Northampton Community College

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) AAS/Certificate/SD

Academic Program Review 2017-2022

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I. Introduction

A. Provide the current purpose of the program.

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) – Associate in Applied Science (AAS)
Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) – Certificate Program
Heating, Ventilation, Air Conditioning (HVAC) – Specialized Diploma (SD)

The HVAC/R industry is a rapidly growing field and is a key component of modern society, the shortage of qualified candidates for job opportunities is a common complaint from business owners and managers. HVAC/R is listed as a High Priority Occupation.

NCC's HVAC/R credit program has been in existence since 2002 and offers a three-tier "Stackable Credential" capability suitable for a wide variety of student situations. Courses completed are applicable to all levels and are intended to prepare graduates for employment in the HVAC/R industry at varying levels of entry and exit.

The first tier is the Specialized Diploma and is designed for completion within one calendar year. This is required by some PA CareerLink funding sources and was also created in response to the needs of business and industry for short-term job training programs. All courses are scheduled every semester to allow full-time students to enter the program in either fall or spring semesters and subsequently complete in the following semester.

The second tier is the Certificate and is designed for completion within 1½ - 2 years, dependent upon time of entry and course scheduling. Graduates will have engaged in all technical courses that are available for the program. With technical elective options, students will also gain skills & knowledge in related fields. The certificate program includes computer literacy and effective communication courses, which will position graduates toward supervisory and management roles.

The third tier is the Associate in Applied Science Degree and is designed for both traditional and non-traditional students in scheduling and course selections. Graduates will enhance their general knowledge with language, diversity, historical, literature, and writing-intensive course selections. They will also gain a better understanding of the engineering principles for which this and similar career fields are built upon.

While not an intended transfer, students are able to attend Bloomsburg University to attain a Bachelor of Applied Science in Technical Leadership. Similarly students are able to transfer to Pennsylvania College of Technology.

B. How does the program advance the mission or Strategic Focus Areas (SFAs) of the college? (Reflect on the program's curriculum, success rates, etc. to highlight where the program specifically promotes one or more of the SFAs.)

The HVAC/R program addresses a number of our SFAs, the first being:

- **Enhancing Student Access**. The stackable credential model is the first, allowing students multiple exit and entry points to enhance their education. The second is our ongoing entry opportunities for our local secondary Career and Technical schools to transfer in with a number of college credits as per our Perkins identified courses granting articulation. The third is our ongoing efforts towards internship opportunities with our workforce partners. Formal internships have included two students with Lehigh University Facilities Department in Summer 2019 and Spring 2022 for which both turned into full-time employment. These students are also continuing to pursue Electrical Technology degree to enhance their job skills. Also postings in our career services has provided employment for students with Jack Lehr, Heating, Cooling and Electric, and Zongora Comfort Solutions.
- **Inspiring Academic Excellence**. Classes and lab activities are designed to engage learners in multiple modalities. Classroom lecture/discussion, video assignments that focus on specific topics, online support assessments, simulation assignments, and in the lab, where hands-on activities foster tactile experience and strength of knowledge.
- **Fostering Diversity & Global Engagement.** In the past year, the college has undertaken improvement in our engagement with integrating activities in a majority of our courses, specifically Diversity, Ethics, and Communication Key Abilities. Topics engaged in the entry-level HVAC101 course address diversity and communication in our workforce. For Diversity, this is primarily engaged with video assignments showing both minorities and women in what has been a traditionally male-dominated field. Communication is primarily assigned using the publisher's online training simulations concerning workplace respect and ethical conduct. Other courses are being integrated with engaging in ethical questions. Such as reviewing various instances of servicing contractors, both good and bad, and discussing the consideration of options for moral business and professional conduct.
- **Engaging with our Communities.** As noted in the first SFA, we are heavily engaged with the external community/employers and have dozens of graduates who have obtained employment and of the employers directly conferred with, the majority are quite pleased with the level of knowledge that our graduates are entering the field with.
- **Advancing Excellence in Technology.** As noted in the second SFA, the program uses varying levels of technology to provide for effective teaching and provide instructional support for all learners. Technical content covers the gamut from residential to commercial/industrial service knowledge.

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

One of the key credentials for this industry is the Environmental Protection Agency (EPA) Refrigerant Usage Certification (Section 608 of the Clean Air Act). Therefore, a very strong component of instruction is preparing students to gain this certification before any level of graduation. Statistically, this program has a higher than average success rate in testing for this credential. Another credential that can be gained is the Occupation Safety & Health Administration (OSHA) 10 Construction Industry Safety Education certification.

I have received two letters of recommendation in January 2022 to include in this audit, one from a student and one from the Steris company, who interned some of my students during the 2021-2022 winter break to facilitate their immediate needs in testing and certifying equipment during seasonal maintenance shutdowns. See addendum to Appendix C.

D. Catalog Description

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

2. Does this description accurately describe the current program?

Yes **X** No _____

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

F. Previous Program Review

1. Provide the date of the last program review: 2017
2. List the recommendations from that review and indicate the extent to which these recommendations have been implemented. Indicate "I" for recommendations implemented, "IP" for those in progress, and "NI" for those not implemented. For those recommendations not implemented, please explain the circumstances.

Table 1. Status of Recommendations from Last Program Review

Recommendation	Status
There is significant need to increase lab space and provide all-weather equipment areas. *Budgetary concerns and college wide limitations to expansion make this unreachable at this time.*	NI
Due to program growth and the desire to maintain quality, there is a need to increase full-time staffing for lab maintenance and instruction. *Budgetary concerns and enrollment do not support this. Although, some progress has been made by utilizing part-time lab positions and student workers.*	IP
Invest in new lab equipment (ongoing recommendation) and integrate instructional technology into the curriculum. *All HVAC courses now utilize Blackboard/Cengage MindTap and Simulations as part of the instruction.*	IP
Limit class sizes by increasing the number of sections being scheduled and offer class both in the fall and spring semesters. *The SD level runs as such with all classes offered at varying times in both semesters.*	IP
Investigate the viability of forming a dedicated advisory committee focused on both the HVAC/R and Electrical Technology programs. *A number of respondents who had a verbal interest did not respond, retired, or were not able to make the commitment. To compound this, when Covid became an educational challenge, a number of businesses retracted their workforces*	NI

and are now picking up again. This will be the highest priority in the coming year.	
Continue the program.	I

II. Program Outcomes

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

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

Yes _____ No **X**

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

B. Program-Level Performance Indicators

Describe the key indicators used to assess the quality and effectiveness of your program relative to its core purpose and the college mission. At a minimum, provide data related to retention, persistence, completion, and transfer/job-placement/licensure in Appendix C (year over year tend data for the last five years). Then select four to five other indicators as applicable to include in Appendix C as well. Suggestions include:

- Indicators of Student Success
- Transfer/job-placement
- National, state, or disciplinary benchmarks
- Student Satisfaction/Feedback, including CCSSE data
- Alumni Survey (conducted by Institutional Research)
- Employer Feedback/Placement Reports (Career Services)
- Other benchmarks as appropriate

Please consult the data provided through the program review website and discuss the unique indictors that demonstrate how your program is fulfilling its purpose as well as supporting the overall institution and/or other programs (i.e., STEM courses supporting Allied Health programs).

A key performance benchmark is the five-year data for students passing the Environmental Protection Agency's US Clean Air Act, Section 608 – Refrigerant Usage Technician Certification. Testing data for the audit period indicates that the program certifies technicians at a higher percentage than the national average.

Successful student performance has provided employment with a number of companies and corporations in technician and facilities roles such as St. Lukes Hospital, Sanofi-Pasteur, Lehigh University, East Stroudsburg University, Steris, Burkholder HVAC, MBI HVAC, and a host of other companies.

Graduation data indicates that there have been 48 graduates at various program levels (AAS, Cert. & SD) during the audit period.

III. Environmental Scan

A. Identify current trends in the program's field or discipline.

Increased usage of Building Automation Systems (BAS) for HVAC.

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

Purchase of BAS trainers in 2021, course development is in progress

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

Yes _____ No **X**

If yes, complete Table 2.

Table 2. Top five program-to-program articulation agreements.

Name of the Institution	Type of Agreement	Average number of student who transfer here each year	Date agreement was last reviewed or updated
Bloomsburg University (BS in Technical Leadership)	60 credit Articulation Agreement	Unknown (data not tracked by program)	2021
Penn College of Technology	Case-by-case	0-1	2018

Have any problems been encountered concerning the transferability of courses?

Yes _____ No **X**

If yes, specify the nature of these problems.

D. Does the program have any inbound articulation agreements?

Yes **X** No _____

If yes, complete Table 3.

Table 3. Inbound articulation agreements.

Name of the Institution	Type of Agreement	Average number of student who transfer here each year	Date agreement was last reviewed or updated

Sending Secondary Career School in PA	Standard Perkins	2	2020

E. Provide regional workforce data with respect to (1) the number of people currently employed in the field; (2) projections for employment growth or decline; and (3) the current salary range. Discuss the implications of these numbers for the program.

