modes of program delivery for the EET courses are lecture/laboratory classes. Many of the courses are offered in both day and evening formats. The program can be completed in two years as a full-time student or longer as a part-time student. Students must attend major field courses on the NCC Campus. Non-major courses, including general education and electives, may be completed on campus, online and/or via accelerated or alternative forms. All technical classes are accompanied by a laboratory session. Typical classes include 2 or 3 hours of lecture and 2 or 3 hours of laboratory weekly, depending on the number of credits for the course.

During the pandemic, courses were offered in either a fully online or hybrid format to accommodate pandemic restrictions. For fully online courses, lectures were held via Zoom, and labs were completed via simulation tools available in the public domain. For hybrid courses, lectures were held via Zoom, and labs were completed onsite with masking, social distancing, and sanitizing procedures in place. Now that pandemic restrictions have eased, all EET lectures and labs are taught in person. It is the EET department's intention to maintain in-person courses as we believe that the strength of our EET program is based on the hands-on experience that is best attained with in-person lectures and labs.

E. Program Locations

Include all locations where the program or a portion of the program is regularly offered (this also includes dual degrees, international partnerships, etc.).

All major courses are offered on the Nashua Community College campus.

F. Public Disclosure

Provide information concerning all the places where the Program Education Objectives (PEOs), Student Outcomes (SOs), annual student enrollment and graduation data are made accessible to the public (See APPM, Sections I.A.6.a and I.A.6.b). This information is typically posted on either the program's or institution's website, if this information is posted elsewhere, please provide the location and how it is accessed. Please provide all URLs if the information is posted on a website.

The college posts program education objectives (PEOs), student outcomes (SOs), and data pertaining to student enrollment and graduation on the college website (https://nashuacc.edu/program/electronic-engineering-technology/). In addition, program education objectives (PEOs) and student outcomes (SOs) are included in the college catalog (https://nashua.cleancatalog.io/electronics/associate-in-science/electronic-engineering-technology).

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G. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

Summarize any Deficiencies, Weaknesses, or Concerns that remain unresolved from the most recent ABET Final Statement. Describe the actions taken to address them, including effective dates of actions, if applicable. If this is an initial accreditation, state it is an initial accreditation.

There are no Deficiencies, Weaknesses, or Concerns that remain unresolved from the final statement of accreditation, 2018-2019 accreditation cycle.

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GENERAL CRITERIA

CRITERION 1. STUDENTS

For the sections below, attach in supplemental information any written policies that apply.

A. Student Admissions

Summarize the requirements and process for accepting new students into the program.

NCC strives to be the preferred provider of two-year secondary education in the Nashua region. As such, the college is an open-admissions institution, and NCC's admissions procedures provide students an equal opportunity for educational advancement and success. The college's Non-Discrimination Policy complies with Federal and State requirements, and the policy is made available to students via the school website, student handbook, and college catalog.

Prior to spring 2019, the college utilized the Accuplacer exam for student placement, and incoming students were required to complete the placement exam prior to enrolling in courses. However, in January 2019, the college made a significant shift in placement practices and now places students using "multiple measures." In the multiple measures process, decisions on student placement are based upon numerous academic factors, including high school GPA, the student's grades in previous math and English courses, and SAT scores. The college holds the belief that basing students' placement decisions on multiple factors is preferable to merely one placement exam score and that the consideration of several factors increases the likelihood that students will be properly placed into appropriate coursework. At this point, NCC utilizes the multiple measures process for most incoming students; however, certain students, such as returning adult learners or students who do not provide previous academic records, are still required to complete the placement exam.

In addition to the general admission requirements, the EET program has several additional requirements and recommendations for incoming students. The program leadership recommends that Electronics Engineering Technology applicants complete high school Algebra I, Algebra II, and Geometry as well as other high school courses such as physics, chemistry, electronics, and computer programming. In addition, the EET program requires students to possess basic writing skills in English and may require incoming students to purchase approximately $100 of minor accessories.

The EET program also requires students to meet the following technical standards:

- Have command of the English language
- Have reading comprehension skills sufficient to read and comprehend manuals and textbooks
- Have communication skills sufficient to prepare required reports
- Be able to understand and follow both written and oral instructions
- Be able to complete requirements for college-level classes

- Possess sufficient mobility, dexterity, and visual acuity to do computer and electronic installations, wiring, and repair
- Read meters, gauges, and other electronic measuring devices
- Judge distance and space relationship of objects
- Distinguish basic colors for determining component values
- Examine computer hardware components and software programs for diagnosis and repair
- Calculate electrical values (voltage, current, resistance)
- Work cooperatively with partners and groups

B. Evaluating Student Performance

Summarize the process by which overall student academic performance is evaluated and student progress towards graduation is monitored. Include information on how the program ensures and documents the students are meeting course prerequisites and how the situation is addressed when a prerequisite has not been met.

Student registration and a record of courses taken are accomplished using an integrated enterprise system (Ellucian Banner) maintained by the Community College System of New Hampshire (CCSNH) Information Technology Department. Academic advisors register students using Banner. Students register for classes using the Student Information System (SIS), which is an interface to Banner. In Fall 2021, NCC adopted EAB Navigate Academic Planner, a tool that allows students to collaborate with their advisors to plan and register for their courses each semester. This tool streamlines the course selection and registration process for students to allow them to keep on track to completion. Similar to SIS, Navigate is also an interface to Banner. All new students are encouraged to meet initially with an advisor to discuss course selection and degree planning and then transition to electronic planning and registration using the EAB Navigate academic planning tool. The academic planning tool provides guidance based on the student's degree requirements and keeps the student on track through completion. Continuing freshmen and upperclassmen can register for courses using Navigate and/or the SIS. The system prevents students from registering for courses if they do not have the prerequisites completed.

Advisors and students can use the Ellucian Degree Works™ program to generate a Degree Evaluation. This evaluation reports which courses a student needs to complete a degree and which courses are used to meet degree requirements. The degree audit informs students and their advisors in their planning for program completion, enabling students to file their Intent to Graduate form in advance of their final semester.

Students who have not met prerequisites are sometimes allowed to take a course with the permission of the program coordinator. This is not a common occurrence and is handled on a case-by-case basis. Students who have failed introductory courses are not allowed to enroll in more advanced courses.

Students are graded on their performance relative to the course objectives stated on syllabi. In most cases, the grade is the result of performance on tests, laboratory work, homework assignments, and final exams or projects. Attendance and class participation are sometimes a minor factor in the grading scheme. The college maintains a detailed course

outline for every NCC course. In addition, a copy of the syllabus for each course is collected in the Academic Affairs Office to ensure consistency with the master course outline.

C. Transfer Students and Transfer Courses

Summarize the requirements and process for accepting transfer students and transfer credit. Include any state-mandated articulation requirements that impact the program.

Students seeking academic credit for courses taken at other institutions are required to:

- Complete the NCC Transfer Request Form,
- Provide an official transcript from the institution in which the course or courses were taken
- Provide a copy of the course description(s)

Upon submission of these materials, the Vice President of Academic Affairs (VPAA), Department Chair (DC), Program Coordinator (PC), or designee evaluates each course to determine if transfer of credit is appropriate. At NCC, only grades "C" or better are considered for transfer.

D. Advising and Career Guidance

Summarize the process for advising regarding curriculum and career matters. Include information on how often students are advised and who provides the advising (program faculty, departmental, college, or university advisor).

At NCC, each newly enrolled student is assigned a primary advisor from the NCC Advising Center, and upon completion of 30 credits, the student is transferred to a faculty advisor. The NCC Advising Center is staffed with four experienced, professional academic advisors who provide year-round academic support for students seeking guidance on course selection, academic concerns, understanding of program and degree requirements, and other academic policies and practices. The college believes that the assignment of newly enrolled students to the Advising Center staff is beneficial because of the year-round structure of the center and the fact that the center offers both day and evening support for students. Upon the completion of 30 credits, students are directed to faculty advisors for information on graduation, transfer, and career opportunities.

Though program faculty are not designated as the primary advisor of freshman students, these faculty are denoted as "secondary" advisors. As such, EET faculty usually maintain an excellent relationship with first-year students and informally advise these students during their initial year on campus. The college believes that this model enables students to receive academic advising from multiple perspectives and ensures that students are properly directed when making academic choices.

In addition, to the college's Advising Center and faculty advisors, NCC provides academic and career counseling to students using the following:

- Veterans' Affairs Student Counselor: This individual certifies VA benefits for eligible veterans and meets with eligible veterans for academic advising and guidance regarding the availability of benefits.
- Department of Multicultural Engagement: This department provides comprehensive support for non-native speakers of English, including registration assistance, tutoring, and academic support. The department also provides a multicultural space on campus and works to promote a sense of belonging at the institution.
- Career Coach: Career Coach is an online career information tool available to NCC students (and potential students) to assist with career choices. The tool provides education requirements, available job postings, and wage information for career fields related to NCC programs.
- College Central Network: College Central Network is an online platform that provides students with resume-building tools, a database of career-interest articles, and nationwide job postings.
- EAB Navigate: This platform serves as an online communication tool for posting "Early Alerts" and providing immediate intervention to students in need. In addition, the service provides a platform for advisors to connect with students and effectively schedule advising sessions.
- NCC Tutoring Center: NCC offers free one-on-one and drop-in tutoring in a variety of academic subjects. This service is available in both face-to-face and online formats.
- Degree Works: This tool serves as a degree audit application that helps students remain on the appropriate pace toward degree completion. Degree Works provides students with a one-page screen to monitor their progress toward graduation and understand how course selection impacts their completion timeline.

E. Work in Lieu of Courses

Summarize the requirements and process for awarding credit for work in lieu of courses. This could include such things as life experience, Advanced Placement, dual enrollment, test out, military experience, etc., but does not include internships taken for credit.

Students can receive academic credit at Nashua Community College for certain learning experiences completed outside of the traditional collegiate learning environment. These experiences could be obtained through a variety of ways, including: Advanced Placement exams, CLEP exams, credit by examination, Running Start courses, or certain prior learning experiences.

College Board Advanced Placement Tests:

NCC recognizes the College Board Advanced Placement Examination Program as a means of evaluating student eligibility for academic credit at the institution. Credit is granted based on the college's policies relating to the AP scores for the various exam subjects. The minimum score to receive credit varies from 3 to 5; no credit is awarded on any AP exam score of less than 3.

College Level Examination Program (CLEP)

NCC students may earn credits by successfully completing the nationally standardized CLEP exam (College Level Examination Program). The college awards credits for courses in the areas of Business, Composition and Literature, Foreign Languages, Social Sciences, Science and Mathematics. The full list of CLEP exams accepted at the institution is available on the college website (https://nashuacc.edu/admissions/placement/clep-policy/), and in all cases, the college sets passing scores at 50 or above.

Credit by Exam (CBE)

Credit by Examination (CBE) may be earned by matriculated students who, by study, training, or experience outside of NCC, have acquired skills or knowledge equivalent to that acquired by students enrolled in a course at the college. In these cases, students may be granted the opportunity to complete an examination or evaluation that covers the instructional material of the course. If successful, the appropriate credits earned are applied to the students' programs. Credit is not given for exam or evaluation grades below C, and students receiving a grade below C are ineligible to retake the CBE in that course.

Running Start Program

NCC's Running Start Program is a dual-enrollment program in which high school students can complete NCC courses while still in high school. These courses are delivered at the local high school during usual school hours and taught by the high school teachers. The program provides students with an opportunity to receive both high school and college credit for these courses.

In order to ensure academic integrity, NCC maintains excellent oversight of Running Start courses. Before a Running Start course is offered, the appropriate NCC program coordinator reviews the credentials of high school faculty to ensure the candidate has appropriate qualifications for college-level instruction. In addition, the high school teachers utilize NCC course outlines, learning outcomes, and similar assignments and exams. To further ensure the course meets college-level academic quality, NCC faculty are required to review and approve the syllabus, examine student work, review student course evaluations, and conduct a class observation at least once during the semester.

Credit for Prior Learning - Experiential Learning

NCC offers students the opportunity to earn college-level credit for previous learning experiences. NCC's Credit for Prior Learning option enables students to demonstrate the knowledge they have gained through life experiences and apply this knowledge towards credit in a degree or certificate program. Students pursuing this option must develop a portfolio and submit it to the appropriate college personnel for assessment. Students must be matriculated at one of the CCSNH colleges to be eligible to apply for experiential credit.

F. Graduation Requirements

Summarize the basic graduation requirements for the program, e.g., total number of credits required, etc., and the administrative process for ensuring and documenting that each graduate completes all graduation requirements for the program. State the formal name of the degree awarded (e.g., Bachelor of Science in Electrical Engineering Technology,

Associate of Science in Engineering Technology, Associate of Applied Science in Civil Engineering Technology).

In order to receive an associate's degree at Nashua Community College, all students must complete a minimum 60 credit hours and complete all specified program requirements. As part of the 60 credit hours, students must successfully complete a minimum of 20 credit hours in General Education courses and a minimum of 30 credit hours in their major program of study. In addition, NCC students must have a cumulative grade point average of at least 2.0 to attain a degree. Depending on their specific course sections, students in the EET program will accumulate between 68 and 72 hours of credits prior to graduation. Students successfully meeting the graduation requirements of the EET program receive an "Associate in Science" in "Electronic Engineering Technology."

In the fall of a student's senior year, EET prospective graduates complete the NCC "Intent to Graduate Form". The student's program coordinator signs the form, and then the student submits the form to the Registrar's Office for approval. At that point, personnel from the office perform a preliminary audit by comparing the student's academic record with the requirements of the EET program profile. This review is performed for the purpose of verifying the student will meet all requirements through the end of the fall semester and is enrolled in the appropriate courses for the spring semester. At the end of spring semester, the college runs final grade reports to ensure graduates have met the appropriate grade and GPA requirements.

G. Records of Student Work/Transcripts

The program will provide records of academic work (transcripts) that certify completion of all program requirements and include the name of the program (major, field of study), the degree awarded and the date the degree was awarded.

The program name and degree awarded must be shown in English exactly as they appear on the Request for Evaluation accepted by ABET. (See APPM, Section I.C.2.b)

Transcripts must also provide at minimum the following:

1) *The name and address of the institution*
2) *Student personal information (names and ID numbers) should be redacted. Provide appropriate alternate identification in place of student name and ID.*
3) *A record of academic work pursued at the institution including identification of courses and/or credits attempted, academic years of each attempt, grade or other evaluation for each attempt, and an indication of all required work attempted, and*
4) *A list of required courses and/or credits for which academic work pursued at another institution(s) was accepted to meet the requirements of the program. (See APPM, Section I.C.2.a.(4))*

The team chair will specify which transcripts to provide. *New programs requesting retroactive accreditation for two academic years prior to the review must provide transcripts from graduates for both academic years. Transcripts should be accompanied by copies of*

degree audits and/or other explanations for interpreting the transcripts. (See APPM, Section I.E.3.a.)

The official NCC transcript indicates the degree awarded, date of award, student's major, course grades, cumulative G.P.A., and date of issue. EET graduates receive the degree: "Associate in Science" in "Electronic Engineering Technology," and any degree honors conferred.

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CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statement

Provide the institutional mission statement.

NCC Mission Statement

Nashua Community College provides quality, academically rigorous, higher-education programs focused on the diverse needs of students and the community.

Educated Person Statement

Nashua Community College helps students improve their lives and become more responsible as informed citizens and educated persons. The college community has defined a set of essential skills to maximize one's role as a contributing member of society. Among those skills are communications, information literacy, scientific reasoning, quantitative analysis, ethical responsibility, critical thinking, global connectedness, and tolerance for ambiguity.

NCC's Institutional Learning Outcomes

Commit

Upon completion of their coursework at NCC, students will be able to:

- Articulate their devotion to the achievement of intellectual growth.
- Exhibit dedication to obtaining the essential skills required in today's workforce.
- Develop strategies for planning and carry out processes to accomplish tasks.

Communicate

Upon completion of their coursework at NCC, students will be able to:

- Write clearly using language that effectively communicates meaning to readers.
- Orally present information using appropriate voice, mannerisms, and expressiveness.
- Consider diversity of audience, situation, and context when communicating.

Collaborate

Upon completion of their coursework at NCC, students will be able to:

- Effectively work in diverse teams and be capable of recognizing and considering multiple perspectives of thought.
- Demonstrate professional conduct while interacting with others at the college, workplace, or community.

Create

Upon completion of their coursework at NCC, students will be able to:

- Effectively employ 21st-century technology to collect and analyze information for academic or intellectual pursuits.

- Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.
- Utilize quantitative analysis when determining the solutions to problems and developing new ideas.
- Demonstrate creativity and ingenuity when completing tasks.

Challenge

Upon completion of coursework at NCC, a student will be able to:

- Demonstrate intellectual curiosity and feel empowered to experiment, test theories, and investigate solutions to problems.
- Demonstrate awareness of societal issues and describe the importance of participation in civic life.
- Articulate the importance of life-long learning and express a desire for continued intellectual growth beyond NCC.

B. Program Educational Objectives

List the program educational objectives and state where these can be found by the public.
This is typically an easy to find web page clearly linked to the program's website

Educational Objectives

The educational objectives of the Electronic Engineering Technology Associate Degree Program are to prepare graduates to have competence in the following curricular areas:

a) the application of circuit analysis and design, computer programming, associated software, analog and digital electronics, and microcomputers, and engineering standards to the building, testing, operation, and maintenance of electrical/electronic(s) systems; and
b) the application of natural sciences and mathematics at or above the level of algebra and trigonometry to the building, testing, operation, and maintenance of electrical/electronic systems.

Student Outcomes

At the completion of the degree in Electronic Engineering Technology, graduates must demonstrate that they will be able to:

1. apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline;
2. design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline;

3. apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature
4. conduct standard tests, measurements, and experiments and to analyze and interpret the results; and
5. function effectively as a member of a technical team

The EET program's educational objectives and outcomes can be found on the EET page of the college website (https://nashuacc.edu/program/electronic-engineering-technology/) and the college catalog (https://nashua.cleancatalog.io/sites/default/files/pdf/pdf_generator/course-catalog-20222023-pdf.pdf?1652204218#page=85).

C. Consistency of the Program Educational Objectives with the Mission of the Institution

Describe how the program educational objectives are consistent with the mission of the institution. A table illustrating how educational objectives support the elements of the institutional mission can be used, in addition to a brief explanation.

NCC's mission is clearly defined, concise, and appropriate for the needs of the community. NCC leadership regards the delivery of first-rate educational content as critically important, and as such, the mission clearly denotes the importance of providing "quality, academically rigorous, higher-education programs." In addition, due to the diverse nature of the NCC student body, the section of the statement that reads "…focused on the diverse needs of students... *"* is also a critical component of the mission, and the college strives to ensure that all students are afforded an equal opportunity at success.

At more specific levels, the college utilizes the 'NCC Educated Person" statement and the college's "Institutional Learning Outcomes" to guide instruction at the institution. These statements clearly define the critical components of students' educational attainment and the characteristics NCC expects of its graduates. As shown below, the EET Program Educational Objectives and the EET Student Outcomes directly align with NCC's Mission, Educated Person statement, and Institutional Learning Outcomes.

Program Educational Objectives - Mapping

1. *The application of circuit analysis and design, computer programming, associated software, analog and digital electronics, and microcomputers, and engineering standards to the building, testing, operation, and maintenance of electrical/electronic(s) systems*

    - **Mission**
        - provides quality, academically rigorous, higher-education programs
    - **Educated Person**
        - Scientific reasoning**,** quantitative analysis, critical thinking
    - **Institutional Learning Outcome**
        - Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.
        - Exhibit dedication to obtaining the essential skills required in today's workforce.

- Utilize quantitative analysis when determining the solutions to problems and developing new ideas.

2. *The application of natural sciences and mathematics at or above the level of algebra and trigonometry to the building, testing, operation, and maintenance of electrical/electronic systems.*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - scientific reasoning, quantitative analysis, critical thinking
- **Institutional Learning Outcome**
  - Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.
  - Exhibit dedication to obtaining the essential skills required in today's workforce.
  - Utilize quantitative analysis when determining the solutions to problems and developing new ideas.

Student Outcomes – Mapping

1. *Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline;*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - scientific reasoning, quantitative analysis, critical thinking
- **Institutional Learning Outcome**
  - Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.
  - Utilize quantitative analysis when determining the solutions to problems and developing new ideas.
  - Demonstrate creativity and ingenuity when completing tasks

2. *Design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline;*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - scientific reasoning, quantitative analysis, critical thinking
- **Institutional Learning Outcome**
  - Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.

- Utilize quantitative analysis when determining the solutions to problems and developing new ideas.
- Demonstrate creativity and ingenuity when completing tasks.

3. *Apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - communications, information literacy, scientific reasoning, critical thinking, global connectedness, and tolerance for ambiguity.
- **Institutional Learning Outcome**
  - Write clearly using language that effectively communicates meaning to readers.
  - Orally present information using appropriate voice, mannerisms, and expressiveness.
  - Consider diversity of audience, situation, and context when communicating.
  - Effectively employ 21st-century technology to collect and analyze information for academic or intellectual pursuits.

4. *Conduct standard tests, measurements, and experiments and to analyze and interpret the results*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - scientific reasoning, quantitative analysis, critical thinking
- **Institutional Learning Outcome**
  - Recognize and apply appropriate problem-solving techniques to draw rational conclusions based on evidence.
  - Utilize quantitative analysis when determining the solutions to problems and developing new ideas.
  - Demonstrate creativity and ingenuity when completing tasks.
  - Demonstrate intellectual curiosity and feel empowered to experiment, test theories, and investigate solutions to problems.

5. *Function effectively as a member of a technical team*

- **Mission**
  - provides quality, academically rigorous, higher-education programs
- **Educated Person**
  - communications, information literacy, scientific reasoning, critical thinking, global connectedness, and tolerance for ambiguity.

- **Institutional Learning Outcome**
  - Effectively work in diverse teams and be capable of recognizing and considering multiple perspectives of thought.
  - Orally present information using appropriate voice, mannerisms, and expressiveness.
  - Consider diversity of audience, situation, and context when communicating.
  - Develop strategies for planning and carry out processes to accomplish tasks.

D. Program Constituencies

List the key program constituencies involved in the review of the program educational objectives. Describe how the program educational objectives meet the needs of these constituencies.

The EET program constituents are:

- Students
- Industry Advisory Board (IAB)
- Businesses that will hire program graduates - Employers
- Educational Institutions to which program graduates will transfer
- Communities where program graduates reside

Students: Nashua Community College is student-oriented. Our goal is to provide services to our students to educate them to become productive individuals.

Our students inform us that they want to possess proficiency in the use of hardware and software. They want to be employed in the industry or pursue more education. Many of them would like to go to work and have their employer pay for the additional education. Technical education typically results in skills that lead to a good living wage, surpassing many other fields. That results in an improved quality of life for many of our students.

Industry Advisory Board: Representatives from the Electronic Engineering Technology field in the Nashua area and representatives from other associate degree programs and baccalaureate programs provide input and feedback on the changing needs of the program.

Employers: Industry entities that have hired students in the past, and may potentially do so in the future. Businesses inform us that they require graduates who can communicate well, work well with others, possess strong problem-solving skills, and are capable of working in the field of electronic engineering technology. ESSCO Calibration Laboratory and BAE Systems are two local companies who have hired NCC EET graduates. Both companies continue to actively solicit recommendations for current and future graduates based on the quality of NCC EET graduates they have hired thus far.

Baccalaureate Programs: An agreement with UNH-Manchester will allow NCC students the option to continue their coursework at UNH-Manchester to earn a Bachelor of Science degree in Electrical Engineering Technology. In addition, some of our students transfer to other four-year schools. Professors from the University of New Hampshire at Manchester

(UNH-M) sit on our IAB and inform us how well our students perform in the electronic engineering technology option at UNH-M.

Local community: Nashua Community College serves the local community. Graduates are able to be productive in the community where they live, the professional community and other areas of interest. Participation in the community can be demonstrated by successful long-term employment, public sector employment, volunteer work, or membership in a professional organization.

E. Process for Review of the Program Educational Objectives

Describe the process used to periodically review the program educational objectives including how the program's key constituencies are involved in this process. Describe how this process is systematically utilized to ensure that the program's educational objectives remain consistent with the institutional mission, the program constituents' needs, and these criteria.

While not required, a table illustrating the following may be helpful to summarize the review process:

Key Constituents involved in the review of PEOs
Timetable for those constituent's review of the PEOs (schedule and when last accomplished)
Manner of the Review (tool or process)
Who/how review results are utilized

Also, it is helpful to provide information about how the processes described above are documented, evidence of which will be necessary in the ABET review process.

Program educational objectives state the goals of our program in broad strokes. Input from program constituents does not directly relate to changes in educational objectives; rather, faculty consider cumulative input from constituents, including student performance and industry trends, when revising educational objectives. This approach is effective because our goal is to produce graduates who have strong cognitive and general technical skills (e.g. problem solving, respect for diversity) rather than specific technical skills (e.g. how to use a specific tool such as NI Multisim's Circuit Simulator). Specific skills may be used as input into program student outcomes where they support our goal of strong general skills.

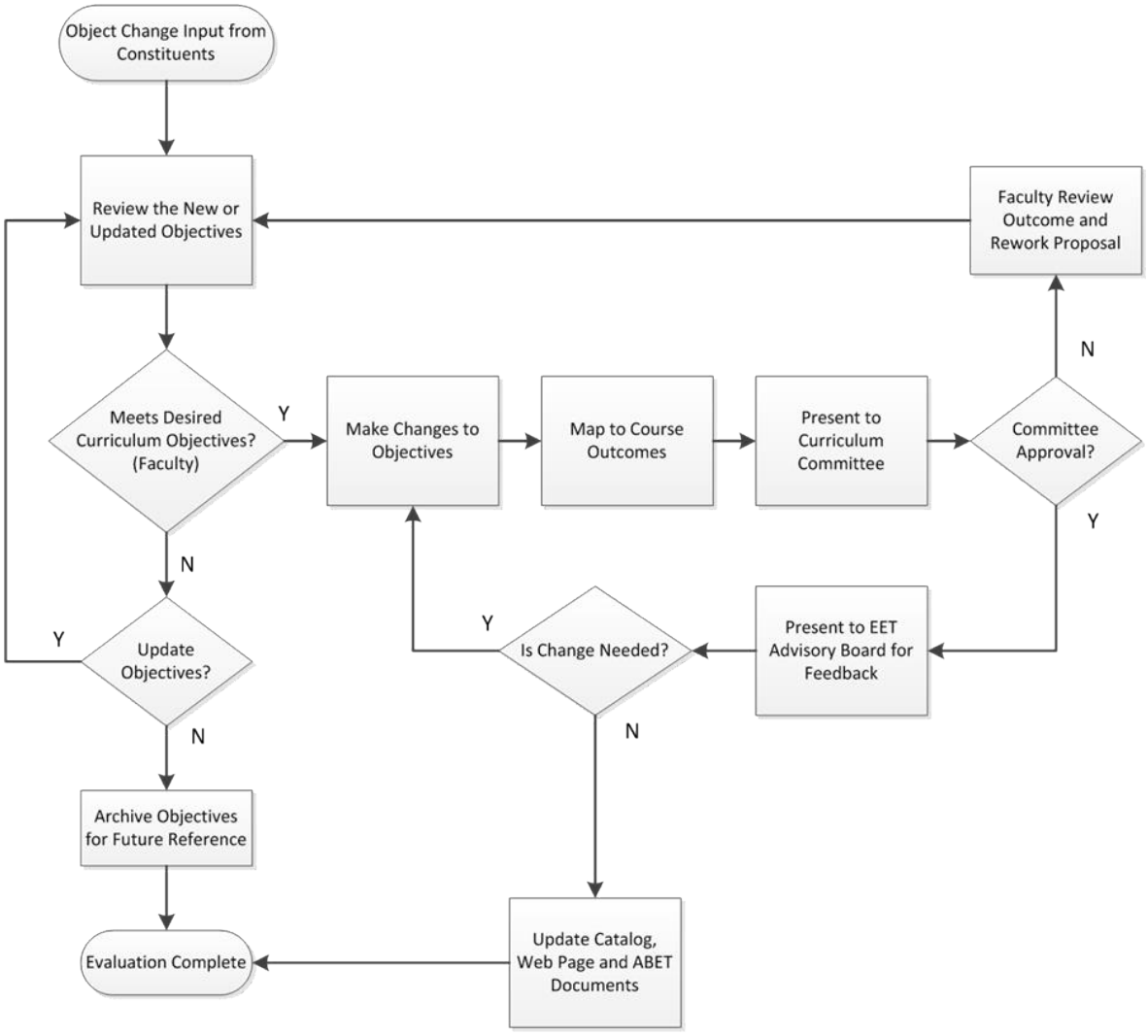
After program educational objectives are revised, they are presented to the Industry Advisory Board (IAB). We take several inputs from the IAB, but we focus on the following questions:

- Is there anything you would like to add to our program educational objectives?
- Do you approve of the list of program educational objectives?

We ask these questions in the context of what skills the IAB would like to see in our graduates.

The process for updating program educational objectives is shown in Figure 2-1.

Figure 2-1 Process for Updating Program Educational Objectives



CRITERION 3. STUDENT OUTCOMES

A. Process for the Establishment and Revision of the Student Outcomes

Describe the process used for establishing, reviewing, and revising student outcomes.

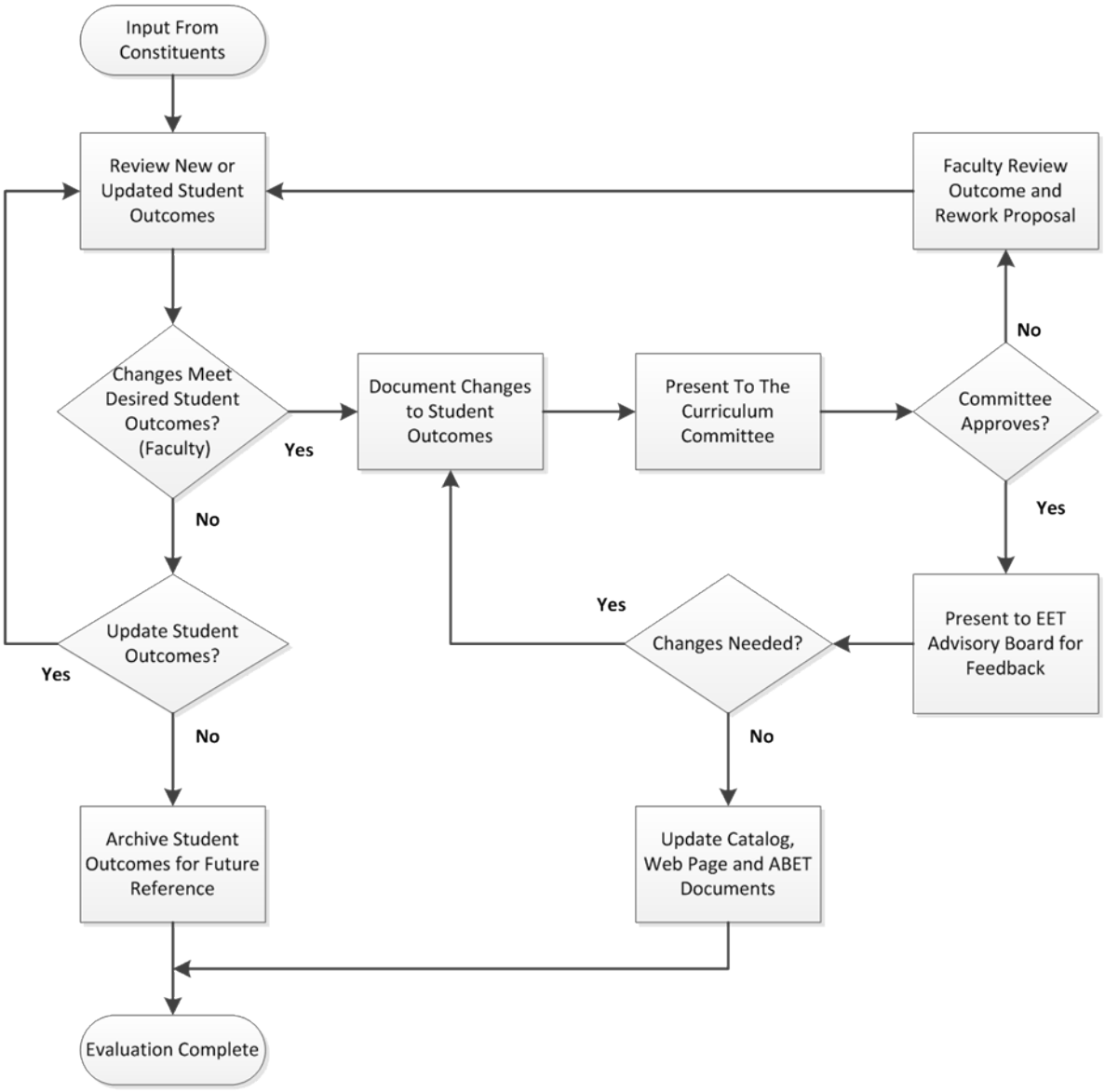
Courses and programs are developed to move from simple to complex concepts through properly sequenced coursework. Prerequisites and co-requisites are clearly identified in course descriptions in the course catalog. Courses in the EET major are integrated with general education courses to enable students to use liberal arts skills and knowledge to build a solid foundation for their chosen careers.

The process of establishing and revising student outcomes is driven by input from program constituents. Industry leaders indicate skills required by graduates, faculty discover technology changes via seminars and online searches, the IAB (Industry Advisory Board) identifies industry trends, and research is conducted to see what courses similar programs contain. These inputs arrive at various intervals during our educational cycle. Some are actionable, and some are kept under advisement for further investigation at a later time. The feedback loop that drives our improvement to the program is continuous. Some of the inputs may require curriculum changes, which is its own process but may or may not require our student outcomes to change. Also, curriculum changes may or may not change student outcomes.

Figure 3-1 below shows the EET process for modifying program student outcomes as a result of constituent input.

Constituent input typically drives curriculum changes. Changes can also come from faculty observation.

Figure 3-1 Process for Establishing or Modifying Student Outcomes



B. Student Outcomes

List the student outcomes for the program. Indicate where the student outcomes are documented and made accessible to the public. These are typically listed on a web page that is clearly linked to the program's website or in a publicly accessible publication.

The EET Student Outcomes are shown in Table 3-1. The EET program's student outcomes can be found on the EET page of the college website (https://nashuacc.edu/program/electronic-engineering-technology/) and the college catalog (https://nashua.cleancatalog.io/sites/default/files/pdf/pdf_generator/course-catalog-20222023-pdf.pdf?1652204218#page=85).

Table 3-1: EET Student Outcomes

EET Program Student Outcomes	
1	Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.
2	Design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline.
3	Apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.
4	Conduct standard tests, measurements, and experiments and to analyze and interpret the results.
5	Function effectively as a member of a technical team.

C. Mapping of Student Outcomes to Criterion 3 Requirements for Student Outcomes

Describe if the student outcomes used by the program are stated differently than the required elements listed in Criterion 3 part A or B. If so, provide the mapping of the program's student outcomes indicating how they address all required Criterion 3 elements one (1) through five (5).

The student outcomes used by the EET program match the student outcomes listed in Criterion 3.

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CRITERION 4. CONTINUOUS IMPROVEMENT

Summarize the program's processes for regularly assessing and evaluating the extent to which the student outcomes are being attained and how those results are used as input for the program's continuous improvement actions. The terms assessment and evaluation have specific definitions, and those definitions can be found in the latest accreditation criteria documentation.

