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

COURSE OUTLINE

ACHP 254 – Domestic & Commercial Heating II

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CANINO SCHOOL OF ENGINEERING TECHNOLOGY
MECHANICAL & ENERGY TECHNOLOGY
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A. **TITLE:** Domestic & Commercial Heating II

B. **COURSE NUMBER:** ACHP254

C. **CREDIT HOURS:** 4

D. **WRITING INTENSIVE COURSE:** No

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

F. **SEMESTER(S) OFFERED:** Spring (fourth semester)

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

H. **CATALOGUE DESCRIPTION:**
This course is a continuation of ACHP 253 focusing on steam boiler selection, design and layout, selection of equipment and pipe sizing. Particular emphasis is given to commercial systems such as fans and pumps. The student will design and layout of control systems based zone and occupant levels. Laboratory covers modern methods of testing heating equipment and systems.

I. **PRE-REQUISITES/CO-COURSES:** ACHP 253 – Domestic & Commercial Heating I

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

Course Objective	*Institutional SLO*
a. Select fans and pumps for various applications	2. Crit. Thinking 3. Prof. Competence
b. Analyze steam heating systems	2. Crit. Thinking 3. Prof. Competence
c. Select components for residential & commercial control systems	2. Crit. Thinking 3. Prof. Competence
d. Perform equipment specification and selection	2. 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
ASHRAE Handbook-Applications

M. **EQUIPMENT:** None

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

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

P. **<u>DETAILED TOPICAL OUTLINE</u>:** See attached

DETAILED OUTLINE: LECTURE-RECITATION
ACHP 254 - DOMESTIC AND COMMERCIAL HEATING II

I. Fans and air Distribution Devices
  A. Fan Types
    1. Axial Fans
    2. Centrifugal Fans
  B. Fan Performance Characteristics
  C. Fan Selection
  D. Fan Ratings
  E. System Characteristics
  F. Fan-System Interaction
    1. System Effect
    2. Selection of Optimum Fan Conditions
  G. Fan Laws
  H. Construction and Arrangement
  I. Installation
  J. Energy Conservation Room Air Distribution
    1. Air Patterns
    2. Location
    3. Types of Air Supply Devices
    4. Applications
    5. Selections
    6. Accessories and Duct Connections
    7. Return Air Devices
II. Centrifugal Pumps, Expansion Tanks, and Venting
  A. Types of Pumps
  B. Principles of Operation
  C. Pump Characteristics
  D. Pump Selection
  E. System Characteristics
  F. System Characteristics and Pump Characteristics
  G. Pump Similarity Laws
  H. Pump Construction
  I. Net Positive Suction Head
  J. The Expansion Tank
    1. System Pressure Control
    2. Compression Tank Size
  K. Air Control and Venting
  L. Energy Conservation
III. Steam Heating Systems and Piping
  A. Classification
    1. Piping Arrangement
      a. One Pipe
      b. Two Pipes
      c. Up Flow

d. Down Flow
e. Dry Return
f. Wet Return

2. Pressure or Vacuum
a. High Pressure
b. Low Pressure
c. Vapor
d. Vacuum
e. Orifice
f. Sub-Atmospheric, Differential, Synchronized

3. Method of Returning Condensate
a. Gravity
b. Condensate Pump
c. Vacuum Pump
d. Alternating Return Trap

B. One Pipe System
1. Conventional Up Feed
2. Up Feed Dripped to a Wet Return
3. Down Feed System
4. Air Valves
a. Thermostatic
b. Quick-Vent
c. Pressure
d. Vacuum

C. Two Pipe Systems
1. Operating Pressures
a. High Pressure, Low Pressure, Vapor, Vacuum
2. Feed
a. Up Flow
b. Down Flow

D. Pipe Sizing
1. Tables for Pipe Sizing for Low Pressure Systems
2. Tables for Pipe Sizing for High Pressure Systems
3. Sizing Piping for One-Pipe Gravity Systems
4. Notes on Gravity One-Pipe Air Vent Systems
5. Sizing Piping for One-Pipe Vapor Systems
6. Sizing Piping for Two-Pipe Low Pressure Systems
7. Sizing Piping for Two-Pipe Vapor Systems
8. Sizing Piping for Two-Pipe Vacuum Systems
9. Steam Traps
a. Float
b. Thermostatic
c. Float and Thermostatic
d. Upright Bucket
e. Inverted Bucket
f. Impulse

IV. Primary and Secondary Pumping
- A. Applications
- B. Advantages of Secondary Pumping
- C. General Theory
  1. Primary Circuit
  2. Secondary Circuit
  3. Common Piping
- D. Primary - Secondary Piping
  1. One Pipe Primary Circuit
  2. Two Pipe Direct Return Primary
  3. Two Pipe Reversed Return Primary
- E. Secondary Zone Piping Arrangements
- F. Controlling Secondary Zones
  1. Intermittent Pump Operation
  2. Constant Circulation Pumps
- G. Typical Control Arrangements
  1. Heating Cooling Systems
- H. Primary - Secondary Design
  1. Design Advantages
     a. Better Control
     b. Larger Temperature Drops
- I. Design One Pipe System
- J. Design Two Pipe Direct Return Primary
- K. Design Two Pipe Reverse Return Primary
- L. Design of Secondary Zone
- M. Design of Common Piping

V. Electric Heating
- A. Electric Heating Units
- B. Electric Space Heating Application
- C. Types of Electric Space-Heating Systems
- D. Equipment and Installation Methods
  1. Convectors
  2. Unit Ventilators
  3. Unit Heaters
  4. Baseboard - Type Unit
  5. Infrared Heaters
  6. Steam Radiator with Immersion Element
- E. Control Methods

VI. Heat Pump Systems
- A. Principles
- B. Energy Efficiency
- C. Types
  1. Air to Air
  2. Water to Air
  3. Earth to Air
  4. Closed Water Loop System

VII. Automatic Temperature Controls
- A. Purpose of Controls
- B. Closed & Open Loop Control Systems
- C. Energy Sources
- D. Types of Control Action
  1. Two Position
  2. Proportional (P)
  3. Integral (I)
  4. Differential (D)
  5. Floating
- E. Controllers
- F. Controlled Devices
  1. Types
  2. Sizing of Devices
- G. Complete Systems

Q. **LABORATORY OUTLINE:** See attached

1. Forward or Backward Curved Blade Fan
2. Study of Construction and Operation of Steam Throttling Calorimeter
3. Performance Study of a Centrifugal Fan Operating with Variable Speed
4. Determination of Thermal Conductivity
5. A Study of a Centrifugal Pump Operating with a Variable Speed
6. Heating Coil Performance Test Using Hot Water as the Heating Medium
7. Operation Characteristics of a VAV fan system
8. Performance of a "Run Around Heat Re-Claim System"
9. Study of Controllers & Sensors
10. Pneumatic Control Operation