NEW YORK CITY COLLEGE OF TECHNOLOGY

OF THE CITY UNIVERSITY OF NEW YORK

PROPOSAL TO ESTABLISH A PROGRAM IN HVAC ENGINEERING TECHNOLOGY

LEADING TO THE BACHELOR OF SCIENCE DEGREE

EFFECTIVE FALL 2024

SPONSORED BY THE DEPARTMENT OF ENVIRONMENTAL CONTROL TECHNOLOGY

Table of Contents

INTRODUCTION

The proposed BS in HVAC Engineering Technology program is designed to expand upon knowledge gained in the Associate in Applied Science (AAS) program in Environmental Control Technology. The AAS program provides a solid foundation of the physical principles, equipment, and construction methods, as well as design fundamentals for Building HVAC and Refrigeration systems. This new program will further prepare students for careers in energy analysis and management, indoor air quality, and decarbonization strategies that emphasize a worldwide movement toward net zero energy use. Students will learn how to conduct energy audits, commission new systems, use Computer-based tools for load calculations and for systems analysis, measure indoor air quality and learn contaminant mitigation strategies. Students are expected to obtain certifications as Certified Energy Manager (CEM), Certified Energy Auditor (CEA) and/ or Certified Building Commissioning Professional.

Commented [RP1]:

Commented [RP2R1]:

The total number of credits will be 120 for this BS in HVAC Engineering Technology degree program. Overall structure of the credits is:

1. **44 credits** of the CUNY Pathways general education requirements (required core, flexible core, college option)
2. **16 credits** of Gen Ed Program-Specific Degree Required course in mathematics, physics, environmental science, and economics
3. **37 credits** of Lower Level HVAC Fundamental courses including Air Conditioning Systems, Combustion Processes, Hydronic Systems, CAD, Air system Design, and Refrigeration.
4. **20 credits** of Upper Level HVAC Advanced courses covering Indoor Air Quality, Computerized building energy modeling, Computerized system modeling, Project Management, Engineering Economics, Testing and Balancing, Energy Auditing, and Commissioning.
5. **3 credits** of Technical Elective courses that teach the latest major and emerging technology and help students become more competitive in job market upon their graduation.

Commented [RP3]:

New B.S. in HVAC Technology Degree requirements

120 credits, minimum of 60 credits in LAS. Articulates from the AAS in Environmental Control Technology

AAS requirements

Core requirements

Course	Title	Credits
ENG 1101	English Composition I	3
MQR	Math 1190 or higher (1275 Preferred)	3 or 4
LPS	Life and Physical Science (Physics 1433 Preferred)	3 or 4
Flex Core	Flexible Common Core Course (WI)	3
Flex Core	Flexible Common Core Course	3
Flex Core	Flexible Common Core Course	3
Flex Core	Flexible Common Core Course	3
	Sub-total	21 to 23 Credits

Program requirements

Course	Title	Credits
ENVC 1110	Principles of Air Conditioning I	3
ENVC 1111	Air Conditioning Systems Laboratory I	1
ENVC 1120	HVAC Systems Graphics	2
ENVC 1210	Combustion Processes and Equipment	3
ENVC 1211	Heating Systems Laboratory	1
ENVC 1220	Hydronic Systems Design	3
ENVC 1250	Fire Protection, Plumbing and Electrical Systems for Buildings	3
ENVC 2311	Refrigeration Laboratory I	1
ENVC 2312	Principles of Refrigeration	3
ENVC 2321	Air Conditioning Systems Laboratory II (WI)	1
ENVC 2322	Principles of Air Conditioning II	3
ENVC 2340	Air Conditioning Systems Design	3
ENVC 2411	Refrigeration Laboratory II	1
ENVC 2420	Principles of HVAC Systems Controls	3
ENVC 2432	Advanced Air Conditioning Systems Design	3
ENVC 2XXX	ENVC Elective (2401, 2421, 2436, 2452, 2900)	3
	Sub-total	37 Credits
	Free Elective	0-2 Credits
	Total	60 Credits

Bachelor of Science Upper level requirements

A minimum of 37 Liberal Arts and Science credits above those in the Associate degree.

Upper Level program credits are 24 credits.

Upper Level Core Requirements

Course	Title	Credits
ENG 1121	English Composition I	3
Flex Core (SW)	Physics I (If not taken at lower level)	3 or 4
Flex Core	Flexible Common Core Course	3
COM 1330	Public Speaking	3
ID	Interdisciplinary Course	3
Lib Art	Liberal Arts Elective	3
Adv Lib Art	Advanced Liberal Arts Elective	3
	Sub-total	21 or 22 credits

Program Liberal Arts and Science Requirements

Course	Title	Credits
PHY 1434	Physics II	4
MAT 1272	Statistics	3
ESCI 1110	Environmental Science I	3
ESCI 1210	Environmental Science II	3
ECON 1401	Microeconomics	3
	Subtotal	16 credits
	Total	37 or 38 credits