The program may report its processes as it chooses but must include the information requested in sections A – F. Alternatively, if the program has a well-established document that program faculty and staff regularly refer to for guidance in their regular continuous improvement processes and activities, and the document provides the information outlined in the below guide, that document could be provided in the appendix.

To make it easier for the reader, **Criterion 4 sections B, D and E** are organized by course, with their associated POLs 1-4, then program student outcomes 1-5. Each course and student outcome includes three sections:

B. Assessment Metrics and Methods of Student Outcomes
D. Evaluation
E. Using Results for Continuous Improvement

NOTE: Documentation to provide specific evidence of continuous improvement will be available during the site visit. This will include detailed data for each assessment tool by year, copies of student work used in assessment methods, rubrics, meeting agendas and meeting minutes, etc.

A. Documentation of Processes

Provide an overview of the documented process for assessing and evaluating student outcome attainment and how the results of the evaluation process are systematically utilized to generate program continuous improvement actions. (Detailed documentation of processes may be included as an appendix.) In the sections below, briefly summarize key elements of that process. Include responsibilities and timetables in the documented process.

The EET Program uses the following performance indicators to assess and evaluate student outcome attainment.

1. **Course Level Assessment / Outcomes = "Points of Learning (POLs)"**
2. **Points of Learning to Student Outcomes Mapping Table**
3. **Senior Exit Surveys**
4. **Feedback from the Industrial Advisory Board**

Each performance indicator is described in detail below.

1. **Course Level Assessment / Outcomes = "Points of Learning (POLs)"**

Course Level Assessments take place for every course in the form of Points of Learning (POL) evaluations. The 4-step process is as follows:

a. **Create the key POLs for each course -** When a course is first created, the instructor proposes a set of key Points of Learnings (POLs) which are then reviewed and approved by the department. These POLs are discussed in terms of their relationship to the curriculum as a whole, and in particular to their support of the departmental program student outcomes. They are then recorded in the "Course Level Assessment (POLs) to Outcomes Mapping Table". The course level assessment to outcomes mapping table is included in **Appendix I**.

b. **The POLs are submitted for approval to the NCC Curriculum Committee (NCC-CC)** – and once approved, used from that point on. Once they have been approved, the POLs are then included in the course syllabus.

c. **Assess the POLs for each course each time it is offered** and record the results. At the end of each semester and/or at the end of the academic year, the POL data is calculated for each course. Each instructor then completes a course assessment that includes the instructor's POL assessment, the students' average self-assessment, and an instructor reflection based on these numbers. A detailed example is shown after the next section.

d. **The EET faculty meet, at least annually, to discuss the course level POL assessments** in the above step. Course level changes may be proposed, including POLs, pedagogical, and anything else related to the course(s). The discussions serve to share practices and also help us identify more general issues that may influence program level assessment. Program internal meeting notes minutes are taken and stored. A detailed example is included below for ELET250N (Microcontrollers).

Detailed example of the Points of Learning (POL) process:

The POLs for each course are stated in the syllabus and measured, where appropriate, throughout the semester through:

- Exam questions
- Labs
- Quizzes
- Homework assignments

In the EET department syllabi, the term *Course Competencies* is used interchangeably with *Points of Learning*. The detailed example below utilizes the POLs and corresponding data from ELET250N Microcontrollers (Fall 2021).

In the ELET250N course syllabus, the following course competencies (POLs) are listed:

Course Competencies:

At the conclusion of this course, students will be able to:

- Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors.
- Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors
- Interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals
- Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.

At the conclusion of the course, the instructor assesses the course and records the calculated POL results in the POL course assessment form. An example of this form is shown in Table 4-1. It captures four types of data.

a. A numerical assessment of the POL by the instructor. For example: the instructor's assessment of POL#1 was **8.05 out of 10**. There is an area for the instructor to add his/her own reflections (optional) and in this case, the instructor had "No major concern" because all POL scores were greater than 7.0.

b. A numerical self-assessment of the POLs by the students. For example, the student's self-assessment for POL #1 was **9.29 out of 10**. An example of the ELET250N Student Course Level Self-Assessment Form is included in **Appendix F**.

c. The specifics of how the POL was assessed. For example, using the same form, POL#1 was evaluated by using the average of Exam 1 Questions 1-9, 32-38, and the semester average for all Homework and Labs for all students.

POL1 = Average of EXAM1(1-9, 32-38)); HW/Labs

Note - HW/Labs counts 2 exam questions
Note - HW 10% / Lab 30%, average is (HW + Lab*3)/4

d. The instructor records their observations, modifications, and takeaways. Table 4-2 shows the instructor's detailed observations for the course.

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Table 4-1: ELET250N POL Course Assessment, Fall 2021

POL Number and Summary		Instructor's Assessment	Student Self-Assessment	Map to ABET Outcomes	Reflection
1	Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors	**8.05**	9.29	See the POL to Outcomes Mapping Table	No major concern
2	Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors	**7.66**	9.14	"	No major concern
3	Interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals	**7.73**	8.71	"	No major concern
4	Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.	**7.61**	7.86	"	No major concern

How were POL scores evaluated for this course?

1	POL1 = Average of EXAM1(1-9, 32-38)); HW/Labs
2	POL2 = Average of EXAM1(22-26, 49); EXAM2(16); HW/Labs
3	POL3 = Average of EXAM2(3,13,14)); EXAM3(2,6,11,12); HW/Labs
4	POL4 = Average of EXAM3(10-14)); HW/Labs

Note - HW/Labs counts 2 exam questions
Note – HW 10% / Lab 30%, average is (HW + Lab*3)/4

Table 4-2: ELET250N Instructor's Observations, Fall 2021

Which POL / course material was most successfully achieved by the students and your thoughts as to why?	#1 – HW/SW architecture of 8051. All POLs were close in values, and all are down from F2020. Best score was achieved for POL 1 because it's a high-level view of the 8051 before we delve into the specific details.
Which POL / course material was least successfully achieved by the students and your thoughts as to why?	#2 – Loops/calls/procedures. Structure of loops/calls/procedure is noticeably different from C++, which is the only other programming language that they are required to take a course in.
What modifications are planned for the next offering of this course?	All POLs are down from F2020: POL 1: 8.81 -> 8.05 POL 2: 8.78 -> 7.66 POL 3: 8.39 -> 7.73 POL 4: 8.97 -> 7.61 First time for this instructor teaching the course. The instructor now has better understanding of what needs to be emphasized and when.
List any other "takeaways" from this section.	Homework needs to be targeted to areas of concern. More examples in lecture, especially with loops and addressing modes. Add more real-world labs so they have a better understanding of applications.

Once the course assessment forms have been reviewed and a course of action has been determined (where appropriate), the faculty implements the changes. Below is a snapshot from the May 27, 2022 EET program internal meeting minutes describing the takeaways that were discussed at the department level for ELET250N, Fall 2021.

ELET250N (F2021)

Results: This course was taught by FT faculty. All POL scores are down from F2020 but are all still above 7.0. This was the first time for the instructor teaching this course. A lab rubric was implemented mid-semester that gave credit for lab performance and eliminated lab reports. This had a positive effect on the POLs. See instructor course assessment for details.

Open Action Items:

- Need to find new microcontroller and textbook for this course. Textbook is no longer available in print, only e-book and the companion microcontroller evaluation board has been discontinued.

2. Points of Learning to Student Outcomes Mapping Table

Student outcomes are calculated based a defined POL to student outcomes mapping. **Appendix G** contains the course level assessment to student outcomes mapping that was utilized for the 2018 NCC ABET Interim report, which references ABET criterion 3, student outcomes a-i. With the change to ABET criterion 3, the POLs needed to be remapped to student outcomes 1-5. **Appendix H** shows the mapping of student outcomes a-i to student outcomes 1-5. Using Appendix H, a new course level assessment to student outcomes mapping was generated to map the course POLs to student outcomes 1-5. The updated course level assessment to student outcome mapping is shown in **Appendix I**. Appendix I was used as the reference for the calculation of all student outcomes.

A snapshot of the course level assessment to student outcomes mapping is shown belong for ELET250N (Microcontrollers). ELET250N POL1, POL2, POL3, and POL4 map to Student Outcome 1. ELET250N POL3 and POL4 map to Student Outcome 2.

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET250N - Microcontrollers	Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors.	✓				
	Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors	✓				
	Interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals	✓	✓			
	Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.	✓	✓			

Because POLs are the source for the student outcome calculations, data from previous years was used to calculate the equivalent student outcomes 1-5 for comparison to AY21-22 numbers.

Student outcome 2 had no mapping from the previous student outcomes a-i. Given the description of student outcome 2, the EET faculty chose appropriate course POLs to include in the calculation.

3. **Senior Exit Surveys**

   In AY2017-2018, program leadership decided to implement the Senior Exit Survey. Each ASEET graduate answers a series of questions regarding their opinion of the EET program and their future plans for school/work. The exit survey is completed anonymously. A copy of the Spring 2022 exit survey is included in **Appendix J**. The student feedback from this exit survey is reviewed as part of the annual EET department meeting and is discussed with the Industrial Advisory Board. The results of the exit survey are stored in Improve.

4. **Feedback from the Industrial Advisory Board**

   The Industrial Advisory Board (IAB) consists of

   - All full-time faculty in the EET program at NCC
   - Other EET faculty from other 2 and 4-year institutions
   - Adjunct faculty
   - Former graduates
   - EE Engineers / Managers from industry

   The goal is for the board to meet at least once a year to review:

   - Program status update since the last meeting
   - Proposed new changes to the curriculum or any course(s)
   - Enrollment trends
   - Program assessment process
   - ABET accreditation processes
   - Senior Exit Survey results
   - How current students and graduates are doing
   - Get feedback from IAB members on what skills employers require in ASEET graduates
   - Get feedback from IAB members on current curriculum and whether it properly addresses industry needs

   The last meeting of the IAB was on May 9, 2022 at NCC. The presentation slides and IAB meeting minutes are stored in the college's assessment tool, Improve. They will also be available in the ABET electronic workroom.

   Additional details regarding the advisory board are included in Criterion 5, Section C, Advisory Committee.

Data Collection:

All program assessment documents are stored in one of the following repositories:

- **Improve** is a software tool provided by Nuventive that provides both document storage and assessment tracking. All full-time faculty have access to this online tool at NCC. Improve can be used to generate assessment reports that summarize the assessment status of a given

course by *Course Competencies*, which is the term used at the college level and is synonymous with the term *Points of Learning* used at the EET department level.

- **Canvas is** the Learning Management System used by NCC for all courses. This is used by the EET faculty as a document repository for any materials that cannot be uploaded or do not apply to Improve. This includes the materials (lecture slides, exams, labs, etc) for each course.

The following table lists where key documents are stored. A screen shot of the Improve directory structure (partial) is shown in Figure 4-1. Figure 4-2 shows the course ELET250N expanded for Fall 2021.

Storage Location	Documents
Improve	Summary of Department Objectives ABET Documents • 2016 Self-Study Report and Final Statement • 2018 Interim Report and Summary of Accreditation Actions • This document, when completed Alumni Information Articulation Agreements AY Program Data Course Outlines ELET Course Assessment Data • Course POL to Outcomes Mapping Table 2018 • Course POL to Outcomes Mapping Table 2022 • EET Assessment Tools 2018 • Excel spreadsheet with five years of POL data for each course and each student outcome By course, organized per semester: • Instructor Assessment Form • Student Course Level Self-Assessment Form • Copy of all exams • An excel spreadsheet of all exam grades by question (used to calculate the POLs) and the student self-assessments. • Final projects (if applicable) • Lab submissions (if submitted electronically) • Lab procedures (AY2021-22) • Homework assignments (AY2021-22) Meeting Minutes

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	• Industrial Advisory Board Minutes
	  • All Meeting Notes
	  • All PPT Presentations
	• Program Internal Meeting Minutes
	Program Plan
	Syllabi

Canvas	All EET course materials used for a given course, which typically include: • PowerPoint Presentations • Exams • Quizzes • Homework Assignments • Lab / Programming Assignments • Syllabus

Figure 4-1: Improve Directory Structure

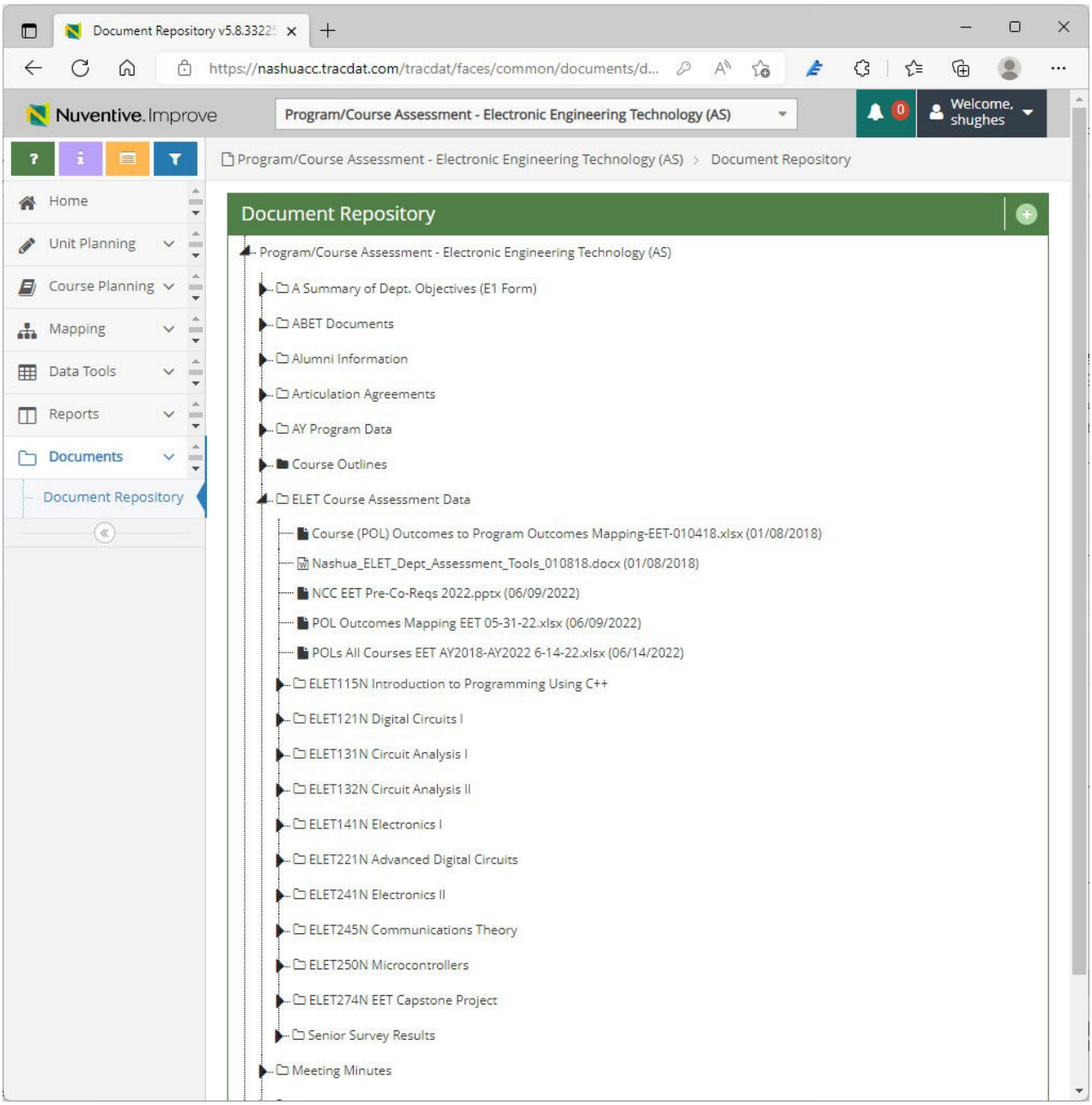
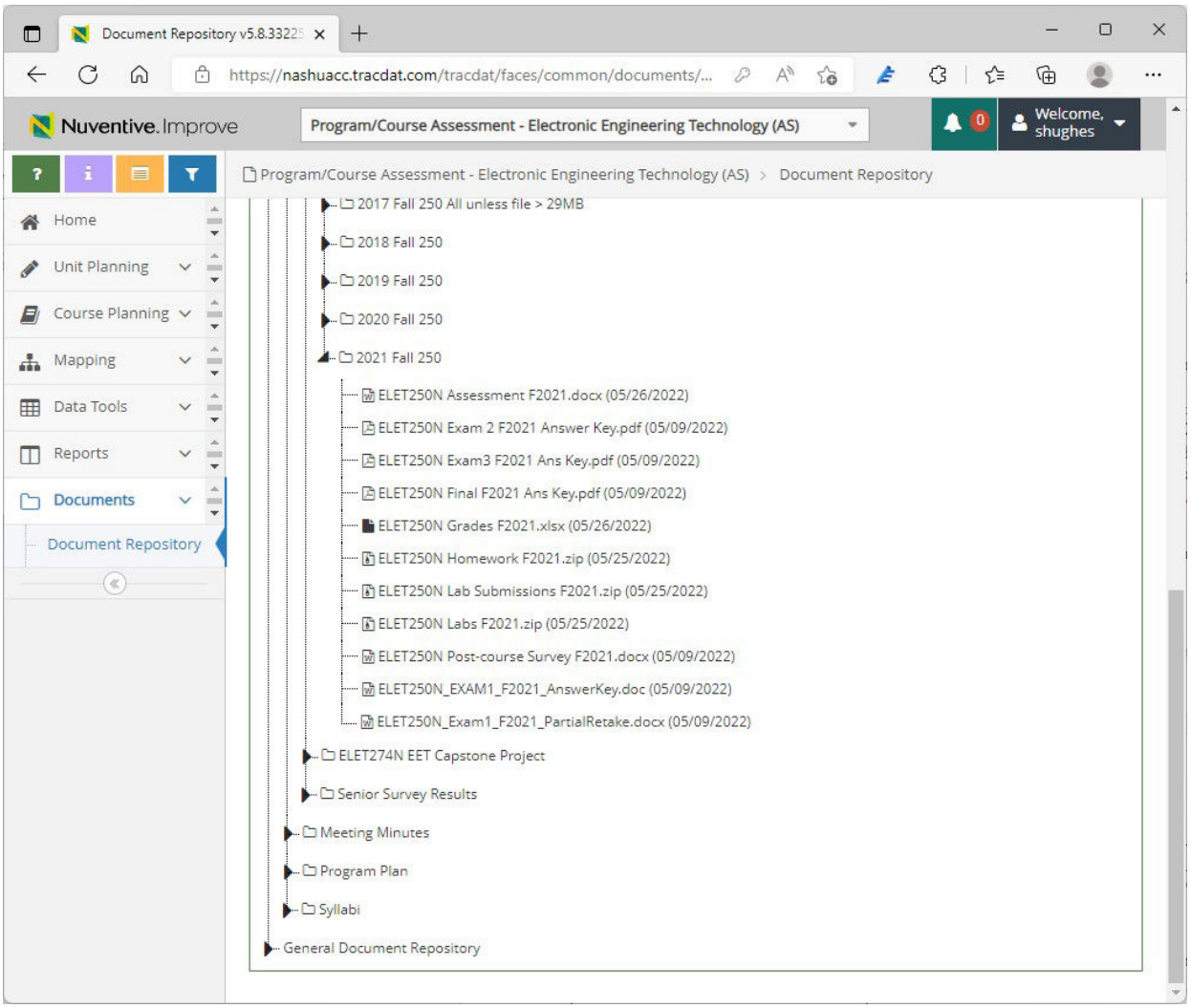


Figure 4-2: ELET250 Expanded in Improve



B. Student Outcome Assessment and Methods

List the metric(s), measure(s) or performance indicator(s) (PI) used for the assessment of each student outcome. A PI identifies the measurable student performance/activity used to assess student attainment of the student outcome. Describe the process for collecting data or making assessments for each student outcome (tabular format recommended). Include examples of assessment instruments in the report, e.g., rubrics in an appendix. Present information for each student outcome individually (e.g. use a separate table, chart or paragraph, for each student outcome.) It is expected that there will be multiple assessment measures for each student outcome or to assess a student outcome using several performance indicators, e.g., written communication assessed in one assignment and verbal communication in another.

See below section organized by course with associated POLs 1-4, then program student outcomes 1-5.

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C. Assessment Schedule and Frequency

Present the schedule and frequency for each type of assessment as well as points of accountability (tabular format is recommended). If student outcomes will be assessed in different years, provide an overview of this via a simple table (student outcome versus year of assessment).

Each EET course has 4 Points of Learning (POLs) used as measures for course assessment. The POLs are listed in the course syllabus, and are interchangeably described as *Course Competencies*, which is the terminology used at the college level.

The course POLs map to the 5 program student outcomes, which are assessed at the end of each academic year once the component POL data is available for each course. The POL to outcomes mapping table for student outcomes 1-5 is included in **Appendix I**.

Course level POLs are evaluated each semester that a course is offered. The target level of attainment for any POL in any course is >= 7.0 out of 10.0.

COURSE POLs	EVALUATION FREQUENCY	ACCOUNTABLITY	EXPECTED LEVEL OF ATTAINMENT
1	Each semester a course is offered	Instructors	>= 7.0
2	Each semester a course is offered	Instructors	>= 7.0
3	Each semester a course is offered	Instructors	>= 7.0
4	Each semester a course is offered	Instructors	>= 7.0

Program student outcomes are evaluated yearly. For each student outcome, the expected level of attainment is >= 7.0 out of 10.0.

STUDENT OUTCOME	EVALUATION FREQUENCY	ACCOUNTABLITY	EXPECTED LEVEL OF ATTAINMENT
1	Yearly	EET faculty	>= 7.0
2	Yearly	EET faculty	>= 7.0
3	Yearly	EET faculty	>= 7.0
4	Yearly	EET faculty	>= 7.0
5	Yearly	EET faculty	>= 7.0

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D. Evaluation

Present the evaluation schedule, points of accountability, and expected level of attainment (if used) for each student outcome. Provide summaries of data collected and evaluation results for recent assessment and evaluation cycles for each student outcome, illustrating current attainment of each student outcome and trends in attainment over time (tabular or graphical presentation is recommended.) Describe how evaluation results are communicated and documented, and provide one or more examples of these communicated evaluations in the report. (Note that excessive averaging of data can negatively impact the evaluation process, e.g., "averaging the averages.")

See below section organized by course with associated POLs 1-4, then program student outcomes 1-5.

E. Using Results of Assessment and Evaluation for Continuous Improvement Actions

Describe how the results of assessment and evaluation of the attainment of student outcomes (from sections C and D above) are systematically used as input for the program's continuous improvement actions. Present points of accountability, schedule, and frequency. Summarize and provide evidence of deliberations, decisions, and actions which have been implemented because of the evaluation of student attainment of the student outcomes. Evidence might include evaluation reports, agendas, faculty meeting minutes, or memos. (Note that it is not expected or required that each student outcome be subject to continuous improvement action after each assessment and evaluation cycle.)

See below section organized by course with associated POLs 1-4, then program student outcomes 1-5.

COURSE POLs:

To make it easier for the reader, **Criterion 4 sections B, D and E** are organized by course, with their associated POLs 1-4, then program student outcomes 1-5. Each course includes three sections:

B. Assessment Metrics and Methods of Student Outcomes
D. Evaluation
E. Using Results for Continuous Improvement

ELET115N: Introduction to Programming Using C++

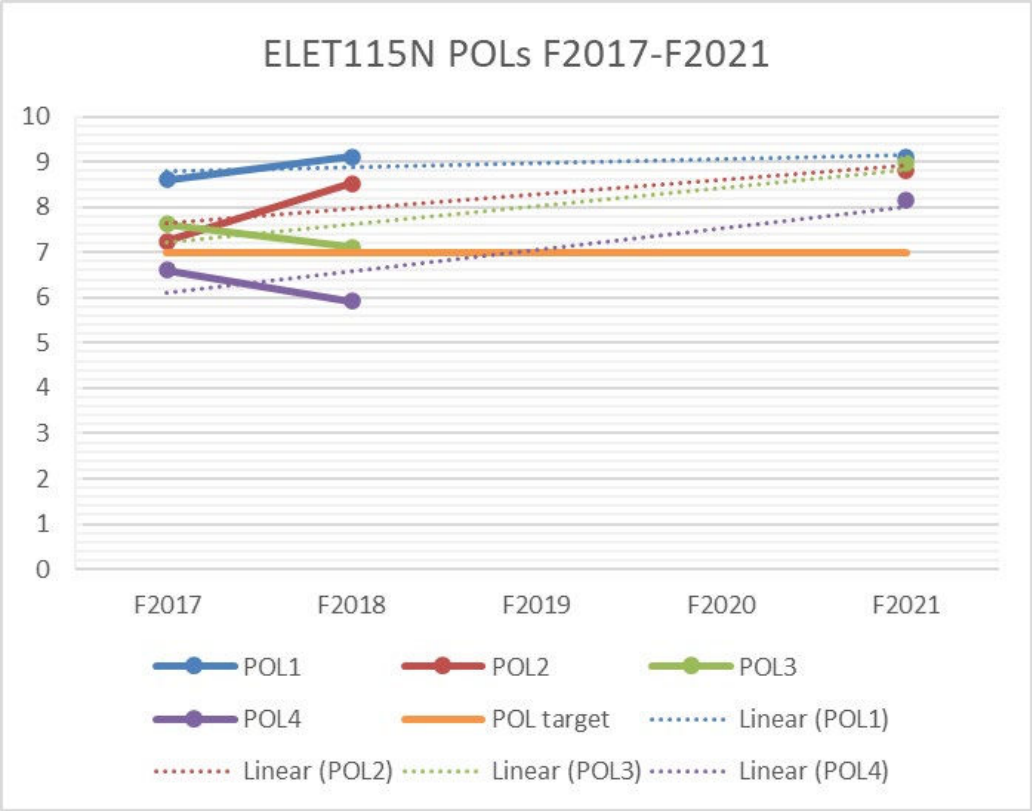
B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET115N Introduction to Programming Using C++	1) Understand the components of a computer system and understand basic design and problem solving strategies using C++ 2) Understand C++ datatypes, Input / Output (I/O), File I/O, expressions, and errors 3) Understand the use of functions, parameter passing and return values from functions 4) Understand C++ control structures – if statements, loops, and conditional logic

D. Evaluation - Data Collected for each POL, F2017-F2021

Prior to AY21-22, if an adjunct instructor taught a course, data was not collected. An adjunct instructor taught the course in F2019 and F2020.

	F2017	F2018	F2019	F2020	F2021
POL1	8.61	9.11			9.11
POL2	7.25	8.53			8.8
POL3	7.62	7.11			8.97
POL4	6.6	5.92			8.17
POL target	7	7	7	7	7
# students	9	10			19



E. Using Results for Continuous Improvement – Summary Analysis

Given that data was not collected for F2019 and F2020, linear lines were included in the graph to extrapolate trends.

POL1 and POL2 are consistent with previous years. POL3 and POL4 have improved from F2018 to F2021. In F2018, lab time was increased from 2 hours to 3 hours. It is believed that this increase in lab time is the source of the upward POL trend.

For F2021, all POLs are > 7.0, so there are no instructor concerns. The detailed instructor POL assessment is available in the college's assessment platform, Improve.

The program internal meeting minutes, dated 5/27/22, list no open action items.

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ELET121N: Digital Circuits I

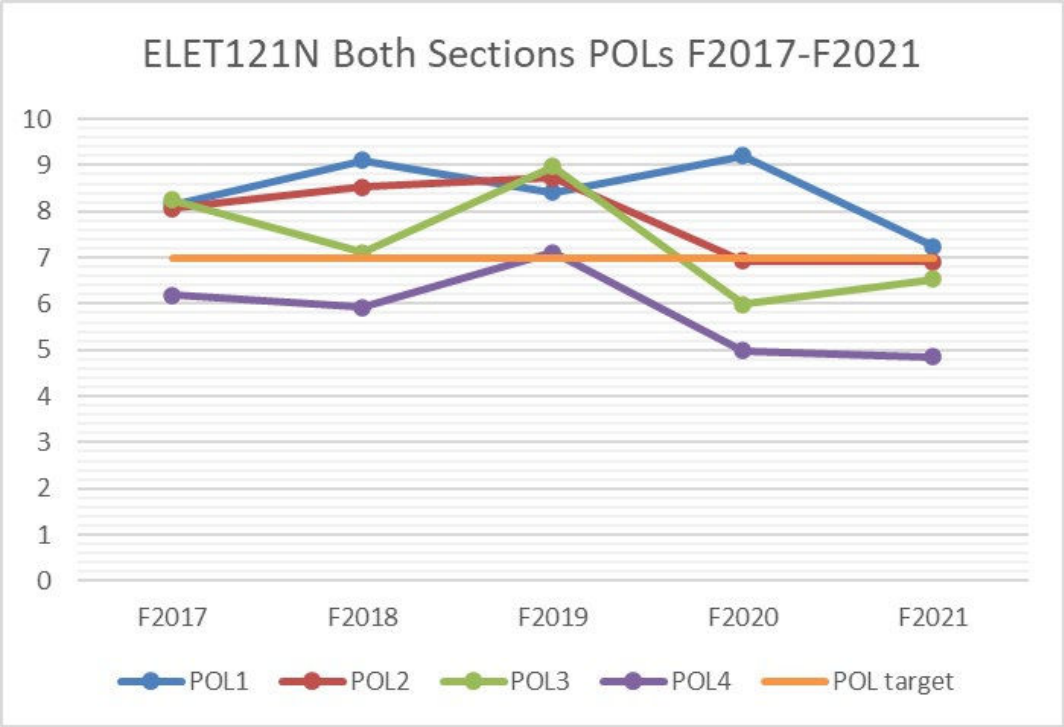
B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET121N Digital Circuits I	1) Convert between number systems and express signed numbers in binary signed magnitude using 1's and 2's complement form 2) Understand and apply Logic Gates, Adders, Encoders, Decoders, Comparators, Multiplexers and Demultiplexers 3) Simplify algebraic expressions using Boolean algebra, DeMorgan's theorems and Karnaugh map to simplify expressions or truth table functions 4) Apply Latches and Flip-Flops and use One-shots and Multivibrators as 5) clocking sources

D. Evaluation - Data Collected for each POL, F2017-F2021

There are two sections of ELET121N taught each semester. Section A is a day course, and Section 1 is an evening course. The POLs were calculated for each course section independently, then aggregated to get overall POL scores for both sections.

	F2017	F2018	F2019	F2020	F2021
POL1	8.15	9.11	8.41	9.20	7.24
POL2	8.07	8.53	8.72	6.93	6.91
POL3	8.24	7.11	8.97	5.99	6.54
POL4	6.19	5.92	7.11	4.98	4.85
POL target	7	7	7	7	7
# students	19	10	21	13	9



E. Using Results for Continuous Improvement – Summary Analysis

POL1 is noticeably down from previous years. POL2 and POL4 are consistent with F2020 but on a downward trend from earlier years. POL3 is up slightly from F2020 but still on a downward trend.

For F2021, only POL1 is > 7.0. Instructor assessments for both day and evening sections include:

- Managing the pace of the course so that latches and flip-flops get sufficient coverage
- Assigning weekly homework regardless of whether a complete chapter has been covered in lecture.

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list two open action items:

- Align both day/evening sections of the course so that both are using the same labs, homework, exams.
- Update the lab rubric to reflect work completed in lab and not have the grade wholly based on the lab report.

ELET131N: Circuit Analysis I

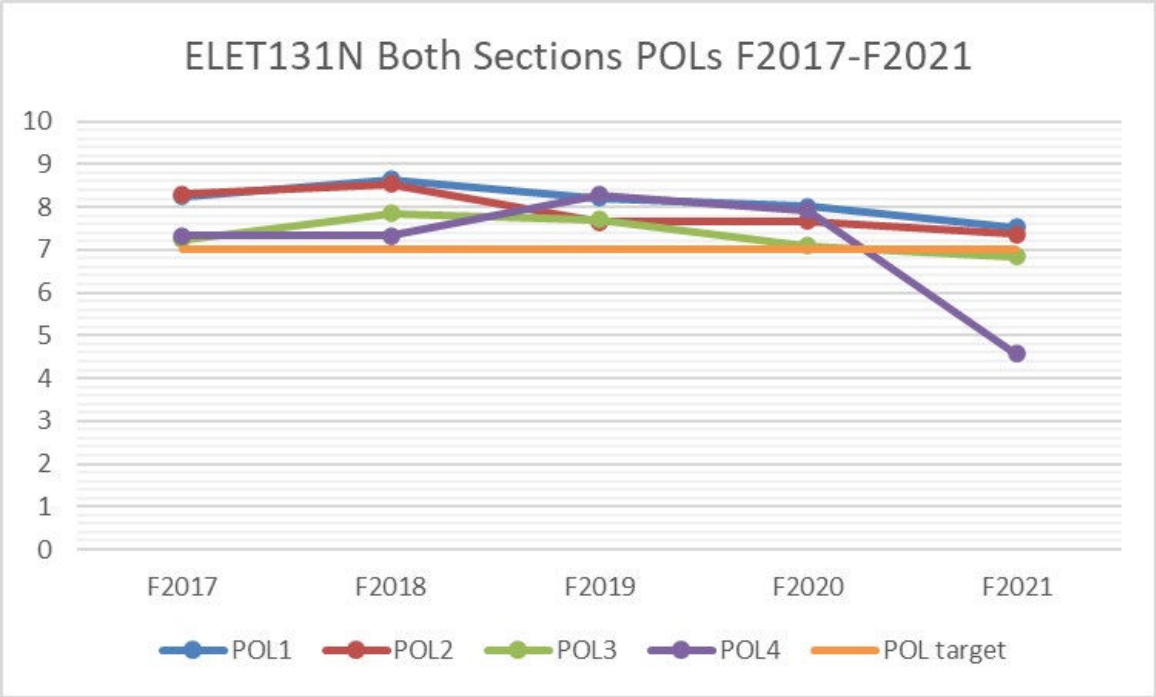
B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET131N Circuit Analysis I	1) Define and solve for current, voltage, resistance, and power in series, parallel, and series-parallel electric circuits using both scientific and engineering notation 2) Calculate voltages and currents using Ohm's law, Kirchhoff's voltage and current laws as well as voltage and current divider equations 3) Calculate electrical quantities using the branch-current, mesh current, and nodal voltage analysis methods 4) Solve complex circuits by applying Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorems

D. Evaluation - Data Collected for each POL, F2017-F2021

There are two sections of ELET131N taught each semester. Section A is a day course, and Section 1 is an evening course. The POLs were calculated for each course section independently, then aggregated to get overall POL scores for both sections.

	F2017	F2018	F2019	F2020	F2021
POL1	8.24	8.64	8.21	8.01	7.53
POL2	8.30	8.54	7.66	7.67	7.37
POL3	7.24	7.85	7.71	7.09	6.85
POL4	7.33	7.33	8.29	7.92	4.57
POL target	7	7	7	7	7
# students	28	12	15	21	17



E. Using Results for Continuous Improvement – Summary Analysis

POL1, POL2, and POL3 are consistent with previous years. POL4 has decreased noticeably from previous years.

For F2021, only POL1 and POL2 are > 7.0. Instructor assessments for both day and evening sections include:

- Spending more lecture and example time on POL4
- Assigning more homework problems to get more practice

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list two open action items:

- Align both day/evening sections of the course so that both are using the same labs, homework, exams.
- Update the lab rubric to reflect work completed in lab and not have the grade wholly based on the lab report.
- More focus on superposition during lecture.

