RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC COURSE OUTLINE

ECTC 202 – Heating Systems Design

I. Basic Course Information

A. Course Number and Title: ECTC 202 – Heating Systems Design

B. New or Modified: Modified

C. Date of Proposal: Fall 2022

NEW

D. Effective Term: Fall 2023

E. Sponsoring Departments: Business and Public Service Department

F. Semester Credit Hours: 5

G. Weekly Contact Hours: 9 Lecture: 6
Laboratory: 3
Out of class work per week: 13.5 hours

H. ☐ Prerequisite (s): None
☐ Corequisite (s): None
☒ Prerequisite (s) and Corequisite (s): None

I. Additional Fees: Laboratory fees

A. Name and e-mail Address of
Department Chair: Tracy Rimple, Tracy.Rimple@raritanval.edu
Divisional Dean: Patrice Marks, Patrice.Marks@raritanval.edu

II. Catalog Description

This is a course which deals primarily with the application of the fundamental facts of engineering to the practical design of central heating systems, primarily hydronic in nature. Previous knowledge of heat transfer processes as applicable to air conditioning design is desirable. Classroom instruction consists of consists of introduction to basic residential construction and systems and engineering design and analysis of hot water (baseboards), steam (radiators), radiant (warm floors), heat pumps, and geothermal heating systems. Throughout the semester the student is also trained in the selection of equipment and peripheral components, and

in the use of engineering-design and computer aided equipment selection software. Particular attention is given to understanding the inherent system inefficiencies that occur due to either over-or under-sizing system components and their negative impact on energy consumption and equipment life expectancy. Students are trained throughout the semester in proper sizing techniques for system performance optimization and energy conservation, as well as introduced to the concept of decarbonization as it will have a major impact on the HVAC industry. Students also practice writing short technical papers, emails, and making presentations to sharpen their technical communication skills.

III. Statement of Course Need

A. Technicians in the Environmental Control Technology field are vital to maintaining physical comfort within our residences. Understanding the design of typical heating systems are integral elements for the education of well-trained technicians in the Environmental Control Technology field.

B. Extensive engineering-design work in the form of laboratory activities is necessary to familiarize students with load calculations, equipment selection, hydronic system design and selection of peripheral components proper of an HVAC system, and which are expected of candidates that want to enter this field of work. Lab activities include but are not limited to computerized engineering design software use, and familiarization with web-based equipment manufacturer engineering and specification documentation.

C. This course generally transfers as a free elective, but it also serves as a Program Elective to Pennsylvania College of Technology for those students graduating with the AAS in Environmental Control Technology who are interested in pursuing B.S. degree at that institution.

IV. Place of Course in College Curriculum

A. Free elective

B. This course meets a program requirement for the A.A.S. Environmental Control Technology Program, and the Environmental Control Technology Certificate.

C. Course transferability: a) for New Jersey schools go to the NJ Transfer website, www.njtransfer.org; b) For all other colleges and universities go to their individual sites.

V. Outline of Course Content

A. Heat Loss Calculations
B. Hot Water Heating Design: Pumping, Series, One-Pipe and Two-Pipe Loops
C. Analysis of Industry and Government Energy Ratings for Boilers
D. Steam Heating Basics: Concepts and One and Two-Pipe Systems
E. Radiant Heat Design: Equipment and material
F. Gas Piping Design

G. Combustion Air Intake Design (Fresh-air for Proper Combustion)
H. Vent Sizing Design
I. Combustion Efficiency Analysis
J. Geothermal Systems Design
K. Design concepts of Domestic Hot Water Loads
L. Basics of Residential Construction
M. Residential Plumbing Systems

VI. Course Learning Outcomes

A. Outcomes

At the completion of the course, students will be able to:

1. Estimate heat losses for residential applications using R-values, U-factors, and infiltration factors in a Modified Manual J spreadsheet tool (GE-4).
2. Select heating boilers and terminal units, estimate heating energy consumption, and identify residential energy conservation measures.
3. Design hot water heating systems including the layout and sizing of the hot water piping system.

B. Assessment Instruments

The following assessment methods may be used:

1. Projects.
2. Homework.
3. Exams.

VII. Grade Determinants

A. Computer Lab performance.
B. Homework.
C. Exams.
D. Class participation
E. Projects.
F. Written Assignments

Modes of Teaching and Learning used in the Course:

A. Lecture/discussion.
B. Small-group and individual work.
C. Computer-assisted instruction.
D. Laboratory work.
E. Student Collaboration.

VIII. Text and Materials

Suggested Texts: I=B=R Guide – Residential Hydronic Heating Installation/Design
Reference Literature: Heat Loss Calculation Guide, Latest Edition, The Hydronics Institute, Inc.
Installation Guide, latest edition, Residential Hydronic (hot water and steam) Heating, Latest Edition, The Hydronics Institute, Inc.

Please note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

IX. Resources

A. Reference books
B. Environmental control manufacturers' performance and specification printed literature
C. Access to OEM engineering websites (OEM= Original Equipment Manufacturer)
D. Instructional videos/DVDs
E. Laptops, engineering design software as well as manuals, and various environmental controls technology-shop instruments and testers available in the lab.

X. Honors Option

Not applicable