Curriculum Framework for Heating, Ventilation, Air Conditioning and Refrigeration Technology Program (HVAC-R)

CIP Code: 47.0201

Initial Review Date: 9/01/2023 (10/01/2025)

Eligibility Dates: 09/01/2023 through 11/01/2030

Credit Award: 19 Credits

Course Equivalencies:

HVAC-R	Credits	TESU Course Equivalent	Effective Dates	For Staff Use
HVAC-R Program	3	MAI-1610	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	3	MAI -1620	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	3	MAI -2020	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	3	MAI -2999	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	3	MAI -2210	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	3	MAI -2620	9/1/2023 – 11/1/2030	MCTS.HVACR
HVAC-R Program	1	APS-2100	9/1/2023 – 11/1/2030	MCTS.HVACR

Gaining Access to the Evaluated Credit Award

The following curriculum was evaluated by Thomas Edison State University (TESU) through its Professional Learning Review (PLR) Process to determine college-credit equivalency for the training program.

The current state approved Career and Technical Education (CTE) programs in New Jersey that have been verified to follow this curriculum, and to be eligible to receive TESU credit upon completion can be found on the Verification Letter.

Question: How does your CTE program become eligible for this credit award for your students?

Answer: To become eligible, and to have your school's name listed on the Verification Letter, please follow these instructions:

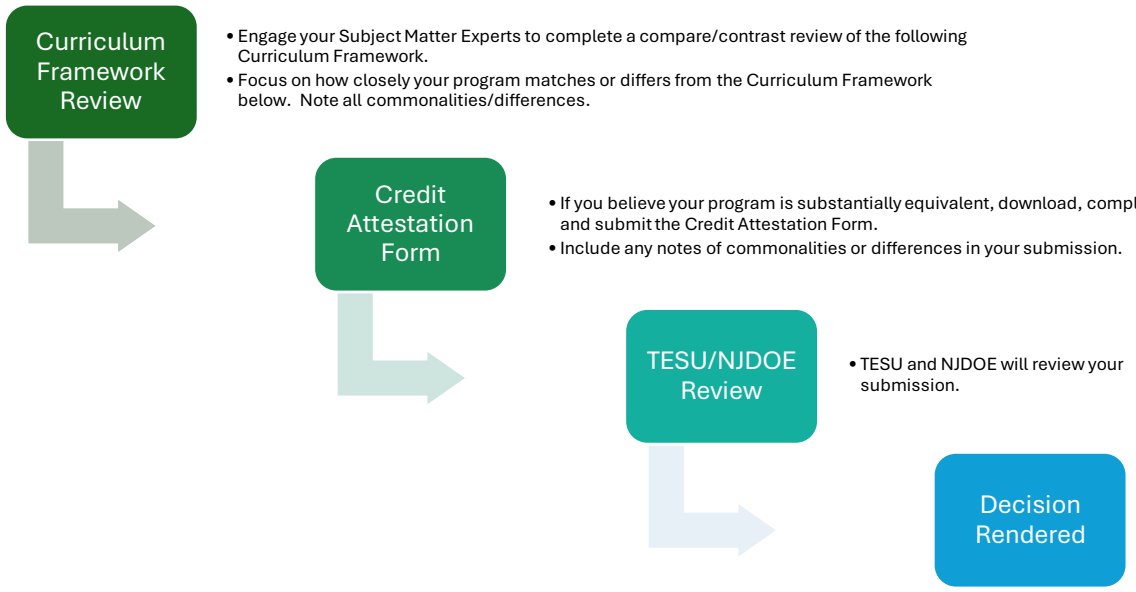
Step 1. Review the following Curriculum Framework and compare it against your school's current state approved CTE program. TESU suggests utilizing your school's subject matter experts for this compare/contrast review. The GOAL of your review is to ensure that the training program in place at your school matches the evaluated program.

Step 2. Complete/Download the Credit Attestation Form for this program on TESU's website.

Step 3. Complete the Credit Attestation Form and email it to plr@tesu.edu.

Step 4. TESU will review the contents and share the attestation form information with the New Jersey Department of Education (NJDOE) for approval.

Step 5. Once approved by TESU and the NJDOE, you will be notified, and an updated Verification Letter will be added to the TESU website for this program.



If you have any questions, or if your compare/contrast review is close but off a little, please contact us at plr@tesu.edu.

