STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

HVAC 254 – Heat Pumps

CIP Code: 15.501

Created by: Jay Simmons
Updated by:

School: CSOET
Department: Mechanical and Energy Technology
Implementation Semester/Year: Fall 2026

A. TITLE: Heat Pumps

B. COURSE NUMBER: HVAC 254

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

# Credit Hours per Week	**3**
# Lecture Hours per Week	**2**
# Lab Hours per Week	**2**
Other per Week	

D. WRITING INTENSIVE COURSE:

Yes	
No	X

E. GER CATEGORY:

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. SEMESTER(S) OFFERED:

Fall	X
Spring	
Fall and Spring	

G. COURSE DESCRIPTION:

This course provides an in-depth study of air source heat pump systems, focusing on the principles, components, and operational characteristics of vapor-compression refrigeration cycles. Students will explore system design, installation parameters, wiring, and troubleshooting techniques essential for efficient and reliable heat pump operation. Emphasis is placed on understanding compressors, condensers, metering devices, evaporators, and the balance of system components, including valves, controls, and refrigerant management in compliance with EPA standards.

H. PRE-REQUISITES: HVAC 101 Refrigeration
CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
a. Explain the vapor-compression cycle and its major components.	SO # 2 HVAC ET		5
b. Interpret wiring diagrams and troubleshoot electrical circuits.	SO # 4 HVAC ET		5
c. Diagnose and resolve common operational issues in heat pump systems.	SO # 4 HVAC ET		5
d. Apply proper installation practices, including sizing and leak detection.	SO # 2 HVAC ET		5
e.			

KEY	Institutional Student Learning Outcomes [ISLO 1 – 5]
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA], Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit, /Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL],* *Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

J. APPLIED LEARNING COMPONENT:

Yes	X
No	

If yes, select [X] one or more of the following categories:

Non-Clinical	X	Community Service	

Practicum			
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS: Silberstein, Eugene, Heat Pumps, 2nd edition, Cengage, 2016

L. REFERENCES:

M. EQUIPMENT: Technology Enhanced Classroom

N. GRADING METHOD: A - F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:
Exams, Quizzes, Homework, Minor Design Projects, Lab Assignments

P. DETAILED COURSE OUTLINE:

I. Vapor-Compression Cycle Theory
   A. Overview
   B. Compressor
   C. Condensers
   D. Metering devices
   E. Condensers
   F. Evaporators

II. Balance of System for Vapor-Compression Cycle
   A. Service Valves
   B. Filter Dryers
   C. Liquid Receivers
   D. Solenoid Valves
   E. Pressure Controls
   F. Relays and Contactors
   G. Refrigerant and EPA

III. Heat Pump Units and Functionality
   a. Common components
   b. Reversing Valves
   c. Bidirectional Metering Devices
   d. Accumulators
   e. Defrost Procedure

IV. Air Source Heat Pumps
   a. Refrigerant Piping
   b. Limits of Operating Temperatures and Efficiencies
   c. Balance Point
   d. Inverter Technology

V. Wiring of Air Source Heat Pump
   a. Schematics
   b. Ladder Logic
   c. Cooling Mode

d. Heating Mode
e. Thermostats
f. Thermistors

VI. Installation Parameters
a. Selecting Location Indoor and Outdoor
b. Proper Sizing
c. Condensate Removal
d. Low Voltage Wire Locations
e. Leak Checking Prior to Start-up
f. System Start Up

VII. Troubleshooting
a. Cause and Effect
b. Indoor and Outdoor Fan Motor Problems
c. Refrigerant Charge Issues
d. Evaluating the Meter Device
e. Evaluating the Reversing Valve
f. Electrical System Issues

VIII. Air Source Heat Pump Maintenance
a. Air Flow
b. The Outdoor Unit
c. Service Call Procedures

Q. LABORATORY OUTLINE:

1. Basic Refrigeration Cycle
2. Identify Components
3. Proper Pipe Layout and Attachment Points
4. Use of EEV and Reversing Valve with Thermostats
5. Defrost Timer with Frozen Thermistors
6. Use a meter to troubleshoot electrical circuit of Heat Pumps
7. Thermistors to Control On/Off Cycles
8. Pressurize Line Sets and Detect Leaks
9. Read a Schematic and Explain the Sequence of Operations
10. Service Call and Typical Maintenance