Regional numbers indicate that Pennsylvania is number five of the industry's top five states in employment.

https://www.bls.gov/oes/2019/may/oes499021.htm

Occupation Title: Heating, Air Conditioning, and Refrigeration Mechanics and Installers
Occupation Code: 49-9021

Location	Estimated total employment (excludes self-employed)	Median hourly wage	Mean hourly wage	Annual mean wage	Job Outlook 2020 - 2030	Employment Change 2020-2030
National	356,960	$23.38	$26.29	$54,690	5% (Slower than average)	19000
State - PA	18,110	$23.42	$25.89	$53,840		
Local*	1,140	$23.57	$25.76	$53,580		

*Local Area: Allentown-Bethlehem-Easton, PA-NJ (includes Carbon, Lehigh, and Northampton PA Counties and Warren County NJ)

Data Sources
National: https://www.bls.gov/oes/current/oes_nat.htm
State - PA: https://www.bls.gov/oes/current/oes_pa.htm
Local – ABE: https://www.bls.gov/oes/current/oes_10900.htm

Currently, the pandemic is still impacting the industry; there was a recent decline in growth. However, in 2018 the industry had "much faster than average growth." Projections for these trades are that some older people are working into normal retirement age, but this will revert rapidly with the increase in the need for HVAC/R equipment and the aging workforce.

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

Yes **X** No _____

If yes, describe the nature of these relationships

The program has membership with the Refrigeration Service Engineers Society. This trade organization provides regular training meetings and allows NCC students to network and gain a student discounted rate that provides access to their online technical library, webinars, and a monthly trade publication.

Additionally, many companies utilize the program to increase the skill set of their employees by enrolling them in specific classes or funding towards a degree. One example is Follett Ice, which has specific courses for its apprenticeship program.

G. Does the program have an advisory committee?

Yes _____ No **X**

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

IV. Curriculum

A. Curriculum Matrix

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

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

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

Yes **X** No _____

If so, describe these changes.

Additional assessments according to the five-year plan for Gen-Ed core development.

In place have been assessments developed for Diversity, Ethics, and Communication.

Yet to identify will be Analyze and Technology; for these, core program learning outcomes will serve as the assessments.

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

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

The sequencing of courses has been fairly stable, with only a few changes over the audit period. Bringing the MATH103 course forward to the first semester and adding more sections for first semester EMEC114 have benefitted student understanding and technical proficiency with the tools of the industry.

The sequence, as shown, is also coordinated across the technical courses to provide for the maximum benefit of scheduling to allow students to craft a viable schedule.

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

   The student learning of the technical coursework for our population is primarily focused upon the "Get Ready for Life after Completion – Career Readiness" category. Students participate in career fairs and engage with our internship department as they are made aware of the opportunities presented. In many cases, they gain employment after their first two semesters and progress towards higher stackable credentials on a full-time or part-time basis as their availability and responsibilities allow.

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

   Yes _____ No **X**

   If so, describe these changes.

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

   The program has been working closely with our internship department and outside sources to gain opportunities with organizations such as Sanofi-Pasteur, Lehigh University, and independent contractors. In most cases, these have turned into full-time employment.

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

   Yes _____ No **X**

   If so, describe these changes.

D. Modality Awareness

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

   HVAC and related courses require significant lab components, so hybrid formats were developed and are employed as needed via Zoom sessions in response to the 2020 global pandemic and college closure.

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

   Yes _____ No **X**

   If so, describe these changes.

V. Assessment

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

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

Table 4. PLO Assessment

Program Learning Outcomes (include all program outcomes that are listed in the College Catalog)	Describe how the outcome has been assessed in the last five-year period.	What have been the results of that assessment?
Demonstrate an ability to work independently & collaboratively.	Students are graded on participation in lab activities independently and in teamwork groups to successfully complete activities.	Students discuss concepts methods of operation and improve on completing lab projects and completing graded worksheets.
Demonstrate competent speaking skills when working with diverse groups.	Classroom and lab discussions relate to industry terminology and how to convey technical content as per standard.	Initially, terminology used is sometimes vague, but reinforcement in the progression of courses demonstrates increased comprehension and better scores on lab sheets and testing.
Describe the operation and application of commonly used types of heating, ventilating, air conditioning and refrigeration systems used in residential and commercial facilities.	Classroom, text, quizzes/testing, and Lab assignments.	Those who apply themselves are better able to refer to missteps and show improvement.
Demonstrate observational, integrative and synthetic skills.	This is primarily evaluated during lab activities as students encounter problems and have to come up with solutions.	Those who discuss with the instructor and amongst their groups improve upon successful lab completion.
Demonstrate proficient research and computer skills in data gathering and analysis.	Students utilize Blackboard research assignments, and the HVAC program uses Cengage MindTap assignments and Simulation performance to evaluate.	Most traditional students do well with these, some non-traditional struggle, but in most cases improve.
Demonstrate a basic framework of technical vocabulary and graphics	Classroom and lab discussions when clarifying the proper terminology are engaged. Graphics interpretation is	Completing higher-level courses in the program demonstrates

interpretation applicable to the area of equipment maintenance and design.	primarily addressed when examining duct layouts and electrical diagrams.	improvements for those who apply themselves.
Describe the principles and function of the mechanical, electrical, and fluid power components and assemblies used in HVAC/R systems.	Lab activity worksheets requiring the answering of open-ended technical questions are routinely used.	Some students score exceptionally higher after doing additional research for these follow-up questions. Unfortunately, others do not achieve an average grade.
Operate, program, troubleshoot, repair, and modify equipment and associated components commonly found in air conditioners, heat pumps, gas burners, oil burners and commercial refrigeration systems.	These activities are routinely engaged during lab activities throughout the sequence of courses.	These activities are the favorite of all students and are evaluated by completing the worksheets.
Demonstrate the proper use of common mechanic tools and measuring gages used in HVAC/R construction and troubleshooting.	These activities are routinely engaged during lab activities throughout the sequence of courses.	These activities are the favorite of all students and are evaluated by completing the worksheets.
Apply mathematics to solving equipment related problems.	Working with pressure and temperature relations, weights, calculation of areas, and variations of equipment sizing, and capacities are employed during lab activities.	Some students struggle with this, but through instructor coaching, peer discussions, most improve dramatically and learn not to fear some calculations.
Analyze and present data in an acceptable and standardized manner.	Written reports, research papers, video summaries, and pseudo-quotes are required throughout the sequence of courses.	The more invested the student, the better they do.
Demonstrate the use of OSHA safety standards in servicing electromechanical equipment.	When completing lab activities, these standards are applied and are reinforced that these requirements are critical for industry safety.	Students improve over the span of coursework.
Demonstrate competent technical writing skills.	Written reports, research papers, video summaries, and pseudo-quotes are required throughout the sequence of courses.	The more invested the student, the better they do.

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

Every semester the instructional staff discusses ways to improve upon student performance. We have improved our implementation and structure of layout, assignments, and instruction sequence using each course's Blackboard shell. Working with Cengage MindTap has improved due to the integration of textbook, simulations, and video access through Blackboard.

Some of the lab activities have been expanded or reduced depending on student comprehension. In addition, some review labs have been integrated into second/third/fourth-semester courses to reinforce and practice skills learned in earlier coursework.

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

One item is the improvement to the functionality and access to the simulations in MindTap. Still, at this point, without burdening the students or the institution with additional cost for another platform, this is not viable at this time.
Other changes are the expansion of current technical activities in the lab, such as Variable Refrigerant Flow (VRF) systems and larger commercial equipment exposure. This is dependent upon an improvement in financial support and facilities expansion.
The most current change expected in the coming year is the addition of a new HVAC course in Building Automation Systems (BAS). The acquisition of the trainers has been completed, and course development is in process.

VI. Students

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

Table 5. Student Enrollment Data

Academic Year	2020-21	2019-20	2018-19	2017-18	2016-17
FALL					
Full-Time	31	30	34	22	26
Part-Time	33	34	31	32	38
Total Fall	64	64	65	54	64
SPRING					
Full-Time	27	26	28	24	23
Part-Time	23	25	30	24	39
Total Spring	50	51	58	48	62

The program has enjoyed fairly consistent enrollment in Fall starts with a slight decline in Spring start students. Still, most HVAC courses, dependent upon Fall/Spring offerings, are usually at capacity upon the start of the semesters.

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

Table 6. Student Demographic Data

Academic Year	2020	2019	2018	2017	2016
RACE/Ethnicity*					
Black or African American	10	8	10	10	9
Hispanic	18	14	14	11	7
Two or more Races	0	2	1	1	2
White	32	38	35	30	45
Sex					
Male	62	62	65	51	60
Female	2	2	0	3	4
*Unreported races or ethnicities had less than 2 during all reporting periods.					

There has been a steady increase in the Hispanic population which has helped to maintain steady enrollment numbers. This is due to this population growing in Bethlehem by 21 percent over the last decade to about 22,000, comprising about 29 percent of the population. Additionally, Allentown has the third highest Hispanic population in the state at over 68,000. https://www.natlawreview.com/article/census-numbers-show-lehigh-valley-diversifying-hispanic-population-now-majority

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

There has been some concern with student comfort during the pandemic, but that concern is decreasing due to strict adherence to Covid protection policies. Another concern is onboarding students into the new Workday system, but that has improved greatly, and how-to instructional videos and reference sheets have been added over the Fall 21 months.

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

Yes **X** No _____

If yes, please describe any initiatives.

The implementation of the areas of study has caused there to be more visibility on our now named "Industry & Manufacturing" page. This has caused an uptick in program information requests.

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

Yes **X** No _____

If yes, please describe any initiatives.

There is an increased awareness for these students to consider continuing or changing their major.

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

They are staying fairly consistent, although the retention rate shows more effort needs to be in educating new students on the technical nature of the coursework. A considerable number come into the trades education not realizing that the course and lab work will be engaging but also challenging. Many do not realize that assignments and coursework are something that cannot be ignored.

G. Comment on transfer rates for students who have and who have not graduated from the program.

There are minimal changes of major for those that have decided to pursue this program. That being said, a certain number of graduates start by declaring for the AAS, but after considering the requirements for the non-technical courses, later complete only the SD or Certificate level of the program to gain employment as soon as possible. While some plan on continuing in later years on a part-time basis towards the AAS.