Program Specific Upper level Requirements

Course	Title	Credits
HVAC 3505	Indoor Environmental Quality Analysis (2 hrs lec, 2 hrs lab)	3
HVAC 3515	Testing and Balancing Lab(1 hour lecture, 2 hours lab)	2
HVAC 3605	Engineering Economics (or FMGT 4710)	3
FMGT 3610	Project Management	3
HVAC 4705	Building Energy Simulation 1 – Load Calculation	3
HVAC 4805	Building Energy Simulation 2 – Building Performance	3
HVAC 4815	Energy Auditing and Commissioning	3
Elective	Choose from one of the following:	3
HVAC 4715 Or HVAC 4825	Digital Control Systems & Smart Buildings Special Topics in HVAC	

Or	2nd ENVC Elective chosen from ENVC 2401 or 2436 and not previously taken		
		Subtotal	23 Credits
		Total	60 to 61 credits

Accreditation

This is expected to be an ABET accredited program in Air Conditioning, Refrigeration, Heating, and Ventilating Engineering Technology, which requires the following curriculum components:

Per ABET:

"*The curriculum must provide baccalaureate degree graduates with instruction in the knowledge, techniques, skills, and ability to use modern equipment in air conditioning, refrigerating, heating, and ventilating engineering technology.*

Baccalaureate degree graduates are well prepared for design and development of complex systems complementing and expanding on lower division work. The curriculum must include instruction in the following topics:

a. basic HVAC&R engineering principles, including heat transfer, fluid mechanics, combustion, air conditioning and refrigeration processes, heating and cooling load calculations, electrical circuits, and controls;

b. application of HVAC&R principles for broadly-defined technical activities, including analysis of equipment and system performance, analysis of system controls, and computerized evaluation of system energy performance;

c. design and analysis of HVAC&R systems for commercial buildings, including pipe and duct design, HVAC&R equipment and system selection, building energy modeling, and economic analysis; and

d. project management for design and installation of HVAC&R systems."

Curriculum Map

Curriculum Map for ABET Requirements

	Curriculum Requirements														
	Basic HVAC & R Principles							Application			Design				PM
	Heat Transfer	Fluid Mech.	Com-bustion	Air Cond & Refrig Processes	Htg. And Clg Load Calcs	Elect. Circuits	Con-trols	Anal. of Equip. and System Perf.	Anal. of System Controls	Comp. Eval of system energy perf	Pipe & Duct Design	HVACR Equip & Sys Sel.	Energy Modeling	Eco-nomic Anal.	Proj. Mgt.
Course No.															
ENVC 1110	•	•		•	•										
ENVC 1111				•		•	•								
ENVC 1120				•							•				
ENVC 1210	•	•	•								•				
ENVC 1211	•		•			•	•	•							
ENVC 1220	•	•		•	•			•				•			
ENVC 1250						•					•				
ENVC 2311	•			•			•	•							
ENVC 2312	•	•		•				•							
ENVC 2321	•	•		•				•	•						
ENVC 2322	•			•	•			•				•			
ENVC 2340	•	•						•			•	•			
ENVC 2411				•		•	•		•						
ENVC 2432	•	•						•			•	•			
ENVC Elect				•										•	
HVAC 3505		•		•				•							
HVAC 3515		•		•				•				•			
HVAC 3605												•		•	
FMGT 3610															•
HVAC 4705				•	•			•		•			•		
HVAC 4805				•				•	•	•		•	•		
HVAC 4815		•		•				•							
Elective															
HVAC 4715							•	•						•	

Brief description of students' expected outcomes after completing the program including employment titles, salaries and/or further educational opportunities.

Graduates of this program can find employment with consulting firms, government agencies, and large corporations as Energy Auditors and Commissioning Engineers, Energy Analysts, Energy Managers, Indoor Air Quality specialists, and HVAC System Designers and technicians.

As this is an emerging field, employment and salary statistics for these positions through government labor offices are not readily available. Much of this demand has only begun to be realized and these job titles often fall within other categories. These positions would qualify as Green Jobs according to the U.S. Bureau of Labor Statistics (BLS). In 2013, due to budget cuts, the programs that reported on green jobs were eliminated.

A survey of employment websites such as Salary.com and Indeed.com indicates that a graduate can be expected to earn the following median annual salaries:

- HVAC Technician $68,279
- HVAC Designer $66,272
- Energy Manager $129,661
- Commissioning Engineer $77,654

As for further education, we intend for this program to be accredited by ABET. Students that have completed this program can apply for programs such as the MS in Energy Management offered by NYIT, the M.S. in Sustainability and Energy Studies at Northwestern University.

- ## Brief description of the potential market for the program.

A number of factors will be driving employment in the HVAC technology area in metropolitan New York City. There has been a push by State and local officials to move away from fossil fuel based systems. Fossil fuels contribute greatly toward greenhouse gas (GHG) emissions and this has been identified by the scientific community as a major contributor to climate change / global warming. According to the New York City Mayor's Office of Sustainability,68% of GHG emissions come from buildings, not from transportation. There are approximately one

million buildings in New York City alone. By performing energy use reductions and switching to electrical HVAC equipment, NYC can reduce its GHG emissions substantially. NYC Local Law 97 requires building owners to report on their energy usage. Buildings not achieving certain energy use intensities can be subjected to financial penalties. These start as early as 2024 and are expected to have steeper penalties after 2030. The goal is to achieve an 80% reduction in GHG emissions by 2050.

