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

COURSE OUTLINE

ACHP 253 – Domestic & Commercial Heating I

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY
Mechanical & Energy Technology
May 2015

A. **TITLE:** Domestic & Commercial Heating I

B. **COURSE NUMBER:** ACHP253

C. **CREDIT HOURS:** 4

D. **WRITING INTENSIVE COURSE:** Yes

E. **COURSE LENGTH:** 15 weeks per semester

F. **SEMESTER(S) OFFERED:** Fall

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
3 hours lecture and 3 hours laboratory per week.

H. **CATALOGUE DESCRIPTION:** An application in heat transfer, including the technical considerations of designing residential and commercial heating systems. Particular emphasis is given to pipe and duct sizing. Includes the study of forced air and hot water heating equipment, air terminal devices, and hydronic terminal units. Laboratory will cover the use us data acquisition equipment utilized by the industry to commission systems.

I. **PRE-REQUISITES/CO-COURSES:** MECH 103 – Intro to HVAC-R

J. **GOALS (STUDENT LEARNING OUTCOMES):**
By the end of this course, the student will able to:

Course Objective	*Institutional SLO*
a. Analyze various types of Boilers and Furnaces	2. Crit. Thinking 3. Prof. Competence
b. Solve fluid flow problems related to pipe and duct design	2. Crit. Thinking 3. Prof. Competence
c. Calculate heat loss from buildings	2. Crit. Thinking 3. Prof. Competence
d. Select heating system components	2. Crit. Thinking 3. Prof. Competence
e. Report to the class on a topic relative to the HVAC industry	1. Communication 3. Prof. Competence

K. **TEXTS:** Air Conditioning Principles and Systems: An Energy Approach by Edward Pita - John Wiley

L. **REFERENCES:** ASHRAE Handbook-Fundamentals
Carrier Design Manual

M. **EQUIPMENT:** None

N. **GRADING METHOD:** (P/F, A-F, etc.) A-F

O. **MEASUREMENT CRITERIA/METHODS:** Exams, Homework & Laboratory Reports

P. **DETAILED TOPICAL OUTLINE:** See attached

I. Boilers and Furnaces
  1. Warm Air Furnaces
    A. Types
      1. Gas and Oil Fired
      2. Lo-Boy
      3. High-Boy
      4. Counter Flow
      5. Horizontal
    B. Furnace Sizes and Ratings
    C. Furnace Selection
  2. Heating Boilers
    A. Construction
      1. ASME Boiler Construction Code
    B. Types of Heating Boilers
      1. Material Construction
      2. Fuels
      3. Purpose of Application
    C. Cast Iron Boilers
      1. Classification
    D. Steel Boilers
      1. Fire Tube
      2. Water Tube
    E. Testing and Rating Codes
      1. ASME Test Codes
      2. EDR Rating
      3. GROSS IBR Output
      4. Net IBR Rating
    F. Boiler Efficiency
      1. Solid Fuels
      2. Liquid and Gaseous Fuels
    G. Rating of Boilers
      1. Net Load
      2. Piping Loss
      3. Design Load
      4. Pick Up Allowance
      5. Gross Loads

II. Fluid Flow in Piping and Ducts
  A. The Continuity Equation
  B. The Flow Energy Equation
  C. Pressure in Closed and Open Systems
  D. Total, Static, and Velocity Pressure
  E. Conversion of Velocity Pressure to Static Pressure (Static Regain)
  F. Pressure Loss From Friction in Piping and Ducts
  G. Friction Loss in Pipe Fittings
  H. Pressure Loss in Pipe Fittings
  I. Piping System Pressure Drop
  J. System Pipe Sizing
  K. Friction Loss From Air Flow in Ducts

L. Aspect Ratio
M. Pressure Loss in Duct Fittings
N. Pressure Loss at Fan Inlet and Outlet
O. Duct System Pressure Loss

III. Building Heat Loss Calculations
A. The Heating Load
B. Heat Transfers
C. Overall Thermal Resistance
D. Overall Heat Transfer Coefficient
E. Heat Transfer Losses
F. Infiltration & Ventilation Losses
G. Design Conditions
H. Room Heat Loss
I. Building Loss
J. Energy Conservation

IV. Hydronic Piping Systems and Terminal Units
A. Piping Arrangements
1. Series Loop
2. One-Pipe Main
3. Two-Pipe Direct Return
4. Two-Pipe Reverse Return
5. Combination Arrangements
6. Three-Pipe System
7. Four-Pipe System
B. Hydronic Terminal Units
1. Radiators
2. Convectors
3. Baseboard
4. Fin-Tube
5. Radiant Panels
6. Unit Heaters
7. Propeller Unit Heaters
8. Cabinet Unit Heaters
9. Fan-Coil Units
10. Induction Units
C. System Water Temperatures
D. Selection of Terminal Units
E. System Design Procedure

V. Air Conditioning Duct Design
A. Duct Design Methods
1. Equal Friction
2. Static Regain
3. Modified Equal Friction
B. Projects of Design Methods

Q. LABORATORY OUTLINE:

1. Pressure Changes in the Duct System
2. Determining Pipe Friction (Steel Pipe)
3. Calibration of an Orifice Meter for Measuring Air Flow
4. Computer Aided Piping Design
5. Air Velocity Measurement
6. Static Pressure Losses in Air Ducts and Elbows
7. Running Performance Test on a Water Source Heat Pump
8. Computer Aided Design: Modified Equal Friction Method
9. Running a Load Test on a Gas Fired Hot Water Heating Boiler
10. Computer Aided Duct Design
11. Performance Test of an Electric Warm Air Furnace
12. Heat Load Calculation Using Building Plans & Specifications