Curriculum Framework

Approved Program Name: HVAC-R

CIP Code: 47.0201

Length of Program: 2 Years/960 Hours

Credit Award: 19 Credits

Course Equivalencies:

HVAC-R	Credits	TESU Course Equivalent	Effective Dates	For Staff Use
HVAC-R Program	3	MAI-1610	9/1/2023 – 11/1/2030	MCTS.HVACR
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The review team concludes that the HVAC-R curriculum provides substantial evidence of college-level learning. The program demonstrates a logical sequence of instruction, moving from foundational knowledge and skills in HVAC-R I through advanced and comprehensive applications in HVAC-R IV. Content is scaffolded, with measurable outcomes, hands-on training, VR Aided training and consistent reference to the International Residential Code, International Fuel and Gas codebook, International Mechanical Codebook OSHA standards, and related trade regulations.

Instruction integrates applied mathematics, blueprint interpretation, code compliance, and business concepts into technical training, ensuring students graduate with both practical competencies and the academic foundation comparable to associate-level coursework in construction and applied technology.

HVAC-R I

The review team found that the HVAC-R I curriculum establishes a substantial foundation in both theoretical and applied aspects of the HVAC-R trade. Instruction introduces essential safety practices, code awareness, and tool operation, while also providing students with the building blocks necessary for future advancement. The curriculum is scaffolded and structured with measurable outcomes, comparable in scope and depth to introductory college-level coursework.

Key areas of focus include:

- HVAC-R terminology, lexicon, and code awareness (International Mechanical Codebook NJ Edition, International Residential Codebook).
- Creation and interpretation of technical drawings of HVAC systems and line sets.
- Health and safety standards, reinforced through OSHA-10 training.
- Proper identification, use, and characteristics of various refrigerants in use.
- Design, installation and troubleshooting of residential furnaces and air conditioning systems.
- Proper sizing, installation, and troubleshooting of residential motors as applied to HVAC.
- Both low and high voltage theory include Ohms law and its application.
- Understand and apply the difference between latent heat and sensible heat as they apply to HVAC-R.

Students also spend several hours completing hands on projects creating duct work assemblies to include transitions, offsets, and filter housing. Students practice connecting pipes using methods such as brazing, flaring, soldiering, glue joints, and compression joints. These experiences establish the technical and safety foundation expected of lower-division college coursework.

HVAC-R II

The review team concluded that HVAC-R II builds meaningfully upon the competencies acquired in HVAC-R I, advancing into more technical and applied domains. Instructional design demonstrates strong sequencing, with measurable outcomes aligned to mid-level college coursework.

Core areas of instruction include:

- Gas piping riser diagrams and load calculations.
- Steel pipe threading (manual and power) with fitting allowances and measurement accuracy.
- Duct design for proper air flow, air filtration, humidity mitigation, and fresh air introduction.
- Manual J HVAC system design for residential units, based on building size, occupant load, building construction, and orientation.
- Electrical theory as it applies to compressors within HVAC-R systems, definite purpose contactors, capacitors, and resistance.
- Heat pumps in cold climates.
- EPA section 608.
- Penetrations, insulation, and fire-stopping in residential and commercial systems.

Students also engage in blueprint drawing and technical drafting and are introduced to the fundamentals of electricity (Ohm's Law, electrical safety, wire sizing), directly applied to HVAC-R related contexts. A new building project from system design, permit application through rough-in and final inspection requires system design, layout, testing, and code compliance. This integrative "capstone" mirrors the rigor of 2000-level applied technology coursework.

Program Exhibit

Program Title: HVAC-R Program

CIP Code: 47.0201

Length: 2 years – 960 hours

Description: The HVAC-R Program prepares individuals to work in the Heating, Ventilation, Air Conditioning, and Refrigeration Industry. Students learn to apply technical knowledge and skills to repair, install, service, and maintain HVAC-R systems. This course includes instruction in diagnostic techniques, the use of testing equipment, and the principles of mechanics, electricity, and refrigeration as they relate to the installation, service, and repair of HVAC-R systems. Air-conditioning and refrigeration technicians install motors, compressors, condensing units, evaporators, and many other components. They connect equipment to duct work, refrigerant lines, and electrical power sources. They add and remove refrigerants and check for proper system operation. In finding defects, the technician must test, repair, and replace parts such as compressors, relays, and thermostats. The air-conditioning and refrigeration technician works with a variety of tools and equipment such as wrenches, metal snips, pipe cutters and benders, acetylene torches, voltmeters, thermometers, pressure gauges, manometers, and many more.