ELET132N: Circuit Analysis II

B. Assessment Metrics – Points of Learning

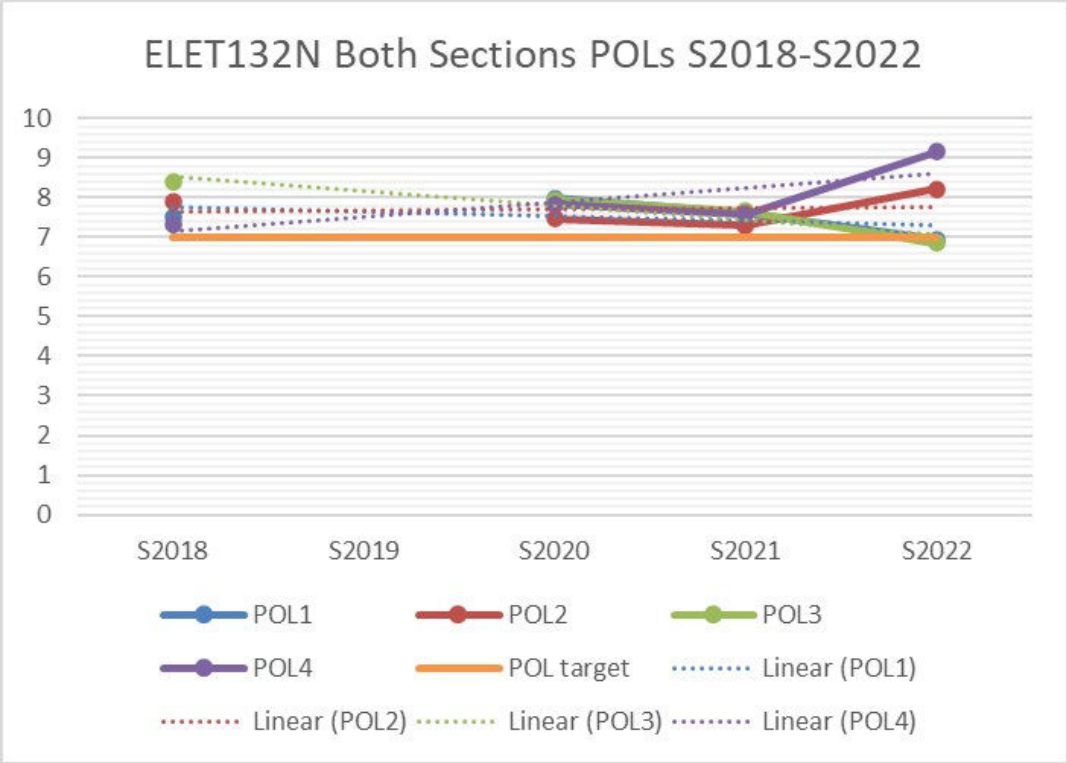
Course	Points of Learning
ELET132N Circuit Analysis II	1) Determine transient (time-varying) responses of capacitive and inductive networks and plot resulting voltages and currents 2) Determine the phase relationship between two sinusoidal waveforms and understand how to calculate the average and effective values of any waveform and using phasor format to add and subtract sinusoidal waveforms 3) Find the total impedance of series, parallel and series-parallel ac circuits and become proficient in applying Thevenin's and Norton's theorems to AC networks 4) Develop confidence in the use of logarithms and decibels to define levels and also become familiar with frequency response of filters and display these using Bode Plots

D. Evaluation - Data Collected for each POL, S2018-S2022

There are two sections of ELET132N taught each semester. Section A is a day course, and Section 1 is an evening course. The POLs were calculated for each course section independently, then aggregated to get overall POL scores for both sections.

Prior to AY21-22, if an adjunct instructor taught a course, data was not collected. An adjunct instructor taught the course in S2019.

	S2018	S2019	S2020	S2021	S2022
POL1	7.51		7.99	7.62	6.95
POL2	7.89		7.47	7.30	8.22
POL3	8.40		7.94	7.65	6.85
POL4	7.33		7.83	7.58	9.15
POL target	7	7	7	7	7
# students	14		8	9	8



E. Using Results for Continuous Improvement – Summary Analysis

Given that data was not collected for S2019, linear lines were included in the graph to extrapolate trends.

POL1, POL2, and POL4 are consistent with previous years. POL3 has slightly decreased from previous years.

For F2021, POL2 and POL4 are > 7.0, but POL1 and POL3 are only slightly less than 7.0. Instructor assessments for both day and evening sections include:

- Assigning more homework problems to get more practice
- Spend more lecture time working on Thevenin/Norton equivalent circuits
- Give more in-class quizzes to identify where students are struggling

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list two open action items:

- Align both day/evening sections of the course so that both are using the same labs, homework, exams.
- Update the lab rubric to reflect work completed in lab and not have the grade wholly based on the lab report.

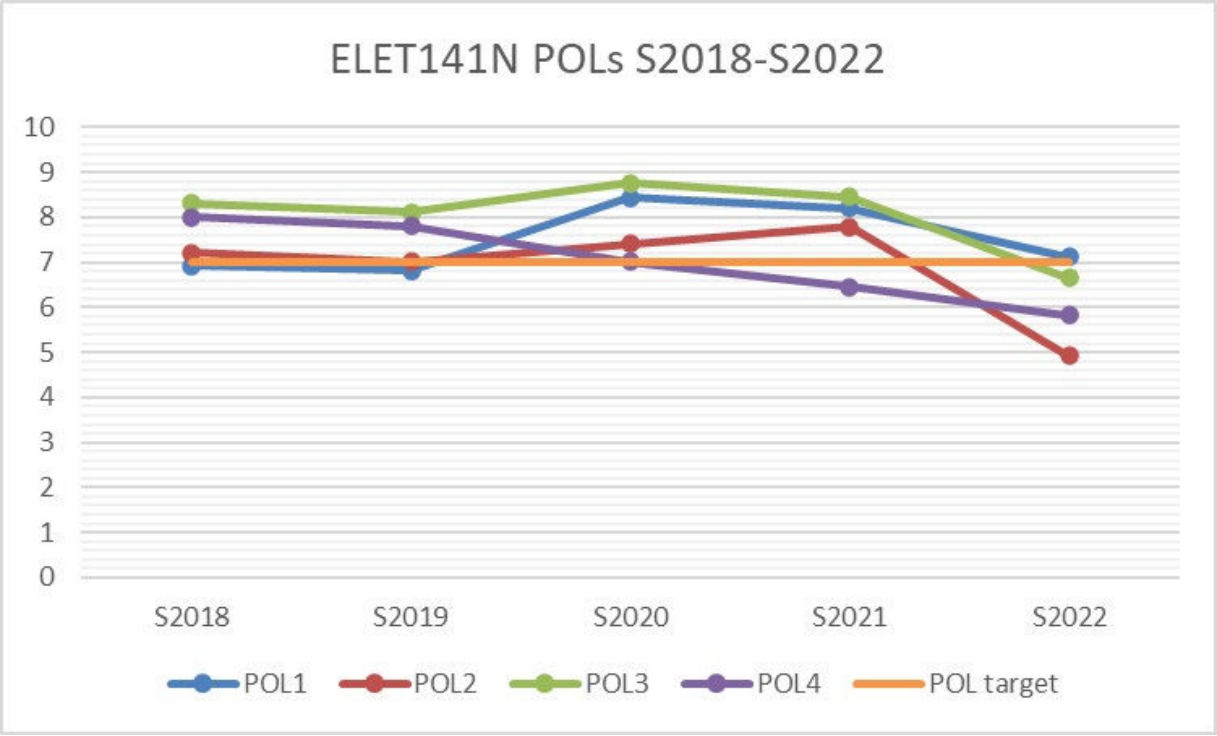
ELET141N: Electronics I

B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET141N Electronics I	1) Define semiconductor principles and construct DC load lines and operating points for diodes, bipolar junction transistors (BJT's) and Field Effect Transistors (FET's) 2) Identify and analyze half-wave and full-wave rectifier circuits as well as clippers, clampers, peak detectors, and voltage multipliers 3) Discuss the operation of the BJT and the FET including biasing them in various configurations and identifying saturation and cut-off points for a given bias 4) Design BJT and FET amplifier networks and use decibels and Bode Plots to understand their Frequency Response

D. Evaluation - Data Collected for each POL, S2018-S2022

	S2018	S2019	S2020	S2021	S2022
POL1	6.93	6.82	8.44	8.21	7.13
POL2	7.21	7.01	7.41	7.78	4.93
POL3	8.31	8.12	8.77	8.45	6.65
POL4	8	7.81	7.02	6.46	5.83
POL target	7	7	7	7	7
# students	9	5	12	9	4



E. Using Results for Continuous Improvement – Summary Analysis

All POLs are decreased from previous years. This was the first time this instructor taught the course.

For F2021, POL1 > 7.0. POL2, POL3, and POL4 are below target. Instructor assessment includes:

- Assigning more homework problems to get more practice
- Provide timely feedback to students with grading
- Prepare lab assignments more thoroughly

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list two open action items:

- Add weekly homework assignments
- Supplement textbook problems with custom problems
- Update the lab rubric to reflect work completed in lab and not have the grade wholly based on the lab report.

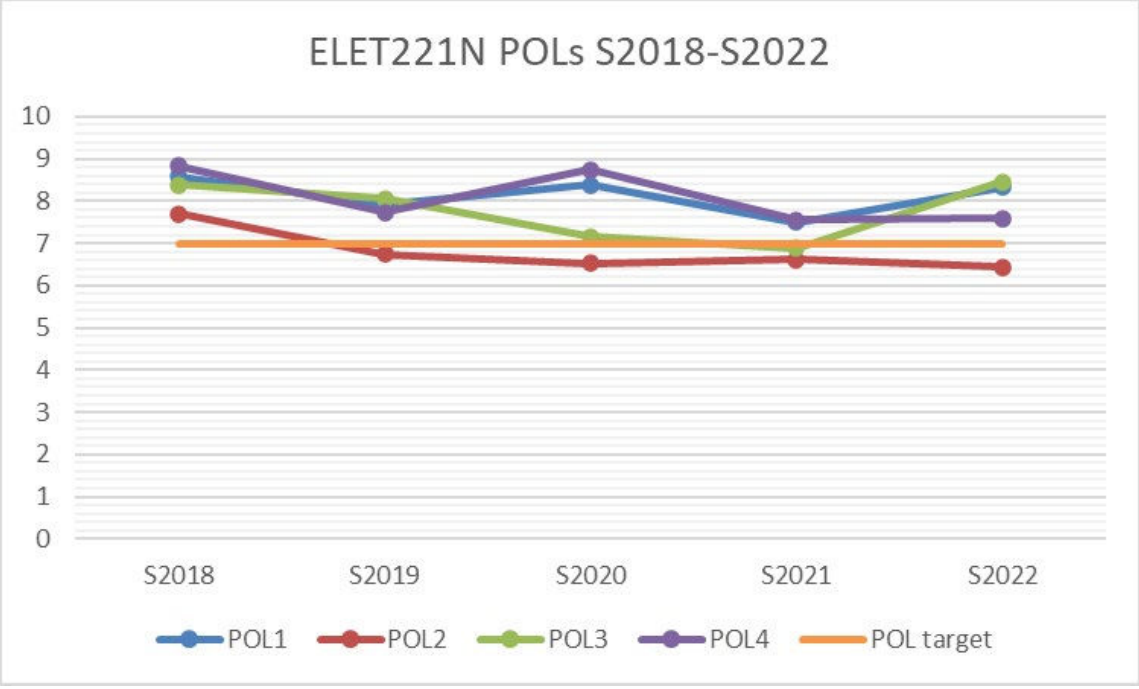
ELET221N: Advanced Digital Electronics

B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET221N Advanced Digital Circuits	1) Understand synchronous and asynchronous circuits by implementing various types of shift register (SR) circuits and using state machines and state diagrams to implement and apply circuits to real world applications 2) Understand memory basics including the various types of memory devices such as RAM, ROM, Flash, etc. 3) Be able to design basic programmable devices such as CPLDs and FPGAs in a real-world application 4) Be able to discuss the computer bus basics including the different types (parallel, serial, USB, etc.)

D. Evaluation - Data Collected for each POL, S2018-S2022

	S2018	S2019	S2020	S2021	S2022
POL1	8.58	7.92	8.39	7.49	8.33
POL2	7.69	6.74	6.53	6.62	6.43
POL3	8.38	8.05	7.16	6.89	8.45
POL4	8.83	7.74	8.74	7.56	7.59
POL target	7	7	7	7	7
# students	10	9	9	9	3



E. Using Results for Continuous Improvement – Summary Analysis

All POLs are consistent with previous years. POL2 has repeatedly been below 7. Memory and memory design are very detailed and somewhat harder than the rest of the course. The belief is that a hardware lab is needed, not just a simulation only lab as has been implemented for the past several years.

Instructor assessment includes:

- Lab rubric was implemented in S2022 that gave credit for lab performance with only 20% of the lab grade based on the lab report. This appears to have had a positive impact.

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list two open action items:

- Need to look at other resources for memory lectures
- Time to start looking at a new textbook

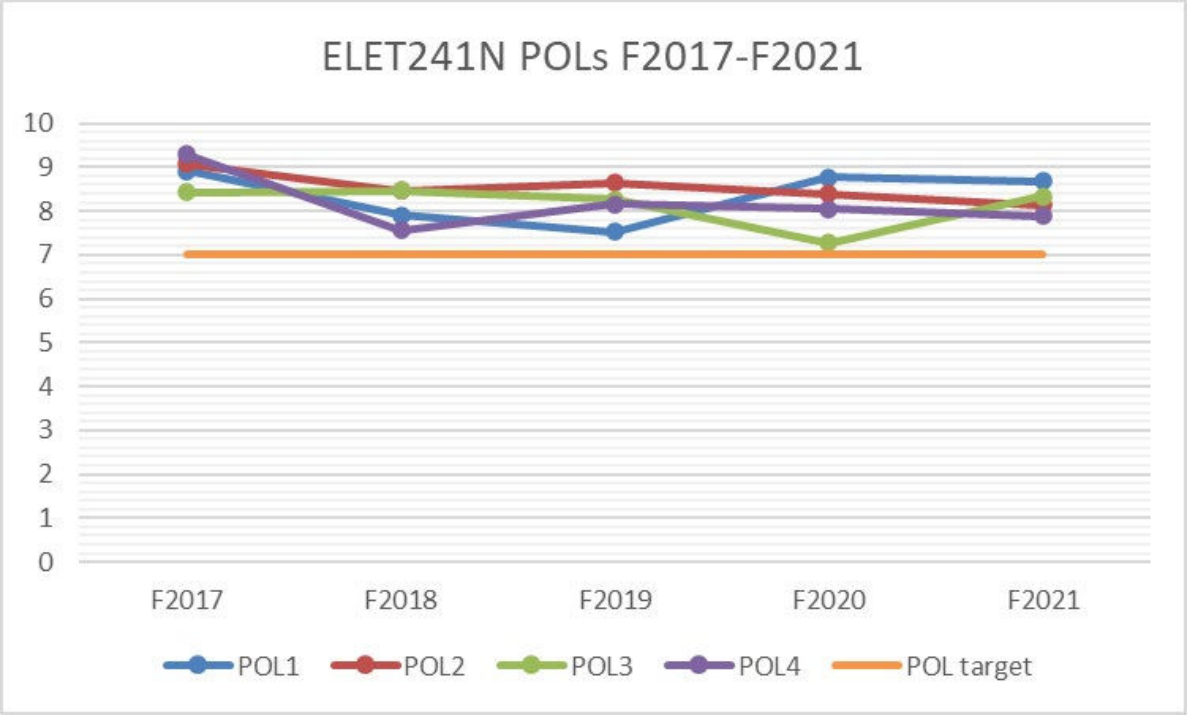
ELET241N: Electronics II

B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET241N Electronics II	1) Understand logarithms, decibels, Bode Plots and Miller Effect Capacitance 2) Be able to calculate Frequency Response for BJT and FET Amplifiers as well as Op-Amps 3) Show how the single-ended output voltage of an Op-Amp depends on its open-loop gain and differential input voltage 4) Work with differential, instrumentation and bridge amplifiers and calculate the effects for AC performance, bandwidth, slew rate and noise

D. Evaluation - Data Collected for each POL, F2017-F2021

	F2017	F2018	F2019	F2020	F2021
POL1	8.91	7.9	7.53	8.77	8.68
POL2	9.07	8.47	8.64	8.39	8.14
POL3	8.43	8.46	8.26	7.27	8.33
POL4	9.29	7.57	8.15	8.05	7.88
POL target	7	7	7	7	7
# students	13	8	9	8	4



E. Using Results for Continuous Improvement – Summary Analysis

All POLs are consistent with previous years. There are no concerns.

Instructor assessment includes:

- Assign more homework problems throughout the semester that focus on op-amp application circuits

The detailed instructor POL assessments are available in Improve.

The program internal meeting minutes, dated 5/27/22, list no open action items.

ELET245N: Communications Theory

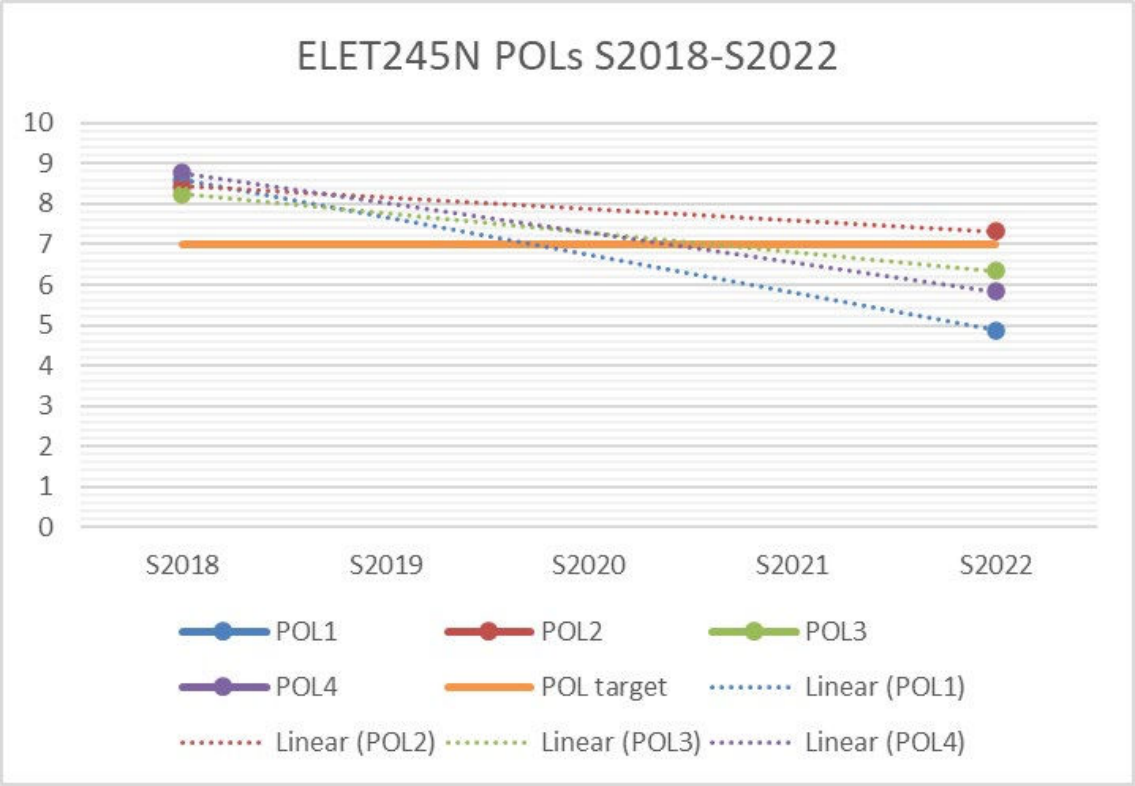
B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET245N Communications Theory	1) Understand the basics of Electronic Communications and Digital Communications 2) Explain the fundamentals of Amplitude Modulation (AM), Frequency Modulation (FM) and know the differences between time division multiplexing, frequency division multiplexing and digital modulation 3) Explain the basics of transmission line theory and perform communication circuit analysis using computer simulations 4) Understand principles of Data Communications

D. Evaluation - Data Collected for each POL, S2018-S2022

Prior to AY21-22, if an adjunct instructor taught a course, data was not collected. An adjunct instructor has taught this course for the last several years. Data was collected in S2018 but not requested again until S2022.

	S2018	S2019	S2020	S2021	S2022
POL1	8.6				4.87
POL2	8.44				7.32
POL3	8.25				6.35
POL4	8.76				5.84
POL target	7	7	7	7	7
# students	9				3



E. Using Results for Continuous Improvement – Summary Analysis

Given that data was not collected for S2018, S2019, S2020, and S2021, linear lines were included in the graph to extrapolate trends.

The small sample size of 3 students makes it difficult to clearly assess a pattern. The POLs are down from S2018. Data will be collected and reviewed in S2023 to see if a pattern exists or if the small sample size is the major factor.

The detailed instructor POL assessment is available in Improve.

The program internal meeting minutes, dated 5/27/22, list no open action items.

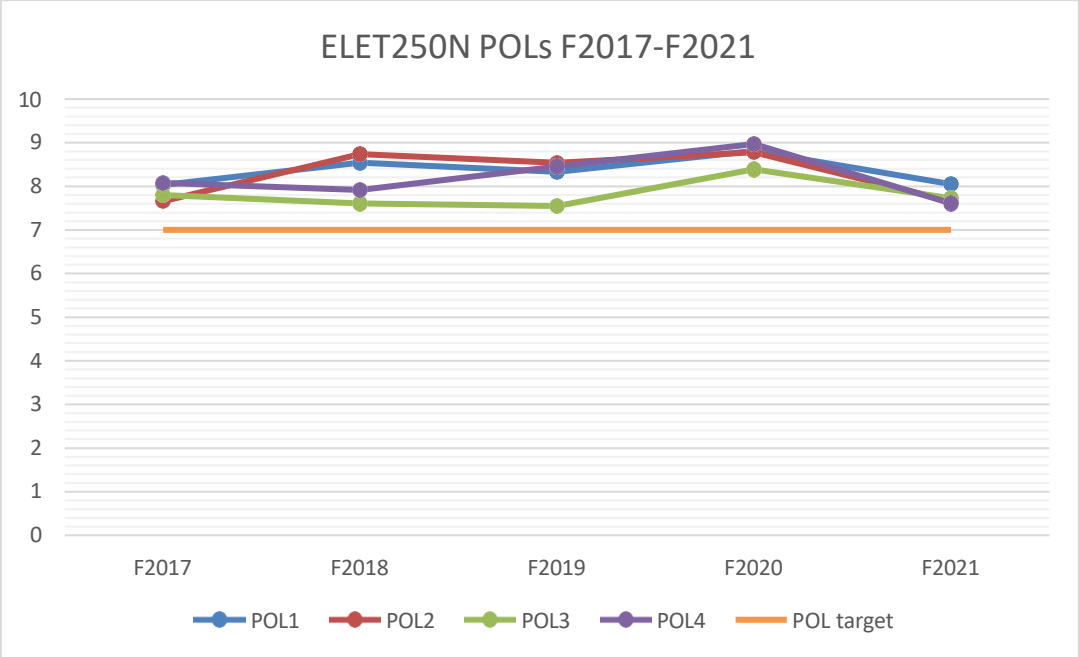
ELET250N: Microcontrollers

B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET250N Microcontrollers	1) Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors 2) Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors 3) Interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals 4) Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques

D. Evaluation - Data Collected for each POL, F2017-F2021

	F2017	F2018	F2019	F2020	F2021
POL1	8.03	8.54	8.33	8.81	8.05
POL2	7.66	8.74	8.54	8.78	7.66
POL3	7.8	7.61	7.55	8.39	7.73
POL4	8.08	7.92	8.45	8.97	7.61
POL target	7	7	7	7	7
# students	9	10	13	8	14



E. Using Results for Continuous Improvement – Summary Analysis

All POLs are consistent with previous years. All POLs for F2021 are > 7.0. There are no concerns.

Instructor assessment includes:
This was the first time the instructor taught the course. The instructor now has a better understanding of what needs to be emphasized and when.

The detailed instructor POL assessment is available in Improve.

The program internal meeting minutes, dated 5/27/22, list one open action items:

- Need to find new microcontroller and textbook for this course. Textbook is no longer available in print, only e-book and the companion microcontroller evaluation board has been discontinued.

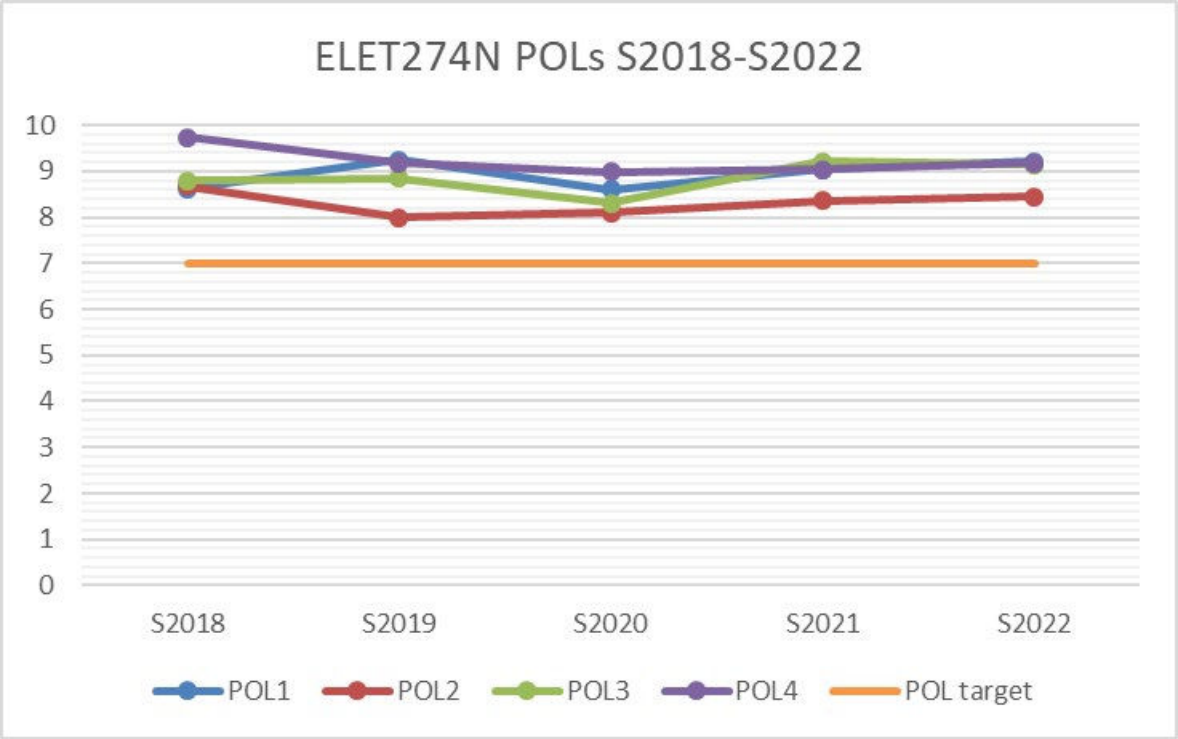
ELET274N: EET Capstone

B. Assessment Metrics – Points of Learning

Course	Points of Learning
ELET274N EET Capstone	1) Create a Project Plan which includes but is not limited to: the project proposal, circuit design, simulation, test plans, bill of materials, flowcharts and software code (where applicable), and demonstration of a working prototype 2) Create a project test evaluation plan to assure the project works as initially specified 3) Apply formal communication skills with client / customer (if applicable), instructor, teammates in both oral and written form. This includes but is not limited to regular status reports and formal public presentation 4) Demonstrate teamwork which includes professional, ethical, and social responsibilities

D. Evaluation - Data Collected for each POL, S2018-S2022

	S2018	S2019	S2020	S2021	S2022
POL1	8.62	9.25	8.6	9.03	9.22
POL2	8.67	8	8.1	8.36	8.44
POL3	8.8	8.85	8.31	9.22	9.15
POL4	9.73	9.17	8.98	9.03	9.17
POL target	7	7	7	7	7
# students	9	7	10	7	9



E. Using Results for Continuous Improvement – Summary Analysis

All POLs are consistent with previous years. All POLs for S2022 are > 7.0. There are no concerns.

Instructor assessment includes:
This was the first time the instructor taught the course. The instructor now has a better understanding of what needs to be emphasized and when.

The detailed instructor POL assessment is available in Improve.

The program internal meeting minutes, dated 5/27/22, list one open action items:

- As stated in the course assessment forms, the concept of test plans (unit, integrated, …) is foreign to the students. This could be improved if the course were longer (across 2 semesters like NHTI) or add another course on these topics such as CSCI140N (System Analysis and Design) has in Computer Science. This is the same action item from the S2021 meeting but with two new FT faculty members, this needs to be revisited.

STUDENT OUTCOMES:

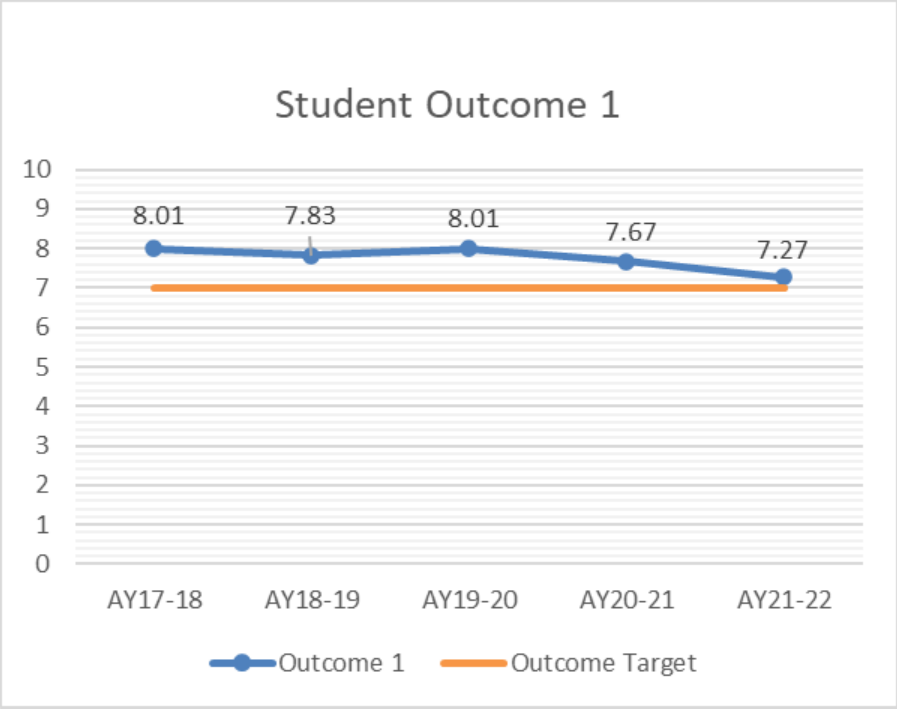
To make it easier for the reader, **Criterion 4 sections B, D and E** are organized by course, with their associated POLs 1-4, then program student outcomes 1-5. Each student outcome includes three sections:

B. Assessment Metrics and Methods of Student Outcomes
D. Evaluation
E. Using Results for Continuous Improvement

STUDENT OUTCOME 1:
Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.

B. Assessment Metrics – Points of Learning
Student outcome 1 data is calculated based on the course POLs as shown in Appendix I. The mapping as shown currently averages 39 out of the 40 available POLs to generate the student outcome 1 results. This mapping was maintained for consistency with the approach used in previous years. However, the current EET faculty have concerns about the number of contributors to this calculation that may be effectively averaging out meaningful information. The current EET faculty will be reviewing how the student outcomes are calculated and will make recommendations. Any recommended changes will be reviewed using the process shown in Figure 3-1 to establish or modify student outcomes.

D. Evaluation – Data for Student Outcome 1, AY17-18 to AY21-22



E. Using Results for Continuous Improvement – Summary Analysis

Student outcome 1 has decreased since AY19-20. Looking at the POL contributors, ELET121N POL4, ELET131N POL4, ELET141N POL2, and ELET245N POL1 were all under 5.0. The focus on improving these course POLs as described in the course assessments should improve this number for AY22-23.

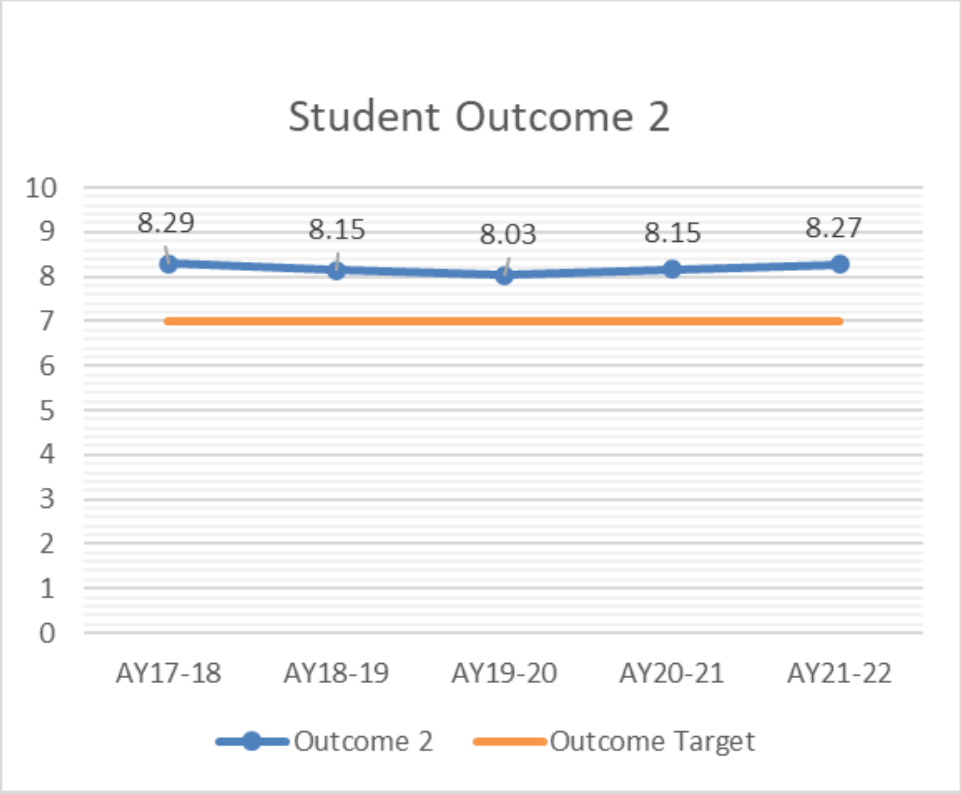
STUDENT OUTCOME 2:

Design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline.

B. Assessment Metrics – Points of Learning

Student outcome 2 data is calculated based on the course POLs as shown in Appendix I. The mapping as shown currently averages 5 out of the 40 available POLs to generate the student outcome 2 results.