Another factor will be the eventual return of workers to office buildings. The shutdown of the economy due to COVID-19 and move to remote working has profoundly affected the local economy. Ensuring a safe work environment will place a strong emphasis on indoor air quality. This and the previously mentioned switch over to electrical based HVAC equipment will drive equipment changes as we go forward. Newer high efficiency equipment will benefit from better trained installers. System designers will be needed to modify these systems. This program is designed to target this need.

With the closing of TCI College several years ago, there is no other program within the five boroughs offering even an Associate degree in HVAC technology. Our Bachelor of Science program would be competing against several Mechanical Engineering Programs in the area. Mechanical Engineering programs, however, do not concentrate in HVAC and most graduates require retraining, whereas, graduates of our program would not.

We expect to obtain articulation agreements with high school programs such as the Bronx Design and Construction Academy and the Urban Assembly School for Green Careers.

Survey of Student Interest

Students were asked about their interest in the new program. The following questions were asked:

1. **"I feel that the new Bachelor degree fulfills a need in the local HVAC market."**
2. **"If this program was available a year or two from now, I would enroll in the program."**
3. **"The HVAC bachelor program covers topics in which I am interested"**
4. **"I am a graduate or soon to be graduate of the AAS in Environmental Control Technology, and I want to enroll in the HVAC degree program to further my career."**

36 out of 41 respondents agreed or strongly that the new program fulfills a need in the local HVAC market. The remaining 5 were neutral.

35 of 41 respondents agreed or strongly agreed that they would enroll in the program if it were available a year or two from now. 6 were neutral.

33 of 41 respondents agreed or strongly agreed that the program covers topics that they were interested in. 7 were neutral and 1 disagreed

33 of 39 graduate or soon to be graduate respondents said "YES", that they want to enroll in the HVAC program.

Enrollment Projections for new B.S. in HVAC Engineering Technology

Forward looking projections are based on enrollment prior to Spring 2021, when COVID-19 reduced enrollment throughout the City University. NYC Local Laws go into effect in 2024, which is anticipated to drive additional enrollment. Here are figures from Spring and Fall 2019:

Spring 2019

ENVC (AAS) Freshmen 39 students,

Total 88 students

Fall 2019

ENVC (AAS) Freshmen 40 students

Total 82 students

In anticipation of program approval for Fall 2024, here are 5 year projections for the AAS program and B.S. program:

Fall 2024

ENVC (AAS) Freshmen 20 students

ENVC (AAS) Total (Freshmen + Continuing) 65

ENVC (BS) Freshmen 20 students (Initial Cohort)

Fall 2025

ENVC (AAS) Freshmen 20 students

ENVC (AAS) Total (Freshmen + Continuing) 65

ENVC (BS) Freshmen 30 students

ENVC (BS) Total (Freshmen + BS Continuing + AAS continuing) 45

Fall 2026

ENVC (AAS) Freshmen 25 students

ENVC (AAS) Total (Freshmen + Continuing) 70

ENVC (BS) Freshmen 35 students

ENVC (BS) Total (Freshmen + BS Continuing + AAS continuing) 60

Fall 2027

ENVC (AAS) Freshmen 25 students

ENVC (AAS) Total (Freshmen + Continuing) 75

ENVC (BS) Freshmen 40 students

ENVC (BS) Total (Freshmen + BS Continuing + AAS continuing) 70

Fall 2028

ENVC (AAS) Freshmen 30 students

ENVC (AAS) Total (Freshmen + Continuing) 75

ENVC (BS) Freshmen 40 students

ENVC (BS) Total (Freshmen + BS Continuing + AAS continuing) 75

- College's existing and needed resources to deliver the program.

The Department has a large amount of existing equipment that can be used for this program, but this should be supplemented with some additional instrumentation and replacement of fossil fuel equipment with electrically powered heat pumps. Students would benefit from the addition of some mock-ups of building subsystems that can used for testing and balancing training. An estimated $150,000 in new equipment would be needed: $50,000 for Heat pump systems ; $40,000 for Testing and Balancing mock-ups; $30,000 for instrumentation and controls: and $30,000 for ancillary work such as Electrical and Plumbing.

As for faculty, it is expected that existing faculty can teach any of the courses, but due to workload, additional faculty will be needed. One new full-time faculty member would serve as the program coordinator for the B.S. in HVAC program. Responsibilities would include course coordination to ensure consistency of the program, scheduling of classes and curriculum modification and development. Adjunct faculty can be hired to teach courses not covered by existing and new faculty.

Appendix

This section includes new course descriptions and outlines.