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

The program only has one teaching administrator, but the Hartzell staff is always willing to talk with new students and show them the lab facilities. We work closely with our designated success navigator to answer any questions and make scheduling suggestions for new students but are also responsive to any others. Once the advising handoff is made, I am the active advisor for the HVAC program and work with students to overcome any scheduling or access difficulties.

VII. Physical and Financial Resources

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

Computer and media presentations are sufficient for instruction. However, additional lab space is needed.

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

There is a need for increased lab space to better implement lab usage and the installation of new equipment on a permanent basis. Currently, most equipment has to be trundled in and out of place depending upon the course. Office space and instructional supplies are adequate. Some new equipment will be needed, but there are a number of items in reserve as equipment fails over time.

C. Discuss library resources.

The library is sufficient for academic courses and has some trade content.

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

Marketing efforts are improving, through a grant from Provident Bank and there are videos in production highlighting certain programs, HVAC being one of them. However, we still do not have enough public exposure and program-specific media. As a result, existing and potential students are often surprised upon discovering what Hartzell Technology hall has to offer.

E. Program costs and income.

Table 7. Financial Data

Academic Year	FY2021	FY2020	FY2019	FY2018	FY2017
Program Income					
Tuition	86,929	48,737	49.627	29,781	53,807
Local Reimbursement	16,326	8,240	8,433	4,942	8,828
Operating Reimb.	39,959	19,983	19,727	11,284	20,305
Total Income	143,214	76,960	77,787	46,007	82,940
Program Costs					
Direct Costs	128,911	57,711	84,754	39,896	74,472
Indirect Costs	69,827	36,546	38,510	21,244	36,234
Total Costs	198,739	94,258	123,264	61,140	110,706
FTE	16.51	9.58	10.04	6.16	11.39
Income per FTE	8,676	8,031	7,750	7,472	7,283
Cost per FTE	12,039	9,836	12,282	9,930	9,721
Inst. Avg. Cost per FTE	8,901	7,820	7,933	7,075	6.703
Rank	25 of 138	32 of 135	10 of 133	20 of 126	13 of 132

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

   College budgetary resources primarily fund the program consumables from year to year.

   Perkins grant funding funded the purchase of 4 BAS training systems ($80K)

   Perkins grant funding funded the purchase of replacement parts for refrigeration trainers ($4.5K)

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

   No. During the previous audit period, we were heavily assisted in funding from a TAACT grant, so program costs were more favorable before entering this audit period. There is a need to increase materials fees currently under consideration with the college president and CFO.

   During the previous audit period, we did not have materials fees associated with our programs at all, these were finally implemented during the 16-17 academic year. We are still working out materials costs to better capture program balance and requests for fee increases. To offset student costs during the last two years and the pandemic, these have not been acted on yet.

   Are you getting additional funding from grants or donors?
   Not at this time.

VIII. Human Resources

A. Briefly describe Program Leadership and oversight.
   The program manager teaches a number of courses and oversees the adjunct faculty to provide resources and training with NCC systems, Blackboard LMS, and other required administrative functions.

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

Table 8. Faculty Demographic Data

Rank	Last Review	Current Review
Professional Staff/ Faculty	1	1
Part-Time Faculty	3	3
Clerical Staff	1	1

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

   No change. There is great difficulty in finding qualified adjuncts from the industry environment, especially with the extension in continued years by elder employees due to the economic concerns from the past decade. This has exacerbated finding additional adjuncts as they are working later past retirement and not inclined to pursue teaching. Consideration of utilization of a weekend opportunity for increase in students and qualified adjuncts is being reviewed.

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

   No change.

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

   There are no full-time faculty associated with this program. The program oversight is with a program manager with teaching responsibilities.

   The percentage of day to evening courses varies by the spring or fall semesters due to scheduling certain courses to allow evening or day students the chance to take certain second-level courses. However, on average, the ratio is 50/50 for day and evening offerings.

   At this point, there are only occasional online sessions scheduled for what are primarily on-ground and in-lab sessions. If an online meeting is scheduled, it is focused on the next steps towards completion in the lab sessions.

C. Faculty Expertise/Experience

1. Northampton hires faculty members who are well-credentialed (see Appendix I, Appendix J, and Appendix K) and understand and embrace the open-access mission of the community college. The faculty and instructors are evaluated at the end of every semester.

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

   All instructors in the program possess decades of experience in their various subject areas and, as part of a highly technical and advancing field, routinely study subject material and trade periodicals, attend training meetings, and engage in webinar sessions from relevant manufacturers.

IX. Analysis of Findings

A. Based upon the data collected in this document, discuss the strengths and weaknesses of your program. *For example: do students progress successfully through courses; are staffing/equipment/facilities needs filled; are assessment efforts successful; etc.*

The HVAC program at NCC is viewed favorably by motivated students and employers in the region. Students that are willing to learn and apply themselves have no trouble finding gainful employment. However, an increase in staffing and facility space are needed to increase visibility to add more teaching content/sections and improve lab maintenance. This is in addition to the need for more targeted marketing to improve program awareness.

B. Based on the data collected in this document, discuss the opportunities for improvement available to your program and the internal and external challenges your program faces. *For example: is the program in demand; are graduates employable/able to transfer; what is the future plan for this program; etc.*

The program is in demand, and successful graduates are readily employable. Future plans for the program include setting up the advisory board and integrating new technology such as variable refrigerant flow systems and more commercial HVAC and refrigeration content and equipment.

C. What additional data that is currently not available would have been helpful to evaluate this program effectively?

Factors of enrollment that do not fully capture non-traditional students who may be taking only certain courses on their own or employer-funded. Most of the data points focus on traditional students.

X. External Review Report

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

XI. Action Plan

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

1. Goal – Integrate the remaining gen-ed assessments into the core curriculum of HVAC courses.
    i. Timeframe: Spring 2023
    ii. Responsible Party: Daniel Philipps
    iii. Resource Implications: The remaining outcomes not yet integrated are the Analyze and Technology outcomes. As these are key items of the programs PLOs, there will be the ability to specifically identify normal coursework assessment to provide for meeting this goal.
2. Goal – Create the new BAS course to integrate content from text and activities with the BAS trainers.

i. Timeframe: Fall 2022 (to allow adoption into Catalog 23-24

ii. Responsible Party: Daniel Philipps

iii. Resource Implications: Curriculum work to program to either add to sequencing or as an option technical elective.

Appendix A: Program Description

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) - A.A.S. DEGREE

Narrative (AAS)

HVAC/R technology continues to become more and more sophisticated with each technological development. Highly efficient and environmentally sustainable equipment provides affordable and reliable comfort in our factories, offices and homes. These systems create the demand for well-trained technicians who can service, maintain, install and retrofit complex equipment.

Graduates of Northampton's HVAC/R Technology associate's degree program are qualified to service and repair air conditioning equipment, oil and gas burners, heat pumps, ventilation equipment, and commercial refrigeration systems located in residences, offices, industrial plants, medical and educational institutions and retail establishments. Earning an associate's degree gives you an additional competitive edge, particularly if you are interested in growing into supervisory positions. It is also a stepping stone to an advanced degree, such as a bachelor of science.

Features

Northampton's Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC/R) Technology program was developed with the assistance of many of the area's leading HVAC/R organizations. Because of this, you can be confident that your studies will meet the demands of local and national HVAC contractors and fuel companies.

Industry-experienced instructors provide the basic fundamentals of electrical and mechanical systems with over 400-hours of in-depth, hands-on study of actual refrigeration, burner and ventilation systems. As a student in the program, you will be prepared to take the EPA Refrigerant Technician licensure test, which is held at NCC. The Practicum course provides an internship experience with an employer, allowing you first-hand experience in HVAC and refrigeration field service. The associate's degree general education coursework rounds out your education, allowing you to communicate and work more effectively with diverse customers, suppliers and co-workers.

Our program can be completed on either a full-time or part-time evening basis. Check with your advisor for more information and options in course selection.

Transfer Information:

- The program is not specifically intended for transfer, but is considered on a case-by-case basis by Pennsylvania College of Technology.
- The program is eligible for the Bloomsburg partnership for their - Bachelor of Applied Science in Technical Leadership, that guarantees 60 credits of transfer for successfully completed AAS degrees.

Career Information: Technician Job titles related to HVAC/R education**:**

- HVAC/R Service; Commercial Refrigeration; Building Automation; Facilities Maintenance

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) – Certificate Program

Narrative

As a graduate of Northampton's HVAC/R certificate program, you will have the qualifications needed to find good-paying employment in this highly technical field. Many of our graduates command above-average salaries as service and installation technicians with HVAC/Mechanical contractors or as maintenance technicians in commercial and industrial facilities.

Features

Our program offers the unique opportunity to learn the concepts and service practices on components and equipment used in HVAC/R systems. You will also learn the proper methods of recovery and handling of refrigerants and be prepared to take the EPA Refrigerant Technician licensure test.

The program's curriculum includes electrical theory, heating and cooling concepts, refrigeration cycle theory, equipment operation, component specification, whole system operation, system calculations, and diagnostic approaches.

If you decide to advance your education further, all of the course work in this certificate program can be applied toward Northampton's Associate in Applied Science (AAS) degree: Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC/R) Technology

Heating, Ventilation, Air Conditioning (HVAC) – Specialized Diploma (SD)

Narrative (SD)

As a graduate of Northampton's Heating, Ventilation and Air Conditioning (HVAC) Technology program, you will have the qualifications needed to find employment in this highly technical field. Many of our graduates command competitive salaries in facilities maintenance jobs and as service and installation technicians in heating and air conditioning service companies.

