



**ACT 111
HEAT PUMPS AND RELATED SYSTEMS
MASTER COURSE SYLLABUS**

****Instructors will provide students with additional course-specific information, including attendance/makeup policies, assignment/test scheduling, and instructor contact information, as necessary and appropriate.****

Prerequisite(s): ACT 102, ACT 106

Corequisite(s): ACT 102, ACT 106

Quarter(s) Offered: All

Class Hours: 3

Lab Hours: 7

Credit Hours: 6

Course Description: Provides instruction on the principles, application, and operation of a residential heat pump system. Topics include: installation procedures, servicing procedures, electrical components, geothermal ground source energy supplies, dual fuel, troubleshooting, valves, and safety.

Student Learning Outcomes: Upon successful completion of this course, the student should be able to:

Installation Procedures

- Discuss heat pump theory.
- Discuss types of heat pumps.
- Identify reversing valve on heat pump and explain its purpose.
- Properly evacuate and charge system with correct amount of refrigerant.
- Identify and explain components found in heat pumps.
- Discuss heat pump thermostats and how they differ from conventional thermostats.
- Install a packaged heat pump
- Install a split system heat pump
- Install auxiliary strip heaters.

Service Procedures

- Install furnace (electric, 150,000 BTU or less).
- Remove or replace furnace (electric, 150,000 BTU or less).
- Install heating blowers.

- Install insulating materials on ducts.
- Connect heating outlets to ducts.
- Lubricate heating blowers.
- Trace heat pump refrigeration cycle for heating and cooling.
- Check charge on heat pumps in cooling cycle.
- Check charge on heat pumps in heating cycle.
- Perform check, test, and start procedure on a heat pump.

Electrical Components

- Identify and explain the various electrical components in the heat pump cycle.
- Install humidistats.
- Install relays.
- Install safety controls.
- Install starting or running capacitors.
- Identify heat pump electrical components
- Identify types of defrost controls.
- Check defrost system.

Geothermal Ground Source Energy Supplies

- Identify and explain various components and theory of geothermal ground source energy supplies.
- Discuss the theory of geothermal ground source energy supplies.
- Trace the refrigeration cycle on a water source heat pump.
- Compare water source heat pump operating characteristics to manufacturer's specifications.

Dual Fuel Heat Pumps

- Identify and explain various components and theory of dual fuel energy.
- Discuss the theory of dual fuel heat pump systems.
- Wire dual fuel control system
- Operate a dual fuel heat pump system.

Troubleshooting

- Measure airflow or pressure with manometers.
- Measure airflow with anemometers.
- Measure airflow with velocimeters.
- Discuss removal of asbestos insulation on ducts or pipes.
- Discuss the inspection and cleaning of ducts.
- Discuss problems related to condenser malfunctions.
- Discuss problems related to evaporator malfunctions.
- Isolate heat pump malfunctions.
- Remove or install crankcase oil heaters.
- Remove or install heat pump components.
- Remove or install heat pumps.
- Discuss removal or installation of pumps.
- Discuss cleaning of water-cooled condensers.
- Troubleshoot and repair an electric furnace or electric resistance heater.
- Solve problems on computer simulator.

- Solve problems in shop on heat pumps.

Valves

- Identify and explain the purpose of a TX, reversing, and check valves in the heat pump cycle.
- Explain the operation and function of the reversing valve.
- Explain the operation and function of check valves.
- Explain the operation and function of piston flow-checks.
- Explain the operation and function of bi-flow expansion valves.

Safety

- Discuss the safety concerns that the technician will adhere to while working on electric heating systems.
- Discuss the safety concerns of the heat pump technician.
- Demonstrate safe practices while working on electrical circuits.
- Demonstrate safe practices while working on refrigeration.

Grading Scale: The grading scale is detailed in the *Catalog and Student Handbook* and listed below for reference. All faculty members follow this scale when assigning grades to reflect a given student's performance in the classroom.

Grade	Numerical Equivalent	Grade Point
A/A*	90-100	4
B/B*	80-89	3
C/C*	70-79	2
D/D*	60-69	1
F/F*	0-59	0

Effective Summer Quarter 2006, Athens Technical College replaced the S/U grading system used for learning support classes with an A*-F* grading system. The registrar uses an asterisk (A*, B*, C*, D*, F*, W*, WF*, WP*) to designate learning support course grades on transcripts and grade reports because these grades are not components of the quarterly grade point average.

Required Textbook(s), including ISBN:

Title: *Fundamentals of HVAC/R*

Author: Stanfield, Skaves (2009)

Publisher: Pearson/Prentice Hall, Columbus Ohio

ISBN 13: 978-0-13-222367-6

Required Equipment/Tools/Resources: (See policy sheet for a list of tool suppliers.)

