

AIR 154 – Air Conditioning and Refrigeration Heating

Revised: Fall 2026

Course Description

Introduces types of fuels and their characteristics of combustion; types, components and characteristics of burners, and burner efficiency analyzers. Studies forced air heating systems including troubleshooting, preventive maintenance and servicing.

Prerequisite:

Credit Hours: 3 Lecture: 2 hours Lab: 2 hours Total: 4 hours per week

Course Objectives (Core Competencies)

- ☒ **Civic Engagement** is the ability to contribute to the civic life and well-being of local, national, and global communities as both as social responsibility and a life-long process. Degree graduates will demonstrate the knowledge and civic values necessary to become informed and contributing participants in a democratic society.
- ☒ **Critical Thinking** is the ability to use information, ideas, and arguments from relevant perspectives to make sense of complex issues and solve problems. Degree graduates will locate, evaluate, interpret, and combine information to reach well-reasoned conclusions and solutions.
- ☒ **Professional Readiness** is the ability to work well with others and display situationally and culturally appropriate demeanor and behavior. Degree graduates will demonstrate skills important for successful transition into the workplace and pursuit of further education.
- ☒ **Quantitative Literacy** is the ability to perform accurate calculations, interpret quantitative information, apply and analyze relevant numerical data, and use results to support conclusions. Degree graduates will calculate, interpret, and use numerical and quantitative information in a variety of settings.
- ☒ **Scientific Literacy** is the ability to apply the scientific method and related concepts and principles to make informed decisions and engage with issues related to the natural, physical, and social world. Degree graduates will recognize and know how to use the scientific method, and to evaluate empirical information.
- ☒ **Written Communication** is the ability to develop, convey, and exchange ideas in writing, as appropriate to a given context and audience. Degree graduates will express themselves effectively in a variety of written forms.

Course Learning Outcomes

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

1. **Explain the principles of combustion and heating theory**, including fossil fuel characteristics, combustion air requirements, draft, venting, and ignition systems.
2. **Identify and explain the operation of major heating system components**, including burners, furnaces, ignition systems, controls, venting systems, and air-delivery components.
3. **Calculate and evaluate heating-system airflow**, including measuring static pressure and determining proper airflow through a heating system.
4. **Use HVAC tools and test instruments safely and correctly** to inspect, measure, test, and evaluate heating-system operation.
5. **Interpret heating-system electrical wiring diagrams** and perform electrical checks on heating equipment.
6. **Demonstrate proper heating-system installation procedures**, including furnace placement and mounting, electrical connections, vent piping, condensate drains, ductwork, thermostats, humidifiers, and electronic air cleaners.
7. **Perform heating-system start-up procedures** and verify that equipment is operating safely and according to its proper sequence of operation.
8. **Troubleshoot heating-system mechanical, electrical, and airflow problems** using a systematic diagnostic process.
9. **Use a digital multimeter to test electrical components** and diagnose electrical faults in heating systems.
10. **Perform basic repairs to heating-system electrical wiring and components** based on troubleshooting results.
11. **Perform preventive maintenance on heating equipment**, including air-delivery, burner mechanical, electrical, and combustion checks.
12. **Evaluate heating-system performance and indoor air quality** and recognize conditions that may affect system efficiency, comfort, and proper operation.

Major Topics to be Included

Throughout the course, the instructor will present material on but not limited to:

- Heating system fundamentals and theory
- Origins and characteristics of fossil fuels
- Principles and processes of combustion

- Combustion air requirements and calculations
- Types of heating systems
- Burners and burner operation
- Ignition systems and sequence of operation
- Draft systems and their applications
- Venting systems and proper venting practices
- Heating system components and their operation
- Heating system electrical controls and wiring diagrams
- HVAC electrical test instruments and proper multimeter use
- Airflow requirements and calculations
- Static pressure measurement and evaluation
- Indoor Air Quality (IAQ)
- Proper use of HVAC tools and instruments
- Furnace location, mounting, and installation
- Furnace electrical connections
- Vent pipe installation and sizing
- Condensate drain installation
- Ductwork installation
- Thermostat installation
- Humidifiers and electronic air cleaners
- Heating system start-up and operational checks
- Heating system sequence of operation
- Mechanical and electrical troubleshooting
- Airflow troubleshooting
- Electrical component testing
- Repair of electrical wiring and components
- Preventive maintenance procedures
- Air-delivery system maintenance
- Burner mechanical maintenance
- Electrical preventive maintenance
- Combustion testing and preventive maintenance

Assessment Types Used in the Course

- Quizzes and Homework Assignments – covering textbook chapters (1–17) and lecture material.
- Lab Reports and Practical Exercises – demonstrating circuit construction, measurement, and troubleshooting skills.
- Midterm and Final Exams – written assessments testing conceptual understanding and problem-solving.

- Practical Skills Test (Hands-On Exam) – evaluating student ability to analyze, test, and service HVAC electrical circuits.
- Class Participation and Discussion – active engagement in lecture and lab activities.