Our program was created in response to the needs of business and industry for short-term job training programs. Students gain in-depth understanding of HVAC systems and maintenance practices at an accelerated pace.

Features

Our program offers the unique opportunity to learn the concepts and practices on components and equipment used in actual HVAC systems. You will also learn the proper methods of recovery and handling of refrigerants and be prepared to take the EPA Refrigerant Technician licensure test.

Coursework includes electrical theory, heating and cooling concepts, the refrigeration cycle, equipment operation and maintenance, component specification, and diagnostic approaches. Progressive courses train in the skills related to commercial AC, residential power wiring/NEC code, oil and gas-fired heating equipment, air-to-air heat pumps, and geothermal system design and installation.

All of the course work in this specialized diploma program can be applied toward Northampton's higher level, HVAC/R Certificate and the Associate in Applied Science (AAS) degrees in Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC/R) Technology.

Career Potential: Facilities Maintenance Mechanic, HVAC Service Technician, and Refrigeration.

Appendix B: Program-Level Learning Outcomes

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) - A.A.S. DEGREE

Graduates of the program will be able to:

- Demonstrate an ability to work independently & collaboratively.
- Demonstrate competent speaking skills when working with diverse groups.
- Describe the operation and application of commonly used types of heating, ventilating, air conditioning and refrigeration systems used in residential and commercial facilities.
- Demonstrate observational, integrative and synthetic skills.
- Demonstrate proficient research and computer skills in data gathering and analysis.
- Demonstrate a basic framework of technical vocabulary and graphics interpretation applicable to the area of equipment maintenance and design.
- Describe the principles and function of the mechanical, electrical and fluid power components and assemblies used in HVAC/R systems.
- Operate, program, troubleshoot, repair and modify equipment and associated components commonly found in air conditioners, heat pumps, gas burners, oil burners and commercial refrigeration systems.
- Demonstrate the proper use of common mechanic tools and measuring gages used in HVAC/R construction and troubleshooting.
- Apply mathematics to solving equipment related problems.
- Analyze and present data in an acceptable and standardized manner.
- Demonstrate the use of OSHA safety standards in servicing electromechanical equipment.
- Demonstrate competent technical writing skills.

Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R) – Certificate Program

Graduates of the program will:

- Demonstrate an ability to work independently and collaboratively.
- Analyze and present data in an acceptable and standardized manner.
- Demonstrate a basic framework of technical vocabulary applicable to the HVAC/R field.

- Demonstrate the proficient use of the tools and diagnostic equipment utilized within the industry.
- Interpret and apply the EPA regulatory laws applicable to refrigerant handling and other environmentally hazardous materials used with HVAC/R systems.
- Be able to describe the principles of operation of residential, commercial, institutional, and industrial HVAC/R equipment.
- Demonstrate the ability to service and repair these systems utilizing industry proven methods and procedures.
- Be able to explain commercial/industrial control systems and demonstrate the troubleshooting skills necessary to solve complex problems.
- Demonstrate knowledge of airflow dynamics and the proper application of components in a commercial refrigeration system.
- Apply math concepts in solving equipment related problems and service invoicing.
- Demonstrate competent communication and technical writing skills.
- Demonstrate observational, integrative, and synthetic skills.

Heating, Ventilation, Air Conditioning (HVAC) – Specialized Diploma (SD)

Graduates of the program will:

- Demonstrate an ability to work independently and collaboratively.
- Analyze and present data in an acceptable and standardized manner.
- Demonstrate a basic framework of technical vocabulary applicable to the HVAC/R field.
- Demonstrate the proficient use of the tools and diagnostic equipment utilized within the industry.
- Interpret and apply the EPA regulatory laws applicable to refrigerant handling and other environmentally hazardous materials used with HVAC/R systems.
- Be able to describe the principles of operation of residential and light commercial heating and cooling equipment.
- Demonstrate the ability to service and repair these systems utilizing industry proven methods and procedures.

Appendix C: Program-Level Performance Indicator Data

EPA Section 608 Air Conditioning & Refrigeration, both Certified and Not Certified

Certifications updated between August 01, 2017 and November 30, 2021

Your Results,

Core	Type I	Type II	Type III
94%, (88/93)	88%, (82/93)	86%, (80/93)	75%, (70/93)

National Results,

Core	Type I	Type II	Type III
80%	75%	67%	62%

https://www.escogroup.org/

Retention, Persistence, and Completion Data

Year	Total Students[a]	Withdrew[b]	Withdrew and transferred[c]	Retained in new major[d]	Retained in same major[e]	Graduated[f]	Graduated and Transferred[g]	% Retained[h]
2019	64	35	0	2	17	11	0	46.2%
2018	65	28	0	2	24	11	0	56.9%
2017	54	27	1	2	19	5	0	48.1%
2016	64	28	0	5	21	10	0	56.3%
2015	63	32	0	2	23	6	0	49.2%

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

Additional Information - Top transfer schools for 2015-2019 – Majors most frequently changed to:

No school had significant transfer since most students finish the program here or change majors but this school had on student transfer. – Community College of Philadelphia

Business Management and General Studies were the majors most frequently changed to.

Letter of commendation for the program effectiveness from internship employer.

STERIS
Life Sciences

Attention: January 26, 2022

Daniel Philips
*HVAC/R & Constr. Mgmt. Edu.*Project:
Northampton Community College - Hartzell Tech Hall 153-F
3835 Green Pond Road - Bethlehem, PA 18020

It is with great pleasure I offer this letter as testament to the outstanding students coming out of Northampton Community College HVAC Program. As the Senior District Manager for the Mid Atlantic region at CECS Inc. a subsidiary of STERIS. I am responsible for the Quality, Timely certification of Critical Environments for many of the top pharmaceutical manufacturers in the region in a very condensed timeframe. Due to some turnover of the CECS workforce I found myself significantly short, qualified workers entering the 2021 winter shutdown and needed to onboard some technically proficient seasonal employees quickly. After connecting with Dan Phillips and getting the opportunity to present the opportunity to the HVAC Classes, CECS Inc hired 6 students to bring on as seasonal employees. Each student was provided a 3 day training course in our Bethlehem facility covering Certification SOPs, Equipment Operation and hands on practical evaluations of the tasks required in testing & certifying Critical Environments.

From day 1, it was evident during the train up and evaluations that these individuals possessed a very solid knowledge of HVAC systems and quickly mastered operation of the equipment associated with Cleanroom Certification: Thermal Anemometers, Holometers, Laser Particle Counters, Photometers and Velgrids. This base knowledge gained at NHCC positioned these students to quickly integrate into 5 to 12 person teams certifying a variety of aseptic spaces and equipment on a condensed time line. Beyond my personal observations during train up, numerous accolades for each of these students were submitted from Project Leads highlighting how quickly these students made an immediate impact on each assigned job, their willingness to work and get the job done for a demanding customer base. Very impressed with the success of this venture and look to build on this years overwhelming success.

In closing, I have had nothing but great experience working with NHCC students. The 2 graduates of this program that I have hired previously have outperformed their peers in all facets of the job and received promotions and assignments as reward for their contributions. I hope to hire all of the students from the 2021 Winter Shutdown again as either a seasonal or permanent employees of CECS Inc STERIS. Great things happening at Northampton Community College!

Respectfully,

James (Jim) Harris
Senior District Manager
Controlled Environment Certification Services, Inc.
A Subsidiary of STERIS Corporation

Controlled Environment Certification Services, Inc.
A Subsidiary of STERIS Corporation
5960 Heisley Road • Mentor OH 44060
1-800-523-9852 • www.sterislifesciences.com • cecs_info@steris.com

Letter of commendation for the program effectiveness from a student.

To Daniel Philipps, HVAC PROGRAM REVIEW

I am very happy with the guidance that I was given by my Advisor/Professor Philipps in what HVAC classes I should take and helping me figure out the best schedule so I could finish in a reasonable time. He was very open to answering all my questions.

For my first semester, I had Professor Philipps for Fundamentals of HVAC/R 1. In the beginning, he had us read a lot about HVAC components and how they work simultaneously to function correctly. To many of us, I am sure we are wondering why so much reading. While as I look back now, I can see how it helped me build my knowledge on how to work on the hands-on labs.

The labs were very interesting and for the most part I was able to understand them. Many people would have liked it more if he would have shown them two to three more times on how to do something, but after he showed it once, he wanted you to do it on your own. I believe his idea was that you could learn to do it on your own and then you could help your fellow students understand as well. This worked because while you helped teach other students on how to do the work, you were also practicing for yourself.

I am very happy with how the HVAC program turned out. It was very detailed, and the teachers were always very nice and ready to answer all of my questions. I would gladly recommend anyone interested in HVAC, or any trades, to go to Northampton Community College to prepare for your future trade career.