Students will earn industry-valued credentials such as OSHA 10 certification, Flexible Gas Line (TracPipe), and the Universal EPA certification. In addition to certifications, students will be enrolled in Interplay Learning, the Department of Labor registered pre-apprenticeship program, earning 144 hours in related technical instruction credit, which counts towards an approved apprenticeship program in New Jersey. All HVAC-R students join their respective Career Technical Student Organization, Skills USA, and compete in local, regional, and state-level competitions.

Students also take part in work-based learning (WBL). WBL exposes students to real-life occupational experiences, allowing them to connect the knowledge and skills learned in class to the workplace. WBL provides students with the opportunity to engage and interact with employers while learning to demonstrate essential employability and technical skills. After the student has achieved the necessary entry-level skills for employment, they will be placed on Cooperative Industrial Education (CIE). Students should enter the CIE program by the end of November in their Senior Year. When a student is placed on a job site, a contract will be signed between the employer, student, and school. While the student is on CIE, the job site will be regularly monitored and evaluated by the CIE Coordinator, and a grade will be determined.

Learning Outcomes:

HVAC-R I

Safety & Professionalism

- To learn safe work practices as they relate to various workplace environments and tasks as related to the HVACR Industry
- To become OSHA 10 Certified
- To demonstrate professional work habits such as timeliness, wearing professional attire, and teamwork

Science

- To gain an understanding of basic Matter, Energy, Gases, and Thermodynamics Fundamentals as they relate to HVACR

Electricity

- To gain a basic understanding of Electrical Fundamentals
- To use their knowledge of Electrical Fundamentals in various HVACR applications
- To use their understanding of electricity to troubleshoot HVACR systems

Air Conditioning

- To demonstrate their understanding of joining metal by completing brazing and soldering projects
- To demonstrate their understanding of PVC by completing related condensate line projects
- To demonstrate their understanding of Sheet Metal by completing sheet metal projects
- To demonstrate their understanding of the Refrigeration Cycle by connecting gauge manifold and evaluating the system operation
- To demonstrate their understanding of Residential Air Conditioning Systems by Replacing a full Air Conditioning System
- To evaluate Air Conditioning Systems Air flow using related tools

Other AC Systems

- To demonstrate an understanding of how Residential Air Conditioning Systems relate to Domestic and Commercial HVACR Systems

Gas Furnace

- To demonstrate an understanding of Gas furnace System Components
- To demonstrate an understanding of Gas furnace System Sequence of Operations

HVAC-R II

HVACR Shop & Fundamentals Review

- To review safe work practices as they relate to various workplace environments and tasks as related to the HVACR Industry
- To review professional work habits such as timeliness, wearing professional attire, and teamwork
- To demonstrate understanding of HVACR Fundamentals that were learned in Year 1

EPA 608 Certification Preparation & Exam

- To become EPA 608 Certified

SkillsUSA Preparation & Local Competition

- To practice industry valued skills to prepare and compete in the Local SkillsUSA Competition

Heating Systems

- To demonstrate an understanding of Heating Systems Components
- To demonstrate an understanding of Heating Systems Sequence of Operations

Heat Pump Systems

- To demonstrate an understanding of Heat Pump System Components
- To demonstrate an understanding of Heat Pump Sequence of Operations

Flexible Gas Line Certification Preparation & Exam

- To become Flexible Gas Line Certified

Energy Management & Conservation

- To demonstrate an understanding of the fundamentals of Energy Management & Conservation

Domestic & Commercial Refrigeration Systems

- To demonstrate an understanding of Domestic Refrigeration System Components
- To demonstrate an understanding of Domestic Refrigeration Systems Sequence of Operations

End of Curriculum Framework

Suggested Degree Programs at TESU

- Associate in Applied Science (A.A.S) in Construction and Facilities Support
- Associate in Applied Science (A.A.S) in Mechanics and Maintenance
- Bachelor of Science (B.S.) in Construction
- Bachelor of Science (B.S.) in Technical Studies

For more information, please contact Thomas Edison State University's Professional Learning Review Office via email at plr@tesu.edu.