D. Evaluation – Data for Student Outcome 2, AY17-18 to AY21-22



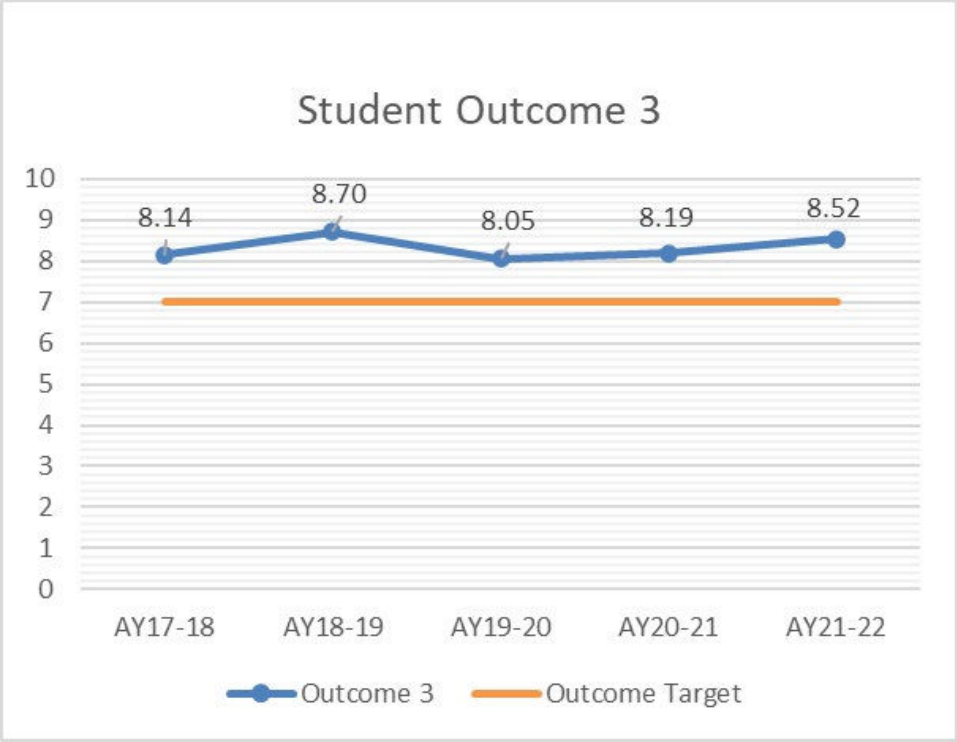
E. Using Results for Continuous Improvement – Summary Analysis

Student outcome 2 has been consistent over the last 5 years. There are no immediate concerns. The course assessments outline suggested improvements for their respective course POLs. Improvements in the contributing POLs will improve student outcome 2.

STUDENT OUTCOME 3:
Apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.

B. Assessment Metrics – Points of Learning
Student outcome 3 data is calculated based on the course POLs as shown in Appendix I. The mapping as shown currently averages 6 out of the 40 available POLs to generate the student outcome 3 results.

D. Evaluation – Data for Student Outcome 3, AY17-18 to AY21-22



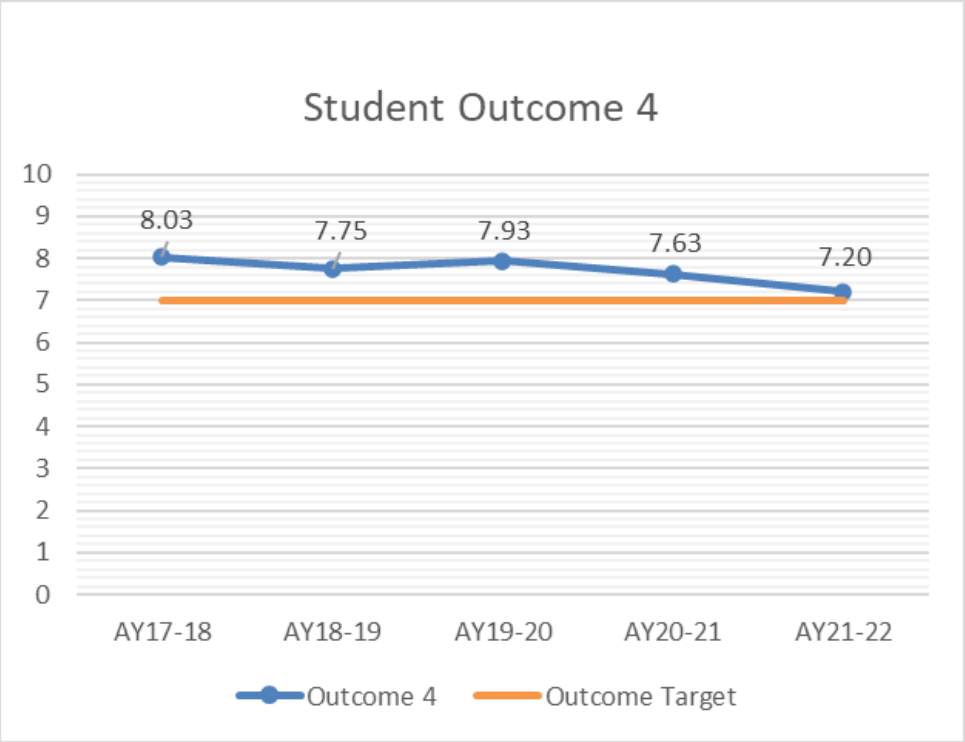
E. Using Results for Continuous Improvement – Summary Analysis
Student outcome 3 has been consistent over the last 5 years. There are no concerns. The course assessments outline suggested improvements for their respective course POLs. Improvements in the contributing POLs will improve student outcome 3.

STUDENT OUTCOME 4:
Conduct standard tests, measurements, and experiments and to analyze and interpret the results.

B. Assessment Metrics – Points of Learning

Student outcome 4 data is calculated based on the course POLs as shown in Appendix I. The mapping as shown currently averages 22 out of the 40 available POLs to generate the student outcome 4 results. This mapping was maintained for consistency with the approach used in previous years. However, the current EET faculty have concerns about the number of contributors to this calculation that may be effectively averaging out meaningful information. The current EET faculty will be reviewing how the student outcomes are calculated and will make recommendations. Any recommended changes will be reviewed using the process shown in Figure 3-1 to establish or modify student outcomes.

D. Evaluation – Data for Student Outcome 4, AY17-18 to AY21-22



E. Using Results for Continuous Improvement – Summary Analysis

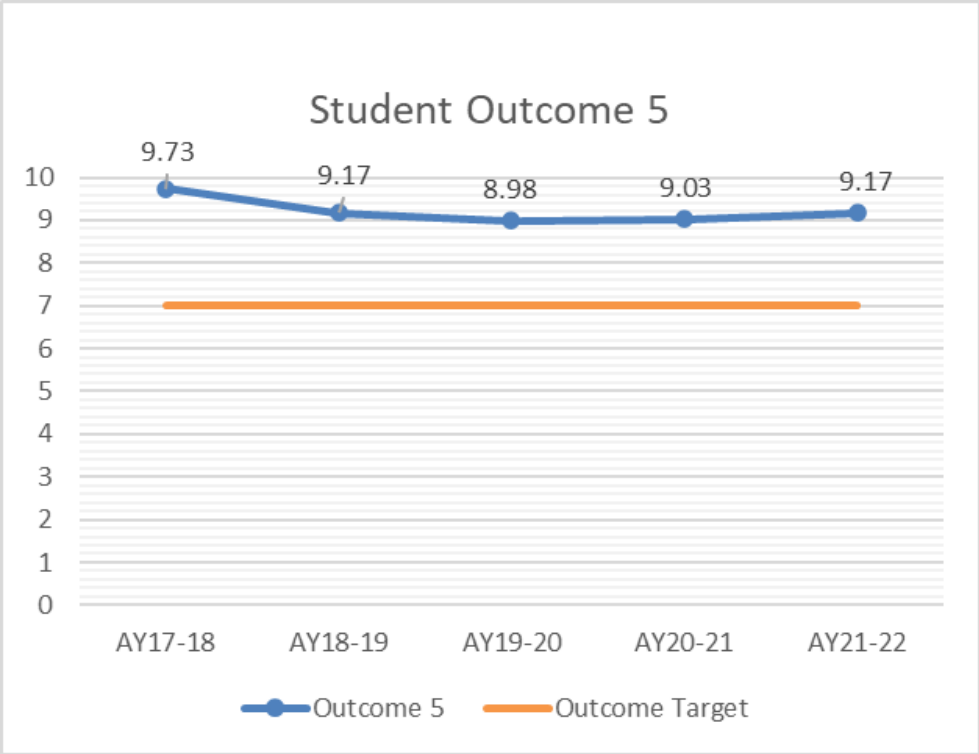
Student outcome 4 has decreased since AY19-20. Looking at the POL contributors, ELET131N POL4, ELET141N POL2, and ELET245N POL1 were all under 5.0. The focus on improving these course POLs as described in the course assessments should improve this number for AY22-23.

STUDENT OUTCOME 5:
Function effectively as a member of a technical team.

B. Assessment Metrics – Points of Learning

Student outcome 5 data is calculated based on a single course POL as shown in Appendix I. This mapping was maintained for consistency with the approach used in previous years. However, the current EET faculty have concerns about using only a single POL to measure teamwork. The current EET faculty will be reviewing how the student outcome is calculated and will make recommendations. Any recommended changes will be reviewed using the process shown in Figure 3-1 to establish or modify student outcomes.

D. Evaluation – Data for Student Outcome 5, AY17-18 to AY21-22



E. Using Results for Continuous Improvement – Summary Analysis

Student outcome 5 has been consistent over the last 5 years. There are no concerns. The ELET274N course assessment outlines suggested improvements for the course POLs. Improvements in the POL4 will improve student outcome 5.

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F. Using Other Input for Continuous Improvement

If other input is also used for continuous improvement of the program, describe it here.

The POLs for each course are stated in the course syllabi and measured, where appropriate, throughout the semester through:

- Exam questions
- Labs
- Quizzes
- Homework assignments

Each POL is normalized to the range 0 – 10.0.

The current assessment method calculates each POL based on the class averages of its component scores.

For example, the POL calculations for **ELET250 F2021** (Microcontrollers) are shown below:

How were POL scores evaluated for this course?
POL1 = Average of EXAM1(1-9, 32-38)); HW/Labs
POL2 = Average of EXAM1(22-26, 49); EXAM2(16); HW/Labs
POL3 = Average of EXAM2(3,13,14)); EXAM3(2,6,11,12); HW/Labs
POL4 = Average of EXAM3(10-14)); HW/Labs
Note - HW/Labs counts 2 exam questions
Note - HW 10% / Lab 30%, average is (HW + Labs*3)/4

For POL1, the class average of Exam1 Q1-9, Q32-38, and the class average of (HW + Labs*3)/4 are used to calculate the final result. If the POL is >= 7.0, the criterion has been met.

Other departments at NCC currently utilize a different approach to assessing course competencies. They measure the course competencies per student and evaluate whether a percentage of students meet a defined threshold for that competency. In an effort to align with the other departments, the EET department has begun to calculate the POLs for each student per course, then compare those results to a defined threshold.

For 100-level courses, the target is 50% of students scoring >= 7.0 for each POL.

For 200-level courses, the target is 70% of students scoring >= 7.0 for each POL.

These calculations will not replace the POL assessment method currently used and documented for ABET but will be used in addition to the current method to evaluate POLs and consequently program student outcomes. The EET department will assess both methods for at least the next 2 years to gauge whether additional insights can be gained into student performance using this individual student assessment method.

Figure 4-3 illustrates a part of the assessment report generated by Improve for ELET250N. In the *Results* column for reporting period 2021-2022 (Fall), there are two assessment methods for POL1. The first assessment method shows the % of students individually scoring >= 7.0 for POL1. In this example, 79% of the 14 students met the criteria, with a target of 70%. The second assessment method shows the average of POL1 for all students. In this example, the average of POL1 for all students was 8.05, so the target of >= 7.0 was met.

Figure 4-3: Improve Report, ELET250N

Program/Course Assessment - Electronic Engineering Technology (AS)

ELET250N:Microcontrollers

Course Competencies	*Assessment Methods*	*Results*	*Use of Results*
1. Intel Embedded Microcontrollers - Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors. **Course Competency Status:** Active **Assessment Cycles:** 2017 - 2018 (Fall), 2018 - 2019 (Fall), 2019 - 2020 (Fall), 2020 - 2021 (Fall), 2021-2022 (Fall)	**Series of Assignments -** Homeworks, Exams, and Labs are used to determine the overall grade. ***Criterion:** 70% of students achieve >= 7.0 out of 10.0	**Reporting Period:** 2021-2022 (Fall) **Result Type:** Criteria Met 79% (05/25/2022) **Total # of Students Assessed:** 14 **# of Students Meeting Criteria:** 11 **Related Documents:** ELET250N Assessment F2021.docx EET Assessment Report 5-31-22.docx	**Use of Results:** EET Assessment Report 5-31-22 document and ELET250N Assessment F2021 document explain the Use of Results. (06/08/2022)
	Series of Assignments - Homeworks, Exams, and Labs are used to determine the overall grade. ***Criterion:** Average of POL for all students >= 7.0 out of 10.0	**Reporting Period:** 2021-2022 (Fall) **Result Type:** Criteria Met Average of POL for all students = 8.05 out of 10.00 (05/26/2022) **Total # of Students Assessed:** 14 **Related Documents:** ELET250N Assessment F2021.docx EET Assessment Report 5-31-22.docx	**Use of Results:** EET Assessment Report 5-31-22 document and ELET250N Assessment F2021 document explain the Use of Results. (05/26/2022)
		Reporting Period: 2020-2021 (Fall) **Result Type:** Criteria Met Average of POL for all students = 8.81 out of 10.00 (12/17/2020) **Total # of Students Assessed:** 8 **Related Documents:** ELET250N-1_F2020_Assessment.docx Electrical Engineering Technology May 31 2021 Assessment Report.docx ELET Assessment Meeting Notes 011421.pdf	**Use of Results:** See Related Documents in Results section: Electrical Engineering Technology May 31 2021 Assessment Report.docx ELET Assessment Meeting Notes 011421.pdf ELET250N-1_F2020_Assessment.docx
		Reporting Period: 2019-2020 (Fall) **Result Type:** Criteria Met Average of POL for all students = 8.33 out of 10.00 (12/23/2019) **Total # of Students Assessed:** 13 **Related Documents:** ELET250N-A_F2019_Assessment.docx	**Use of Results:** See Related Document in Results section: ELET250N-A_F2019_Assessment.docx
		Reporting Period: 2018 - 2019 **Result Type:** Criteria Met Average of POL for all students = 8.54 out of 10.00 (12/19/2018) **Total # of Students Assessed:** 10 **Related Documents:** ELET250N-A_F2018_Assessment.docx	**Use of Results:** See Related Document in Results section: ELET250N-A_F2018_Assessment.docx
		Reporting Period: 2017 - 2018 **Result Type:** Criteria Met Average of POL for all students = 8.03 out of 10.00 (02/06/2018) **Total # of Students Assessed:** 9 **Related Documents:** ELET250N-A_F2017_Assessment (2).docx ELET Assessment Meeting Notes 020518.docx	**Use of Results:** Will keep the using the Final Project instead of a Final Exam going forward. Both Professor's Poteat and Marcotte Agree on 12/12/2017. See Related Documents in Results section: ELET Assessment Meeting Notes 020518.docx and ELET250N-A_F2017_Assessment (2).docx (02/06/2018)

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CRITERION 5. CURRICULUM

A. Program Curriculum

The applicable program criteria could include statements that add specificity to the general curricular requirements found in Criterion 5 to differentiate the discipline designated by the program's title. These should be included in the program's coursework. Contact ABET at etac@abet.org if you have questions about the program criteria that apply to your program.

1. *Complete Table 5-1 that describes the plan of study for students in this program, including information on course offerings in the form of a recommended schedule by year and term, along with average section enrollments for all courses in the program over the two years immediately preceding the review. State whether the program is based on a quarter system or a semester system and complete a separate table for each option in the program.*

   The plan of study for students in the EET program is contained in Table 5-1. The program is based on a semester system.

   The objectives in the Nashua Community College Electronics Engineering Technology program are to place our students in competitively compensated entry-level positions or to assist them in pursuing baccalaureate programs. We achieve these objectives by offering well-structured sequences of courses that build on the skills learned one semester after the next. A spiral approach to education is applied; students are introduced to concepts which are reinforced with a more in-depth perspective. Each theoretical concept is backed by numerous hours of practical laboratory experience. The vast majority of classes run with 2 hour or 3 hour lectures plus 3 hours of laboratory time. This amount of laboratory time provides our students the opportunity to work directly with faculty to grasp the concepts presented in the lecture/theory part of the course.

   We are continuously evaluating the curriculum and modifying it to maintain currency with the ever-changing technology. We are mindful that fundamentals that do not change radically. Problem solving techniques, basic technical skills, presentation, and communications skills do not change as rapidly as the new software and hardware platform technologies. We start with solid fundamentals and then modify our courses to include the latest technologies.

2. *Briefly describe how the curriculum and its associated prerequisite structure support the attainment of the student outcomes.*

   The EET program student outcomes are listed below with an elaboration of how our curriculum aligns with each outcome:

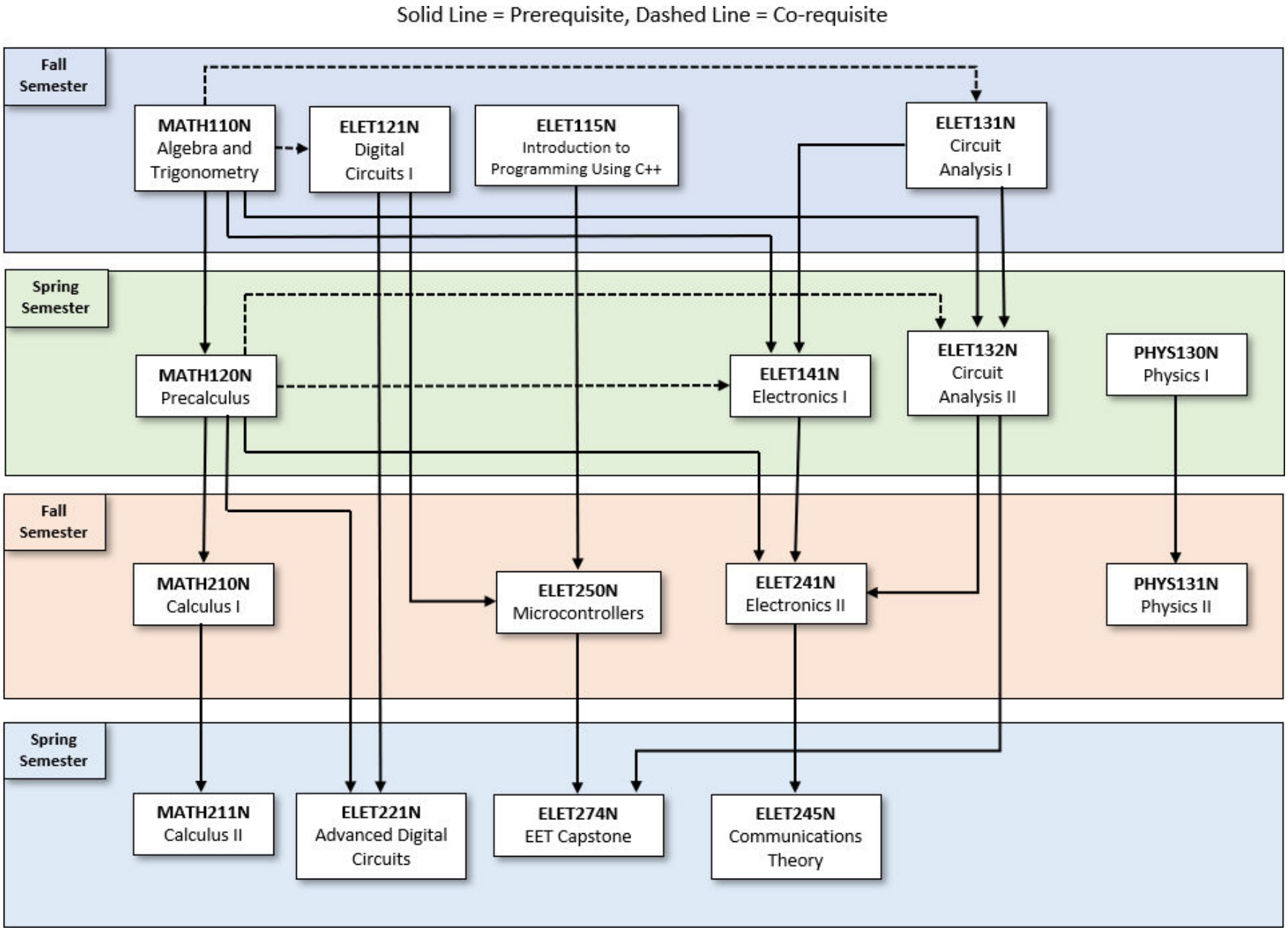
STUDENT OUTCOME	CURRICULUM ALIGNMENT
1. Apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	All EET courses with a focus on technology include a lecture component in which students learn theoretical knowledge and a lab component in which students learn hands on skills. As the students progress through courses and through the program, problems become increasingly more complex, and a greater level of independence is required to complete assignments.
2. Design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline.	Students in ELET221N, ELET250N, and ELET274N build on skills learned in previous courses to design solutions to in-depth problem statements. In ELET221N and ELET250N, problem statements include real-word applications defined by the instructor. In ELET274N (Capstone), the students define their own detailed problem statement via their project proposal, then design and implement a solution.
3. Apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.	Students in ELET131N, ELET132N, ELET141N, and ELET142N produce written reports that meet defined format requirements. Many students enter the program with weak written and oral communication skills. There is a learning curve in this regard, but students eventually succeed. Expressions in graphical modes are practiced and reinforced in lectures and labs given in ELET131N, ELET132N, ELET141N and ELET241N. Extensive use of oscilloscopes, circuit simulators and Excel workbooks is integrated into the laboratory work.

4. Conduct standard tests, measurements, and experiments and to analyze and interpret the results.	Every EET course includes a lab component. Electrical circuits and electronics courses include ELET121N, ELET131N, ELET132N, ELET141N, ELET221N, ELET241N, ELET245N, ELET250N, and ELET274N. In these courses, students learn the basics of dc and ac circuit theory and how to construct circuits that include passive and active electronic components, embedded microcomputer systems, and laboratory equipment. Individual hardware components are covered in ELET131N, ELET141N and ELET121N. ELET132N, ELET241N and ELET221N cover the integration of hardware components into a more complex circuits and electronic functions. ELET250N covers the programming and control of electronic hardware. In each lab, students are instructed in the construction of circuits, measurements of defined parameters, and analysis and interpretation of results.
5. Function effectively as a member of a technical team.	The EET Capstone course introduces students to industry work and provides a starting point for working as a member of a technical team. Capstone students are expected to work with their teammates to help debug hardware/software issues and provide productive feedback on oral presentations. While their projects are individually defined and implemented, Capstone students are expected to support each other to achieve project success.

3. *Attach a flowchart or worksheet that illustrates the prerequisite structure of the program's required courses. If there are differences between the current curriculum and the one in effect for the graduate's transcripts to be sent to the evaluators, please provide prerequisite structure for both sets of requirements.*

   This section illustrates current prerequisites required for the EET curriculum as of this writing. See Figure 5-1, EET Program Course Prerequisites and Co-requisites

Figure 5-1: EET Program Course Prerequisites and Co-requisites



4. *Describe how your program meets the specific requirements for each curricular area (Mathematics, Discipline Specific Content, Other Content, Physical and Natural Sciences, etc.) specifically addressed by either the general criteria or the specific program criteria, which should be shown in Table 5-1. Describe how the application of algebra and trigonometry (for A.S. programs) or integral and differential calculus or other mathematics above the level of algebra and trigonometry (for B.S. programs) is accomplished.*

   ELET131N (Circuit Analysis I) and ELET132N (Circuit Analysis II), ELET141N (Electronics I), and ELET241N (Electronics II) require the ability to apply a practical knowledge of math, at the level of algebra, trigonometry, and physics to electrical and electronic circuits. To support this requirement, MATH110N (Algebra and Trigonometry) is a co-requisite for ELET131N and a prerequisite for ELET132N. MATH120N (Precalculus) is a co-requisite for ELET141N and a prerequisite for ELET241N.

   The EET curriculum includes MATH210N (Calculus I). This is consistent with many ABET accredited ASEET degrees and gives the students a foundation in Calculus that the program leadership believes is essential to a well-rounded ASEET graduate. It is also consistent with our dual-admission agreement with the University of New Hampshire – Manchester BSEET program. MATH211N (Calculus II) is available as a major elective that students can choose if they intend to continue their education at the bachelor's degree level in either EET or Electrical Engineering.

   The EET curriculum includes PHYS130N (Physics I) and PHYS131N (Physics II), each with 3 hours of lecture and 3 hours of lab. This gives the students a broader understanding of the physical sciences and reinforces mathematical skills, problem-solving skills, lab techniques, and communication of qualitative and quantitative information orally and written.

   In ENGL101N (College Composition), students learn to write clearly and effectively for defined audiences through a variety of strategies. In ELET122N (Technical Writing), students learn how to analyze technical documents and write a variety of technical assignments, including instructions, feasibility reports, and proposals. This gives the students a foundation in written communication that is essential to success in the workplace.

   In PSYC130N (or behavioral social science elective), students explore intrapersonal (within self) and interpersonal (between self and others) aspects of human relationships. An understanding of basic psychological concepts and their connection to interpersonal relationships are presented. Integration of effective communication, stress reduction, and team and leadership strategies in both the home and workplace will be encouraged.

5. *Describe how industry and engineering standards and codes; public safety and health; and local and global impact of engineering solutions on individuals, organizations and society are addressed in the curriculum.*

   The EET Capstone course described in Section 8 introduces the students to the expectations for professional conduct in the workplace. This includes exposure to industry standards for documentation. As part of their project presentation, the students are asked to consider and comment on how their project could potentially impact the greater community, both locally and globally.

6. *Describe how professional and ethical responsibilities, diversity and inclusion awareness, and quality and continuous improvement are addressed in the curriculum.*

   Professional behavior is expected of all students in the program. Students are expected to use professional language and to behave appropriately towards one another. Due to the multicultural backgrounds of our students, this can sometimes be a challenge; however, the program instructors are aware of these challenges and provide effective guidance to students with regard to professional conduct. We impress on them the need to do the required work, take notes, and the benefit of professional behavior and initiative.

   Ethical behavior is enforced in all EET courses; students must complete their own work. Consequences range from obtaining a zero grade on an assignment to failing the course or being dismissed from the program. Students who cheat and copy the work of others are usually discovered in introductory courses and don't usually complete the program.

   The EET plan of study requires a Humanities course, HUMA230N**,** Ethics in the Workplace. The course is an introductory study of classical and contemporary ethical philosophies and how these philosophies apply to current business practices. The course stresses analytical and problem-solving skills to comprehend the ethical dimensions of business relationships: employer to employee; managers to owners; manufacturers to consumers; and corporations to the environment.

   In the EET Capstone course, there is a lecture/quiz specific to ethics in engineering. We discuss the IEEE Code of Ethics, the Association for Computing Machinery (ACM) Code of Ethics, and the National Society of Professional Engineers (NSPE) Code of Ethics.

7. *Describe how the curriculum provides physical or natural science content and laboratory experiences appropriate to the discipline and the laboratory experiences of the students.*

   EET first year courses teach students the basic skills required in the field of electronic engineering technology. Students learn the practical knowledge of their field of study and obtain hands on experience in labs, both in the context of theory of circuit analysis, electronic devices, digital logic, computer programming and hardware used in the electronic engineering technology industry. Each core EET course includes 3-hour

laboratory experiments each week to supplement classroom lectures. Second year courses include more advanced courses in electronics, digital circuits, group projects and the construction of electronic circuits and software control processes that require final presentations and documentation.

The EET curriculum includes PHYS130N (Physics I) and PHYS131N (Physics II), each with 3 hours of lecture and 3 hours of lab. This gives the students a broader understanding of the physical sciences and reinforces mathematical skills, problem-solving skills, lab techniques, and communication of qualitative and quantitative information orally and written.

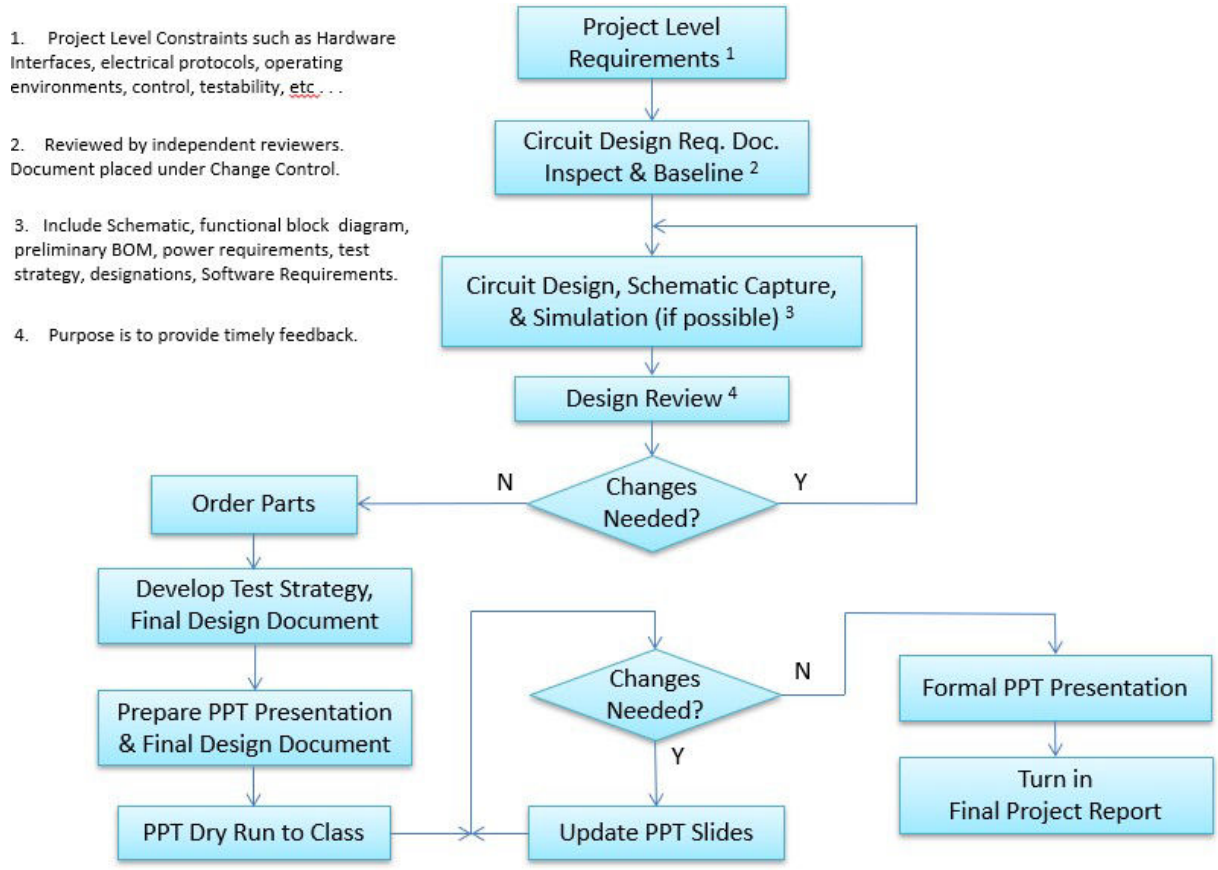
8. *Describe how the curriculum accomplishes a capstone or integrating experience (required by either the general criteria for baccalaureate programs or program criteria) and describe how this experience develops student competencies in applying both technical and non-technical skills in solving problems.*

The EET Capstone course requires that students implement a design of their choosing that utilizes the breadth of technical skills they have learned throughout the EET program. Their project must utilize both their hardware and software skills. The course requires developing a project proposal, documenting schedule/status, tracking a Bill Of Materials (BOM) and associated project cost, and writing a test plan. The culmination of the EET Capstone course is presentation of their completed work both in writing and in person to an audience of professors, students, advisory board members, and industry partners.

The Capstone experience introduces students to industry work and provides a starting point for networking with industry professionals. We often find that industry professionals contact us looking for students and graduates with specific skills.

The EET Capstone Activities Flow Chart is shown in Figure 5-2.

Figure 5-2: EET Capstone Activities Flowchart



9. *If your program allows cooperative education or internships to satisfy curricular requirements specifically addressed by either the general or program criteria, describe the academic component of this experience and how it is evaluated by the program.*

   The Electronic Engineering Technology program does not have a formal cooperative education component in its curriculum; however, as mentioned above, there is a Capstone project (ELET274N).

10. *Describe by example how the evaluation team will be able to relate the course materials (course syllabi, course material, and sample student work, etc.), to compliance with Criterion 5 or specific Program Criteria. (See APPM Section I.E.5.b.(2) regarding Materials.)*

    a. *Evaluators will review samples of course materials including course syllabi, example assignments and exams, and representative examples of graded student work, typically ranging from excellent through poor. Specifically, materials will include:*

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1) *illustration of topic coverage required in Criterion 5 or specific Program Criteria requirements;*
2) *work samples demonstrating student progression in increasingly complex technical specialties; and*
3) *when applicable, example of capstone projects or integrating experiences.*

b. *At the program's discretion, other materials that illustrate novel, unusual or creative efforts to enrich the curriculum and/or attainment of student outcomes may be provided.*

During the evaluator site visit, display material in the ABET electronic workroom will be consistent with the Program's Course of Study. It will demonstrate students' development and attainment of student outcomes as they progress through the program. The display materials will provide examples of student work, outcome assessment methods and rubrics.

Additional materials that will be available for review during the visit to further demonstrate achievement related to this criterion:

- Examples of textbooks
- Examples of graded homework assignments, lab reports, quizzes, exams, and finals
- EET Capstone project examples
- Minutes of Industrial Advisory Board meetings
- Minutes of EET department meetings
- Raw data from assessment methods
- Reports from Improve

Table 5-1 Curriculum

Associate in Science in Electronic Engineering Technology

Course (Department, Number, Title) List all courses in the program by term starting with first term of the first year and ending with the last term of the final year. FR = Freshman, First Year SR = Senior, Second Year	Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]	*Curricular Area (Credit Hours)*				Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1] Lecture / Lab
		Math and Physical /Natural Sciences	Discipline Specific Content	General Education /General Studies	Other		
ELET115N Introduction to Programming Using C++ (2 Lecture, 3 Lab) (FR Fall Semester)	R		3			FA20, FA21	22
ELET121N Digital Circuits I (2 Lecture, 3 Lab) (FR Fall Semester)	R		3			FA20, FA21	8
ELET131N Circuit Analysis I (3 Lecture, 3 Lab) (FR Fall Semester)	R		4			FA20, FA21	13 / 9
ENGL101N College Composition (4 Lecture, 0 Lab) (FR Fall Semester)	R			4		FA20, FA21	19
MATH110N Algebra and Trigonometry (4 Lecture, 0 Lab) (FR Fall Semester)	R	4				FA20, FA21	13
ELET132N Circuit Analysis II (3 Lecture, 3 Lab) (FR Spring Semester)	R		4			SP21, SP22	12 / 6
ELET141N Electronics I (3 Lecture, 3 Lab) (FR Spring Semester)	R		4			SP21, SP22	7
ENGL122N Technical Writing (3 Lecture, 0 Lab) (FR Spring Semester)	R			3		SP21, SP22	19
MATH120N Precalculus (4 Lecture, 0 Lab) (FR Spring Semester)	R	4				SP21, SP22	16
PHYS130N Physics I (3 Lecture, 3 Lab) (FR Spring Semester)	R	4				SP21, SP22	21
ELET250N Microcontrollers (3 Lecture, 3 Lab) (SR Fall Semester)	R		4			FA20, FA21	13 / 6
ELET241N Electronics II (3 Lecture, 3 Lab) (SR Fall Semester)	R		4			FA20, FA21	7
HUMA230N Ethics in the Workplace (3 Lecture, 0 Lab) (SR Fall Semester)	R			3		FA20, FA21	21

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Course (Department, Number, Title) List all courses in the program by term starting with first term of the first year and ending with the last term of the final year. FR = Freshman, First Year SR = Senior, Second Year	Indicate Whether Course is Required, Elective, or a Selective Elective by an R, an E or an SE[2]	*Curricular Area (Credit Hours)*				Last Two Terms the Course was Offered: Year and, Semester, or Quarter	Average Section Enrollment for the Last Two Terms the Course was Offered[1] Lecture / Lab
		Math and Physical /Natural Sciences	Discipline Specific Content	General Education /General Studies	Other		
MATH210N Calculus I (4 Lecture, 0 Lab) (SR Fall Semester)	R	4				FA20, FA21	20
PHYS131N Physics II (3 Lecture, 3 Lab) (SR Fall Semester)	R	4				FA20, FA21	10
ELET221N Advanced Digital Circuits (3 Lecture, 3 Lab) (SR Spring Semester)	R		4			SP21, SP22	6
ELET245N Communications Theory (2 Lecture, 2 Lab) (SR Spring Semester) **and/ or**	SE		3			SP21, SP22	4
MATH211N Calculus II (4 Lecture, 0 Lab) (SR Spring Semester)	SE	4				SP21, SP22	11
ELET274N EET Capstone Project (1 Lecture, 3 Lab) (SR Spring Semester)	R		2			SP21, SP22	8
PSYC130N Human Relations **or** General Education Core Requirement Elective: Behavioral Social Science (3 Lecture, 0 Lab) (SR Spring Semester)	SE			3		SP21, SP22	17
TOTALS		20-24	32-35	13			
OVERALL TOTAL CREDIT HOURS FOR THE DEGREE	68-72						
PERCENT OF TOTAL		29-33%	47-49%	18-19%			

1. For courses that include multiple elements (lecture, laboratory, recitation, etc.), indicate the average enrollment in each element.
2. Required courses are required of all students in the program, elective courses are optional for students, and selected electives are courses where students must take one or more courses from a specified group.
3. General Education or General Studies, are required core courses outside of the major (e.g. art, history, social sciences, etc.)