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM for HVAC 3505

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Indoor Environmental Quality Analysis
Proposal Date	10/27/2022
Proposer's Name	R. Polchinski
Course Number	HVAC 3505
Course Credits, Hours	3 Credits (2 hours Lecture, 2 hours Lab
Course Pre / Co-Requisites	ENVC 2321 and ENVC 2340
Catalog Course Description	This course introduces the fundamentals of indoor environmental quality (IEQ) analysis, with emphasis of thermal environment and indoor air quality (IAQ). Students learn how to design field measurements to analyze IEQ in buildings; how to develop the standard operation procedure (SOP) for IEQ analysis; methods of data acquisition and continuous monitoring of the indoor environments; selection and treatment of various instruments for monitoring environmental parameters; main environmental parameters to determine various indexes for IEQ; and fundamentals of lighting and acoustic environments.
Brief Rationale Provide a concise summary of why this course is important to the department, school or college.	Indoor Air quality is an important area of practice within the HVAC field. The removal of harmful chemicals and biological hazards such as viruses through filtration and dilution (ventilation) is key to maintaining a safe environment for building occupants. This course provides knowledge and skills that will open up employment opportunities for our students.
CUNY – Course Equivalencies Provide information about equivalent courses within CUNY, if any.	None
Intent to Submit as Common Core If this course is intended to fulfill one of the requirements in the common core, then indicate which area.	This will not be a Common Core course
For Interdisciplinary Courses: - Date submitted to ID Committee for review - Date ID recommendation received	N/A

- Will all sections be offered as ID? Y/N	
Intent to Submit as a Writing Intensive Course	No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

This course is part of a new Program submission. All documentation for the coursed is included in the Program Proposal

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	
• Title, Number, Credits, Hours, Catalog course description	*
• Brief Rationale	*
• CUNY – Course Equivalencies	*
Completed Library Resources and Information Literacy Form	
Course Outline Include within the outline the following.	
Hours and Credits for Lecture and Labs If hours exceed mandated Carnegie Hours, then rationale for this	*
Prerequisites/Co- requisites	*
Detailed Course Description	*
Course Specific Learning Outcome and Assessment Tables • Discipline Specific • General Education Specific Learning Outcome and Assessment Tables	*
Example Weekly Course outline	*
Grade Policy and Procedure	*
Recommended Instructional Materials (Textbooks, lab supplies, etc)	*
Library resources and bibliography	
Course Need Assessment. Describe the need for this course. Include in your statement the following information.	
Target Students who will take this course. Which programs or departments, and how many anticipated? Documentation of student views (if applicable, e.g. non-required elective).	*
Projected headcounts (fall/spring and day/evening) for each new or modified course.	*
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	*
Where does this course overlap with other courses, both within and outside of the department?	*
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	Y
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	*

Course Design Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	R
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	L
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	
How does this course support Programmatic Learning Outcomes?	Yes
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	No
Additional Forms for Specific Course Categories	
Interdisciplinary Form (if applicable)	NA
Interdisciplinary Committee Recommendation (if applicable and if received)* *Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	NA
Writing Intensive Form if course is intended to be a WIC (under development)	NA
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	NA
(Additional materials for Curricular Experiments)	
Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

NEW YORK CITY COLLEGE OF TECHNOLOGY
OF THE CITY UNIVERSITY OF NEW YORK

ENVIRONMENTAL CONTROL TECHNOLOGY PROGRAM

HVAC 3505 – INDOOR ENVIRONMENTAL QUALITY ANALYSIS

COURSE DESCRIPTION:

This course introduces the fundamentals of indoor environmental quality (IEQ) analysis, with emphasis of thermal environment and indoor air quality (IAQ). Students learn how to design field measurements to analyze IEQ in buildings; how to develop the standard operation procedure (SOP) for IEQ analysis; methods of data acquisition and continuous monitoring of the indoor environments; selection and treatment of various instruments for monitoring environmental parameters; main environmental parameters to determine various indexes for IEQ; and fundamentals of lighting and acoustic environments.

Prerequisites: ENVC 2321 , ENVC 2340 2 cl hrs, 2 lab hrs, 3 cr.

TEXT: No text is required. Instructions will be provided for each session.

REFERENCES:

1. ASHRAE, 2017, Handbook of Fundamentals.

2. Faye C. McQuiston & Jeffrey Spitler, "Heating Ventilating and Air Conditioning – Analysis and Design: Analysis and Design, Sixth Edition", Wiley.