Josiah LaBadie – January 2022

Appendix D: Curriculum Matrix

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

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

Program Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EME C 101	HVA C 101	EME C 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVA C 102	HVA C 124	HVA C 140	ENG L 101	ELTC 107	EME C 135	ENGL 151T	CMTH 102	PHY S 152	HVAC 250	HVAC 204
1. Demonstrate an ability to work independently & collaboratively.	I	I	I	I					R	R	R		R	R			R	R, M	R, M
2. Demonstrate competent speaking skill when working with diverse groups.	I															R, M			
3. Describe the operation and application of commonly used types of heating, ventilating, air conditioning and refrigeration systems used in residential and commercial facilities.			I						R	R	R			R				R, M	R, M

Program Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EMEC 101	HVAC 101	EMEC 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVAC 102	HVAC 124	HVAC 140	ENGL 101	ELTC 107	EMEC 135	ENGL 151T	CMTH 102	PHYS 152	HVAC 250	HVAC 204
4. Demonstrate observational, integrative and synthetic skills.	I	I	I	I	I	I		R	R	R	R	I, R	R	R	R, M	R, M	R	R, M	R, M
5. Demonstrate proficient research and computer skills in data gathering and analysis.			I			I, R			R	R	R	I, R			R, M	R, M		R, M	R, M
6. Demonstrate a basic framework of technical vocabulary and graphics interpretation applicable to the area of equipment maintenance and design		I	I	I				I, R	R	R	R		R	R				R, M	R, M
7. Describe the principles and function of the mechanical, electrical, and fluid power components and assemblies used in HVAC/R systems.		I	I	I					R	R	R		R	R			R	R, M	R, M
8. Operate, program, troubleshoot, repair and modify equipment and associated components commonly found in air conditioners, heat pumps, gas burners, oil burners, and commercial refrigeration systems.		I	I	I					R	R	R		R	R				R, M	R, M

Program Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EMEC 101	HVAC 101	EMEC 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVAC 102	HVAC 124	HVAC 140	ENGL 101	ELTC 107	EMEC 135	ENGL 151T	CMTH 102	PHYS 152	HVAC 250	HVAC 204
9. Demonstrate the proper use of common mechanic tools and measuring gages used in HVAC/R construction and troubleshooting.		I	I	I			I, R		R	R	R		R	R				R, M	R, M
10. Apply mathematics to solving equipment related problems.		I	I	I	I				R	R	R		R	R			R, M	R, M	R, M
11. Analyze and present data in an acceptable and standardized manner.	I	I	I	I	I	I		R	R	R	R	I, R	R	R	R, M	R, M	R, M	R, M	R, M
12. Demonstrate the use of OSHA safety standards in servicing electromechanical equipment.		I	I	I			I, R		R	R	R		R	R				R, M	R, M
13. Demonstrate competent technical writing skills.		I	I	I				R	R	R	R	I	R	R	R, M	R	R, M	R, M	R, M

Appendix E: Key Abilities Program Matrix

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

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

5. ***Engage in Ethical Questions***

- *Students are able to identify ethical choices, consider alternatives and consequences, and choose actions keeping in mind everyone affected.*

Gen Ed (Key Abilities) Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EMEC 101	HVAC 101	EMEC 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVAC 102	HVAC 124	HVAC 140	ENGL 101	ELTC 107	EMEC 135	ENGL 151T	CMTH 102	PHYS 152	HVAC 250	HVAC 204
Communicate: Share their ideas powerfully and clearly.		A	A						A	A	A							A	A
Analyze and Solve Problems: See and solved the problems around them, using solid data to draw and communicate reasonable conclusions.		A	A						A	A	A							A	A

Gen Ed (Key Abilities) Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EMEC 101	HVAC 101	EMEC 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVAC 102	HVAC 124	HVAC 140	ENGL 101	ELTC 107	EMEC 135	ENGL 151T	CMTH 102	PHYS 152	HVAC 250	HVAC 204
Understand Diversity: Understand how each individual's experiences shape our society, and how societies, in turn, shape the way local and global resources are used.			A																
Engage in Ethical Questions. Identify choices, consider alternatives and consequences, and choose actions keeping in mind everyone affected.			A																

Gen Ed (Key Abilities) Learning Outcomes *(Upon completion of the program, students will be able to…)*	COLS 101	EMEC 101	HVAC 101	EMEC 114	MATH 103	CISC 101	OSAH 101	CMGT 104	HVAC 102	HVAC 124	HVAC 140	ENGL 101	ELTC 107	EMEC 135	ENGL 151T	CMTH 102	PHYS 152	HVAC 250	HVAC 204
Use Technology. Select and ethically use appropriate technology to create, communicate, and discover.		A	A						A	A	A							A	A

Communicate:

- Lab Reports in EMEC101 and HVAC102
- Tech Video Q&A Assignments all HVAC courses
- Final Research Paper in HVAC102
- Final Bid Document in HVAC204 and HVAC250

Analyze and Solve Problems

- EPA Refrigerant Usage Certification
- Lab Wiring and troubleshooting
- Lab equipment analysis and troubleshooting/repair
- Standardized final exams and assessments

- All coursework and labs

Understand Diversity

- All PowerPoints and class materials will be reviewed and updated as needed.
- HVAC101 - Research will be completed to include a diversity topic
- Incorporating YouTube videos into lessons (EdPuzzle, etc.)
    - https://www.youtube.com/watch?v=-dWxzUBn6uo&ab_channel=RCadellCook
    - https://www.youtube.com/watch?v=NvXpBE3YouE&ab_channel=WadiSpeaks
    - https://www.youtube.com/watch?v=Kx2x0W79cz4&ab_channel=RCadellCook
    - https://www.youtube.com/watch?v=AeSRVU-j1kQ&ab_channel=WordofAdviceTV
    - https://www.youtube.com/watch?v=Rg8hE1JQT2U&ab_channel=MaineEnergyMarketersAssociation
    - https://www.youtube.com/watch?v=sew49OhxM50&t=9s&ab_channel=BudgetHeating%2CCooling%26Plumbing
    - https://www.youtube.com/watch?v=_sIFwlZMrrU&ab_channel=WWHVAC
- Note: A majority of the supporting course items are supplied by the textbook companies and cannot be modified by NCC.

Engage in Ethical Questions

- Communication coursework instructions.

Use Technology

- Successfully showing understanding of the various equipment in the HVAC labs
- All HVAC coursework, lab work, and exams

Appendix F: Program Map

HEATING, VENTILATION, AIR CONDITIONING, & REFRIGERATION (HVAC/R) – Associate in Applied Science (AAS) (2019-2020 Catalog)
Heating, Ventilation, Air Conditioning & Refrigeration (HVAC/R)– Certificate (CE);
Heating, Ventilation, & Air Conditioning (HVAC) – Specialized Diploma (SD)

Student Name: _____

Advisor Name: _____

Developmental Education Courses *(if required)*

English Placement			Math Placement		
☐	ACLS025	Academic Reading and Writing Skills I	☐	MATH 020	Pre-Algebra
☐	ACLS026	Academic Reading and Writing Skills II	☐	MATH 022	Elementary Algebra
☐	ACLS050	Introduction to Academic Literacy	☐	MATH 026	Intermediate Algebra
☐	ENGL027	Writing Skills Workshop			

SEMESTER-BY-SEMESTER PROGRAM MAP FOR FULL-TIME STUDENTS Courses are listed in preferred order of completion
Plans can be modified to fit the needs of part-time students by adding more semesters
Choose your courses with your Success Navigator or Faculty Advisor.

Complete	**Semester 1**						
	Course #	Course Title	Credits	Applies to	Gen Ed	Term/Location Offered (Fall, Winter, Spring, Summer) (Bethlehem, Monroe, Fowler, Online)	Pre-requisites / Co-requisites (PRE / CO)
☐	COLS101	College Success	1	AAS, CE, SD		FA, SP, SU; BETH, MROE, DIST	
☐	CISC101	Introduction to Computers	3	AAS, CE	CL	FA, SP, SU; BETH, MROE, DIST	
☐	EMEC101	Electrical Fundamentals	3	AAS, CE, SD		FS, SP, SU; BETH	
☐	EMEC114	Mechanical Skills for the Trades	2	AAS ,CE, SD		FS, SP, SU; BETH	
☐	HVAC101	Fundamentals of HVAC/R I*	4	AAS ,CE, SD		FA, SP, SU; BETH	PRE or CO: EMEC101
☐	MATH103	Applications in Mathematics	3	AAS ,CE, SD	QL	FA, SP, SU; BETH, MROE, DIST	
☐	OSAH100	Industry Outreach Safety Education	1	AAS ,CE, SD		F, SP; BETH	
		Total Semester Credits:	17				
Complete	**Semester 2**						
	Course #	Course Title	Credits	Applies to	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
☐	CMGT104	Construction Print Reading	3	AAS,CE, SD		FA, SP; BETH	
☐	ELTC107	Electrical Wiring I	3	AAS, CE, SD		FA, SP; BETH	PRE: EMEC101
☐	ENGL101	English I	3	AAS, CE	Communication	FA, SP, SU; BETH, MROE, DIST	PRE: ENGL Placement Policy
☐	HVAC102	Fundamentals of HVAC/R II	3	AAS, CE, SD		FA, SP; BETH	PRE: EMEC101, HVAC101
☐	HVAC124	Heating: Gas, Oil, Solar Thermal, Air & Hydronic Systems	4	AAS, CE, SD		FA, SP; BETH	PRE: EMEC101
☐	HVAC140	Heat Pump Systems	2	AAS, CE, SD		FA, SP; BETH	PRE: EMEC101, HVAC101

		Total Semester Credits	18				
Complete	**Semester 3**						
	Course #	Course Title	Credits	Applies to	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
☐	CMTH102	Introduction to Communication	3	AAS	Communication	FA, SP, SU; BETH, MROE, DIST	
☐	EMEC135	Electrical Motors and Controls	4	AAS, CE		FA, SP, SU; BETH	PRE: EMEC101
☐	ENGL151T	English II (Technical Writing)	3	AAS	Communication	FA, SP, SU; BETH, MROE, DIST	PRE: ENGL101
☐	PHYS152	Physical Science II	3	AAS	Science	FA, SP, SU; BETH, DIST	
☐		Technical Elective	3	AAS, CE		FA, SP, SU; BETH, MROE, DIST	
		Total Semester Credits	16				
Complete	**Semester 4**						
	Course #	Course Title	Credits	Applies to	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
☐	HVAC204	Refrigeration System Troubleshooting	3	AAS, CE		SP; BETH	PRE: HVAC102
☐	HVAC250	HVAC Airflow and Distribution	3	AAS, CE		SP; BETH	PRE: EMEC101, HVAC101
☐	HVAC260G	HVAC/R Technology Practicum (WI)	2	AAS	WI	SP; BETH	PRE: ENGL101 and completion of 3 semesters of HVAC/R Technology AAS degree program or instructor approval
☐		AH, SIT, or SSHB General Education Elective	3	AAS	AH, SIT, or SSHB	FA, SP, SU; BETH, MROE, DIST	
☐		AH, SIT, or SSHB General Education Elective	3	AAS	AH, SIT, or SSHB	FA, SP, SU; BETH, MROE, DIST	
☐		Elective [*Technical Elective for CE*]	3	AAS, CE		FA, SP, SU; BETH, MROE, DIST	
		Total Semester Credits:	17				
		Total Degree Credits:	68 (AAS)	51-53 (CE) HVAC/R Technology Certificate		29 (SD) HVAC/R Technology Specialized Diploma	

