

ARC 230

ENVIRONMENTAL SYSTEMS

COURSE DESCRIPTIONS:

Prerequisites: ARC 111 and MAT 121

Corequisites: None

This course introduces plumbing, mechanical (HVAC), and electrical systems for the architectural environment. Topics include basic plumbing, mechanical, and electrical systems for residential and/or commercial buildings with an introduction to selected code requirements. Upon completion, students should be able to develop schematic drawings for plumbing, mechanical, and electrical systems and perform related calculations. Course Hours per Week: Class, 3. Lab, 3. Semester Hours Credit, 4.

LEARNING OUTCOMES:

A student who successfully completes this course should be able to:

- a. Calculate U-values for various building components
- b. Calculate Total Heat Loss and Heat Gain for a building (using manual J or selected software)
- c. Perform a temperature gradient calculation
- d. Calculate the cost of heating
- e. Determine the size of duct work, tonnage of heating plant
- f. Perform calculations using the Psychometric chart
- g. Understand the basic operation of HVAC equipment, plumbing & piping systems & electrical distribution systems
- h. Understand protection systems
- i. Draw a riser diagram

OUTLINE OF INSTRUCTION:

- I. Course overview; Energy and Environment
 - A. Climate and the site
 - 1) Microclimates
 - 2) Direct sun, daylight and sun charts
 - 3) Ventilation and cooling
- II. Energy and Architectural Design
 - A. The building envelope and its components
 - B. Envelopes and energy leakage
- III. Environmental Planning
 - A. Passive solar planning

- B. Natural day lighting and heating
 - C. Windowless buildings
- IV. Climate Control Systems
- A. Exterior ducting
 - B. Downfeed air distribution
 - C. Electrical systems
- V. Energy Conservation
- A. Heat pumps
 - B. Solar assisted heat pumps
- VI. Heat Loss and Heat Gain
- A. Regulation of the thermal environment
 - B. Comfort and metabolism
 - C. Criteria for thermal comfort
 - 1) Design conditions
 - 2) ASHRAE Comfort Standard (55-74)
- VII. Nature of Heat Flow
- A. Homogenous solids and conductivity
 - B. Air spaces and emittance
 - C. Effects of air motion
- VIII. Overall co-efficient of heat transmission
- A. Conductivity (K)
 - B. Conductance ©
 - C. Emissivity (E)
 - D. Thermal Resistance (R)
- IX. Heat loss computations
- A. Thermal resistance of plane air spaces
 - B. Surface conductance and resistance for air
 - C. Thermal properties of typical building and insulating materials
 - D. U-value resulting from adding insulation
 - E. Concrete slabs
 - F. Windows, skylights and light transmitting partitions
 - G. Doors
 - H. Air Infiltration and air changes
 - I. Attics, basements and crawl spaces
 - J. Heat transfer factors
- X. Energy Code Calculations
- A. Purpose
 - B. Format
 - C. Procedure

- 7) Vents and stacks
- 8) Gas lines
- 9) Riser diagrams

I. Electrical systems and system components

- 1) National Electric Code
- 2) Amperage
- 3) Circuits
- 4) Breakers
- 5) Conductors
- 6) Ground
- 7) Outlet
- 8) Receptacle
- 9) Service entrance
- 10) Service panel
- 11) Low voltage switching
- 12) Fixtures

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J. Drawing Electrical Plan

- 1) Location of panel
- 2) Outlet symbols
- 3) S0.004 Tw 2an

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