3. Performance Measurement Protocols for Commercial Buildings, ASHRAE.

4. Performance Measurement Protocols for Commercial Buildings: Best Practice Guide, ASHRAE

5. Fundamentals of Building Operation, Maintenance, and Management. ASHRAE

6. Ian M. Shapiro. Energy Audits and Improvements for Commercial Buildings. Wiley.

COURSE OUTLINE

Week 1 Introduction to Indoor Environmental Quality (IEQ)

Week 2 Design of field measurement (problem definition)

Week 3	**Development of Standard Operating Procedure (SOP)**
Week 4	**Instrumentation and calibration process**
Week 5	**Analysis of weather conditions and weather monitoring systems**
Week 6	**Introduction of indoor thermal environment analysis**
Week 7	**Measurement of indoor temperature distributions**
Week 8	**Thermal comfort analysis in buildings**
Week 9	**Differential pressure measurement**
Week 10	**Standard protocols for Indoor Air Quality (IAQ) index**
Week 11	**Sampling Methods of Volatile Organic Compounds (VOCs) in air**
Week 12	**Continuous monitor of Particular Matters (PMs)**
Week 13	**Airtightness and ventilation effectiveness**
Week 14	**Introduction to lighting environment analysis (Project presentation)**
Week 15	**Introduction to acoustic environment analysis (Project presentation)**

PROGRAM STUDENT LEARNING OUTCOMES:

Upon completion of this course, students will be able to:

1. **Describe the fundamental properties of good indoor environmental quality (IEQ)**
2. **Design field measurements to analyze IEQ in buildings**
3. **Prepare standard protocols to determine IEQ in buildings**
4. **Verify the applicability of field measurements and instrumentation**
5. **Define problems by performing level 1 analysis in order to design detailed analysis**
6. **Apply methods to continuously monitor indoor environments;**
7. **Select proper environmental parameters;**
8. **Use instruments to effectively attain field data and analyze set of data**
9. **Visualize attained data**
10. **Determine the acceptability of IEQ in buildings.**

GENERAL EDUCATION STUDENT LEARNING OUTCOMES

In this course, students will obtain the following General Education competencies:

1. **Economics / Business knowledge in Management**
2. **Quantitative knowledge in Basic Math, algebra, and geometry/spatial relationships.**
3. **Reading skills from reading technical articles / manuals.**
4. **Reading skills from reading directions / procedural texts**
5. **Reading skills from reading theoretical / conceptual texts**
6. **Reading skills from reading diagrams**
7. **Reading skills from reading Building Codes and laws**
8. **Reading skills from reading codes and standards**
9. **Professional values in problem solving, analytical skill, decision-making, and critical judgment based on precedents**
10. **Ethical values in environmental stewardship.**

ACADEMIC INTEGRITY

Students and all others who work with information, ideas, texts, images, music, inventions and other intellectual property owe their audience and sources accuracy and honesty in using crediting and citation of sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, Academic Dishonesty is prohibited in the City University of New York and is punishable by penalties, including failing grades, suspension and expulsion.

COURSE GRADING STANDARDS:

LAB WORKS	**20%**
PROJECT PROGRESS REPORT	**30%**
FINAL PROJECT REPORT	**30%**
HOMEWORK	**10%**
ATTENDANCE	**10%**

FINAL GRADES

Grade	Numerical Grade Ranges	Quality Points
A	**93-100**	**4.0**
A-	**90-92.9**	**3.7**

B+	**87-89.9**	**3.3**
B	**83-86.9**	**3.0**
B-	**80-82.9**	**2.7**
C+	**77-79.9**	**2.3**
C	**70-76.9**	**2.0**
D	**60-69.9**	**1.0**
F	**59.9 and below**	**0.0**
WU	**Unofficial Withdrawal**	**0.0**

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM for HVAC 3515

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Testing and Balancing Lab
Proposal Date	10/26/2022
Proposer's Name	Robert Polchinski
Course Number	HVAC 3515
Course Credits, Hours	2 credits (1 hour lecture, 2 hours lab)
Course Pre / Co-Requisites	ENVC 1220 and ENVC 2321 and ENVC 2340
Catalog Course Description	Testing, Adjusting and Balancing (TAB) is the process of checking and adjusting all environmental systems in a building to produce the design objectives. In this course students will learn about the instruments used to measure the temperature, flow rates, pressure and power usage of equipment used air and water based HVAC systems. The theory and practice of adjusting and balancing these systems will also be discussed and demonstrated.
Brief Rationale Provide a concise summary of why this course is important to the department, school or college.	Testing and Balancing is an important aspect in achieving an efficient commercial HVAC system installation. Air balancing is a Controlled Inspection requirement of the NYC Dept. of Buildings
CUNY – Course Equivalencies Provide information about equivalent courses within CUNY, if any.	None
Intent to Submit as Common Core If this course is intended to fulfill one of the requirements in the common core, then indicate which area.	This will not be a Common Core course
For Interdisciplinary Courses: - Date submitted to ID Committee for review - Date ID recommendation received - Will all sections be offered as ID? Y/N	N/A
Intent to Submit as a Writing Intensive Course	No

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

This course is part of a new Program submission. All documentation for the coursed is included in the Program Proposal

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	
• Title, Number, Credits, Hours, Catalog course description	✓
• Brief Rationale	✓
• CUNY – Course Equivalencies	✓
Completed Library Resources and Information Literacy Form	
Course Outline Include within the outline the following.	
Hours and Credits for Lecture and Labs If hours exceed mandated Carnegie Hours, then rationale for this	✓
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables • Discipline Specific • General Education Specific Learning Outcome and Assessment Tables	
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	
Course Need Assessment. Describe the need for this course. Include in your statement the following information.	
Target Students who will take this course. Which programs or departments, and how many anticipated? Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	
Where does this course overlap with other courses, both within and outside of the department?	

Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	Y
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	
Course Design Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	
How does this course support Programmatic Learning Outcomes?	
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	
Additional Forms for Specific Course Categories	
Interdisciplinary Form (if applicable)	
Interdisciplinary Committee Recommendation (if applicable and if received)* *Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	
Writing Intensive Form if course is intended to be a WIC (under development)	
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	
(Additional materials for Curricular Experiments)	
Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

NEW YORK CITY COLLEGE OF TECHNOLOGY
OF THE CITY UNIVERSITY OF NEW YORK

HVAC TECHNOLOGY PROGRAM

HVAC 3515 – TESTING AND BALANCING LAB

Course Description:

This lecture course will teach students the

Prerequisites: ENVC 1220 and ENVC 2321 and ENVC 2340

Hours/ Credits: 1 lecture hours, 2 lab hours, 2 credits

Text: Testing and Balancing of HVAC Air and Water Systems, 6th Edition by Samuel C. Sugarman, ISBN 9788770223539

COURSE OUTLINE

Week 1- Course Introduction.
Units of Measurement. Why We Test and Balance HVAC Air and Water Systems. Units of Heat . Units of Humidity , Standard Air ,Pressure Units for HVAC Air and Water .Calculations

Week 2 - General Testing and Balancing Procedure for Air and Water Systems. Office Work (Pre-inspection), Field Inspection, Central HVAC System. Psychrometrics (air / humidity)

Week 3 - Air Handling Equipment and Air Distribution System
Measuring air velocity. Measuring volumetric flow at outlets and inlets. Test and Balance of the Air Distribution System, Volume dampers

Week 4 - Fan Speed and Drives, Belts, Constant Air Volume Systems

Week 5 - Variable Air Volume Systems
VAV boxes, Variable speed drives, Energy savings. VAV Troubleshooting Guide

Week 6 - Outside, Economizer, Return, and Exhaust Air Systems
Outside Air, Air-Side Economizer, Return Air Systems.
Toilet Exhaust Systems

Week 7 - Fans
Fan Operation, Fan Designations, Centrifugal Fans, Axial Fans
Fan Performance Curves, Fan Classes, Fan Tables, Multiple Fan

Arrangements, System Curve, Fan Performance, Inlet and Outlet Conditions, Fan Laws

Week 8 - Mid-term Exam

Week 9 - Water Systems
Review of Mid-term
Types of Hydronic (Water) Systems.
Piping system, System Pressure drop, pressure gauges, temperature gauges, Valves

Week 10 - Centrifugal Pumps
Pump Operation, Pump Laws, Pump Performance Curve, Operating Point, System Curve, Multiple Pump Arrangements, Net Positive Suction Head (Npsh), Pump Shutoff Test

Week 11 - Control Valves
Two-way and three-way valves, Valve Cv, pressure independent valves. Balancing the water system

Week 12 - Sound and Vibration
Sound measurements. Acceptable sound levels. Vibration measurement. Controlling vibration

Week 13 - Motors and Electrical Measurements
Motor and Electrical Terminology, Drive Terminology, Motor Terminology, Electrical Instruments, Rotational Speed Instruments.

Week 14 - HVAC Commissioning
What is HVAC Commissioning? The HVAC Commissioning Process, Tab and HVAC Commissioning Schedules, Job Site Inspections, Field Test Procedures, Field Testing

Week 15 -FINAL EXAM

Program Student Learning Outcomes:

Upon completion of this course, students will know:

General Education Student Learning Outcomes

In this course, students will obtain the following General Education competencies:

1. **Quantitative knowledge in Basic Math, algebra, and geometry/spatial relationships.**
2. **Scientific knowledge using scientific method of experimentation, observation, and/or recording / processing of data.**
3. **Reading skills from reading directions / procedural texts**
4. **Reading skills from reading codes and standards**
5. **Visual communication skills in graphic representation / visualization**
6. **Writing communication skills in technical reporting**
7. **Writing communication skills in preparing field notes**
8. **Inquiry / research skills in problem solving, choosing applicable equations / principles, utilizing math applications, and accuracy**
9. **Inquiry / research skills in graphing and collaboration / teamwork.**
10. **Professional values in Trouble-shooting.**

ACADEMIC INTEGRITY

Students and all others who work with information, ideas, texts, images, music, inventions and other intellectual property owe their audience and sources accuracy and honesty in using crediting and citation of sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, Academic Dishonesty is prohibited in the City University of New York and is punishable by penalties, including failing grades, suspension and expulsion.