Instructional materials and student work verifying compliance with ABET criteria for the categories indicated above will be required during the review

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B. Course Syllabi

In Appendix A of the Self-Study Report, include a syllabus for each course used for the degree using the recommended format guidelines found there.

See Appendix A for all course syllabi.

C. Advisory Committee

Describe the composition of the program's advisory committee (for example: individuals, company/organization, and job title) and describe how it is representative of organizations served by the program's graduates. Describe activities of the advisory committee, provide evidence (i.e., minutes of meetings) that it periodically reviews the program's curriculum and program educational objectives, and advises the program of the current and future aspects of the technical fields for which the graduates are being prepared.

The EET and CET (Computer Engineering Technology) programs maintain a common Industrial Advisory Board (IAB). The Industrial Advisory Board members represent the industries and businesses that have often employed our graduates. Also, members of our board include faculty from other academic institutions whose programs are similar to ours. The primary purpose of the advisory board is to help maintain a relevant and quality educational program. The committee exists to advise, assist, support and advocate for career and technical education. It has no legislative, administrative, or programmatic authority and is advisory only. Members are volunteers who share an expert knowledge of the career tasks and competency requirements for specific occupations. The duties of the board include, but are not limited to:

- Helping with long term academic planning and accreditation.
- Advise, support and advocate for career and technical education.
- Assist in increasing the prominence of the EET/CET department within the community.
- Provide input and feedback on program educational objectives.
- Provide input and feedback on student outcomes.
- Providing advice on curricular issues and helping to make sure the curriculum is relevant to practicing electronic and computer engineers and/or technicians.

Members of the IAB represent a large cross section of industry and in a variety of capacities. All companies represented by IAB members are principally located in Southern New Hampshire and Northern Massachusetts and have a vested interest in the success of the EET/CET programs. The educational institutions represented are UNH-Manchester, NHTI and NCC. NCC and NHTI have the only ABET-accredited ASEET programs in NH. UNH-Manchester has the only ABET-accredited BSEET in NH.

The formal participation of the advisory board members at annual meetings and the informal conversations when needed gives members, faculty and administrators, and students

opportunities to review the program's curriculum and advise on the establishment, review, and revision of its program educational objectives and student outcomes.

Advice of the Industrial Advisory Board on current and future needs of industry and trends give the program a way to ensure its graduates are adequately prepared for their career. IAB participation from members of four-year institutions helps our program better prepare those students with baccalaureate aspirations.

The most recent Advisory Board meeting was held on May 9, 2022 at NCC. Minutes for this meeting, and for past IAB meetings, will be available for review by the ABET visiting team.

CRITERION 6. FACULTY

A. Faculty Qualifications

Describe the qualifications of the faculty and how they are adequate to cover all the curricular areas of the program and meet any applicable program criteria. This description should include the composition, size, credentials, and experience of the faculty. Complete Table 6-1. Include faculty curriculum vitae in Appendix B, using the recommended format guidelines found there.

The Electronic Engineering Technology (EET) Department has two full-time professors and two adjunct professors. Susan Hughes is the EET Program Coordinator (PC) and a full-time EET professor, and also the program coordinator for the Computer Engineering Technology (CET) program. This is her first-year teaching at Nashua Community College after 8 years as an adjunct professor in the EET department at New Hampshire Technical Institute (NHTI) in Concord, NH. As program coordinator, Susan has primary responsibility for advising the EET/CET students. Program coordinators implement degree and certificate programs under the direction of Department Chairs. Program coordinators assist Department Chairs with the recruitment of faculty, development of curricula, assessment of program effectiveness, and resolution of student concerns. Program coordinators also evaluate transfer of credits, participate in Open House events, construct the budget for the program, lead the Industry Advisory Board and participate in the work of various College committees. In addition, the program coordinator visits local high schools and speaks to the engineering bound students about the EET program.

Austin Hewin is the second full-time EET professor. This is his first year teaching at Nashua Community College after 12 years as a professor in the EET program at Fayetteville Technical Community College in Fayetteville, NC. Austin has primary responsibility for the maintenance and organization of the EET lab. He assists the program coordinator as needed, including but not limited to advising EET/CET students, assessment of program effectiveness, participating in Open House events, and recruiting at local high schools.

The EET department currently employs two adjunct professors. James Noon currently teaches ELET141N (Electronics I) and ELET132N (Circuit Analysis II). He has significant experience in analog circuit design. Ali Hammoodi currently teaches ELET121N (Digital Circuits I) and ELET245N (Communications Theory). He has a PhD in

Telecommunications and Network Theory. Both are well qualified to teach the courses they have been assigned.

The EET Program is under the Department of Engineering and Computing Sciences. The interim Department Chair is Professor Barry Garside, who is also the Associate Vice President of Academic Affairs.

Our faculty is a compilation of great teaching experience, industry experience and advanced educational degrees. Their industry experience facilitates relating the electronic engineering labs and theories to real-world industry examples. Table 6-1 contains faculty qualifications.

In the past year, both full-time faculty members have taught one course for the Computer Sciences department. This allows our full-time faculty to maintain and enhance our programming expertise, which is an essential component of any EET program. It has also allowed us to continue to employ our two adjunct faculty each semester while maintaining our required full-time faculty workload, despite lower enrollment in the EET program over the last few years.

B. Faculty Workload

Complete Table 6-2, Faculty Workload Summary and describe this information in terms of institutional workload expectations or requirements for the current academic year.

Table 6-2, Faculty Workload Summary provides the information related to faculty workload.

Full-time faculty workload is governed by the Collective Bargaining Agreement between the Community College System of New Hampshire (CCSNH) and the New Hampshire Higher Education Union (NHHEU)/IBEW 2320. The current agreement in place is valid until June 30, 2022. The FT Faculty Collective Bargaining Agreement can be found on the CCSNH website.

- Article 8 of the "Agreement" specifies the work year and schedule for the faculty.
- Article 10 of the "Agreement" specifies the faculty workload and describes the responsibilities of the faculty.

A tentative agreement has been reached to extend the CBA, with a vote scheduled in Summer 2022.

Adjunct faculty are represented by the State Employees' Association of New Hampshire, Inc., SEIU Local 1984 (SEA). The Adjunct Faculty Collective Bargaining Agreement 2017-2018 can be found on the CCSNH website.

To summarize, each full-time faculty is required to teach 15-18 contact hours per semester for a total of 30 - 36 contact hours per academic year. Prior to final approval by the Vice President of Academic Affairs, the program coordinator assigns the workload so that over an academic year, faculty and administration have maximum flexibility. In determining a faculty member's instructional load, the program coordinator takes into consideration such factors as lab and lecture hours, number of preparations, number of students, and other

responsibilities, serving on campus committees, or working on assigned non-classroom projects.

C. Faculty Size

Discuss the adequacy of the size of the faculty in maintaining continuity, stability, and oversight of the program, and describe the extent and quality of faculty involvement in interactions with students and advising.

With two full-time faculty, the EET department is adequately sized to meet the needs of the 2022-2023 academic year. In addition, we have two adjunct faculty as well as support personnel. Our adjunct faculty teach evening courses only as they both work full-time in the industry. The number of our personnel facilitates reasonable class sizes and maximizes our student/instructor interaction. Larger class size is common in the first year, with a smaller class size in the second year.

The full-time faculty members provide oversight, continuity, and stability to manage the curriculum reasonably. The full-time faculty, consulting with adjunct faculty and the department head, have the appropriate authority for the creation, delivery, evaluation, and modification of courses that comprise the program, through the documented curriculum change process.

D. Professional Development

Provide a description of program professional development support for faculty and a general description of how faculty avail themselves of these opportunities to maintain competency and contribute to their discipline (specific recent activities for each faculty member should be noted in their CV in Appendix B).

NCC leadership fully acknowledges the value of life-long learning and strongly encourages faculty to engage in meaningful professional development activities and ongoing educational opportunities. Moreover, the college recognizes that these endeavors are particularly critical for faculty in technical fields and highly supports EET professors pursuing activities of this nature. In most cases, the institution funds professional development activities through the college's general funds; however, in certain cases, faculty receive professional training through grant opportunities. In addition, the Community College System of New Hampshire provides faculty a 100% tuition abatement for any course taken within the Community College System.

Over the past two years, the challenges brought about by the worldwide pandemic have led to a smaller number of NCC employees who have participated in professional development activities. Despite this fact, the EET faculty at NCC have engaged in several activities aimed at improving the quality of instruction, enhancing program assessment, and ensuring the EET curriculum remains current with industry standards. These activities include the Embedded Systems Conference (2019), a Basics of Program Assessment (2022), and ABET Accreditation & Assessment Essentials (2022). The college fully supports professional

development of this nature and encourages EET faculty to pursue future training in the coming semesters.

E. Authority and Responsibility of Faculty

Describe the role played by the faculty with respect to course creation, modification, and evaluation, their role in the definition and revision of program educational objectives and student outcomes, and their role in the attainment of the student outcomes. Describe the roles of others on campus, e.g., dean or provost, with respect to these areas.

At NCC, faculty have responsibility for the construction, oversight, and evaluation of curriculum and student learning. Department chairs and program coordinators play a particularly important role in these processes and are responsible for instructional content, course sequence, scheduling, and the hiring of faculty. In addition, they, along with program faculty, ensure program content is coherent, up-to-date, and in line with the needs of business and industry.

Each course at NCC has a corresponding "Course Outline Form" detailing important course information, including course name, number, course description, learning competencies, number of credits, and prerequisites. DCs and PCs review course outlines on a regular basis to ensure that courses remain current and have appropriate breadth, depth, and logical progression of subject content, and any PC or DC wishing to make changes to any of the elements on the form must go through the college's Curriculum Committee to do so. In order to maintain proper record keeping and preserve historical accuracy, NCC stores all the Course Outline Forms on the college's assessment platform, Improve.

The college's Curriculum Committee plays a critical role in ensuring programs and courses at NCC are relevant, maintain a high level of quality, and are delivered with integrity. The committee is comprised of six faculty members from various academic areas in the college and is responsible for approving proposed curricular changes and ensuring such changes meet the needs of students and align with the institutional mission. During the academic year, the committee meets monthly and reviews proposals regarding course additions and deletions, learning outcomes, prerequisites, course titles, and credit hours. In the approval process, the committee takes into account numerous educational and institutional considerations, including the college mission, institutional capacity, available resources, business and industry trends, impact on other college programs, and faculty expertise.

NCC regards the evaluation and assessment of student learning as critically important and devotes significant institutional resources to the completion of this work. Moreover, in recent years, the college has made great strides in embedding assessment into the culture of the institution. Each program coordinator at NCC is responsible for the assessment of student learning within their own program, and the college's Associate Vice President of Academic Affairs is assigned the responsibility of guiding assessment efforts across campus. Faculty are expected to record relevant data, evaluate student learning, use the data for instructional improvement, and store such data in the college's assessment platform, Improve. Though the quality of assessment efforts varies across programs, most liberal arts programs are performing meaningful assessment and evaluation of student work. For instance, the mathematics department performs an ongoing assessment of all mathematics courses at the

institution and maintains excellent documentation of this work. A segment of the mathematics department's MATH120N Precalculus Assessment Report can be seen in Figure 6-1, and the English department's ENGL101N College Composition Report can be seen in Figure 6-2.

Figure 6-1: Segment of MATH120N Algebra and Trigonometry Assessment Report

MATH120N: Precalculus

Course Competencies	*Assessment Methods*	*Results*	*Use of Results*
7. Express Complex Numbers - Express complex numbers in rectangular, polar and exponential forms **Course Competency Status:** Active	**Exam -** Final Exam Question(s) ***Criterion:** 60% of students will achieve a grade of 75% or higher on these problems	**Reporting Period:** 2021-2022 (Spring) **Result Type:** Criteria Not Met 44% (06/01/2022) **Total # of Students Assessed:** 18 **# of Students Meeting Criteria:** 8	**Use of Results:** The following is planned to further improve student performance. Modify instructional techniques to improve student performance on practice problems. (i.e. include practice assignments graded based on accuracy, administer quizzes based on assigned practice problems etc..). Modify assessment methods to Include a review section on each exam to give students multiple opportunities to receive feedback on their performance. Changes to be implemented Fall 2022 (06/09/2022)

Figure 6-2: Segment of ENGL101N College Composition Report

ENGL101N:College Composition

Course Competencies	*Assessment Methods*	*Results*	*Use of Results*
#1 Writing Process Steps - Use the following steps in the writing process as the way to develop writing product • Prewrite • Write/draft • Revise • Edit **Course Competency Status:** Active	**Research Paper -** Persuasive Essay graded with rubric ***Criterion:** 80 percent of students will earn 80 percent or better (B- or 3 on rubric) **Notes:** Spring 2021	**Reporting Period:** 2021-2022 (Spring) **Result Type:** Criteria Not Met 74 percent of students met this criteria. (01/03/2022) **Total # of Students Assessed:** 69 **# of Students Meeting Criteria:** 51 **Related Documents:** ENGL101 Spring 2021 Final Assessment Rubric Spreadsheet.xlsx Persuasive Essay Rubric for Students--Revised 2020.docx	
	Research Paper - Persuasive research essay graded with common rubric. ***Criterion:** 80 percent of students will earn 80 percent or better (B- or 3 on rubric)	**Reporting Period:** 2021-2022 (Fall) **Result Type:** Criteria Not Met 67 percent of students met the criteria. (02/01/2022) **Total # of Students Assessed:** 119 **# of Students Meeting Criteria:** 80 **Related Documents:** Fall 2021 ENGL101N Course Competency_Results.xlsx Persuasive Essay Rubric for Students--Revised 2020.docx	**Use of Results:** This competency was not met in Fall 2021 or Spring 2022. In order to improve, instructors will utilize Canvas's peer review function so students can spend more time workshopping/editing one another's papers. Also, instructors will conference, one-on-one, with students on both research essays. (06/16/2022)

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Table 6-1. Faculty Qualifications

Electronic Engineering Technology

Faculty Name	Highest Degree Earned- Field and Year	Rank [1]	Type of Academic Appointment[2] T, TT, NTT	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/summer work in industry
Susan Hughes	MS Electrical Engineering, 1994	P	NA	FT	8	9	1	NA	L	M	L
James Austin Hewin	MS Electrical Engineering, 1999	P	NA	FT	13	13	1	NA	L	M	L
Ali Hammoodi	PhD Telecommunications and Network Engineering, 2018	A	NA	PT	6	7	3	NA	M	M	H
James Noon	MS Electrical Engineering, 1992	A	NA	PT	20	3	3	NA	L	M	H

Instructions: Complete a row for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the review.

1. Code: P = Professor ASC = Associate Professor AST = Assistant Professor I = Instructor A = Adjunct O = Other
2. Code: TT = Tenure Track T = Tenured NTT = Non-Tenure Track
3. At the institution
4. The level of activity, high, medium, or low, should reflect an average over the year prior to the review plus the two previous years.

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Table 6-2. Faculty Workload Summary

Electronic Engineering Technology

Faculty Member (name)	PT or FT[1]	Classes Taught (Course No./Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching ELET/CSCI Courses	Research or Scholarship	Other[4]	
Susan Hughes	FT	Introduction to Programming Using C++ (ELET115N-A/3) Fall 2021 Digital Circuits I (ELET121N-A/3) Fall 2021 Microcontrollers (ELET250N-1/4) Fall 2021 Advanced Digital Electronics (ELET221N-A/4) Spring 2022 EET Capstone (ELET274N-1/2) Spring 2022 Introduction to Programming Using C++ (CSCI175N-A/3) Spring 2022	100	NA	NA	100
Austin Hewin	FT	Digital Circuits I (ELET121N-AL1/3) Fall 2021 Digital Circuits I (ELET121N-1/3) Fall 2021 Circuit Analysis I (ELET131N-A/4) Fall 2021 Circuit Analysis II (ELET132N-A/4) Spring 2022 Electronics I (ELET141N-1/4) Spring 2022 Essentials of Systems Analysis and Design (CSCI140N-A/3) Spring 2022	100	NA	NA	100
Ali Hammoodi	PT	Circuit Analysis I (ELET131N-1/4) Fall 2021 Communications Theory (ELET245N-1/3) Spring 2022	100	NA	NA	100
James Noon	PT	Electronics II (ELET241N-1/4) Fall 2021 Circuit Analysis II (ELET132N-1/4) Spring 2022	100	NA	NA	100

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution
2. For the academic year for which the Self-Study Report is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution. *If a faculty member teaches for more than one program or is an administrator, indicate level of effort for only specific program activities (teaching, etc.).*
6. *Do not include faculty in units that teach service courses, e.g., math or science.*

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CRITERION 7. FACILITIES[1]

A. Offices, Classrooms and Laboratories

Summarize each of the program's facilities, at each location where the program is offered, in terms of their ability to support the attainment of the student outcomes and ability to provide an atmosphere conducive to learning.

1. *Offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment typically available there.*

   Susan Hughes, EET Program Coordinator and full-time EET faculty member, has an office in Room 100. Austin Hewin, full-time EET faculty member, has an office in Room 169. Both full-time faculty offices are located adjacent to the EET lab in Room 171.

   Full-time faculty are provided with a computer and supporting software for the courses they teach. Adjunct faculty meet with students in any available space. There are multiple computers available for adjunct faculty to use in addition to the lab computers in Room 171, which have specific course related software on them. There is adjunct faculty office space in Room 100 with computers and a printer/copier. Full time faculty and staff also have desk phones for their use. All faculty and staff have access to any printer/copier on campus. Students can use computers in the EET lab or in the library.

   Office supplies such as pens and office stationery are available in the stockroom cabinet located in Room 100. Requests for items not readily available need to go through purchase-order requisition cycle.

2. *Classrooms and associated equipment typically available where the program courses are taught.*

   Section 3 addresses both classroom and laboratory facilities.

3. *Laboratory facilities including modern tools and equipment that support instruction. Include those facilities used by students in the program, even if they are not dedicated to the program, and state the times they are available to students. Complete Appendix C by listing the major pieces of equipment used by the program in support of instruction. Programs with multiple offering sites should list the equipment and designate its location.*

   The department classrooms and laboratories are furnished with equipment to accomplish the program objectives in an atmosphere conducive to learning. Equipment purchases in the EET Program are guided by our commitment to achieve these objectives as well as to reflect current industry standards and practices.

[1] Include information concerning facilities at all sites where program courses are delivered.

The EET laboratory in Room 171 houses hardware and computing equipment along with the software tools used in the programs and are characteristic of what our students most likely will encounter in industry and in their professional practice.

Additionally, EET students have access to other classrooms and laboratories at the college for mathematics, physics, and general education electives. All classrooms are equipped with projectors or digital displays. Most classrooms also have electronic smartboards.

Conference rooms can easily be reserved for faculty use.

Streeter Room 171

Room 171 is the laboratory for all courses in the Electronic Engineering Technology program. The lab is equipped with a projector and an ENO Smartboard. It has a total of ten lab benches, each equipped with one ESD dissipative chair and an anti-static table mat with wrist strap. The 10 Electro-Static Dissipative chairs have ESD chains which contacts the dissipative carpeting.

Each lab bench consists of a DELL Optiplex 3010 PC equipped with 6 GB of RAM and an Intel i5 processor running at 3.20 GHz. The hard disk drive (HDD) has 930 GB of storage space. Two (2) USB ports as well as a DVD/CD drive are included on the PC. Windows 10 Enterprise operating system is running on the PC.

The following software is installed on each PC:

1. LTspice XVII (17.0.32.0) – Analog Circuit Simulation (ELET131N, ELET132N, ELET141N, ELET241N, ELET274N)
2. NI MultiSim 14.1 (14.1.0) and Logisim (2.7.1) – Digital Circuit Simulation (ELET121N, ELET221N)
3. Quartus Prime Lite Edition (20.1.1) – FPGA Development (ELET221N)
4. Keil µVision5 (5.27.1.0) – 8051 Microcontroller Development (ELET250N)
5. TeraTerm (4.75) – 8051 Microcontroller Development (ELET250N)
6. Atmel Flip (3.4.7) – 8051 Microcontroller Development (ELET250N)
7. Arduino IDE (1.8.2) – Arduino Development (ELET274N)
8. Microsoft Visual Studio Community 2019 (16.11.10) – C++ Programming (ELET274N)
9. Microsoft Office 2016 – Office Software (word processor, spreadsheet, presentation, etc.)

Each lab bench has two oscilloscopes, an HP multimeter, a function generator, and power supplies (see Appendix C for a detailed list of lab equipment). Each of the 10 lab benches has enough room for the collaboration required to build teamwork skills or for individualized instruction required to build problem solving skills. There is also enough space for students to generate and read schematics, solve equations, and test their circuits. All EET related work is conducted in rooms with sufficient space and equipment needed to support application of theoretical and practical knowledge in the pursuit of problem-solving skills.

Streeter Room 170

Room 170 is a computer lab equipped with an ENO Smartboard, networked computers, and a ceiling mounted projector. This computer lab, used for ELET115N – Introduction to Programming using C++, is equipped with 20 Dell computer workstations. The students purchase their own USB Flash drives.

B. Computing Resources

Describe any computing resources (workstations, servers, storage, networks including software) used by the students in the program, at each location where the program is offered, whether in program laboratories or other parts of the institution (e.g., college). Include a discussion of the accessibility of institution-wide computing resources available to all students via various locations such as student housing, library, student union, off-campus, etc. State the hours the various computing facilities are open to students. Assess the adequacy of these facilities to support the scholarly and professional activities of the students and faculty in the program.

Nashua Community College is a single building with many wings. There are a multitude of classrooms, a precision manufacturing shop, an automotive facility/garage, lab spaces, a student center, gymnasium, library and auditorium. The Information Technology (IT) Department provides computing and communications infrastructure, services, and support for students, faculty, and staff.

The library houses over 25 machines which are available during library hours of 8 am to 6 pm weekdays. The machines are installed with most of the software used in the classrooms. Any student can use them on a first come, first serve basis. Students can access the library printer which is one of 11 spread across the campus. The library also offers 2-week loaner laptops to students.

Matriculated students are eligible to borrow a laptop long-term from the college. They can take the machine home with them. They are eligible as long as they are enrolled at Nashua Community College. At any time, there are up to 30 machines in students' hands from this program.

There is Wi-Fi throughout the campus. Wi-Fi access is available via the same account and password used for email. There are also multiple academic servers for specific uses. Computer backup and storage is accomplished both on campus and periodically at an off-site back-up facility for data integrity.

There are approximately 250 student computers in various classrooms across the campus. There are approximately 100 staff and faculty computers.

NCC is part of the seven college Community College System of NH which shares a common Student Information System (SIS), Student Email and Learning Management System (Canvas). Students have access to these systems via the internet when off campus. Nashua Community College is a member of Microsoft Azure. The college maintains a

repository of Microsoft software available for students to download for free or to order DVDs or CDs for a nominal fee. Computers are installed with Microsoft Visual Studio for C++ development and with Eclipse for mixed Java and C++ development.

C. Guidance

Describe how students in the program are provided appropriate guidance, including safety, regarding the use of the modern tools, equipment, computing resources, and laboratories.

Every EET course includes a lab component. At the beginning of the semester, students are provided with step-by-step instructions in how to use the technology required for a course or they are directed to readily available resources with that level of instruction. Additional support is also available, including:

- Step-by-step documents for starting and using programs.
- References to internet resources for starting and using technologies.
- Access to instructors during office hours, lab hours, by appointment, and when professors are available.
- Individualized instruction during lab based on student need.

For example, the instructor may demonstrate the proper way to cut and strip wire for use on breadboards by showing the students in a laboratory demonstration. The instructor may share the desktop computer screen with students while using a software tool such as Tinkercad to instruct students on the proper wiring of a breadboard. The instructor may teach the students the proper way to set a DC voltage on the power supply. In these examples, the instructor is performing the task while the students watch or follow along.

A secondary method of guidance is given through materials provided by the instructor. For example, a link to a YouTube video may be posted on the Canvas LMS so that students can learn how to create and simulate a circuit in LTspice. The professor may provide the students with written step-by-step instructions for using a particular piece of software as another example of guidance.

A final method of guidance is the instructor working one-on-one with a student during office hours or laboratory times. This method of guidance allows students to receive additional help as needed.

When resources are not available, students are not left to fend for themselves; the instructor will step in and provide assistance.

When using any new piece of test equipment, safety protocols are communicated to the students. For example, students are instructed to turn power off before physically modifying an electronic circuit.

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D. Maintenance and Upgrading of Facilities

Describe the policies and procedures for maintaining and upgrading the tools, equipment, computing resources, and laboratories used by students and faculty in the program.

NCC leadership recognizes the importance of maintaining quality equipment, tools, and educational resources for students. To ensure resources are properly distributed to academic programs, the college has a systematic process for determining the appropriate allocation of funds. This process is outlined in Criterion 8, Section B of this document.

NCC is in the process of completing a new STEM wing on campus, with a section devoted to the EET program. The estimated completion date for this facility is June 2023. This facility will consist of 2 faculty offices for the full-time EET faculty, one main lab equipped with 12 lab benches for student use, and a second smaller lab dedicated to the EET capstone course equipped with 5 lab benches.

The labs will be furnished with new equipment that has been approved by the President of the college as follows:

- 19 UniSource PS-2303 Triple Output DC Power Supply
- 19 BK Precision 2831E True RMS Bench Digital Multimeter
- 19 BK Precision 4040B 20 MHz DDS Function Generator

The existing Agilent and Keysight Oscilloscopes will be used in these labs until additional funding is approved to upgrade this equipment.

In addition to test equipment, the college provides all components and materials needed for EET students to succeed in the course labs. These components include but are not limited to the following:

- Wire cutters and 22 AWG solid strand wire
- Breadboards/protoboards
- Passive components such as resistors, capacitors, and inductors
- Active components such as transistors and operational amplifiers
- Digital IC components such as NAND, NOR, Binary Adders, and Magnitude Comparators

The 10 computers in the EET lab are scheduled for upgrade during Summer 2022 to the following machines:

- Lenovo Thinkstation P330
    - Intel Core i7 @ 3.00 GHz
    - 16 GB DDR4 RAM
    - Western Digital 256 GB NVMe Solid State Drive
    - Western Digital 1 TB storage drive
    - Intel UHD Graphics 630
    - DVD Optical Drive

These computers will have the most current version of the software programs needed by EET students installed. This software includes but is not limited to:

- LTspice
- Logisim
- Visual Studio 2019
- Teraterm
- Atmel Flip
- Quartus Prime Lite
- Keil uVision
- Arduino

Nashua Community College is committed to providing students in the EET program with quality resources to achieve their educational goals. The college is investing significant money to build the new EET labs and furnish these labs with quality test equipment. The college is also providing funding for the new Lenovo computers to strengthen the computing resources used in the EET program. Finally, the EET faculty is committed to providing all materials and components needed by the students as well as ensure the latest software versions for the students in the EET courses.

E. Library Services

Describe and evaluate the capability of the library (or libraries) to serve the program, at all locations where the program is offered, including the adequacy of the library's technical collection relative to the needs of the program and the faculty, the adequacy of the process by which faculty may request the library to order books or subscriptions, the library's systems for locating and obtaining electronic information, and any other library services relevant to the needs of the program. Describe how the library supports the scholarly and professional activities of the students and faculty.

All NCC students have access to the services and resources provided at the Walter R. Peterson Library and Learning Commons. The area is approximately 18,000 square feet and houses both cooperative and silent study areas, desktop computers, various seating areas, meeting spaces, study carrels, the college testing center, and tutoring services. The space is utilized by NCC students to study, access academic resources, receive research assistance, obtain help with basic instructional technology, meet with tutors, and use college computers, scanners, and printers.

NCC recognizes the critical importance of providing students with timely access to academic resources that facilitate student learning and appropriate support services. As such, the college's library resources are extensive, comprehensive, and readily available to students. Students have access to more than 40 research databases, including comprehensive multidisciplinary databases such as ProQuest Central and EBSCO Academic Search Premier and specialized databases such as ProQuest's Computer Science database. Moreover, students have 24/7 access to the library's collection of 100,000 e-books and over 40,000 streaming videos covering many academic subject areas.

Library personnel are trained to assist students with a variety of academic needs and are available to students in person and by phone, email, or chat via the library's website. The

library staff also maintains online research and citation guides for students. To facilitate student access to these electronic resources and services, the college's learning management system offers direct, round-the-clock access to the library website from inside each course. The college librarian is available to faculty for scheduling classroom-based library instruction and to consult about finding course resources, including e-books and OER texts.

The NCC library also houses the college's Tutoring Center. NCC offers free tutoring to all students in a variety of academic disciplines, including mathematics, English, and ESL. The Tutoring Center offers drop-in and face-to-face tutoring, and in most cases, students receive assistance from current NCC faculty members. In addition, all NCC students have access to free online tutoring through the online platform *SmartThinking*. The tool is embedded into the college's learning management system, and it enables students to have access to around-the-clock academic support in a wide variety of academic subject areas.

F. Overall Comments on Facilities

Describe how the program ensures the facilities, tools, and equipment used in the program are safe for their intended purposes. (See APPM section I.E.5.b.(1).)

NCC provides students with an outstanding physical learning environment to meet the needs of students and align with the institution's mission. The college facilities are current, appealing, and well maintained, and the layout of the campus layout creates an atmosphere is conducive to learning and safe for students to study or engage socially. The campus has multiple public open areas available for student use, and student activity areas are appropriately separated from classrooms to ensure classroom instruction is not disturbed. The Plant Maintenance Engineer ensures the entire NCC facility properly adheres to all safety and code requirements, and performs annual safety audits for all physical facilities, mechanical equipment, and utilities on campus.

The college's EET instructors consider student safety as critically important, and as such, each instructor meticulously covers safety procedures for the specific equipment used in their course. In addition, students are always supervised by faculty when using lab equipment in the EET lab, and the room is locked when no instructors are available.

CRITERION 8. INSTITUTIONAL SUPPORT

A. Leadership

Describe the leadership of the program and discuss its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the program.

The leadership organization of Nashua Community College's EET program is properly structured, thoughtfully designed, and appropriate for ensuring effective program management (Figure 3). In this organizational model, the EET Program Coordinator (PC) oversees the direct operations of the program and is responsible for ensuring that all program faculty are meeting the appropriate standards. The PC reports directly to the EET Interim Department Chair, and the two regularly consult on matters pertaining to accreditation, scheduling, curricular decisions, and budgetary matters. When matters pertaining to broader institutional issues arise, the department chair and program coordinator meet with the college's VPAA and President for consultation and guidance.

The immediate management of NCC's EET program has undergone a considerable transformation since the last ABET comprehensive visit in 2016; however, the leadership from the institution's highest level has remained remarkably constant. NCC's President has been in office for nearly 25 years, and as such, she has a remarkably thorough understanding of college and system processes, budgeting, academia, and strategic planning. Moreover, she fully recognizes the importance of programmatic accreditation, oversaw the college's first ABET accreditation in 2009, and has directed the EET program through various accreditation proceedings since that time.

NCC's Vice-President of Academic Affairs (VPAA) began serving in the position in the fall of 2017 and is responsible for overseeing all academia at the college. Prior to serving as VPAA, this individual worked at NCC for nearly a decade as a faculty member, program coordinator, and department chair. As such, she has a thorough understanding of NCC's academic operations, hiring procedures, and budgeting processes. Moreover, as a former instructor, she has an excellent grasp of pedological techniques, trends in higher education, and instructional best practices. In her role as VPAA, this individual communicates regularly with the EET department chair and program coordinator on matters pertaining to course scheduling, faculty assignments, budgetary matters, and student issues. In addition, she provides guidance regarding program planning and the determination of future program goals and objectives.

In the early spring of 2021, both of the full-time EET faculty members announced their intention to retire at the end of the semester. In addition to the challenges usually faced in situations such as this, one of these instructors also served as the Computing Science, Technology & Engineering Department Chair, and the other served as the EET Program Coordinator. As such, these individuals played a critical role in the development and delivery of subject content as well as the upkeep, organization, and management of the program operations. Fortunately, the two instructors remain committed to the institution and extremely devoted to the program. In fact, even in retirement, both individuals maintain regular communication with the current program leadership, and each serves as a member of

the program's Industrial Advisory Board. As such, despite the somewhat unusual circumstances, the personnel transition has gone quite smoothly, with minimal disruption of program operations.