- Safety glasses
- Work gloves
- Calculator
- Ruler, English & Metric
- Digital Pocket Thermometer

- 6 In 1 Driver with Flat, Phillips, 1/4" Hex, and 5/16" Hex Bits
- Tool box, pouch, etc.
- Large Straight Screwdriver
- Medium Straight Screwdriver
- Small Straight Screwdriver for Thermostats
- Large Phillips Screwdriver
- Medium Phillips Screwdriver
- Nut-driver Set 1/4, 5/16, 11/32, 3/8, 7/16
- 8" Adjustable Wrench
- 12" Adjustable Wrench
- Channellock Pliers
- Schrader Valve Core Tool
- Refrigeration Valve Stem Ratchet Wrench
- Refrigeration Manifold Gauge Set for R22 & R410a
- Inspection Mirror
- Hex Key Set (Allen Wrench)
- Sling Psychrometer
- Multimeter
- Clamp on Amp Meter
- Non-Contact Voltage Detector
- ** Lockout For Single Or Double Pole Breaker
- Lock
- Fuse puller

Instructional Technologies Employed: Instruction is provided in lecture format, supplemented with audio-visual presentations and computer simulations. Lab work is performed individually during any of the available open lab periods.

Attendance: Regular class attendance is important and expected. The college considers both tardiness and early departure from class as forms of absenteeism. Students absent from class for any reason are still responsible for all work missed. Instructors have the right to determine whether work missed can be made up and have the liberty to set reasonable expectations for attendance based on frequency of class meetings and on the instructional delivery method, subject, type, and level of the class. Class attendance policies will be clearly stated for students by their respective instructors on separate documents (course outlines/schedules) or appendices to the master syllabus.

Grading Policy and Criteria: Final course grades are derived from homework assignments (15%), quizzes (15%), lab work (50%) and a written final (20%). Students are graded on lab assignments according to the grading rubric for that assignment. Students are responsible for completing each assignment and submitting each completed assignment to an instructor for evaluation. The student's shop grade is determined by averaging the project grades using a weighted average. Work which is not completed will be averaged as a grade of 0.

Work Ethics: To fulfill the responsibility to teach essential workplace ethics, the college evaluates program students on attendance, character, teamwork, appearance, attitude, productivity, organizational skills, communication, cooperation, and respect. Because students are preparing for employment, it is essential that they become accustomed to standards of behavior in the workplace. At the conclusion of the quarter, faculty members assign separate numerical work ethics grades which appear beside the course letter grades on both transcripts and grade reports. The work ethics grading scale is as follows: 3 (Exceeds Expectations), 2 (Meets Expectations), 1 (Needs Improvement), and 0 (Unacceptable).

Academic Honesty: Academic honesty is expected at all times. Any student found to have engaged in academic misconduct such as cheating, plagiarism, or collusion is subject to disciplinary sanctions as outlined in the Student Code of Conduct detailed in the *ATC Catalog and Student Handbook*. The term “plagiarism” includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgment. The term “collusion” includes, but is not limited to, the unauthorized collaboration with any other person in preparing work offered for academic credit. Students are advised that faculty routinely use **turnitin.com** both to prevent plagiarism and to assist in verifying when/if it has occurred.

Course Withdrawal: Students may withdraw from a course without academic penalty until the midpoint of the quarter (as stated in the Academic Calendar published in the *ATC Catalog and Student Handbook*). By withdrawing before the midpoint of the quarter, the student is automatically assigned a grade of W, which does not affect quarterly or cumulative grade point average. Grades of W will affect satisfactory academic progress for financial aid purposes. **Students who stop attending class(es) without formally withdrawing risk earning a final grade of F, which will appear on the academic transcript.** Refer to the *ATC Catalog and Student Handbook* for further details.

Academic Support Center: The Academic Support Centers of Athens Technical College (ATC) provide free tutoring for enrolled students. Both instructors and peer tutors provide tutoring in almost all subjects offered by the college. Information about the Center is accessible via the ATC website at www.athenstech.edu. To find out the specific services available on the Athens, Greene, and Walton Campuses, please call (706) 583-2839. To contact the Academic Support Center on the Elbert County Campus, please call (706) 213-2129.

Americans with Disabilities Act: Any student who believes he/she is eligible for accommodations in the classroom and/or during testing due to a documented disability is encouraged to contact the Director of Student Support Services at (706) 355-5081, or the Coordinator of Disability Services at (706) 355-5006, to apply for assistance. It is our goal at Athens Technical College to provide equal access to education for all students.

Cell Phones and Electronic Devices: Students are strictly prohibited from using cell phones and personal electronic devices within college-owned/operated facilities without the explicit permission of a faculty or staff member.

Food/Drinks in Classroom: Food and beverages (other than water) are not allowed in classrooms/labs.

Warranty of Graduates: The Department of Technical and Adult Education warrants every graduate of technical programs in which students may earn technical certificates of credit, diplomas, or associate degrees. The warranty guarantees that graduates demonstrate the knowledge and skills and can perform each competency as identified in the industry-validated standards established for every program of study. If one of our graduates educated under a standard program or his/her employer finds that the graduate is deficient in one or more competencies as defined in the course/program standards, Athens Technical College will retrain the employee at no instructional cost to the employee or the employer. This guarantee is in effect for two years after graduation.

TEACH Act: According to the TEACH Act of 2002, Athens Technical College is obligated to advise you that instructional material included in this course may be subject to copyright protection. As such, you must not share, duplicate, transmit, or store the material of this course beyond the purpose and time frame explicitly stated in the syllabus of your course. If you are not certain whether a particular piece of material is covered by copyright protection, you should contact your instructor and obtain his/her written clarification. Failing to observe copyright protection is a violation of law.