Notes*:*

- *In conjunction with this course (HVAC101) the non-credit seminar/testing session: ACRNC107 - EPA Refrigerant Usage Certification is scheduled.
- Students are advised to select the Technical Writing option for ENGL 151(T), but Literature or Report Writing are accepted.
- Technical Electives: any CADM, EMEC, ELEC, ELTC, ENGG, CHEM, CISC, or WELD except CADM 100, EMEC 115, ENGG 100, OR ENGG117.
- For the General Education Electives, students must select one course from the list of approved courses in two of the following categories: Arts & Humanities (AH); Social Science: Societies and Institutions over Time (SIT); Social Science: Scientific Study of Human Behavior (SSHB); One course should be designated as Diversity (D).
- Completion of HVAC 260G satisfies the Writing Intensive (WI) requirement.

Program Narrative:

- HVAC/R technology continues to become more and more sophisticated with each technological development. Highly efficient and environmentally sustainable equipment provides affordable and reliable comfort in our factories, offices and homes. These systems create the demand for well-trained technicians who can service, maintain, install and retrofit complex equipment.
- Graduates of Northampton's HVAC/R Technology associate's degree program are qualified to service and repair air conditioning equipment, oil and gas burners, heat pumps, ventilation equipment, and commercial refrigeration systems located in residences, offices, industrial plants, medical and educational institutions and retail establishments. Earning an associate's degree gives you an additional competitive edge, particularly if you are interested in growing into supervisory positions. It is also a stepping stone to an advanced degree, such as a bachelor of science.

Program Learning Outcomes:

- Demonstrate an ability to work independently & collaboratively.
- Demonstrate competent speaking skills when working with diverse groups.
- Describe the operation and application of commonly used types of heating, ventilating, air conditioning and refrigeration systems used in residential and commercial facilities.
- Demonstrate observational, integrative and synthetic skills.
- Demonstrate proficient research and computer skills in data gathering and analysis.
- Demonstrate a basic framework of technical vocabulary and graphics interpretation applicable to the area of equipment maintenance and design.
- Describe the principles and function of the mechanical, electrical and fluid power components and assemblies used in HVAC/R systems.
- Operate, program, troubleshoot, repair and modify equipment and associated components commonly found in air conditioners, heat pumps, gas burners, oil burners and commercial refrigeration systems.
- Demonstrate the proper use of common mechanic tools and measuring gages used in HVAC/R construction and troubleshooting.
- Apply mathematics to solving equipment related problems.
- Analyze and present data in an acceptable and standardized manner.
- Demonstrate the use of OSHA safety standards in servicing electromechanical equipment.
- Demonstrate competent technical writing skills.

Transfer Information:

- The program is not specifically intended for transfer, but is considered on a case-by-case basis by Pennsylvania College of Technology.
- The program is eligible for the Bloomsburg partnership for their - Bachelor of Applied Science in Technical Leadership, that guarantees 60 credits of transfer for successfully completed AAS degrees.

Career Information: Technician Job titles related to HVAC/R education: HVAC/R Service

- Commercial Refrigeration
- Building Automation
- Facilities Maintenance

See https://northampton.emsicc.com/careers/heating-and-air-conditioning-mechanic-and-installer for information on career options and earning potential.

Arts & Humanities (AH) Electives	Societies & Institutions over Time (SIT) Electives	Diversity (D) Electives
ARTA 100 Art and Visual Thinking	CMTH 221 History of Broadcasting	BIOS 126 Environmental Science
ARTA 101 Art History Survey	GEOG 101 World Geography	BIOS 210 Environmental Biology
CMTH 110 Introduction to the Theatre	GEOG 151 Geography of the U.S. and Canada (G-WI)	BUSA 115 Intro to International Business
CMTH 111 Acting I	GLBL 130 Intro to Global Studies	CJST 250 Contemporary Issues in Criminal Justice
CMTH 115 Technical Theatre	GLBL 160 Field Experience & Acad Research in GS	CMTH 126 The Communication Arts
CMTH 117 Stagecraft	GLBL 230 Global Studies Capstone	CMTH 211 Plays: Classical to Contemporary
CMTH 126 The Communication Arts	HIST 103 Ancient and Medieval History	CMTH 215 Intercultural Communication
CMTH 189 Stage Voice and Movement	HIST 113 American History I (G-WI)	DANC 101 Dance History
CMTH 190 Stage Production	HIST 121 The Black Experience (G-WI)	ENGL 151L English II (Literature)
CMTH 206 Directing	HIST 123 African Civilization	ENGL 205 American Literature I
CMTH 211 Plays: Classical to Contemporary (G-WI)	HIST 140 Modern Chinese History	ENGL 211 Plays: Classical to Contemporary
CMTH 212 Acting II	HIST 153 Found of Mod Euro History, 1300-1815 (G-WI)	ENGL 215 Multicultural Adolescent Literature
CMTH 218 Theatre Portfolio	HIST 163 American History II	ENGL 250 Latin American Literature
CMTH 220 Introduction to Film	HIST 165 The American Experience of Warfare	ENGL 251 British Literature II
DANC 101 Dance History	HIST 166 Civil War and Reconstruction (G-WI)	ENGL 253 Creative Writing
DANC 110 Ballet I	HIST 168 History of the Middle East (G-WI)	ENGL 255 American Literature II
DANC 120 Modern Dance I	HIST 173 Mod European History, 1815 to Present (G-WI)	ENGL 256 Modern Poetry
DANC 130 Jazz I	HIST 210 History of Mod Science, 1859 to Present	ENGL 257 20th Century Lit by Women
DANC 210 Ballet II	HIST 211 History of Pennsylvania	ENGL 260 Contemporary Literature
DANC 220 Modern Dance II	INTS 202 The Architecture of the City: Classic to Contemporary	ENGL 264 Irish Literature
DANC 230 Jazz II	POLS 101 Introduction to Political Science	ENGL 265 African-American Literature
ENGL 201 British Literature I (G-WI)	POLS 105 American Constitutional Law (G-WI)	ENGL 267 Poetry Writing
ENGL 203 Shakespeare (G-WI)	POLS 110 American National Government (G-WI)	GEOG 101 World Geography
ENGL 205 American Literature I (G-WI)	POLS 150 Peace Studies & Conflict Resolution (Study Abroad)	GEOG 121 Environmental Sustainability
ENGL 211 Plays: Classical to Contemporary (G-WI)	POLS 170 Politics of Modern Turkey (Study Abroad)	GEOG 151 Geography of the U.S. and Canada
ENGL 215 Multicultural Adolescent Literature (G-WI)	POLS 202 International Relations	GEOG 210 Weather and Climate
ENGL 250 Latin American Literature (G-WI)	POLS 205 Women and Politics (G-WI)	GLBL 130 Intro to Global Studies
ENGL 251 British Literature II (G-WI)	POLS 251 State and Local Government (G-WI)	GLBL 160 Field Experience & Acad Research in GS
ENGL 253 Creative Writing	SOCA 102 Cultural Anthropology (G-WI)	GLBL 230 Global Studies Capstone
ENGL 255 American Literature II (G-WI)	SOCA 105 American Ethnicity	HIST 113 American History I
ENGL 256 Modern Poetry (G-WI)	SOCA 160 Issues in Contemporary Genocide & Mass Violence	HIST 121 The Black Experience
ENGL 257 20th Century Lit by Women (G-WI)		HIST 140 Modern Chinese History
ENGL258 Fiction Writing		HIST 165 The American Experience of Warfare
ENGL 260 Contemporary Literature (G-WI)		HIST 166 Civil War & Reconstruction
ENGL 264 Irish Literature (G-WI)	Scientific Study of Human Behavior (SSHB) Electives	HIST 168 History of the Middle East
ENGL 265 African-American Literature (G-WI)	ECON 201 Macroeconomics	HIST 173 Mod Euro History: 1815-Present
ENGL 267 Poetry Writing	GEOG 121 Environmental Sustainability (G-WI))	HUMA 121 American Work Experience
HUMA 121 The American Work Experience (G-WI)	GEOG 140 Investigating Climate Change	HUMA 140 Intro to Women and Gender Studies
HUMA 140 Intro to Women and Gender Studies (G-WI)	GEOG 271 Intro to Geographic Info Systems	HUMA 150 Nature of the Environment
HUMA210 Creativity and the Origin of Ideas	HUMA 250 Research Methods in Social Sciences (G-WI)	HUMA210 Creativity and The Origin of Ideas
JOUR 101 Journalism and Society	INTS 250 Study Abroad	INTS 201 Implement Sustain Energy Sys in Dev Com
Modern Language - All MDLA Courses	PSYC 103 Introduction to Psychology (G-WI)	Modern Language - All MDLA Courses
MUSC 101 Introduction to Music	PSYC 230 Introduction to Health Psychology	PHIL111 On Death and Dying
PHIL 111 On Death and Dying (G-WI)	PSYC 235 Dev Child Psychopathology	PHIL 121 World Religions
PHIL 121 World Religions	PSYC 245 Cognitive Psychology	PHIL 204 Asian Philosophies