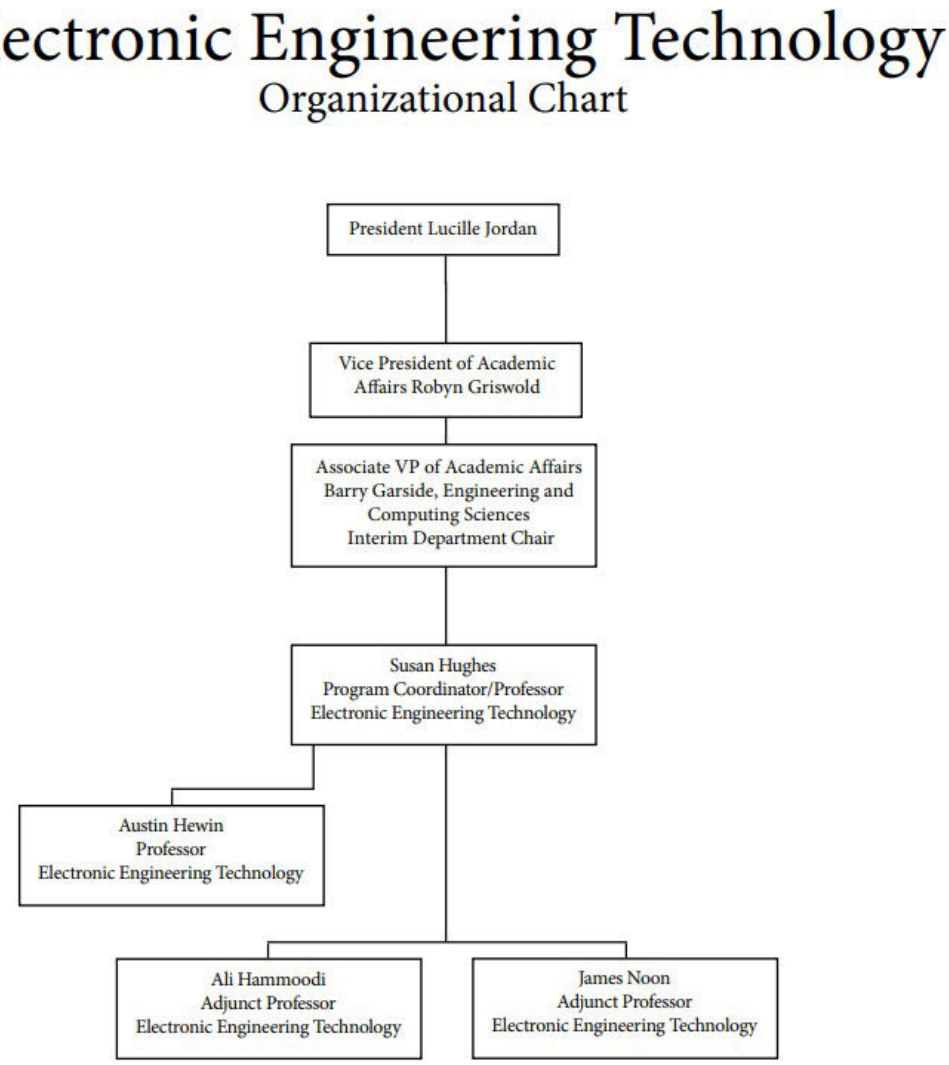
In the summer of 2021, the college faced the decision to replace the outgoing Computing Science, Technology & Engineering Department Chair. Due to the importance of the position and the complex nature of the position's requirements, the college decided to appoint the Associate Vice President of Academic Affairs (AVPAA) as Interim Department Chair. This individual previously served as a mathematics professor and department chair and also has experience overseeing the Computer Science and Data Analytics programs. As a result, he has extensive experience in classroom instruction, program and department management, and curricular matters. In addition, this individual chaired the college's self-study during their most recent comprehensive accreditation review. As such, he has a keen understanding of matters pertaining to institutional and programmatic accreditation and is profoundly aware of the importance of ABET accreditation and the steps required to maintain good standing with accrediting bodies. As a result of the AVPAA's extensive experiences in these areas, the college felt that assigning him to the Interim Department Chair position would help ensure program operations would remain uninterrupted and minimize the potential for any disturbances in the delivery of educational content to students.

In spring 2021, upon being made aware of the upcoming retirements of the two full-time EET faculty members, college leadership immediately set about hiring highly qualified individuals for the positions. The two positions were posted in April 2021, and in the following month, the college hired two outstanding new EET faculty members. Both of the newly hired faculty members have significant teaching experience at similar institutions, and both have extensive experience in engineering fields. As such, the college, at the time of hiring, was confident these two individuals would continue the effective delivery of subject content to learners and provide quality classroom instruction to EET students. Now, after one year of reflection, the confidence that college leadership placed upon these two individuals was not without merit. Both of the newly hired professors are talented, knowledgeable, professional, and committed to the highest quality of instruction and student education. The college is extremely pleased with the performance of the EET faculty and greatly appreciates their contributions to the program.

One of the newly hired EET instructors was also asked to take on the role of EET program coordinator. This individual previously worked as an EET adjunct professor at one of CCSNH's sister colleges, and as a result, is familiar with the usual needs of EET programs, and the manner in which programs of this type operate. As such, she was an excellent candidate for the program coordinator position, and when offered, she readily accepted. Since that time, she has proven herself to be a highly effective leader, who responds to the needs of students, capably handles the day-to-day operations of the program, and provides excellent guidance and mentorship for the other program faculty. In addition, she maintains excellent communication with the Interim Department Chair and VPAA. As a result, matters pertaining to budgeting, scheduling, faculty, or student issues are effectively articulated and brought to the attention of college leaders at various levels. This effective communication helps ensure that issues are properly reviewed and discussed and also helps ensure that important topics are considered from various lenses and perspectives. At this point, both the

EET program and the college administration feel the current organization is extremely effective and quite pleased with the managerial and operational results of the department.

Figure 8-1: EET Organizational Chart



B. Program Budget and Financial Support

1. *Describe the process used to establish the program's budget and provide evidence of continuity of institutional support for the program. Include the sources of financial support including both permanent (recurring) and temporary (one-time) funds.*

2. *Describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc., or technology.*

3. *To the extent not described above, describe how resources are provided to acquire, maintain, and upgrade the infrastructures, facilities, and equipment used in the program.*

4. *Assess the adequacy of the resources described in this section with respect to students in the program attaining the student outcomes.*

The state of New Hampshire recognizes the critical role the Community College System of New Hampshire (CCSNH) plays in educating state residents and sustaining an adequate workforce. As a such, the state legislature maintains a commitment to financially support CCSNH institutions and support the state's community colleges in achieving their missions. In dispersing these resources, the state of New Hampshire appropriates general funding to the Community College System, and these funds are then dispersed to the system colleges in accordance with their enrollment, strategic goals, and financial needs.

In recent years, NCC has received additional financial support from federal funds made available as a result of the worldwide pandemic. However, under usual circumstances, NCC derives revenue from four primary sources:

- The state of New Hampshire's general fund
- Tuition and fees
- Capital Budget requests
- Grants

In the most recent fiscal year, NCC received approximately $7.6 million from state appropriations and $7.3 million from tuition and fees, and as one might expect, college leadership carefully considers numerous internal and external factors when constructing the annual budget. The leadership team solicits input from a wide range of institutional personnel and considers factors such as position vacancies, program needs, campus repairs and improvements, and strategic initiatives when determining the distribution of available funds across campus. The college's financial procedures are thorough, comprehensive, and deliberate, and NCC carefully considers enrollment and retention data when building financial models that guide the institution.

The college's fiscal year begins on July 1st, and though institutional budgeting is ongoing, the college constructs much of its annual budget in January and February of each year. During this time, college leaders meet with program coordinators to review each program's projected needs with regard to personnel, equipment, instructional materials, membership dues, recruitment activities, and professional development. In addition, the parties discuss the program's future goals, strategic planning, and potential opportunities to enhance student learning. At the conclusion of this discussion, each program coordinator formally submits a budget proposal to the college leadership team for approval.

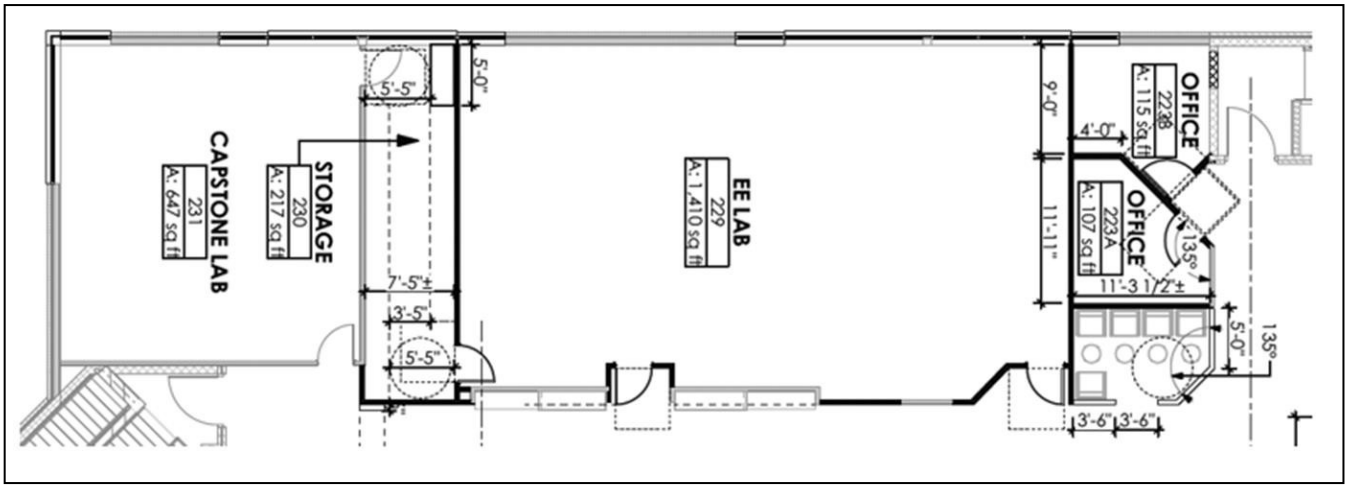
Due to the challenges brought about by a declining number of high school graduates, an extremely competitive labor market, and the worldwide pandemic, NCC has experienced an enrollment decline in recent years. Despite this decline in student enrollment, the program has maintained two full-time instructors, an appropriate number of adjunct faculty, and stable program funding with regard to supplies, food, and staff development over this period (Table 8-1). Moreover, in the spring of 2022, the college president approved funding for an

additional $21,000 of EET equipment, including power supplies, digital multimeters, and function generators.

Table 8-1

Budget FY19	Budget FY20	Budget FY21	Budget FY22
$3,562.25	$5,182.04	$3,886.54	$4,125.00

The EET program currently operates in facilities originally constructed decades ago and, as such, is in need of a new physical learning environment for operation. In recognition of this need, in 2021, NCC leadership secured approximately $2.5 million in state funding to completely revamp the second floor of the college's Streeter Hall building and construct a STEM technology wing for students in Computer Science, Mathematics, Computer Networking, Cybersecurity, and Electronic Engineering Technology. The STEM wing will consist of state-of-the-art classrooms for EET students, separate Capstone and EET labs, faculty offices, a conference room, and student collaborative workspaces.



This new setting will be a dramatic upgrade over the current EET facilities, and program faculty are eagerly anticipating relocating into the new area and recognize the benefit the new environment will play in the effective delivery of program content. The construction of this project began in spring 2022 and is expected to be completed by June 2023.

C. Staffing

Describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the program. Discuss methods used to retain and train staff.

The college regards the EET program as a primary component of the institution's educational offerings and recognizes the importance of providing the program with appropriate staffing to properly deliver academic content to students. In fact, over the past years, program courses have maintained a student-to-teacher ratio of approximately 9:1, and program faculty recognize and appreciate the value small class sizes play in ensuring student success. Due to

the beneficial student-to-instructor ratio, students often get to know their professors well and perceive the program as welcoming, comfortable, and accommodating to their specific needs.

The program is comprised of two-full time instructors, one of whom serves as the EET Program Coordinator, and two adjunct instructors. Each of these individuals is highly qualified, with extensive experience in both academic and industry settings, and capable of delivering high-quality instruction to students. The program coordinator is responsible for the day-to-day operations of the program as well as the program's longer-term strategic planning. As program coordinator, this individual maintains regular communication with all program faculty, the interim department chair, and VPAA to ensure matters pertaining to college operations or the delivery of course content is properly understood by all parties. The college regards this arrangement as highly effective and appropriate for maintaining the appropriate operations of the program and quality academic instruction.

The EET program is also fortunate to employ two highly trained adjunct instructors. Each of these instructors is highly credentialed with extensive experience in industry settings. Each of these individuals has worked at NCC for 3 years and as such, they are quite familiar with the program content, college policies, program instructional delivery methods, and the needs of NCC's EET students.

D. Faculty Hiring and Retention

1. *Describe the process for hiring of new faculty.*
2. *Describe strategies used to retain current qualified faculty.*

NCC has a systematic and coherent hiring process for full-time faculty. The President and VPAA annually evaluate the composition of the faculty, review recent retirements and resignations, and consider enrollment trends across the institution. At that point, they determine the number of full-time faculty positions needed at the institution and the programs in which the newly hired instructions will serve. Available positions are then posted on the CCSNH intranet for seven days for internal candidates, and after that point, the position is advertised publicly on various online platforms.

Upon receiving an appropriate set of applicants, the program coordinator and VPAA review the candidates and assemble an interview committee. Depending on the circumstances, the composition of this committee can vary, but it usually consists of some combination of the program coordinator, department chair, VPAA, Human Resources Director, and additional faculty member or members. In most cases, after the initial interview, the committee invites several candidates to return for a second interview, and often, the candidates are asked to present a teaching lesson to the group. At that point, the committee moves two or three candidates to the President for final interviews and selection.

The college's process for hiring adjunct instructors is less formal but is nevertheless effective in attracting and securing qualified personnel for positions. When program coordinators recognize a need for an adjunct faculty member, the PC contacts the Human resources officer, and an advertisement is then posted on various online job posting sites. Applicants submit an application to the Human Resources office, and these applications are subsequently shared with the program coordinator. At that point, the program coordinator

reviews candidate credentials, schedules interviews, and offers adjunct positions to candidates as needed.

The college leadership recognizes the contributions that both full-time and adjunct instructors make to the institution and take steps to maintain a positive relationship with instructors and retain qualified faculty. Primarily, college leadership believes that faculty ought to feel supported. As such, administrators maintain an "open door" policy and respond quickly to faculty questions and concerns. The college believes this approach enhances the morale at NCC and improves the sense of community on campus.

E. Support of Faculty Professional Development

Describe the adequacy of support for faculty professional development, how such activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.

NCC leadership fully acknowledges the value of life-long learning and strongly encourages faculty to engage in meaningful professional development activities and ongoing educational opportunities. Moreover, the college recognizes that these endeavors are particularly critical for faculty in technical fields and highly supports EET professors pursuing activities of this nature. In most cases, the institution funds professional development activities through the college's general funds; however, in certain cases, faculty receive professional training through grant opportunities. In addition, the Community College System of New Hampshire provides faculty a 100% tuition abatement for any course taken within the Community College System.

Over the past two years, the challenges brought about by the worldwide pandemic have led to a smaller number of NCC employees who have participated in professional development activities. Despite this fact, the EET faculty at NCC have engaged in several activities aimed at improving the quality of instruction, enhancing program assessment, and ensuring the EET curriculum remains current with industry standards. These activities include the Embedded Systems Conference (2019), a Basics of Program Assessment (2022), and ABET Accreditation & Assessment Essentials (2022). The college fully supports professional development of this nature and encourages EET faculty to pursue future training in the coming semesters.

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PROGRAM CRITERIA

Describe how the program satisfies any applicable program criteria. If already covered elsewhere in the Self-Study Report, provide appropriate references.

[NOTE: It can be useful to list the program criteria requirements and then include a description or reference for how the program satisfies each of those requirements. The applicable program criteria could also include statements that add specificity to the curricular and faculty requirements found in Criteria 5 and 6. These should be included in the program's required coursework.]

This section can consist of the listing of required topics and indicating which courses contain that content. The program should expect to provide examples of student work in each topic area to validate the students are doing work related to each topic.

ABET: Electronic Engineering Technology 2-year curriculum
https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-technology-programs-2022-2023/#criteria

"The curriculum must provide associate degree graduates with instruction in the knowledge, techniques, skills and use of modern tools necessary to enter careers in the application, installation, manufacturing, operation and/or maintenance of electrical/electronic(s) systems. Graduates of associate degree programs have strengths in the building, testing, operation, and maintenance of electrical systems.

The curriculum must include the following topics:

a. application of circuit analysis and design, computer programming, associated software, analog and digital electronics, microcomputers, and engineering standards to the building, testing, operation, and maintenance of electrical/electronic(s) systems; and

b. application of natural sciences and mathematics at or above the level of algebra and trigonometry to the building, testing, operation, and maintenance of electrical/electronic systems."

The following tables describe how the Electronic Engineering Technology Program at Nashua Community College meets the ABET stated Program Criteria objectives:

PROGRAM CRITERIA	The application of circuit analysis and design
Course	**Topics**
ELET131N: Circuit Analysis I	DC circuit analysis, including mesh and nodal analysis and network theorems such as Norton's and Thevenin's
ELET132N: Circuit Analysis II	AC circuit analysis techniques including mesh and nodal analysis, and network theorems such as Norton's, Thevenin's, Resonance and basic filters

PROGRAM CRITERIA	Analog and digital electronics
Course	**Topics**
ELET141N: Electronics I	Analysis and application of electronic circuits utilizing semiconductor diodes, operational amplifiers, and transistors
ELET241N: Electronics II	Non-ideal characteristics of op-amps and other electronic devices.
ELET121N: Digital Circuits I	Logic gates, Base 2, 10, and 16 number systems, BCD, Gray and ASCII codes, Boolean algebra, Karnaugh maps, flip-flops.
ELET221N: Advanced Digital Electronics	Flip-flop operations, applications, counter designs using state machines, state diagrams, shift registers, memory devices.

PROGRAM CRITERIA	Computer programming, associated software and microcomputers
Course	**Topics**
ELET115N: Introduction to Programming Using C++	Structured design of code with variables, decisions, loops, functions, arrays, and introduction of pointers. Use of professional programming design approaches and coding style.
ELET250: Microcontrollers	A system level approach to the specification, decomposition, hardware/software development, and system integration for the implementation of embedded system. Microprocessor architecture, instruction sets, interfacing, and real-time programming techniques in assembly language.
ELET221N: Advanced Digital Electronics	FPGA design and development using VHDL.

PROGRAM CRITERIA	**Engineering standards to the building, testing, operation, and maintenance of electrical/electronic(s) systems**
Course	**Topics**
ELET274N: EET Capstone	Document, design and build a project that will use a typical industry project management process and use of Electronic Design Automation (EDA) tools.

PROGRAM CRITERIA	**The application of natural sciences and mathematics at or above the level of algebra and trigonometry to the building, testing, operation, and maintenance of electrical/electronic systems.**
Course	**Topics**
ELET241N: Electronics II	Non-ideal characteristics of op-amps and other electronic devices. Gain, linearity, sensors, modulation, Bode plots, SCRs, TRIACs and optoelectronics. EDA tools are used to reinforce the theory with electronic analysis simulations.
ELET245N: Communications Theory	Electronic communication theory including AM, FM, digital modulation, basic transmission line theory and communication circuit analysis.
ELET274N: EET Capstone	This course is the culmination of two years of theoretical study in the electronics engineering field and is intended to exercise and enhance the student's practical competency in that field.

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APPENDICES

APPENDIX A – COURSE SYLLABI

Please use the following format for the course syllabi (2 pages maximum in Times New Roman 12-point font)

1. *Course number and name*
2. *Credits and contact hours*
3. *Instructor's or course coordinator's name*
4. *Text book, title, author, and year*
    a. *other supplemental materials*
5. *Specific course information*
    a. *brief description of the content of the course (catalog description)*
    b. *prerequisites or co-requisites*
    c. *indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program*
6. *Specific goals for the course*
    a. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a topic.*
    b. *explicitly indicate which of the program's student outcome(s) listed within Criterion 3 or any other outcomes are addressed by the course.*
7. *Brief list of topics to be covered*

Course No. _MATH110N_____ **Title:** Algebra and Trigonometry

Hours per week:_____4__ Instructor: Robert Rock

Credits:____4___ Semester/Year: Fall 2021_____

Course Description:

his course covers essential algebraic and trigonometric concepts and prepares students for future study of pre-calculus and calculus. Algebraic topics include: quadratic functions, radical equations, transformations, composite functions, polynomial functions, remainder and factor theorems, and rational functions. Trigonometry topics include right triangle trigonometry and the laws of Sines and Cosines. Vectors are also studied and applications are emphasized.

Prerequisite: Placement Test or Permission of Instructor. Students who do not satisfactorily place into MATHN110N with the required Accuplacer or SAT scores will be required to enroll in the corresponding Co-Requisite Workshop.

Required Textbook: The textbook for this class is available for free online, in web view and PDF format. Available at: https://openstax.org/details/books/algebra-and-trigonometry

You can also purchase an abbreviated print version via the campus bookstore that contains only the appropriate sections. Or you can purchase a full print from OpenStax on Amazon.com. ISBN 1938168372

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Simplify exponential expressions
- Perform basic operations on radicals and complex numbers
- Solve quadratic equations by factoring, completing the square, and by using the quadratic formula
- Find inverse functions and the composition of functions.
- Perform Transformation of Functions.
- Apply the remainder theorem and factor theorem.
- Solve oblique triangles by using the law of Sines and the law of Cosines
- Apply trigonometric functions to solve word problems
- Perform vector operations and apply these to problem solving

Grading:

Exams (4) [lowest exam grade is dropped] 60%

Assignments 20%

Final Exam 20%

Topics Covered:

Content Topic	**Subtopics**
Exponents and Radicals	A. Exponents and scientific notation B. Radicals and rational expressions
Other Algebra Topics	A. Complex numbers B. Solving quadratic equations C. Solving other types of equations D. Graphing quadratic equations
Functions	A. Relations, functions B. Composition of functions C. Transformations D. Inverse functions E. Applications
Polynomial and Rational Functions	A. Remainder and Factor Theorems B. Polynomial Equations C. Graphing D. Locating roots.
Trigonometric Laws and Vectors	A. Right Triangle Trigonometry B. Law of Sines C. Law of Cosines D. Introduction to vectors E. Applications

Course No. _MATH120N___ **Title:** Pre-Calculus

Hours per week:_____4__ Instructor: Christine Morris

Credits:____4___ Semester/Year: Spring 2022_____

Course Description:

This course is intended to prepare students for the study of calculus. Students will investigate the properties of exponential, logarithmic, and trigonometric functions. Trigonometry topics include graphs of trigonometric functions, identities, inverse trigonometric functions, and trigonometric identities. Other topics include complex numbers, polar coordinates, conics, and DeMoivres' Theorem. Additionally, a selection of topics from the following list may be chosen by the instructor: sequences and series, mathematical induction, binomial expansions, systems of equations and inequalities, introduction to derivatives. Mastery of the topics in this course will prepare the student for Calculus. Applications will be integrated throughout the course and particular attention will be paid to the process of problem solving.

Prerequisite: Placement Test or MATH110N or permission of instructor.

In order to perform the proper mathematical procedures necessary for calculus, it is imperative thatstudents have mastery of algebra and trigonometry material.

Required Textbook: The textbook for this class is available for free online, in web view and PDF format. Available at: www.openstax.org/details/precalculus

You can also purchase an abbreviated print version via the campus bookstore that contains only the appropriate sections. Or you can purchase a full print from OpenStax on Amazon.com. ISBN: 1938168348

Online Lab: XYZ Homework (OpenStax Pass Access Code) - ISBN: 9781630981464

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Solve and graph polynomial, rational, exponential and logarithmic functions.
- Simplify problems using properties of logarithms.
- Use and apply radian measure.
- Graph trigonometric functions.
- Prove trigonometric identities.
- Recognize and graph the conic sections.
- Express complex numbers in rectangular, polar and exponential forms.
- Apply the knowledge of mathematical concepts to problem solving
- Apply skills to several optional topics such as sequences, series, mathematical induction,limits, matrix solutions to systems of linear and nonlinear equations and inequalities.

Grading:

- Unit Exams 60%
- Homework and Assignments 10%
- Homework Quiz 10%
- Final Exam (comprehensive) 20%

Topics Covered:

Topics	**Subtopics**
Transcendental Functions and their Graphs	A. Exponential Functions B. Logarithmic Functions C. Trigonometric Functions D. Solving equations E. E. Applications
Functions	A. Relations, functions B. Composition of functions C. Inverse functions D. Applications
Polynomial and Rational Functions	A. Remainder and Factor Theorems B. Polynomial Equations C. Graphing D. Locating roots.
Complex Numbers	A. Cartesian B. Polar
Determining and Graphing Conics	A. Parabolas B. Circles C. Ellipses D. Hyperbolas
Optional additional topics	A. Sequences B. Series C. Mathematical Induction D. Binomial Expansions E. Systems of Equations F. Systems of inequalities G. Limits

Course No. _MATH210N____ **Title:**_____Calculus I_____

Hours per week:_____4__ Instructor: Christine Morris

Credits:____4___ Semester/Year: Fall 2021_____

Course Description:

Calculus is introduced through studies of functions, limits, differentiation and higher order derivatives. Problems in maximum, minimum and related rates are considered. Integration is introduced by analyzing the definite and indefinite integral, and areas.

Prerequisite: Placement Test or MATH120 or Permission of instructor.

Required Textbook:

William Briggs, Lyle Cochran, Bernard Gillett, Calculus: Early Transcendentals, Pearson, 3rd Ed.

ISBN: 9780134763644

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Discuss the notion of a limit
- Evaluate limits of algebraic and trigonometric functions
- Know and apply the basic rules for differentiation, including power rule, chain rule, product rule, quotient rule, and implicit differentiation
- Accurately find the derivative of trigonometric, inverse trigonometric, exponential, and logarithmic functions
- Use differentiation in applications including optimization and related rates, and L'Hopital's Rule
- Know and apply the fundamental theorem of calculus
- Evaluate integrals and be able to calculate the area under a curve

Grading:

- Unit Exams 60%
- Homework and Assignments 10%
- Homework Quiz 10%
- Final Exam (comprehensive) 20%

Topics Covered:

Content Topic	Subtopics
Limits	A. Definition of a limit B. Finding limits graphically C. Evaluating limits D. Infinite limits
Differentiation	A. Definition of derivative B. Power rule C. Chain rule D. Product rule E. Quotient rule F. Derivatives of transcendental functions G. Implicit Differentiation
Applications of Differentiation	A. First and second derivative tests B. Optimization C. Related rates D. L'Hopital's rule
Integration	A. Fundamental Theorem of Calculus B. Anti-derivatives C. Definite integrals D. Basic Integration techniques E. Area under curves

Course No. MATH211N **Title:** Calculus II

Hours per week: 4 Instructor: Christine Morris

Credits: 4 Semester/Year: Spring 2022

Course Description:

This course is a continuation of Calculus I. Topics include definite and indefinite integration and the use of calculus in the calculation of areas and volumes. Various integration methods are covered including: integration by parts, trigonometric substitution, and partial fractions. Improperintegrals are introduced as well as the study of infinite sequences and series, power series, Taylor series, and determining convergence or divergence of series.

Prerequisite: MATH210N

Required Textbook: William Briggs, Lyle Cochran, Bernard Gillett, Calculus: Early Transcendentals, Pearson, 3rd Ed. ISBN: 9780134763644

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Evaluate improper integrals
- Solve problems involving constant of integration
- Integrate expressions in trigonometric, logarithmic, or exponential form
- Integrate by trigonometric substitution
- Integrate by parts
- Solve first order differential equations
- Apply integration techniques in solving problems
- Find the volume using both the disc and shell methods
- Create and use power series
- Determine if a sequence converges or diverges

Grading:

- Unit Exams 60%
- Homework and Assignments 10%
- Homework Quiz 10%
- Final Exam (comprehensive) 20%

Topics Covered:

Content Topic	**Subtopics**
Application of Integration	A. Area under curves B. Disc method of calculating volume C. Shell method of calculating volume
Integration Techniques	A. Integration by parts B. Trigonometric integrals C. Rationalizing substitutions D. Partial Fractions E. Improper Integrals F. Introduction to differential equations
Sequences and Infinite Series	A. Sequences B. Integral Test C. Ratio Test and Comparison Tests
Power Series	A. Determine the radius of convergence of power series B. Represent functions using Taylor series C. Determine the radius of convergence for Taylor series

Course No. _ENGL101N_____ **Title:** College Composition_____

Hours per week: ____4_____ Instructor: Ann Healy

Credits:____4___ Semester/Year: Fall 2021_____

Course Description:

In this course, students learn to write clearly and effectively for defined audiences through a variety of strategies. Emphasis is on the writing process from pre-writing through drafting, revising and editing. Students gain confidence through learning the basic principles of effective expository composition and the application of these principles in writing essays and documented papers. Students become aware of the variety of strategies, behaviors, habits and attitudes and choose those that help them improve. Students will also read and examine a wide variety of writers and writing styles.

Prerequisite: Students who do not satisfactorily place into ENGL101N with the required Accuplacer or SAT scores will be required to enroll in the corresponding Co-Requisite Workshop.

Required Textbook: The textbook for this class is free and available on Canvas. You can find it under the Textbook button on Canvas.

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

1. Use the following steps in the writing process as the way to develop writing product:
    - Prewrite
    - Write/draft
    - Revise
    - Edit
2. Adapt the writing process to produce writing product that:
    - Has a focus
    - Is developed
    - Is organized
    - Uses language appropriate to the purpose and audience or uses standard written English
    - Uses appropriate format
    - Is a communicating, readable document
3. Recognize writing problems.
4. Experience writing as a complex process involving recursive steps.

Grading:

Narrative Essay 15 %
Process Essay 15 %
Cause/Effect Essay (documented research essay) 20 %
Persuasive Essay (documented research essay) 25 %
Quizzes, homework, rough drafts, etc. 20 %
Oral Defense of Persuasive Argument (final exam) 5 %

Topics Covered:

I. Generate ideas
    A. free write
    B. brainstorm
    C. cluster
    D. outline
    E. journal
II. Define audience
III. Thesis and organization
IV. Modes of writing
V. Construct drafts
VI. Revise
VII. Research techniques

Course No. ENGL122N **Title:** Technical Writing

Hours per week: 3 Instructor: David Sciuto

Credits: 3 Semester/Year: Spring 2022

Course Description:

This course gives students a foundation for communicating effectively in the context of industry and the professional world. Applying principles used in business and industry, students will analyze technical documents and write a variety of technical assignments including instructions, feasibility reports and proposals.

Prerequisite: ENGL101N or ENGL110N.

Required Textbook:

Main Text

Technical Writing Essentials by Suzan Last Licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted. Note: You DO NOT need to register this textbook online: https://pressbooks.bccampus.ca/technicalwriting/

Secondary Texts

• Communication at Work by Jordan Smith Licensed under a Creative Commons Attribution 4.0 International License, except where otherwise noted. https://ecampusontario.pressbooks.pub/communicationatwork/

• Technical Writing by Allison Gross, Annemarie Hamlin, Billy Merck, Chris Rubio, Jodi Naas, Megan Savage, and Michele DeSilva Licensed under a Creative Commons Attribution-Noncommercial-ShareAlike 4.0 International License, except where otherwise noted. https://openoregon.pressbooks.pub/technicalwriting/

• Online Technical Writing by David McMurrey Licensed under a Creative Commons Attribution 4.0 International License. https://www.prismnet.com/~hcexres/textbook/

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

1. Recognize the characteristics of technical writing.
2. Distinguish appropriate purpose, audience and medium for the technical document.
3. Apply the strategies of the writing process to specific requirements of technical writing.
4. Develop written documents, such as a proposal, progress report, instructional document, employment papers, feasibility report, letters, etc.
5. Design documents where graphic aids are an integral part of the readability of the document.

Grading:

- Written Projects and Assignments -- 60%
    - Project 1a-1b: Letters & Resume -- 10%
    - Project 2: Instructions -- 15%
    - Project 3: Progress Report -- 20%
    - Oral Presentations -- 15%
- Quizzes -- 10%
- Participation/Discussion -- 15%
- Final Exam -- 15%

Topics Covered:

I. Basic aspects of technical writing
   A. The place of writing in technical work
   B. Principles of technical writing
   C. Style

II. Techniques of technical writing
   A. Definition
   B. Description of a mechanism
   C. Process

III. Reports
   A. Emails
   B. Instructions
   C. Feasibility reports
   D. Proposals
   E. Process
   F. Technical analysis

IV. Graphic Aids
   A. Purpose
B. Type
   C. Integration within report

Course No. HUMA230N **Title:** Ethics in the Workplace

Hours per week: 3 Instructor: Jennifer Tripp

Credits: 3 Semester/Year: Fall 2021

Course Description:

An introductory study of classical and contemporary ethical philosophies and how these philosophies apply to current business practices. The course stresses analytical and problem-solving skills to comprehend the ethical dimensions of business relationships: employer to employee; managers to owners; manufacturers to consumers; and corporations to the environment.

Prerequisite: ENGL101N or ENGL110N.

Required Textbook:

Main Text

The textbook for this class is free and available on Canvas. You can find it inside the "Start Here" Module. It's also right here: https://openstax.org/books/business-ethics/pages/1-introduction

Business Ethics by Stephen M. Byars and Kurt Stanberry. Published by OpenStax on Sep 24, 2018 in Houston, Texas.

Course Objectives (Points of Learning):

Students will be able to:

1. Understand an overview of the major philosophical bases of business ethics
2. Appreciate and understand the role of social responsibility expected of the American corporation by the general public
3. To understand the potential conflict in the American business between profits and ethical responsibility
4. To improve analytical skills through critical reading of case studies

Grading:

Assignment	Weight
Class Discussion	15%
Tests	25%
Field of Study Ethical Situation/Case Study PowerPoint	15%
Code of Ethics Written Assignment	15%
Textbook Case Study PowerPoint with partner	15%
Final Exam	15%
Total	***100%***

Topics Covered:

Topic One Ethical Issues in Business
Topic Two Moral Philosophies, Social Responsibility, and an Ethical Decision-Making Framework
Topic Three How the Organization and Significant Others Influence Ethical Decision-Making
Topic Four The Role of Opportunity and Conflict and Effective Ethics Programs
Topic Five: Corporate Values and International Business

Course No. ELET115N **Title:** Introduction to Programming Using C++

Hours per week: 2 Lab/3 Class 3 Instructor: Susan Hughes

Credits: 3 Semester/Year: Fall 2021

Course Description:
Students will be introduced to fundamentals of programming and logical problem-solving using object-oriented methods and the C++ language. No prior knowledge of programming is assumed. Focuses are on effective structured design of code with variables, decisions, loops, functions, arrays and introduction of pointers. Use of professional programming design approaches and coding style will be used in laboratory assignments. Completion of this course provides the programming design skills necessary to complete the EET program.

Prerequisite: Placement into college-level math.

Required Textbook:
Starting out with C++ From Control Structures through Objects", by Tony Gaddis, 9th Edition. ISBN 13: 978-0-13-444382-9; Note: You can use the 6th, 7th, 8th or 9th edition for this course.

For students who are planning to take advanced C++ courses at NCC, the 9th edition is required. The advanced courses are CSCI230N and CSCI278N.
For students who are not planning to take the advanced C++ courses, the "brief" version of the textbook is sufficient: "Starting out with C++; Brief Version" By Tony Gaddis. ISBN 13: 978-1-256-85896-6 Pearson
Or the Gaddis "Brief Version – 8th Edition"

Course Objectives (Points of Learning):

1. Understand the components of a computer system and understand basic design and problem-solving strategies using C++.
2. Understand C++ datatypes, Input / Output (I/O), File I/O, expressions, and errors.
3. Understand the use of functions, parameter passing and return values from functions.
4. Understand C++ control structures – if statements, loops, and conditional logic.

Grading:

Exams	35%
Class Participation	5%
HW, Lab Assignments and Performance	50%
Final Project	10%

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Topics Covered:

Content Topics	**Subtopics**
Intro to Computers and Programming	Into to C++
Expressions and Interactivity	Making Decisions
Looping	Functions
Arrays	Searching and Sorting
Pointers	Characters, Strings and the string class
Structured Data	Files
Classes	

Course No. ELET121N **Title:** Digital Circuits

Hours per week: 2 Class/3 Lab Instructor: Austin Hewin

Credits: 3 Semester/Year: Fall 2021

Course Description:

This course is a presentation of fundamental concepts in digital theory needed for more advancedstudy of digital circuits. The subject areas are number systems, digital codes, Boolean algebra, Karnaugh Mapping Techniques, basic logic gates, and flip-flops.