HVAC 3515 - TESTING AND BALANCING LAB

Semester:
Instructor:
Office:
Contact:

Office Hours: **TBA**

COURSE GRADING STANDARDS

LAB REPORTS	**50%**
Mid-term	**20%**
FINAL EXAM	**20%**
PARTICIPATION	**10%**

FINAL GRADES

Grade	Numerical Grade Ranges	Quality Points
A	**93-100**	**4.0**
A-	**90-92.9**	**3.7**
B+	**87-89.9**	**3.3**
B	**83-86.9**	**3.0**
B-	**80-82.9**	**2.7**
C+	**77-79.9**	**2.3**
C	**70-76.9**	**2.0**
D	**60-69.9**	**1.0**
F	**59.9 and below**	**0.0**
WU	**Unofficial Withdrawal**	**0.0**

New York City College of Technology, CUNY

NEW COURSE PROPOSAL FORM for HVAC 3605

This form is used for all new course proposals. Attach this to the Curriculum Modification Proposal Form and submit as one package as per instructions. Use one New Course Proposal Form for each new course.

Course Title	Engineering Economics
Proposal Date	
Proposer's Name	Robert Polchinski
Course Number	HVAC 3605
Course Credits, Hours	3 Credits, 3 hours
Course Pre / Co-Requisites	ENVC 2436, MAT 1190 or higher
Catalog Course Description	A course that provides students with techniques to compare the costs of alternative systems and equipment. Balance sheet analysis. Time value of money: simple and compounded interest, annuities and loans, cash flow, profitability analysis and rate of return. Effect of inflation, depreciation, taxes and tax credits. Cost estimation, cost benefit analysis. Risk analysis: forecasting, cash flow, simple probability theory, decision trees.
Brief Rationale Provide a concise summary of why this course is important to the department, school or college.	In Engineering practice, several alternatives can satisfy an operational requirement. The cost to install and to operate, can vary among the alternatives and among energy sources. Higher efficiency equipment typically costs more but saves money in energy usage costs. Comparing the life-cycle cost of proposed equipment is an essential task when analyzing alternatives and proposing a solution. This course will provide students with the techniques to perform these analyses. Other Engineering Technology Programs within the college can benefit from this course, as well.
CUNY – Course Equivalencies Provide information about equivalent courses within CUNY, if any.	ENGR 27600 Engineering Economics at CCNY is a requirement within the B.S. in Earth Science and Environmental Engineering Program as well as Electrical Engineering. The College of Staten Island offers a course ECO 285 called Economics for Engineers, but it is not equivalent. No other CUNY campuses offer an equivalent.
Intent to Submit as Common Core	This will not be a Common Core course

If this course is intended to fulfill one of the requirements in the common core, then indicate which area.	
For Interdisciplinary Courses: - Date submitted to ID Committee for review - Date ID recommendation received - Will all sections be offered as ID? Y/N	N/A
Intent to Submit as a Writing Intensive Course	This will not be a Writing Intensive Course

Please include all appropriate documentation as indicated in the NEW COURSE PROPOSAL Combine all information into a single document that is included in the Curriculum Modification Form.

This course is part of a new Program submission. All documentation for the coursed is included in the Program Proposal

NEW COURSE PROPOSAL CHECK LIST

Use this checklist to ensure that all required documentation has been included. You may wish to use this checklist as a table of contents within the new course proposal.

Completed NEW COURSE PROPOSAL FORM	
• Title, Number, Credits, Hours, Catalog course description	✓
• Brief Rationale	✓
• CUNY – Course Equivalencies	✓
Completed Library Resources and Information Literacy Form	
Course Outline Include within the outline the following.	
Hours and Credits for Lecture and Labs If hours exceed mandated Carnegie Hours, then rationale for this	✓
Prerequisites/Co- requisites	✓
Detailed Course Description	✓
Course Specific Learning Outcome and Assessment Tables • Discipline Specific • General Education Specific Learning Outcome and Assessment Tables	✓
Example Weekly Course outline	✓
Grade Policy and Procedure	✓
Recommended Instructional Materials (Textbooks, lab supplies, etc)	✓
Library resources and bibliography	
Course Need Assessment. Describe the need for this course. Include in your statement the following information.	

Target Students who will take this course. Which programs or departments, and how many anticipated? Documentation of student views (if applicable, e.g. non-required elective).	
Projected headcounts (fall/spring and day/evening) for each new or modified course.	
If additional physical resources are required (new space, modifications, equipment), description of these requirements. If applicable, Memo or email from the VP for Finance and Administration with written comments regarding additional and/or new facilities, renovations or construction.	
Where does this course overlap with other courses, both within and outside of the department?	
Does the Department currently have full time faculty qualified to teach this course? If not, then what plans are there to cover this?	
If needs assessment states that this course is required by an accrediting body, then provide documentation indicating that need.	
Course Design Describe how this course is designed.	
Course Context (e.g. required, elective, capstone)	R
Course Structure: how the course will be offered (e.g. lecture, seminar, tutorial, fieldtrip)?	L
Anticipated pedagogical strategies and instructional design (e.g. Group Work, Case Study, Team Project, Lecture)	L
How does this course support Programmatic Learning Outcomes?	✓
Is this course designed to be partially or fully online? If so, describe how this benefits students and/or program.	✓
Additional Forms for Specific Course Categories	
Interdisciplinary Form (if applicable)	
Interdisciplinary Committee Recommendation (if applicable and if received)* *Recommendation must be received before consideration by full Curriculum Committee	
Common Core (Liberal Arts) Intent to Submit (if applicable)	
Writing Intensive Form if course is intended to be a WIC (under development)	
If course originated as an experimental course, then results of evaluation plan as developed with director of assessment.	
(Additional materials for Curricular Experiments)	
Plan and process for evaluation developed in consultation with the director of assessment. (Contact Director of Assessment for more information).	
Established Timeline for Curricular Experiment	