PHIL 201 Introduction to Philosophy	PSYC 255 Abnormal Psychology	POLS 101 Introduction to Political Science
PHIL 202 Ethics and Moral Problems (G-WI)	PSYC 258 Developmental Psychology (G-WI)	POLS 105G American Constitutional Law
PHIL 204 Asian Philosophies	PSYC 265 Psychology of Sex and Gender	POLS 150 Peace Studies & Conflict Resolution (Study Abroad)
PHIL 211 Ancient Philosophy	SOCA 103 Principles of Sociology (G-WI)	POLS 202 International Relations
PHIL 215 Modern Philosophy	SOCA 125 Sociology of Families (G-WI)	POLS205 Women & Politics
PHIL 225 What is Freedom?	SOCA 210 Sociology of Gender	POLS 251 State & Local Government
		PSYC 258 Developmental Psychology
		SOCA 102 Cultural Anthropology
		SOCA103 Principles of Sociology
		SOCA 105 American Ethnicity
Electives: All courses except: OXX-level courses; EARL 221, EARL 222.		SOCA 150 Deviance
		SOCA160 Issues in Cont Genocide & Mass Violence
		SOCA204 Social Problems

Appendix G: Co-curricular Map

PROGRAM NAME: **HEATING, VENTILATION, AIR CONDITIONING, & REFRIGERATION (HVAC/R)**

AY 18-19

	0 - 15 credits	16 – 30 credits	31 – 45 credits	46+ credits
Get the Courses You Need	Take the following courses:	Take the following courses:	Take the following courses:	Take the following courses:
	COLS101 College Success (1) CISC101 Introduction to Computers (3) **EMEC101 Electrical Fundamentals (3)** EMEC117 Industrial Rigging (1) EMEC118 Hand and Power Tools (1) **HVAC101 Fundamentals of HVAC/R I (4)** MATH103 Applications in Mathematics (3) OSAH100 Industry Outreach Safety Education (1) 17 Credits	CMGT104 Construction Print Reading (3) **ELTC107 Electrical Wiring I (3)** ENGL101 English I (3) **HVAC102 Fundamentals of HVAC/R II (3)** **HVAC124 Heating: Gas, Oil, Solar Thermal, Air & Hydronic Systems (4)** **HVAC140 Heat Pump Systems (2)** 18 Credits	CMTH102 Introduction to Communication (3) **EMEC135 Electrical Motors and Controls (4)** ENGL151T English II (Technical Writing) (3) PHYS152 Physical Science II (3) Technical Elective (3) 16 Credits	**HVAC104 Refrigeration System Troubleshooting (3)** **HVAC150 HVAC Airflow and Distribution (3)** **HVAC260G HVAC/R Technology Practicum (WI) (2)** AH, SIT, or SSHB General Education Elective (3) AH, SIT, or SSHB General Education Elective (3) Elective [Technical Elective for CE] (3) 17 Credits
	For details on course requirements, see the Program Map.	*For details on course requirements, see the Program Map.*	*For details on course requirements, see the Program Map.*	*For details on course requirements, see the Program Map.*
Engage with the Spartan Experience	- Attend at least one campus recreation event - Attend Guest Speakers - Join student club(s) - Review academic plan - Seek out community service/ service-learning opportunities	- Attend Guest Speakers - Discuss elective/gen ed options - Explore internships via Career Services - Seek out community service/ service-learning opportunities - Tour Fowler/Fab Lab	- Attend Guest Speakers - Mentor new students - Research Center for Innovation & Entrepreneurship - Seek out community service/ service-learning opportunities	- Apply for student awards - Attend Guest Speakers - Mentor new students - Seek out community service/ service-learning opportunities

Get Ready for Life after Completion – Career Readiness	- Attend Career Service Sessions - Attend on-campus Career Fairs – Fall & Spring semesters at both Bethlehem & Monroe campuses - Complete the career readiness GPS to help select a potential Business major	- Attend on-campus Career Fairs – Fall & Spring semesters at both Bethlehem & Monroe campuses - Attend sponsored company tours - Complete stackable credentials	- Arrange job shadowing experience - Attend on-campus Career Fairs – Fall & Spring semesters at both Bethlehem & Monroe campuses - Complete stackable credentials - Explore Internships, externships – list potential experiences - Explore job shadowing experience – list potential employers - Research practicum sponsors (list potential employers) - Resume Development - Social media creation or update	- Apply for FT jobs - Apply for graduation - Attend on-campus Career Fairs – Fall & Spring semesters at both Bethlehem & Monroe campuses - Complete practicum - Complete stackable credentials - Review and take certification testing
Get Ready for Life after Completion – Transfer Readiness	- Identify transfer colleges/universities – list transfer articulation agreements or other transfer opportunities	- Contact Transfer Advisor to gain knowledge of application process - Create list of potential transfer schools	- Attend college fairs/visits- View list of articulation agreements- Choose your transfer institution and gather application materials - Ask a professor(s) for an "excellent" reference	- Apply for graduation- Apply for transfer to a college or university at the beginning of the semester.

Appendix H: Assessment Plan

	Program Learning Outcomes (PLOs)
AY 2020-2021	1, 3, & 12 HVAC101, OSAH101, EPA Cert.
AY 2021-2022	4 & 5 HVAC 102
AY 2022-2023	6 & 7 HVAC102, 124, 140
AY 2023- 2024	8 & 9 HVAC204, 250
AY 2024-2025	10 & 11 HVAC204, 250
AY 2025-2026	2 – HVAC101 13 – HVAC204, 250

Assessment of PLOs

PLO #1 - Demonstrate an ability to work independently & collaboratively.

- This is done on a continuous basis during lab activities where students must be able to successfully complete projects and activities, either individually or as a team. Lab worksheets and observed activities demonstrate completion of this PLO. Success in these activities is also demonstrated by the superior percentage of certification, compared to national averages, exhibited in testing for EPA certification (first item in Appendix C).

PLO #2 - Demonstrate competent speaking skills when working with diverse groups.

- This is done on a continuous basis during lab activities where communication with their diverse student peers is demonstrated in discussion of learning concepts and being able to convey this knowledge both verbally and in written form on the lab worksheets.

PLO #12 - Demonstrate the use of OSHA safety standards in servicing electromechanical equipment.

- Students learn the principles of OSHA safety in the OSAH101 course. Successful students also receive a 10-hour OSHA Construction Safety certification upon completion. They must also demonstrate these safety principles in accessing and troubleshooting lab equipment during these activities.

PLO #4 - Demonstrate observational, integrative and synthetic skills.

- This is evaluated on an ongoing basis in homework, testing, troubleshooting simulation completion and in lab activities. Students demonstrate the ability to observe a problem, factor that into diagnosis, and complete repairs.

PLO #5 - Demonstrate proficient research and computer skills in data gathering and analysis.

- Student must utilize BlackBoard and Cengage MindTap online to complete assignments.

Attached is a grading of assignments for HVAC101:

Fall 2021 for (1120523)

Item Grade
Unit 4 Video Q&A 100.00
LabMan Unit 04-NEC Quiz 79.9992
Safety & Soft Skills Sims 97.00
Unit 5-6 Video Q&A 100.00
LabMan Unit 05-06 Quiz 69.6969
Unit 7 Video Q&A 100.00
LabMan Unit 07 Quiz 70.00
Lab 7-1, 7-2, 7-4, & Project 100.00
Unit 1 Video Q&A 80.00
LabMan Unit 01 Quiz 85.00
Lab 1-1 Temp Convert 100.00
Unit 2 Video Q&A 100.00
LabMan Unit 02 Quiz 99.9999
Lab 2-1 Spec Grav 100.00
Unit 3 Video Q&A 80.00
LabMan Unit 03 Quiz 52.00
Lab 3-3 P/T Convert 100.00
HVAC I Quiz U1-7 78.125
Unit 9 Video Q&A 100.00
Unit 8-10 Video Q&A 100.00
LabMan Unit 09 Quiz 75.6756
LabMan Unit 08 Quiz 73.3326
LabMan Unit 10 Quiz 70.5876
Labs 9:1, 8:1-2-3, 10:2-3-4 100.00
Unit 13 Video Q&A 100.00
LabMan Unit 13 Quiz 69.2307
LabMan Unit 11 Quiz 85.7136
Unit 12 Video Q&A 100.00
GRADE INFORMATION

LabMan Unit 12 Quiz 99.999
Sim Chllnge1: Electric HVAC 85.00
Unit 12 - Labs 12:1/2 100.00
Unit 13 - Lab 13:1 100.00
Unit 14-15 Video Q&A 100.00
LabMan Unit 14 Quiz 95.6516
LabMan Unit 15 Quiz 81.25
Unit 14 - Lab 14:2 100.00
Unit 15 - Labs 15:1/3 100.00
NCC Wiring Project -
Unit 45 Video Q&A 100.00
Unit 46 Video Q&A 100.00
Sim Chllnge2: Window A/C 0.00
LabMan Unit 45 Quiz 80.9523
LabMan Unit 46 Quiz 73.3326
Labs 45:1-8-9 100.00
Labs 46:1-2-3 -
Participation 93.00

Homework/Quizzes (20%) 88.16329%
Labs/Sims/Prt Grade (25%) 87.80%
HVAC I Mid-Term 71.50
Mid-Term Exam + Practical (25%) 71.50
HVAC I Final 77.3314
Final Exam (30%) 77.3314
Course Grade (cumulative) 80.65707%
Willis Carrier -
Alice H. Parker -
David Crosthwait Jr. -
Fredrick McKinley Jones -
Kaylie Grandell -
4/4/22, 4:33 PM Print Report – Blackboard Learn
https://northampton.blackboard.com/webapps/gradebook/do/instructor/viewReport?course_id=_149749_1&columndesc=false 3/13

Appendix I: Teaching Faculty Credentials

Daniel Philipps, Program manager, Certified Member of RSES, EPA Universal Certification, Associates in General Studies – NCC

Experienced with: Hospital HVAC/R systems, supermarket refrigeration, plastics process chilled water systems, ground water containment systems, and commercial HVAC/R systems in restaurant/convenience store chains.