Prerequisites: **Co-requisite**: MATH110N

Required Textbook:

Digital Fundamentals, 11/E Thomas L. Floyd ISBN-10: 0132737965 • ISBN-13: 9780132737968
©2015
Prentice Hall • Published 07/14/2014

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

1. Convert between number systems and express signed numbers in binary signed magnitude using 1's and 2's complement form
2. Understand and apply Logic Gates, Adders, Encoders, Decoders, Comparators, Multiplexers and de-multiplexers
3. Simplify algebraic expressions using Boolean algebra, DeMorgan's theorems and Karnaugh map to simplify expressions or truth table functions
4. Apply Latches and Flip-Flops and use One-shots and Multivibrators as clocking sources

Grading:

Exams	45%
Final Exam	15%
Class/Lab Professionalism	5%
HW, Lab Assignments and Performance	40%

Topics Covered:

Content Topics	**Subtopics**
Introduction	A. Digital and Analog B. Waveforms C. Basic logic D. Test and Measurement instruments

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Number Systems, Operations, and codes	A. Decimal B. Binary C. Conversion between the two D. Binary Math E. Complement F. Signed numbers G. Arithmetic with Signed H. Hex Numbers I. Binary coded Decimal J. Digital Codes K. Error Codes
Logic gates	A. And B. Or C. Nand D. Nor E. Xor and EXOR
Boolean Algebra and Logic Simplification	A. Boolean Algebra (BA) – Laws B. DeMorgan's Theorems C. Logic Simplification Using BA D. Standard Form E. Karnaugh Map F. SOP / POS
Combinatorial Logic	A. Basic circuits B. Implementing C. Universal Properties of NAND & NOR Gates D. Pulse wave operation
Functions of Combinatorial Logic	A. Half and Full Adders B. Parallel adders C. Ripple carry and look ahead adders D. Comparators E. Decoders F. Encoders G. Code converters H. Muxs I. Demuxs J. Parity Generators / Checkers
Latches, Flip-flops, and timers	A. Latches B. Flip Flops and applications C. One-shots D. Astable multivibrator

Course No. ELET131N **Title:** Circuit Analysis I

Hours per week: 3 Class/3 Lab Instructor: Ali Hommoodi

Credits: 4 Semester/Year: Fall 2021

Course Description:

Theory and laboratory work on DC current, voltage, resistance, Ohm's law, energy, power, series-parallel circuits, network theorems and networks. Brief introduction to AC current, voltage and power.

Prerequisites: Co-requisite: MATH110N

Required Textbook:

- Floyd Thomas L., Buchla David M., Principles of Electric Circuits: conventional current version, 10th Edition, 2020

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Define and solve for current, voltage, resistance, and power in series, parallel, and series-parallel electric circuits using both scientific and engineering notation
- Calculate voltages and currents using Ohm's law, Kirchhoff's voltage and current laws as well as voltage and current divider equations
- Calculate electrical quantities using the branch-current, mesh current, and nodal voltage analysis methods
- Solve complex circuits by applying Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorems

Grading:

Exams	45%
Final Exam	15%
Class/Lab Professionalism	5%
HW, Lab Assignments and Performance	40%

Course No. ELET132N **Title:** Circuit Analysis II

Hours per week: 3 Class/3 Lab Instructor: Austin Hewin

Credits: 4 Semester/Year: Spring 2022

Course Description:

Theory and laboratory work on AC current, voltage, impedance, power, series-parallel circuits, network theorems and networks. Theory and laboratory work on magnetism and magnetic circuits, resonant circuits, transformers, and filters.

Prerequisites: ELET131N and MATH110

Corequisite: MATH120N (or permission of the Program Coordinator).

Required Textbook:

- Floyd Thomas L., Principles of Electric Circuits: conventional current version, 10th Edition, 2020 ISBN-13: 9780134879499

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Determine transient (time-varying) responses of capacitive and inductive networks and plot resulting voltages and currents.
- Determine the phase relationship between two sinusoidal waveforms and understand how to calculate the average and effective values of any waveform and using phasor format to add and subtract sinusoidal waveforms.
- Find the total impedance of series, parallel and series-parallel ac circuits and become proficient in applying Thevenin's and Norton's theorem to ac networks.
- Develop confidence in the use of logarithms and decibels to define levels and also become familiar with frequency response of filters and display these using Bode Plots.

Grading:

Exams:	45%
HW, Lab Assignments and Performance	40%
Class/Lab Professionalism	5%
Final Exam	10%

Course No. ELET141N **Title:** Electronics I

Hours per week: 3 Class/3 Lab Instructor: Austin Hewin

Credits: 4 Semester/Year: Spring 2022

Course Description:

This is a study of the physical behavior of electronic devices. Emphasis is on analysis and application of electronic circuits utilizing semiconductor diodes, bipolar transistors, and field effecttransistors. Topics covered include rectification, clipping and clamping circuits, regulated power supplies, basic circuits, biasing of transistors, and simplified AC modeling of transistor circuits.
Simulation tools are used to reinforce the theory. Laboratory experimentation reinforces classroomtheory with practical work.

Prerequisites: ELET131N and MATH110N

Co-requisite: MATH120N (or permission of the Program Coordinator).

Required Textbook:

- Malvino / Bates, Electronic Principles, 9th Edition, 2021 ISBN-13: 978-1259852695

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Define semiconductor principles and construct DC load lines and operating points for diodes, bipolar junction transistors (BJT's) and Field Effect Transistors (FET's).
- Identify and analyze half-wave and full-wave rectifier circuits as well as clippers, clampers, peak detectors and voltage multipliers.
- Discuss the operation of the BJT and the FET including biasing them in various configurations and identifying saturation and cut-off points for a given bias
- Design BJT and FET amplifier networks and use decibels and Bode Plots to understand their Frequency Response.

Grading:

Exams:	45%
HW, Lab Assignments and Performance	40%
Class/Lab Professionalism	5%
Final Exam	10%

Topics Covered:

Content Topics	Subtopics
Diodes	A. Solid State Physics B. Atomic Structure of Silicon, Germanium and GaAs C. Diode notations and symbols D. Forward and Reverse Bias E. Diode Testing F. LEDs G. Zener diodes H. Transformers and Rectification I. Power Supplies J. Other Diode Applications K. Special Purpose Diodes
Bipolar Junction Transistors (BJT)	A. Transistor configurations B. Voltage Amplification C. BJTs as switches D. Bias circuits E. Voltage and current source circuits F. Feedback G. BJT Amplifiers (CC, CE and CB) H. BJT AC Analysis I. Power amplifiers and feedback J. BJT Modeling K. Cascaded systems
Field Effect Transistors (FET)	A. Types of FETs B. FET biasing C. FET Amplifiers D. Amplifier Networks E. BJT and FET Frequency Response

Course No. ELET241N **Title:** Electronics II

Hours per week: 3 Class/3 Lab Instructor: James Noon

Credits: 4 Semester/Year: Fall 2021

Course Description:

This course is a continuation of Electronics I covering more advanced electronics topics with a variety of applications. Emphasis is on analysis and application of operational amplifiers. The non-ideal characteristics of op-amps and other electronic devices will be discussed with applications emphasizing offset, gain and linearity. Other topics may include but are not limited
to; differential amplifiers, frequency response, A/D and D/A circuits, active filters, troubleshootingof lab test circuits and analysis using computer electronic analysis simulation.

Prerequisites: ELET141N, ELET132N, MATH120N or permission of EET Program Coordinator.

Required Textbook:

- Malvino / Bates, Electronic Principles, 9th Edition, 2021 ISBN-13: 978-0-07-337388-1

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Understand logarithms, decibels, Bode Plots and Miller Effect Capacitance
- Be able to calculate Frequency Response for BJT and FET Amplifiers as well as Op-Amps
- Show how the single-ended output voltage of an Op-Amp depends on its open-loop gain and differential input voltage.
- Work with differential, instrumentation and bridge amplifiers and calculate the effects for AC performance, bandwidth, slew rate and noise.

Grading:

Quizzes and HW	20%
Exams:	30%
Lab Assignments	35%
Class/Lab Professionalism	5%
Final Exam	10%

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Topics Covered:

Content Topics	**Subtopics**
FET Amplifiers	A. P-Channel vs. N-Channel B. Common-Gate C. Source Followers
BJT and FET Frequency Analysis	A. Frequency Responses B. Logs, Decimals and Bode Plots
Operational Amplifiers & Applications	A. Op-Amp Definitions and Specs B. Differential and common mode operation C. Applications – summing, instrumentation and active filters
Power Amplifiers	A. Class A, B, C and D operations B. Series fed Class A amplifier
Linear Digital ICs	A. Comparators B. D/A Converters C. VCOs D. Phase-Lock Loops
Feedback and Oscillator Circuits	A. Various circuits B. Wein-Bridge circuits C. Tuned oscillator circuits
Power Supplies and Voltage Regulators	A. Power supplies B. Voltage regulators C. IC Voltage regulators and applications D. Other 2-terminal devices

Course No. ELET250N **Title:** Microcontrollers

Hours per week: 3 Class/3 Lab Instructor: Susan Hughes

Credits: 4 Semester/Year: Fall 2021

Course Description:

Today's computers fall into two categories. The first uses high performance microprocessors such as the Intel Pentium Class of Processors. The second category focuses on issues of space, cost, low power and fast development in products such as wireless phones, automobiles, security systems, and appliances. These lower performance processors are called Microcontrollers and are merely a lower power version of the larger microprocessors. The principles of operation are the same. This course focuses on this second category and the Hardware and Software design of these Microcontrollers.

Students will learn how to design embedded systems via both lecture and laboratory instruction. Laboratory projects will include designing, building and testing of these systems and evaluating the HW / SW tradeoffs. Note that ELET250N is a required course for all Computer Engineering and Electrical Engineering Majors.

Prerequisites: ELET141N and ELET115N (or CSCI175N)

Required Textbook:

"the 8051 microcontroller, a system's approach" By Mazidi, Mazidi and McKinlay. ISBN 13: 978-0-13-508044-3, 2013 Pearson (currently OUT OF PRINT). However, you can use it as you can find it but the page numbers will be different that the one below). OR the following – which is preferred! "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Mazidi, Mazidi, and McKinlay" Second Edition ISBN: 0-130119402-X, 2006 Pearson

Course Competencies (Key Points of Learning):

At the successful completion of this course, the student should be able to:

- Analyze the Hardware and Software Architectures of the Intel Family of EmbeddedMicroprocessors.
- Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers andmicroprocessors
- Interface the on-board ROM, RAM, registers, timers, counters, serial port, and generalpurpose I/O to digital, analog, and time-varying input and output signals
- Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.

Grading:

Exams:	45%
HW, Lab Assignments and Performance	40%
Class/Lab Professionalism	5%
Final Exam	10%

Course No. ELET221N **Title:** Advanced Digital Circuits

Hours per week: 3 Class/3 Lab Instructor: Susan Hughes

Credits: 4 Semester/Year: Spring 2022

Course Description:

This course is a continuation of the fundamental concepts in digital theory. The subject areas are flip-flop operations, applications, counter designs using state machine, state diagrams, shift registers and memory devices. Also covered will be CPLD design and development and the various types of media and data busses. Hands-on laboratory experiments, which augment the learning process, are an integral part of this course. The labs demonstrate real world implementation of otherwise abstract academic concepts and provide valuable experience in designing, testing, and debugging circuits.

Prerequisites: ELET121N; MATH120N

Required Textbook:

Digital Fundamentals, 11/E Thomas L. Floyd ISBN-10: 0132737965 • ISBN-13:

9780132737968 ©2015 • Prentice Hall • Published 07/14/2014

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Understand synchronous and asynchronous circuits by implementing various types of shift register (SR) circuits and using state machines and state diagrams to implement and apply circuits to real world applications.
- Understand memory basics including the various types of memory devices such as RAM, ROM, Flash, etc.
- Be able to design basic programmable devices such as CPLD's and FPGAs in a real-world application.
- Be able to discuss the computer bus basics including the different types (parallel, serial, USB, etc).

Grading:

Quizzes and Homework	20%
Exams:	30%
Professionalism/Class Participation	5%
Labs	35%
Final Exam	10%

Topics Covered:

Content Topic	Subtopics
I. Latches, Flip-Flops and Timers	A. Latches B. Edge triggered Flip-Flops C. Flip-Flop Operating Characteristics D. Flip-Flop Applications E. One-Shots F. Astable Multivibrator
II. Counters	A. Asynchronous Counters B. Synchronous Counters C. Up/Down Counters D. Design of Synchronous Counters E. Cascaded Counters F. Counter Decoding G. Counter Applications
III. Shift Registers	A. Operations B. Serial In/Parallel Out C. Serial In/Serial Out D. Parallel In/Parallel Out E. Parallel In/ Serial Out F. Bi-Directional SR G. SR Counters H. SR Applications
IV. Memory and Storage	A. Memory Basics B. RAM C. ROM D. Programmable ROM E. Flash F. Memory Expansion G. Magnetic and Optical Storage
V. Signal Interfacing	A. Converting Analog Signals to Digital B. Analog-to-Digital Conversion Methods C. Digital-to- Analog Conversion Methods
VI. Computer Concepts	A. The Basic Computer B. Bus Standards C. Basic Operation D. Internal Interfacing

Course No. ELET245N **Title:** Communication Theory

Hours per week: 2 Class/2 Lab

Credits: 3 Semester/Year: Spring 2022

Course Description:
Study of principles of radio frequency communication, modulation systems, pulse, digital modulation circuits, transmission line and propagation. This course is offered in the evening only.

Prerequisites: Prerequisites: A grade of 'C-' or better in ELET241N.

Required Textbooks:

- Frenzel, Electronic Communication Systems, 4th Edition, 2016
- ISBN-13: 978-0-07-337385-0

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Understand the basics of Electronic Communications and Digital Communications.
- Explain the fundamentals of Amplitude Modulation (AM), Frequency Modulation (FM) and know the differences between time division multiplexing, frequency division multiplexing and digital modulation.
- Explain the basics of transmission line theory and perform communication circuit analysis using computer simulations.
- Understand principles of Data Communications.

Grading:

In class Quizzes / Exams:	35%
HW	15%
Lab Assignments	35%
Class/Lab Professionalism	5%
Final Exam	10%

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Topics Covered:

Introduction to Electronic Communications
Electronics review with intro to FFT analysis
Amplitude Modulation (AM)
Frequency Modulation (FM)
Digital Communications
Phase Locked Loops (PLL)
Multiplexing and de-multiplexing communications channels
Digital Data Transmission
Communications Networks
Transmission Lines

Course No. ELET274N **Title:** Communication Theory

Hours per week: 3 Class/2 Lab Instructor: Susan Hughes

Credits: 3 Semester/Year: Spring 2022

Course Description:

An independent lab project using the student's knowledge of digital/analog electronic circuits and microprocessors. Students will design and build a working model of their selected project. The project will be built, troubleshot and demonstrated by the end of the semester. This course is offered in the evening only.

Prerequisites: ELET132N, ELET250N

Required Textbook: NA

Course Objectives (Points of Learning):

- Create a Project Plan which includes but is not limited to: the project proposal, circuit design, simulation, test plans, bill of materials, flowcharts and software code (where applicable), and demonstration of a working
- Create a project test evaluation plan to assure the project works as initially specified.
- Apply formal communication skills with client / customer (if applicable), instructor, teammates in both oral and written form. This includes but is not limited to regular status reports and formal public presentation.
- Demonstrate teamwork which includes professional, ethical, and social responsibilities

Grading Items:

The course is set up using a Project Management format. Deliverables are gated are as follows:

- Project Complexity
- Project Selected and Preliminary Design defined
- Procure Parts & Begin Assembly
- Refine the Design and Begin Testing
- Finalize (Refine) the Design
- Demonstrate the design
- Dry run PowerPoint Presentation
- Formal Presentation before faculty, IAB members and other students
- Technical Write-up

They will tentatively count toward the final grade as follows:

Schedule	30%
Testing	30%
Communications	30%
Professionalism	10%

Topics Covered:

Content Topic	Subtopics
Schedule	• Initial Circuit Design (+BOM) • 2nd round of CD & SW Flowcharts (if applicable), and simulation • Project Design Test Plans • Demonstration of Working Project
Testing	• Initial Project Test Plans (created before final project completed) • Initial Project Evaluated • Based on initial Evaluation, revise the Test plans • Final Test and revised Plan
Communications	• Informal oral communications to customers, instructor, teammates. • Deliver formal communications in the form of PowerPoint as well as demonstration and description of project. • Written Reports: ongoing status reports and a final project paper
Teamwork, Ethical and Social Responsibilities	• Demonstrate teamwork in the class. • Understand Engineering Codes of Conduct and Codes of Ethics.

Course No. PHYS130N **Title:** Physics I

Hours per week: 3 Class/2 Lab Instructor: Robert Bragdon

Credits: 4 Semester/Year: Spring 2022

Course Description:

Serves as the first semester of a one-year course which serves the field of physics at a non-calculuslevel. Topics include force and motion, vectors, gravity, energy and momentum, heat and thermodynamics, oscillations, and waves and sound. Prerequisites:

Prerequisite: MATH110N (A grade of C or better is recommended)

Required Textbook: Coletta; Physics Fundamentals Second Edition; Physics Curriculum & Instruction 2010; ISBN 9780971313453

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Apply mathematical skills, at the algebraic level, to analyze physical situations.
- Demonstrate problem solving skills in problems concerning physical situations.
- Explain the relevance and importance of physics to everyday experiences.
- Demonstrate lab techniques based on the scientific method.
- Demonstrate the ability to communicate both qualitative and quantitative information,orally and written.

Grading:

Homework	10%
Labs	25%
Exams	45%
Final Exam	20%

Topics Covered

Introduction to the Study of Physics	Motion in One Dimension
Motion in Two Dimensions	Forces and Motion
Circular Motion and Gravitation	Rotational Motion and Equilibrium
Momentum	Energy, Work and Heat
Thermal Properties of Matter	Fluids
Oscillations	Forces and Motion
Work and Energy	Momentum and Collisions
Circular Motion and Gravitation	Rotational Motion and Equilibrium
Solids and Fluids	

Course No. PHYS131N **Title:** Physics II

Hours per week: 3 Class/2 Lab Instructor: Robert Bragdon

Credits: 4 Semester/Year: Fall 2021

Course Description:

A continuation of the study of physics at the non-calculus level. Topics include waves and sound, optics, electricity and magnetism, atoms, nuclei and modern physics.

Prerequisite: PHYS130N

Required Textbook: Coletta; Physics Fundamentals Second Edition; Physics Curriculum & Instruction 2010; ISBN 9780971313453

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Apply mathematical skills, at the algebraic level, to analyze physical situations.
- Demonstrate problem solving skills in problems concerning physical situations.
- Explain the relevance and importance of physics to everyday experiences.
- Demonstrate lab techniques based on the scientific method.
- Demonstrate the ability to communicate both qualitative and quantitative information,orally and written.

Grading:

1. Homework 10%
2. Labs 25%
3. Exams 45%
4. Final Exam 20%

Topics Covered:

Waves and Sound	Wave Optics
Geometric Optics	Electricity
Simple Circuits	Magnetism
AC Circuits (Time Permitting)	Modern Physics
Magnetism	Geometric Optics
Modern Physics (as time permits)	

Course No. PSYC130N **Title:** Human Relations

Hours per week: 3 Instructor: David Rondeau

Credits: 3 Semester/Year: Spring 2022

Course Description:

This course will promote student exploration of intrapersonal (within self) and interpersonal (between self and others) aspects of human relationships. An understanding of basic psychological concepts and their connection to interpersonal relationships will be presented. Integration of effective communication, stress reduction, and team and leadership strategies in both the home and workplace will be encouraged.

Prerequisite: N/A

Required Textbook: Interpersonal Communication with Access Code 4th Edition Floyd, K.; McGraw Publication ISBN: 978-125-987-6776

Course Objectives (Points of Learning):

At the successful completion of this course, the student should be able to:

- Define and describe basic psychological concepts as they relate to human relationships.
- Describe basic concepts related to personality and apply to understanding of self and others.
- Define emotion and analyze the role it has on individual behavior. Describe effective communication within social networks and promote student assessment of their own
- Describe effective communication within social networks and promote student assessment of their own
- Define stress and identify the effect it has on behavior and performance.
- Critically analyze the role human factors play in one's ability to be an effective worker.
- Identify characteristics associated with teamwork and leadership and evaluate one's application of those characteristics.
- Compare strategies intended to improve difficult relationships.
- Synthesize and apply knowledge of human relationships to professional settings.

Grading:

Assignment	Weight
Weekly Connect	**25%**
Final Journal Entry	**15%**
Connect Quiz	**15%**
Observation Papers	**25%**
Discussion Board	**20%**

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Topics Covered:

Content Topic Introduction and Overview	**Subtopics**
About Communication	A. Nature Vs. Nurture –Influence on Communication B. Communication Needs C. Models of Human Communication D. Why Interpersonal Communication Matters E. Identifying Competent Communication
Culture and Gender	A. Understanding How Culture Affects Communication B. Understanding How Gender Affects Communication
Intrapersonal Communication	A. Understanding Self-Concept B. Self-Esteem C. Communicating the Self-Self Disclosure D. Exampling Emotional Regulation
Interpersonal Communication Skills	A. The Nature of Language B. The Use and Abuse of Words C. Improving Language Use

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APPENDIX B – FACULTY VITAE

Please use the following format for the faculty vitae (2 pages maximum in Times New Roman 12-point type)

1. *Name*
2. *Education – degree, discipline, institution, year*
3. *Academic experience – institution, rank, title (chair, coordinator, etc., if appropriate), when (ex. 1990-1995), full time or part time*
4. *Non-academic experience – company or entity, title, brief description of position, when (ex. 1993-1999), full time or part time*
5. *Certifications or professional registrations*
6. *Current membership in professional organizations*
7. *Honors and awards*
8. *Service activities (within and outside of the institution)*
9. *Briefly list the most important publications and presentations from the past five years – title, co-authors if any, where published and/or presented, date of publication or presentation*
10. *Briefly list the most recent professional development activities*

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James Austin Hewin
Bedford, NH 03110
jamesaustinhewin@gmail.com

TEACHING EXPERIENCE
Electronic Engineering Technology Instructor

Nashua Community College, Nashua, NH – August 2021 – present
Teach core courses required for the Associate of Science in EET degree:

- Circuit Analysis I
  - DC electricity, Ohm's Law, Kirchhoff's Laws, Mesh and Nodal Analysis, Superposition Theorem, Thevenin's and Norton's Theorems
- Digital Circuits I
  - Number Systems, Logic Gates, Combinational and Sequential logic, Boolean algebra and Karnaugh mapping
- Circuit Analysis II
  - AC electricity, Ohm's Law, Kirchhoff's Laws, Superposition Theorem, Thevenin's and Norton's Theorems, Filters, Bode Plots, Resonance
- Electronics I
  - Semiconductor Principles, Diodes, Rectifiers, Bipolar Junction Transistors

Fayetteville Technical Community College, Fayetteville, NC – September 2009 – July 2021
Taught core courses required for the Associate of Science in EET degree:

- Circuit Analysis I/Circuit Analysis I Lab
  - AC and DC electricity, Ohm's Law, Kirchhoff's Laws, Mesh and Nodal Analysis, Superposition Theorem, Thevenin's and Norton's Theorems
- Analog Electronics I
  - Diodes, Bipolar Junction Transistors, MOSFET Transistors, transistor biasing, single-stage amplifiers
- Digital Electronics
  - Number Systems, Logic Gates, Combinational and Sequential logic, Boolean algebra and Karnaugh mapping, VHDL and Schematic Capture
- C Programming
  - Data types, variables, expressions, conditional statements, loops, programs with electronics applications, structures, functions, debugging
- Adv C/C++ Programming
  - Object oriented programming
- Microprocessor Systems
  - Programming and Interfacing to the PIC16F628A microprocessor using assembly language

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TECHNICAL EXPERIENCE

Member of Technical Staff

TRW/Northrop Grumman, Redondo Beach, CA – July 1996 – May 2009

ASIC/FPGA design and verification using VHDL

Presentation of designs at Internal Design Reviews

EDUCATION

North Carolina State University

Computer Programming Certificate, December 2019

University of Southern California

M.S. Electrical Engineering, August 1999

Georgia Institute of Technology

B.S. Electrical Engineering (magna cum laude), June 1996

COLLEGE SERVICE

- National Technical Honor Society – FTCC Chapter – Co-advisor/Treasurer – 2015 – 2021
- Advising and assisting students in registration
- Participating in recruitment events at local schools as well as on-campus at college

PROFESSIONAL QUALIFICATIONS

Engineer-In-Training, October 2001

COMPUTER SKILLS

LTspice and Multisim, Tinkercad (circuit simulation)
Netbeans IDE, Eclipse IDE, cygwin (computer program development)
Quartus Prime Lite IDE (FPGA development)

TEACHING VIDEOS

Multiple technical videos on topics of computer programming, circuit analysis, using software, analog electronics and digital electronics
https://www.youtube.com/channel/UC0LEA8A8zGX11aJxv9gSsAA

500 WORD NEWSPAPER ARTICLES

1. FPGAs: Fun Programming Gate Arrays – published October 2019
2. C Programming: Solving problems in a fun way – published February 2021

*Up & Coming Weekly - **https://www.upandcomingweekly.com/**

** Articles available upon request

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SUSAN HUGHES Email: suemarkh@comcast.net
Hampton, NH 03842

SUMMARY

Professor and EET Program Coordinator with experience instructing in both the classroom and laboratory instruction. Specific expertise in C++ programming, digital design, DC circuits, and digital electronics. Demonstrated ability to adapt coursework from in-classroom to online. Effective communicator, guiding students through problem solving and debugging techniques in both classroom and online environments.

EDUCATION

Master of Science, Electrical Engineering
University of New Hampshire Durham, NH 12/1994

Bachelor of Science, Electrical Engineering
University of New Hampshire Durham, NH 5/1992

SKILLS

Design Experience		**Leadership Experience**	
- Digital Design	- C/C++ Programming	- Creating Schedules	- Financial Management
- FPGA Design	- Schematic Capture	- Fundraising	- Proposals
- VHDL	- Arduino Programming	- Teaching	- Performance Evaluation

ACADEMIC EXPERIENCE

Nashua Community College 8/21 - present
Professor and Program Coordinator, Electronic Engineering Technology and Computer Engineering Technology
Responsibilities include:

- EET/CET Program Coordinator
  - Instructor course/lab assignments
  - Hiring/evaluating adjunct professors as needed
  - Lead for EET ABET accreditation activities
  - Working with industry partners to establish pathways to employment
- Lecture and laboratory instruction for the following courses:
  - Digital Circuits I - Advanced Digital Electronics
  - Microcontrollers - Introduction to Programming Using C++
  - EET Capstone

New Hampshire Technical Institute 9/13 – 6/21
Adjunct Professor, Electronic Engineering Technology
Responsibilities included:

- Lecture and laboratory instruction for Introduction to Programming with C++
- Laboratory instruction for the following courses:
  - Electric Circuits I - Advanced Digital Electronics
  - Digital Fundamentals - Integrated Circuits and Interfacing

- For advanced classes, responsible for writing lab procedures, including a series of lectures and labs on FPGA design using schematic capture and VHDL in Intel/Altera Quartus Prime Lite design environment

New Hampshire Technical Institute 5/15 – 6/21
Lab Technician, Electronic Engineering Technology
Responsibilities include:

- Calibrating and maintaining laboratory equipment
- Selecting and procuring parts and equipment in support of EET/CPET/AGGP programs
- Mentoring students as needed with problem solving and/or debugging outside of the classroom environment
- Exploring new technologies for advanced digital electronics course applications
- Assisting in collection and organization of data for ABET accreditation of EET/CPET programs

NON-ACADEMIC EXPERIENCE
Lucent Technologies
Technical Manager, ASIC/FPGA Design 7/00 – 11/02

- Responsibilities included staff assignments, performance review and salary administration, coordination between groups on overall staff plan and direction of ASIC/FPGA community
- Coordinating ASIC and FPGA proposal development, including schedule, cost analysis, and architecture
- Interfacing with external vendors for device manufacture and production, including negotiating schedule, process interval, model quantities, risk production device cost and liability, and model production device cost
- Supporting complete verification and validation of ASIC and FPGA devices, coordinating with hardware and software teams to ensure full test coverage

Lucent Technologies
ASIC Design 2/99-6/00

- Block designer and lead verifier for 3 million gate Synchronous Optical Network (SONET) ASIC. Responsibilities included vendor RFQ, I/O specifications, design and verification of components, integration of transmission interfaces, device-level verification, development of device test plan, formulation of verification strategy for device team, and coordination of the day-to-day activities of a large group of verifiers.

Lucent Technologies
Circuit Design 1/95-1/99

- Overall responsibility for 155 Mb/s switch design, including architecture and interface documentation, schematic capture, layout decisions based on board materials, board stack-up, component placement, signal routing, as well as reviewing completed layout for any timing issues, unit test of circuit card functionality, comprehensive unit test of all ASICs on the circuit card, answering any questions related to circuit card functionality as it pertained to hardware and software applications.

Ali I. Hammoodi – PhD

Aihammoodi@ualr.edu

CURRENT JOB

Signal Integrity Engineer - Project Manager {Full Time)

Amphenol Inc.
200 innovative Way, Suite 201
Nashua, NH, 03060

EDUCATION

Ph.D. Telecommunications and Network Engineering **December 2018**
University of Arkansas at Little Rock 4.0 GPA

- Developed new methodology for designing and evaluating of flexible antennas using machine learning based on Artificial Neural Networks (ANNs)

M.Sc. Systems Engineering **December 2015**
University of Arkansas at Little Rock 4.0 GPA

- Introduced a new concept of sequentially-rotated circular-polarized antennas arrays for GPS applications.

B.Sc. Telecommunications Engineering **June 2011**
University of Technology, Baghdad, Iraq 4.0 GPA

EXPERIENCE

Signal Integrity Engineer - Project Manager January 2019 to Present

- Lead different design platforms from development to production
- Project planning and management
- Working as part of a multi-disciplinary team in the development of next generation high speed backplane and interconnect products
- Working on next generation technologies and processes that support the development of high-speed interconnect products
- Helping customers across a wide range of sectors solving their high-speed data transmission problems
- Helping the internal Sales Engineers to develop strategies for product break-in at existing and new accounts based on our SI expertise

Senior Electrical Engineer October 2018 - December 2019
Spectra Microsystems Inc., Little Rock, Arkansas, USA

- Leads the design, build and qualification of passive and active high data rates (High Frequency) modules for datacenter and ARNR applications
- Recommends changes in designs or technical procedures to improve

product/system performance

- Conducts and coordinates analytical simulations (SPICE) for the whole channel of active cable design up to 25Gbps
- Provides development input to design teams and creates electrical product models and documentation
- Analyze variation dependence and parametric optimization of different product and correlate signal integrity and power integrity of simulation versus measurement
- Works in laboratory environment to validate design and correlate measurement with simulations using VNA, TOR and Oscilloscope
- Develop empirical and analytical electrical test procedures and specifications and design and development of test fixtures for testing mated connector solutions
- Design characterization and customer verification test vehicles that include working with PCB design & fabrication houses
- Perform detailed design reviews for customers and provide recommendations, making selection of appropriate signaling and interconnect technology for high performance links

Electrical Engineer January 2016 - September 2018
Spectra Microsystems Inc., Little Rock, Arkansas, USA

- Understanding and implementation of USB, DisplayPort, HDMI, and SFF specifications to design and develop passive and active paddle cards for virtual reality, augmented reality, and datacenter applications
- Printed circuit board (PCBs) design using Mentor Graphic software (DxDesigner, PADS, and Router) for USB3 Gen1 and Gen2 (Type-C, Type-A, Type-B), DisplayPort (HBR2 and HBR3), miniDisplayPort (HBR2 and HBR3), HDMI, SFP28, and QSFP28 applications
- Modeling and analyzing of high-speed paddle cards up to 25 Gbps using EM simulators and 2D field solvers to evaluate signal integrity, power integrity, and full channel loss budget
- Compliance testing of several passive and active products, including DisplayPort, USB3 (Gen1 and Gen2), HDMI, QSFP28, SFP28, and DDQSFP28
- Conducting troubleshooting and failure analysis of defective products on production lines to find the root cause, and developing new methods to improve the quality of the process
- Developing test plans for ARNR products and deploying software to program IC's and set the best equalization setting for active paddle cards

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JAMES NOON
Merrimack, NH 03054
jpjnoon@comcast.net

PROFESSIONAL EXPERIENCE:

2017 – present **Manager, Applications Engineering**, Analog Devices (formerly Linear Tech) Manchester, NH Continue in similar role within ADI Power Product Group. Manage Application Engineering activities in the Manchester Design Center. Responsible for system and application engineering technical activities as well as recruiting, and mentoring Applications Engineers and Engineering Technicians.

2008 – present **Applications Engineering Section Leader**, Linear Technology (acquired by Analog Devices) Manchester, NH Responsible for system analysis and design for power converter products. Contribute to new product definition. Lead Si evaluation and system/application circuit design and development efforts for monolithic converters. Train Field Engineers. Develop reference and custom designs for strategic customers.

2019-present **Adjunct Professor**, Nashua Community College, Nashua, NH Teach electronics and circuit analysis classes.

2007 – 2008 **Principal Systems Engineer**, CHiL Semiconductor, Tewksbury, MA Responsible for new product definition for digital power controllers for multi-phase, high current converters. Led system analysis and design efforts for power controller products. Developed control algorithms for high efficiency, fast transient response applications. Significant contributions to product development leading to several patents.

2003 – 2007 **Senior Principal Design Engineer**, Oztek Corp., Merrimack, NH Led design and development efforts in an engineering firm. Responsibilities included project management as well as hardware design of embedded control systems and power electronic circuits and systems. Projects included development of a DSP based interleaved PFC with Phase-Shifted Full-Bridge DC-DC Converter, DC-DC and AC-DC converters and a 3-phase 200kW, 480V grid-tie inverter.

1994-2003 **Applications Engineering Manager**, Texas Instruments Corp.,(formerly Unitrode Integrated Circuits), Merrimack, NH Responsible for applications engineering within the System Power Management business unit. Managed Applications Engineering for the power product line with a group of engineers and technicians in three locations (NH, NC, TX). Technical responsibilities included new product development, circuit design and custom power system design for key customers. Technical liaison to university research programs and member of companywide technical steering committee. Elected TI Senior Member Technical Staff.

Principal Systems Engineer (Unitrode), Responsible for new product development, including definition of new Integrated Circuit architectures. Designed and developed new power stage topologies and control techniques for power converters including PFC, ZVS/ZCS, DC-DC, and off-line converters.

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1992-1994 **Design and Development Engineer**, Lutron Electronics, Coopersburg, PA
Responsible for design and development of lighting control circuits for dimming florescent ballasts. Developed a high frequency resonant inverter and the companies first power factor correction circuits. Investigated and solved complex system interaction issues. Developed control and circuit techniques for very low dimming behavior in fluorescent lamps.