NEW YORK CITY COLLEGE OF TECHNOLOGY
OF THE CITY UNIVERSITY OF NEW YORK

HVAC TECHNOLOGY PROGRAM

HVAC 3605 – ENGINEERING ECONOMICS

Course Description:

This lecture course will explore and apply the methods used to make economic decisions when selecting building systems and equipment from two or more alternatives. Some prior knowledge of Microsoft Excel is recommended.

Prerequisites: MAT 1190 or higher; ENVC 2436

Hours/ Credits: 3 lecture hours, 3 credits

Text: Basics of Engineering Economy, 3rd Ed., Leland Blank

ISBN: 978-1-259-87598-4

COURSE OUTLINE

Week 1 - Course Introduction. Foundations of Engineering Economy
Chapt. 1, Pages 1-42

Week 2 - How Time and Interest affect Money
Chapt. 2, Pages 43 - 78

Week 3 - Nominal and Effective Interest Rates
Chapt. 3, Pages 79 - 106

Week 4 - Present Worth Analysis
Chapt. 4, Pages 108 - 136
Project 1

Week 5 - Annual Worth Analysis
Chapt. 5, Pages 137 - 153

Week 6 - Rate of Return Analysis
Chapt. 6, Pages 154 - 194

Week 7 - Mid-term Exam

Week 8 - Benefit/ Cost Analysis
Chapt. 7, Pages 196 - 221

Week 9 - Break-even, Payback, Sensitivity, Risk Analysis
Chapt. 8, Pages 222 - 275

Week 10 - Replacement and Retention Decisions
Chapt. 9, Pages 276 - 301

Week 11 - Effects of Inflation
Chapt. 10, Pages 302 - 326
Project 2
Week 12 - Cost Estimation / Depreciation Methods
Chapt. 11, Pages 303 – 338, P. 352
Chapt. 12, Pages 358 – 366, P 380, 383

Week 13 - After-Tax Economic Analysis
Chapt. 13, Pages 384 - 423

Week 14 - Alternative Evaluation including non-Economic Attributes
Capt. 14, Pages 424 - 434
Review for Final

Week 15 -FINAL EXAM

Program Student Learning Outcomes:

Upon completion of this course, students will be able to:

1. **Describe finance terms such as Principal, Interest, rates, Future Worth and Present worth.**
2. **Calculate future value of investments using compound interest for one-time payments and annuities.**
3. **Calculate the Present worth of an annuity and perform a Life Cycle Cost Analysis.**
4. **Incorporate inflation into the value of investments**
5. **Analyze investments considering taxes.**
6. **Compare alternatives for energy saving measures**

General Education Student Learning Outcomes

In this course, students will obtain the following General Education competencies:

1. **Economics / Business knowledge in Project Management**
2. **Economics / Business knowledge in Financial Management**
3. **Reading skills from reading directions / procedural texts**
4. **Reading skills from reading theoretical / conceptual texts**
5. **Visual communication skills in graphic representation / visualization**
6. **Writing communication skills in analysis**
7. **Computer-based media skills in spreadsheet software**
8. **Inquiry / research skills in problem solving, choosing applicable equations / principles, utilizing math applications, and accuracy**

9. **Professional values in problem solving, analytical skill, decision-making, and critical judgment based on precedents**
10. **Ethical values in business conduct.**

ACADEMIC INTEGRITY

Students and all others who work with information, ideas, texts, images, music, inventions and other intellectual property owe their audience and sources accuracy and honesty in using crediting and citation of sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, Academic Dishonesty is prohibited in the City University of New York and is punishable by penalties, including failing grades, suspension and expulsion.

HVAC 3605 - ENGINEERING ECONOMICS

Semester:
Instructor:
Office:
Contact:

Office Hours: **TBA**

COURSE GRADING STANDARDS

MID-TERM EXAM	**35%**
FINAL EXAM	**35%**
PROJECTS	**20%**
PARTICIPATION	**10%**

FINAL GRADES

Grade	Numerical Grade Ranges	Quality Points
A	**93-100**	**4.0**
A-	**90-92.9**	**3.7**
B+	**87-89.9**	**3.3**
B	**83-86.9**	**3.0**
B-	**80-82.9**	**2.7**
C+	**77-79.9**	**2.3**
C	**70-76.9**	**2.0**
D	**60-69.9**	**1.0**
F	**59.9 and below**	**0.0**
WU	**Unofficial Withdrawal**	**0.0**