Michael Bara, Equipment Breakdown Risk Control Specialist, CNA Insurance, EPA Universal Certification

Experienced with: Inspection and standards of commercial HVAC/R equipment, high and Low-pressure boilers, chiller equipment and is licensed to inspect these systems in states such as PA, NJ, NY, CT, MD, and MA.

Mark Ringer, Specialized Diploma, Better Home Heat Council of the Lehigh Valley, EPA Universal Certification, HVAC/R Facilities Technician, St. Luke Hospital Network

Experienced with: Hospital HVAC/R systems and gas and oil heating systems.

Brien Delaney, NJ Sheet Metal and Airflow specialist, Business Owner

Experienced with: Ductwork design and installation standards, airflow measurement, and testing and balancing of systems.

Appendix J: Evaluations – Full Time

1 COURSE EVALUATION : (-)						
		Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
1.1	The course materials (syllabus, course calendar, handouts, assignments, etc...) are clear and understandable.	○	○	○	○	○
1.2	Assignments allowed me to demonstrate my learning.	○	○	○	○	○
1.3	The instructor promotes an atmosphere of mutual respect.	○	○	○	○	○
1.4	The instructor creates an environment in which students feel comfortable contributing.	○	○	○	○	○
1.5	The instructor helps students relate course material to their lives.	○	○	○	○	○
1.6	The instructor provides useful feedback to students.	○	○	○	○	○
1.7	The instructor demonstrates interest in teaching the subject matter.	○	○	○	○	○
1.8	The instructor is open to feedback from students.	○	○	○	○	○
1.9	*Predefined optional question*	○	○	○	○	○
1.10	*Predefined optional question*	○	○	○	○	○
1.11	*Predefined optional question*	○	○	○	○	○
1.12	*Predefined optional question*	○	○	○	○	○
1.13	*Predefined optional question*	○	○	○	○	○
1.14	*Predefined optional question*	○	○	○	○	○
1.15	*Predefined optional question*	○	○	○	○	○
1.16	*Predefined optional question*	○	○	○	○	○
1.17	*Predefined optional question*	○	○	○	○	○

Appendix K: Evaluations – Part Time

1 COURSE EVALUATION : (-)

		Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
1.1	The course materials (syllabus, course calendar, handouts, assignments, etc...) are clear and understandable.	○	○	○	○	○
1.2	Assignments allowed me to demonstrate my learning.	○	○	○	○	○
1.3	The instructor promotes an atmosphere of mutual respect.	○	○	○	○	○
1.4	The instructor creates an environment in which students feel comfortable contributing.	○	○	○	○	○
1.5	The instructor helps students relate course material to their lives.	○	○	○	○	○
1.6	The instructor provides useful feedback to students.	○	○	○	○	○
1.7	The instructor demonstrates interest in teaching the subject matter.	○	○	○	○	○
1.8	The instructor is open to feedback from students.	○	○	○	○	○
1.9	The instructor was well prepared for class.	○	○	○	○	○
1.10	The instructor explained ideas and concepts in ways that I could understand.	○	○	○	○	○
1.11	I understood how my grade would be calculated for this class.	○	○	○	○	○
1.12	The instructor responded to emails and requests for assistance in a timely manner.	○	○	○	○	○

1.13 What did you like most about this course? Briefly explain.

1.14 What did you like least about this course? Briefly explain.

1.15 What advice would you give to another student who is considering taking this course?

1.16 Please provide additional comments.

Appendix L: External Review Report

This is an external evaluation of the Heating, Ventilation, and Air Conditioning & Refrigeration (HVAC/R) program at Northampton Community College. The student can choose an Associate in Applied Science, Specialized Diploma, or Certification.

Northampton Community College 2022

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External evaluation of HVAC-R Programs at Northampton Community College

This evaluation is based on the following information:

- Site visits for both classroom work and lab exercises
- Interviews with Mr. Daniel Philipps
- Review of course outline and content of material used
- All material available on-line and obtained on site
- Preview of the previous HVAC-R programs

Scope of Audit

The HVAC-R program at Northampton Community College is designed for new students as well as experienced students who can refine their skills. This program focuses on basic and advanced HVAC-R theory which prepares the student for the real world. With real world work in mind, NCC gives the students hands-on training and introduces a broad range of equipment. This is extremely important because a vast amount of equipment and tools are required to install, maintain, and fix any system.

It is becoming extremely hard to locate and hire a competent HVAC technician in this current market. I have seen a shift in the type of work our younger generation strives to achieve. Specifically, this industry has become more driven towards energy efficiency, building and residential automation, and conserving energy in general. This speaks volumes to the next generations. It gives the HVAC career more avenues to specialize in.

The leading motivation of this audit is to research the HVAC-R programs and acquire information pertinent to making improvements to the course. I will take a tour of the facilities and complete several interviews with Mr. Daniel Phillips in the process. I will interview current and former students working in the HVAC field and review course outlines and materials.

Overall evaluation

Northampton Community College and Mr. Daniel Philipps have built and sustained a comprehensive HVAC/R program. I first toured the facilities in February of 2022. It was impressive to see how far this program has come in ten+ years. The amount of commercial and industrial equipment the students have available to them only help them in their future endeavors. I was extremely happy to see that Mr. Philipps was in the process of setting up BAS controls trainers for the students. BAS is the future of HVAC with sustainability and efficiency being the driving force. One of the things I notice when hiring

here at Lehigh is the lack of knowledge with the use of regular power and hand tools. It is great to see that NCC spends time on simple, yet commonly ignored skills.

While touring NCC, I met a few instructors and students. They appeared to be enthusiastic and eager to get the classes under way. Lehigh has hired three students from this program, two in HVAC and one in maintenance. The first quality I notice in these employees is the strong background in HVAC theory. Knowing how things work makes learning the art of troubleshooting less cumbersome. One of the HVAC technicians has been with us for three years and has quickly become a high contributor to our department. Jonis Lainez says, "The HVAC/R program at NCC was directed by Dan Philipps. He is an outstanding educator and has always challenged me to reach my highest potential. Dan was also my career counselor. He cares for his students beyond NCC, and I am a recipient of his commitment." Another technician from NCC quickly became one of our main controls technicians and the main Lehigh University HVAC electrician. Unfortunately, this tech has recently left us for Florida. Before he moved, he landed a position immediately. He is now holding a state position as an HVAC/electrician. Candy Pena says, "I loved the option of taking classes at night while working. Dan Philipps was a very knowledgeable professor and always made class interesting." I have nothing bad to say about any student hired from this program. Consequently, I will look to hire from this program in the future.

In addition, I have researched the NCC website. I found the site well organized and easy to navigate. After exploring the HVAC/R program, I learned that there are many options a student can take to get a diploma, certificate, or an associates degree. With NCC's "Stackable Credential Alignment," the student has the option to get certified and secure a job while still pursuing a diploma or associates degree. I really like seeing general education classes in this program as well. Classes like Intro to Communication, Intro to Information Technology, and Physical Science II give the students a more well-rounded approach to their careers. The "VIEW FAQ" section was also a pleasant surprise. Students can find information such as average HVAC salaries, career placement (100%), and industry certifications that students can obtain as part of the program.

During a final interview with Daniel Philipps, he reviewed Blackboard and Cengage MindTap. Below I have noted some benefits/complaints of these tools.

- Seems to free up time for more lab and hands on training
- Gives students the choice to use a free E-book and save on textbook costs
- Links to videos and tutorials which adds a different and possibly more helpful perspective to learn
- Provides real world HVAC troubleshooting simulation and challenges
- Blackboard corresponds to syllabi and gives the student real-time progress and scoring

- Cengage MindTap seems to have issues with lagging communication and project submission
- Some students have voiced opinions of frustration with Cengage MindTap

Recommendations:

1. Partner with businesses to have students shadow HVAC technicians while they are in school to help them decide on which direction they want to go.
2. In the HVAC/R FAQ's section on the NCC website, list the specialized areas of work which a student can pursue after this program such as: air balancing, facilities maintenance, BAS controls technician, industrial technician, refrigeration technician, etc.
3. List the local companies in the Lehigh Valley that student can work for. This will give them the confidence to apply for a position that they would normally shy away from.
4. Continue to add new equipment to the hands-on portion of the program. This will ensure that the students see the newest technologies.
5. Research, remedy, or replace Cengage MindTap as students and online reviews do not look favorable.

Closing:

I appreciate the chance to evaluate and research the HVAC/R program at NCC. I sincerely believe this program is an excellent way for people in this field to advance their knowledge and skills. It is also a great way to bolster one's career. This program has definitely progressed over the years and I look forward to see how NCC and Mr. Philipps improves this program. I wish this program the best of luck and look forward to hiring more HVAC prospects in the future.

Genuinely,

Jason Jones

Assistant Director, HVAC

Lehigh University

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Bethlehem, PA 18015