U.S. PATENTS:
8,461,816: "Coefficient scaling depending on number of active phases"
8,330,444: "Power supply circuit and dynamic switch voltage control"
8,242,759: "Power supply circuit and multi-phase control based on peak and average current"
8,024,138: "Power supply circuitry, collection and reporting of power supply parameter information"
7,982,446: "Power supply circuit with dynamic control of a driver circuit voltage rail" 6,717,826: "Method to reduce bus voltage stress in a single-stage single switch power factor correction circuit"

PUBLICATIONS:

Select Publications Authored and/or Co-Authored:
Battery Life Extension & Storage Considerations, IDTechEx Energy Harvesting & Storage USA 2014 Nov 20, 2014

Untapped Potential: Energy Harvesting Solutions, IDTechEx Wireless Sensor Networks & RTLS USA Nov 08, 2012

Practical Design Considerations for Thermal and Photovoltaic Energy Harvesting Applications, Sensors Conference 2011

A DSP Based Digitally Controlled Interleaved PFC Converter, IEEE Applied Power Electronics Conference 2005, March 2005

EDUCATION:
Virginia Polytechnic Institute and State University, Blacksburg, VA M.S. Electrical Engineering with concentration in Power Electronics, August 1992 Thesis: Design of a Multi-Module Multi-Phase Battery Charger for the NASA EOS Space Platform Testbed. Thesis Advisor: Dr. F.C. Lee

Graduate Research Assistant, Virginia Power Electronics Center, Blacksburg, VA Contributed to the development of the power electronics' test bed for the NASA EOS satellite. 1990-1992

The College of New Jersey, Ewing, NJ B.S. Engineering Science with concentration in Electrical Engineering

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APPENDIX C – EQUIPMENT

Please list the major pieces of equipment used in support of the program instruction at all locations where the program is offered. Include location and purpose of the equipment.

Streeter Hall 171

10 - Agilent Technologies Model DSO5034A, 4-Channel, 300 MHz, 2GSa/sec Digital Oscilloscope

10 – Keysight Model DSOX1102G, 2-Channel, 100 MHz, 2GSa/sec Digital Oscilloscope with function generator

40 – WeePro Model Vpro850L handheld Digital Multimeter

9 – BK Precision Model 1610 Single Output DC Power Supply

10 – HP Model 6235a Triple Output DC Power Supply

8 – HP Model 33120A 15 MHz Function/Arbitrary Waveform Generator

8 – HP Model 34401A Multimeter

8 – HP Model E3631A Triple Output DC Power Supply

6 – Goldstar Model FG-2002C Function Generator

3 – Agilent Model E3632A DC Power Supply

1 – HP Model 6236B Triple Output Power Supply

1 – HP Model 6299A DC Power Supply

1 – HP Model 6216C Power Supply

1 – HP Model 6216A Power Supply

2 – Genrad Model 1657 RLC Digibridge

1 – HP Model 3585A Spectrum Analyzer (20 Hz – 40 MHz)

1 – Agilent Model E4404B Spectrum Analyzer (9 kHz – 6.7 GHz)

1 – Tektronix Model 465B Oscilloscope

1 – HP Model 6237B Triple Output Power Supply

10 – Dell Optiplex 3010 PCs with Mouse, Keyboard and 22” High Resolution Display

Streeter Hall 169 (Faculty Office)

2 - Agilent Model 6655A, 0-120V, 0-4A, System DC Power Supply

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APPENDIX D – INSTITUTIONAL SUMMARY

Programs are requested to provide the following information.

1. The Institution

a. Name and address of the institution.

Nashua Community College
505 Amherst Street
Nashua NH, 03063

b. Name and title of the chief executive officer of the institution.

Lucille Jordan, President – Nashua Community College

c. Name and title of the person submitting the Self-Study Report.

Susan Hughes, Program Coordinator – Electronics Engineering Technology

d. Name the organizations by which the institution is now accredited, and the dates of the initial and most recent accreditation evaluations.

Nashua Community College is accredited by the New England Commission of Higher Education (NECHE). The college received initial accreditation in 2002 and the most recent comprehensive review took place in spring 2018. In addition, the college submitted a progress report in Summer 2020.

2. Type of Control

Description of the type of managerial control of the institution, e.g., private-non-profit, private-other, denominational, state, federal, public-other, etc.

NCC is part of the seven-college Community College System of New Hampshire (CCSNH), and is a regionally accredited, public, two-year community college. The CCSNH System has been self-governing since 2007.

The Community College System of NH consists of seven colleges:

1. Great Bay Community College
2. Lakes Region Community College
3. Manchester Community College
4. Nashua Community College
5. NHTI – Concord's Community College
6. River Valley Community College
7. White Mountains Community College

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3. Educational Unit

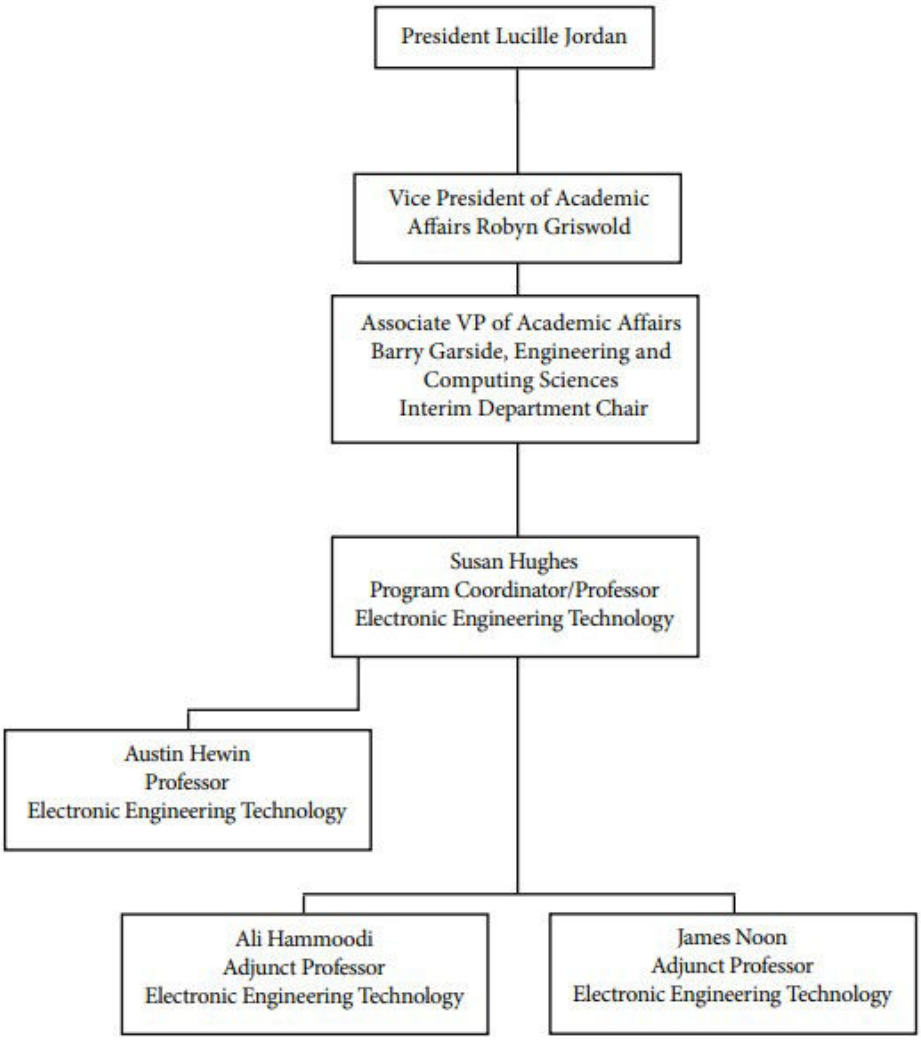
Describe the educational unit in which the program is located including the administrative chain of responsibility from the individual responsible for the program to the chief executive officer of the institution. Include names and titles. An organization chart may be included.

The EET program at Nashua Community College is one of six programs in the Engineering and Computing Sciences department. The department is currently made up of many faculty who are new to the NCC environment. Consequently, the NCC Associate Vice President of Academic Affairs currently serves as the interim department chair (Figure D-1).

When the need arises, the EET program coordinator is the first point of contact for instructors in the program. The PC handles matters pertaining to classroom instruction, curriculum, textbook selection, purchasing, program recruitment, new instructor onboarding, and program assessment. When situations arise requiring additional input or oversight, the program coordinator communicates with the Department Chair or, when necessary, the VPAA.

Figure D-1

Electronic Engineering Technology
Organizational Chart



4. Academic Support Units

List the names and titles of the individuals responsible for each of the units that teach courses required by the program being evaluated, e.g., mathematics, physics, etc.

- Jennifer Tripp, Professor & Chair: Department of Arts, Humanities, Communication & Design
- Christine Morris, Professor & Chair: Department of Mathematics & Science
- Jayne Barnes, Professor & Chair: Department of Social, Educational & Behavioral Sciences

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5. Non-academic Support Units

List the names and titles of the individuals responsible for each of the units that provide non-academic support to the program being evaluated, e.g., library, computing facilities, placement, tutoring, etc.

- Walter R. Peterson Library and Learning Commons: Frances Keenan: Library Director
- Tutoring Center: Frances Keenan: Library Director
- Disability Services: Jodi Quinn: Disabilities Services Coordinator
- Department of Multicultural Engagement: Elizabeth Berry, Professor and Chairperson
- Online Learning: Alan Foucault, Coordinator of Online Learning
- Academic Advising: Caitrin Brisson, Director of Academic Advising Center

6. Credit Unit

It is assumed one semester or quarter credit normally represents one class hour or three laboratory hours per week. One academic year normally represents at least 28 weeks of classes, exclusive of final examinations. If other standards are used for this program, the differences should be indicated.

The EET program at Nashua awards credits in a manner consistent with ABET policy and commonly accepted practices in higher education. Face-to-face and online courses meet the federal definition of a clock and credit hour as defined in the Electronic Code of Federal Regulations (CFR Title 34, Subtitle B, Chapter VI, Part 600, Subpart A, 600.2). The college clearly communicates the credit hour definition via the Catalog, Student Handbook, and course syllabi. The credit hour definition reads:

A credit hour shall be the equivalent of one (1) hour of classroom or direct faculty instruction and a minimum of two (2) hours of out-of-class student work each week for 15 or 16 weeks.

A credit hour shall be allocated based on the following:

Category	**Contact Hours per Week**	**Contact Hours per Semester (based on 15-week semester)**
Class	1	15
Laboratory	2 or 3	30-45
Clinical	3 to 5	45-75
Practicum, Fieldwork	3	45
Internship	3 to 6	45-90
Co-op	Variable by Dept.	Variable by Dept.

`

7. Tables

Complete the following tables for the program undergoing evaluation.

Table D-1. Program Enrollment and Degree Data

Give official fall term enrollment figures (head count) for the current and preceding four academic years and undergraduate and graduate degrees conferred during each of those years. The "current" year means the academic year preceding the review.

FT--full time
PT--part time

Electronic Engineering Technology

Academic Year			Enrollment Year			Total
			Fresh	Senior	Transfers	Undergrad
2021-2022	Fall 2021	FT	3	2	3	28
		PT	7	6		
	Spring 2022	FT	3	2	2	
		PT	5	8		
2020-2021	Fall 2020	FT	3	6	4	43
		PT	10	12		
	Spring 2021	FT	1	7	2	
		PT	9	10		
2019-2020	Fall 2019	FT	12	7	2	51
		PT	10	12		
	Spring 2020	FT	12	5	2	
		PT	8	11		
2018-2019	Fall 2018	FT	10	2	4	55
		PT	13	16		
	Spring 2019	FT	4	6	4	
		PT	13	12		
2017-2018	Fall 2017	FT	6	5	4	67
		PT	20	14		
	Spring 2018	FT	6	7	5	
		PT	20	12		

Table D-2. Personnel

Electronic Engineering Technology

Year[1]: Fall 2021

	HEAD COUNT		FTE[2]
	FT	PT	
Administrative[2]	1/8	0	1/8
Faculty (tenure-track)[3]	N/A	N/A	N/A
Other Faculty or Technical Staff (excluding Student Assistants)[4]	2	2	2 1/2
Student Teaching Assistants[5]	N/A	N/A	N/A
Technicians/Specialists	0	0	0
Office/Clerical Employees	0	0	0
Others[6]	0	0	0

Comments:

- Interim Department Chair does not teach EET courses.
- Program Coordinator (PC) responsibility is in addition to full-time teaching responsibilities.
- There are no tenure-track faculty nor are there teaching assistants.
- The EET department does not have a dedicated lab technician. The full-time faculty are responsible for lab organization, equipment maintenance, and component ordering.
- The EET department does not have dedicated administrative or clerical support. The department utilizes shared administrative and clerical support at the college level, which is efficient and continually meets or exceeds the EET department expectations.

Report data for the program being evaluated.

1. *Data on this table should be for the fall term immediately preceding the review. Updated tables for the fall term when the ABET team is conducting the review are to be prepared and presented to the team at the time of the review.*

2. *Persons holding joint administrative/faculty positions or other combined assignments should be allocated to each category according to the fraction of the appointment assigned to that category.*

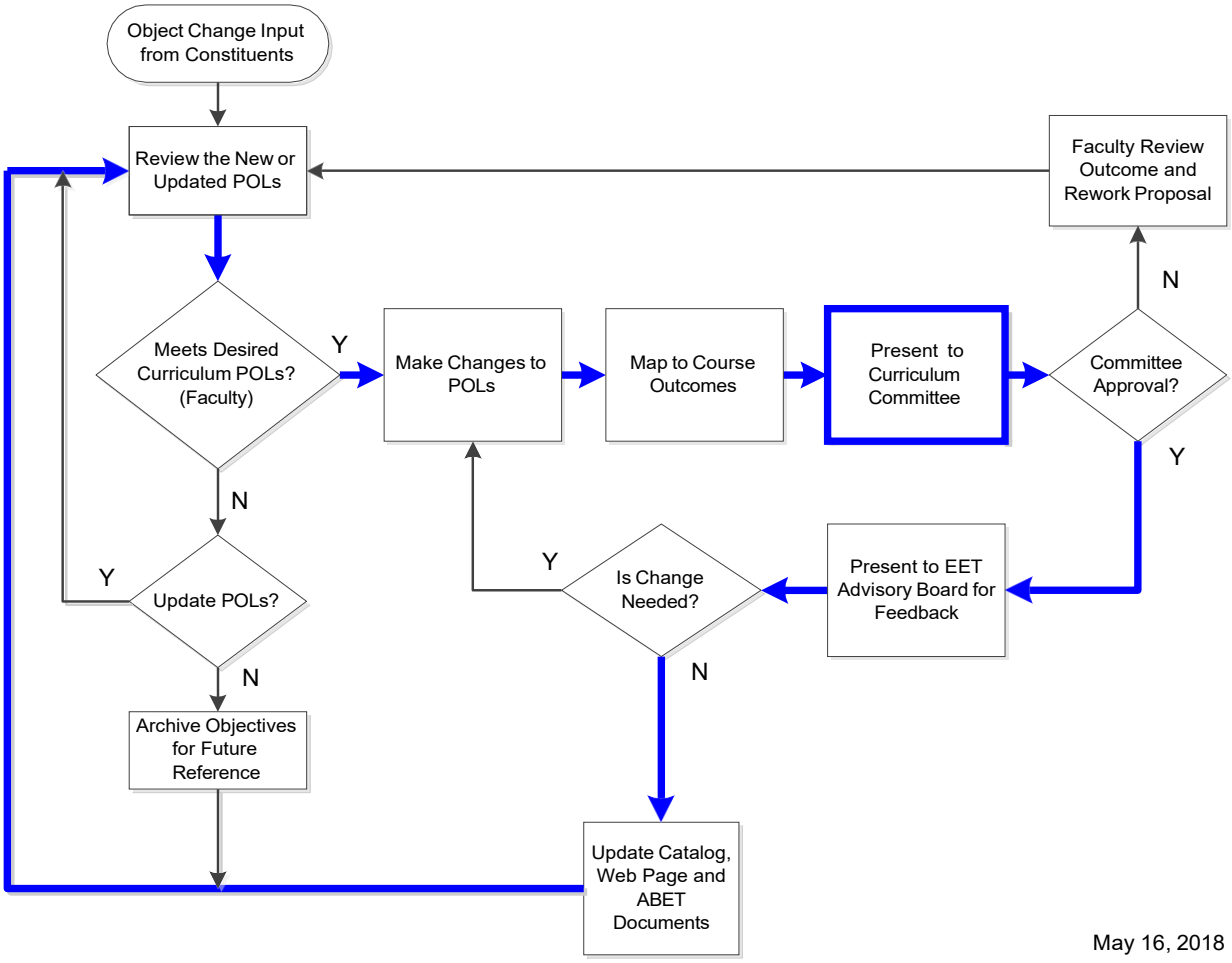
3. *For faculty members, 1 FTE equals what your institution defines as a full-time load.*

4. *Individuals that are involved in the delivery of technical content for the program but that cannot be categorized into any of the other categories.*

5. *For student teaching assistants, 1 FTE equals 20 hours per week of work (or service). For undergraduate and graduate students, 1 FTE equals 15 semester credit-hours (or 24 quarter credit-hours) per term of institutional course work, meaning all courses — science, humanities, and social sciences, etc.*

6. *Specify any other category considered appropriate, or leave blank.*

APPENDIX E – NCC CURRICULUM COMMITTEE APPROVAL PROCESS



APPENDIX F – ELET250 POST-COURSE SURVEY F2021

ELET250N Post-Course Survey F2021

Please complete the following post-course survey. This is NOT for a grade!

Please select ONLY 1 answer for each of the following questions.

Thank you.

Printed Name: _____

What do you know about: ***The Hardware and Software Architectures of the Intel Family of 8051/8052 Embedded Microprocessors?***

- Never heard of it.
- Heard of it but don't really know what it is.
- I might know this but not sure.
- I remember learning this but would need my book or notes to do it again.
- I remember some of this and could do some problems.
- I know this now.

What do you know about: ***Understanding and interpreting coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors?***

- Never heard of it.
- Heard of it but don't really know what it is.
- I might know this but not sure.
- I remember learning this but would need my book or notes to do it again.
- I remember some of this and could do some problems.
- I know this now.

What do you know about: ***Interfacing to the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals?***

- Never heard of it.
- Heard of it but don't really know what it is.
- I might know this but not sure.
- I remember learning this but would need my book or notes to do it again.
- I remember some of this and could do some problems.

- I know this now.

What do you know about: ***Applying microcontroller principles to real world situations? This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.***

- Never heard of it.
- Heard of it but don't really know what it is.
- I might know this but not sure.
- I remember learning this but would need my book or notes to do it again.
- I remember some of this and could do some problems.
- I know this now.

APPENDIX G – POL TO OUTCOMES MAPPING, STUDENT OUTCOMES A-I

This is the course level assessment to outcomes mapping table that was referenced in the 2018 NCC Interim Report. It maps the course POLs to the Criterion 3 student outcomes A-I. It is included here as an explanation of the mapping of outcomes A-I to outcomes 1-5. The detailed excel spreadsheet is included in the ABET electronic workroom.

OUTCOMES (on TracDat)

updated - 1/4/2018 - Professors Marcotte and Poteat

	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET115N = C++	Understand the components of a computer system and understand basic design and problem solving strategies using C++.		✓			✓				
	Understand C++ datatypes, Input / Output (I/O), File I/O, expressions, and errors.	✓		✓						
	Understand the use of functions, parameter passing and return values from functions.	✓		✓						
	Understand C++ control structures – if statements, loops, and conditional logic.	✓		✓						

	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET121N - Dig. Circuits I	Convert between number systems and express signed numbers in binary signed magnitude using 1's and 2's complement form		✓							
	Understand and apply Logic Gates, Adders, Encoders, Decoders, Comparators, Multiplexers and de-multiplexers	✓		✓		✓				
	Simplify algebraic expressions using Boolean algebra, DeMorgan's theorems and Karnaugh map to simplify expressions or truth table functions		✓							
	Apply Latches and Flip-Flops and use One-shots and Multivibrators as clocking sources		✓							
ELET131N - Circuit Anal. I	**Current, Voltage and Power** - Define and solve for current, voltage, resistance, and power in series, parallel, and series-parallel electric circuits using both scientific and engineering notation		✓	✓						
	Ohm's Law and Kirchoff's Laws - Calculate voltages and currents using Ohm's law, Kirchho?'s voltage and current laws as well as voltage and current divider equations		✓	✓						
	Branch, Mesh and Nodal Analysis - Calculate electrical quantities using the branch-current analysis, mesh analysis, and nodal analysis methods		✓	✓						
	Superposition, Thevenin's, Norton's and Maximum Power Theorems - Solve complex circuits by applying Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorems		✓	✓						

	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET132N - Circuit Anal. II	**Capacitive and Inductive Networks** Determine transient (time-varying) responses of capacitive and inductive networks and plot resulting voltages and currents.	✓		✓		✓	✓			
	Phase and phaser format Determine the phase relationship between two sinusoidal waveforms and understand how to calculate the average and effective values of any waveform and using phasor format to add and subtract sinusoidal waveforms.	✓		✓		✓	✓			
	Impedance of series, parallel, and series/parallel circuits Find the total impedance of series, parallel and series-parallel ac circuits and become proficient in applying Thevenin's and Norton's theorem to ac networks.	✓		✓		✓				
	Levels and frequency response of filters Develop confidence in the use of logarithms and decibels to define levels and also become familiar with frequency response of filters and display these using Bode Plots.	✓		✓		✓	✓			
ELET141N - Elec. I	Define semiconductor principles and construct DC load lines and operating points for diodes, bipolar junction transistors (BJT's) and Field Effect Transistors (FET's).		✓	✓		✓				
	Identify and analyze half-wave and full-wave rectifier circuits as well as clippers, clampers, peak detectors and voltage multipliers.		✓	✓		✓				
	Discuss the operation of the BJT and the FET including biasing them in various configurations and identifying saturation and cut-off points for a given bias.		✓	✓		✓				
	Design BJT and FET amplifier networks and use decibels and Bode Plots to understand their Frequency Response.		✓	✓		✓				

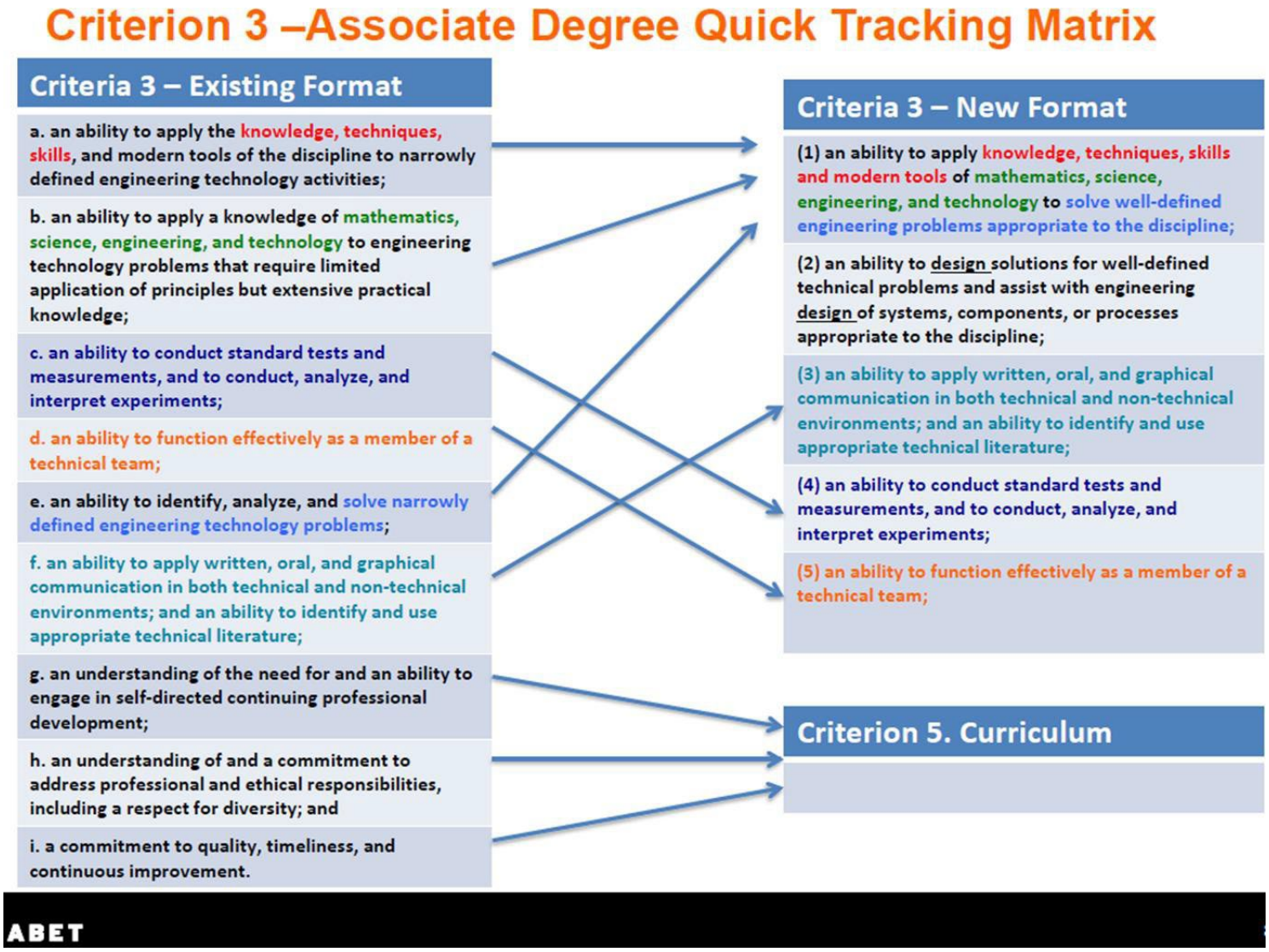
	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET221N - Adv. Dig. Circuits	Understand synchronous and asynchronous circuits by implementing various types of shift register (SR) circuits and using state machines and state diagrams to implement and apply circuits to real world applications.	✓		✓		✓				
	Understand memory basics including the various types of memory devices such as RAM, ROM, Flash, etc.	✓		✓						
	Be able to design basic programmable devices such as CPLD's and FPGAs in a real world application.	✓		✓						
	bus basics including the different types (parallel, serial, USB, etc).	✓								
ELET241N - Elec. II	Understand logarithms, decibels, Bode Plots and Miller Effect Capacitance		✓	✓						
	Be able to calculate Frequency Response for BJT and FET Amplifiers as well as Op-Amps		✓	✓		✓				
	output voltage of an Op-Amp depends on its open-loop gain		✓	✓		✓				
	Work with differential, instrumentation and bridge amplifiers and calculate the effects for AC performance, bandwidth, slew rate and noise.		✓	✓		✓				

	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET245N - Comm Theory	Understand the basics of Electronic Communications and Digital Communications.	✓		✓		✓				
	Explain the fundamentals of Amplitude Modulation (AM), Frequency Modulation (FM) and know the differences between time division multiplexing, frequency division multiplexing and digital modulation.	✓		✓		✓				
	transmission line theory and perform communication circuit analysis using computer simulations.	✓		✓		✓				
	Understand principles of Data Communications.	✓	✓							
ELET250N - Microcontrollers	Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors.	✓								
	understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors	✓		✓						
	interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals	✓		✓						
	Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.		✓			✓	✓			

	POLs	**Applying Techniques & Tools** - (a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.	**Applying Practical Knowledge** - (b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge.	**Measuring & Experimenting** - (c) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** – (d) an ability to function effectively as a member of a technical team.	**Solving Problems** - (e) an ability to identify, analyze, and solve narrowly defined engineering technology problems.	**Communicating** - (f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Professional Improvement** - (g) an understanding of the need for and an ability to engage in self-directed continuing professional development.	**Ethical Behavior** - (h) an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity.	**Commitment** - (i) a commitment to quality, timeliness, and continuous improvement.
ELET274N - EET Capstone	Create a Project Plan which includes but is not limited to: the project proposal, circuit design, simulation, test plans, bill of materials, flowcharts and software code (where applicable), and demonstration of a working prototype.	✓					✓	✓		✓
	Create a project test evaluation plan to assure the project works as initially specified.					✓	✓	✓		✓
	skills with client / customer (if applicable), instructor, teammates in both oral and written form. This includes but is not limited to regular status reports and formal public presentation.					✓	✓			
	Demonstrate teamwork which includes professional, ethical, and social responsibilities				✓				✓	

APPENDIX H – MAPPING OF OUTCOMES A-I TO OUTCOMES 1-5

This is mapping that was used to update our student outcomes data from Criteria 3 A-I to Criteria 3 1-5.



APPENDIX I – POL TO OUTCOMES MAPPING, STUDENT OUTCOMES 1-5

This is the course level assessment to student outcomes mapping table that is currently in use for calculation of the program student outcomes. It maps the course POLs to the Criterion 3 student outcomes 1-5. The detailed excel spreadsheet is included in the ABET electronic workroom.

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET115N - C++	Understand the components of a computer system and understand basic design and problem solving strategies using C++.	✓				
	Understand C++ datatypes, Input / Output (I/O), File I/O, expressions, and errors.	✓			✓	
	Understand the use of functions, parameter passing and return values from functions.	✓			✓	
	Understand C++ control structures – if statements, loops, and conditional logic.	✓			✓	

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET121N - Digital Circuits I	Convert between number systems and express signed numbers in binary signed magnitude using 1's and 2's complement form	✓				
	Understand and apply Logic Gates, Adders, Encoders, Decoders, Comparators, Multiplexers and de-multiplexers	✓			✓	
	Simplify algebraic expressions using Boolean algebra, DeMorgan's theorems and Karnaugh map to simplify expressions or truth table functions	✓				
	Apply Latches and Flip-Flops and use One-shots and Multivibrators as clocking sources	✓				
ELET131N - Circuit Analysis I	Define and solve for current, voltage, resistance, and power in series, parallel, and series-parallel electric circuits using both scientific and engineering notation	✓			✓	
	Calculate voltages and currents using Ohm's law, Kirchhoff's voltage and current laws as well as voltage and current divider equations	✓			✓	
	Calculate electrical quantities using the branch-current analysis, mesh analysis, and nodal analysis methods	✓			✓	
	Solve complex circuits by applying Superposition, Thevenin's, Norton's, and Maximum Power Transfer theorems	✓			✓	

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET132N - Circuit Analysis II	Determine transient (time-varying) responses of capacitive and inductive networks and plot resulting voltages and currents.	✓		✓	✓	
	Determine the phase relationship between two sinusoidal waveforms and understand how to calculate the average and effective values of any waveform and using phasor format to add and subtract sinusoidal waveforms.	✓		✓	✓	
	Find the total impedance of series, parallel and series-parallel ac circuits and become proficient in applying Thevenin's and Norton's theorem to ac networks.	✓			✓	
	Develop confidence in the use of logarithms and decibels to define levels and also become familiar with frequency response of filters and display these using Bode Plots.	✓		✓	✓	
ELET141N - Electronics I	Define semiconductor principles and construct DC load lines and operating points for diodes, bipolar junction transistors (BJT's) and Field Effect Transistors (FET's).	✓			✓	
	Identify and analyze half-wave and full-wave rectifier circuits as well as clippers, clampers, peak detectors and voltage multipliers.	✓			✓	
	Discuss the operation of the BJT and the FET including biasing them in various configurations and identifying saturation and cut-off points for a given bias.	✓			✓	
	Design BJT and FET amplifier networks and use decibels and Bode Plots to understand their Frequency Response.	✓			✓	

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET221N - Advanced Digital Circuits	Understand synchronous and asynchronous circuits by implementing various types of shift register (SR) circuits and using state machines and state diagrams to implement and apply circuits to real world applications.	✓	✓		✓	
	Understand memory basics including the various types of memory devices such as RAM, ROM, Flash, etc.	✓			✓	
	Be able to design basic programmable devices such as CPLDs and FPGAs in a real world application.	✓	✓		✓	
	including the different types (parallel, serial, USB, etc).	✓				
ELET241N - Elecronics II	Understand logarithms, decibels, Bode Plots and Miller Effect Capacitance	✓			✓	
	Be able to calculate Frequency Response for BJT and FET Amplifiers as well as Op-Amps	✓			✓	
	Op-Amp depends on its open-loop gain and differential input voltage.	✓			✓	
	Work with differential, instrumentation and bridge amplifiers and calculate the effects for AC performance, bandwidth, slew rate and noise.	✓			✓	

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET245N - Communications Theory	Understand the basics of Electronic Communications and Digital Communications.	✓			✓	
	Explain the fundamentals of Amplitude Modulation (AM), Frequency Modulation (FM) and know the differences between time division multiplexing, frequency division multiplexing and digital modulation.	✓			✓	
	Explain the basics of transmission line theory and perform communication circuit analysis using computer simulations.	✓			✓	
	Understand principles of Data Communications.	✓				
ELET250N - Microcontrollers	Analyze the Hardware and Software Architectures of the Intel Family of Embedded Microprocessors.	✓				
	Understand and interpret coding schemes, such as Assembly Language Fundamentals, including looping, calls, and procedures and the differences between microcontrollers and microprocessors	✓				
	Interface the on-board ROM, RAM, registers, timers, counters, serial port, and general purpose I/O to digital, analog, and time-varying input and output signals	✓	✓			
	Apply microcontroller principles to real world situations. This includes develop real-time assembly language programs using linear, polling, handshaking, and interrupt techniques.	✓	✓			

Student Outcomes - Updated 5-31-2022						
	POLs	**Applying Techniques & Tools** - (1) an ability to apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline.	**Solutions** - (2) an ability to design solutions for well-defined technical problems and assist with engineering design of systems, components, or processes appropriate to the discipline.	**Communicating** - (3) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature.	**Measuring & Experimenting** - (4) an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.	**Team Work** - (5) an ability to function effectively as a member of a technical team.
ELET274N - EET Capstone	Create a Project Plan which includes but is not limited to: the project proposal, circuit design, simulation, test plans, bill of materials, flowcharts and software code (where applicable), and demonstration of a working prototype.	✓	✓	✓		
	Create a project test evaluation plan to assure the project works as initially specified.	✓		✓		
	Apply formal communication skills with client / customer (if applicable), instructor, teammates in both oral and written form. This includes but is not limited to regular status reports and formal public presentation.	✓		✓		
	Demonstrate teamwork which includes professional, ethical, and social responsibilities					✓

APPENDIX J – SENIOR EXIT SURVEY

EET/CET Graduate Exit Survey – Spring 2022

1. Are you graduating from the EET or CET program?

    a. EET
    b. CET

2. What are you planning to do after graduation?

    a. Work full time in the EET/CET field
    b. Work part time in the EET/CET field and continue my education
    c. Continue my education (full time)
    d. Continue to look for work
    e. Go to work in a non-EET/CET field

3. How confident do you feel that the NCC has prepared you for the challenges ahead?

    a. Very confident
    b. Confident
    c. Somewhat confident
    d. Not confident

4. Do you think that you have the knowledge and know-how to solve challenging Electronic Engineering/Computer Engineering problems?

    a. Yes
    b. Likely
    c. Maybe
    d. No

5. Did you have any EET/CET related co-ops or summer jobs? If yes, please comment on your experiences.

    a. Yes
    b. No

6. Do you plan to pursue any of the following (ever)? Check all that apply.

    a. I am going to enroll in a BS program
    b. I am going to take some short courses or additional training
    c. I intend to continue to learn about new developments in the field
    d. I might engage in some further training in the field
    e. I don't plan to continue pursuing further training in the field

7. If you are going to continue your education, where do you plan to go?

8. List up to 3 strengths of our EET program.
9. List up to 3 weaknesses of our EET program (or things you would like to see improve).
10. Do you have a job or have already been accepted to a BS program yet?

Submission Attesting to Compliance

Only the Dean or Dean's Delegate can electronically submit the Self-Study Report.

ABET considers the on-line submission as equivalent to an electronic signature of compliance attesting to the fact that the program conducted an honest assessment of compliance and has provided a complete and accurate disclosure of timely information regarding compliance with ABET's Criteria for Accrediting Engineering Technology Programs to include the General Criteria and any applicable Program Criteria, and the ABET Accreditation Policy and Procedure Manual.