SAULT COLLEGE
of Applied Arts and Technology
Sault Ste; Marie

COURSE OUTLINE

BUILDING SCIENCE

PHY 228-2

revised June, 1982

BUILDING SCIENCE IV

PHY 228-2

Text: Mechanical and Electrical Equipment for Buildings by Mr. Guinnes and Stean; Publisher: John Wiley, 6th Ed

REFERENCE TEXTS:

Fundamentals of Solar Heating by Richard C. Sherbert, L.D. Ryan

The Solar Home Book by Anderson and Riondom.

Solar Tec Design Handbook by Solar Tech Corp.

The Passive Solar Energy Book by Edward Mazria.

Applied Solar Energy by Meinel.

Harvest the Sun by Nick Nicholson.

Residential Heat Pump Application Manual.

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UNIT I - Heat Pump Application

Design concepts including sizing procedures, design installation techniques, basic refrigeration and heat pump theory, packaged and split systems, air to air heat pump selection, cooling load procedures system design.

UNIT II - Active Solar Systems

Design concepts, solar characteristics, microclimatology, siting and orientation, building envelope interactions, solar insolation calculations, flat plate collector design, solar storage medium distribution systems, system controls, economics of solar heating.

UNIT III - Passive Solar Systems

Design concepts, direct gain and indirect gain systems, thermal storage walls, attached greenhouses, preliminary calculation methods, climate design data, materials, applications and details, passive solar design examples, energy conservation other alternate energy applications.

NO.	PERIODS	TOPIC DESCRIPTION	REFERENCE
		UNIT I - Heat Pump Applications	
1	1	Introduction	
2	2	Refrigeration Theory	
3	2	Heat Pump Theory	
4	2	Cooling Load Estimating	
5	1	Types of Systems	
6	2	Sizing the Heat Pump	
		UNIT II - Active Solar Systems	
1	1	Introduction	
2	1	Design Concepts	
3	1	Siting and Orientation	
4	1	Envelope Characteristics	
5	2	Solar Insolation Characteristics and Design	
6	2	Flat Plate Collector Design	
7	1	Storage Medium and Sizing	
8	1	Distribution Systems and Controls	
9	I	Economics of Solar Heating	
		UNIT III - Passive Solar Systems	
1	1	Design Concepts	
2	1	Direct Gain and Indirect Gain Systems	
3	2	Thermal Storage	
4	1	Attached Greenhouse	
5	2	Climate Design Data and Design Calculations	
6	2	Material Applications and Details	
7	1	Energy Conservation	

SPECIFIC OBJECTIVES

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UN T 1 - Heat Pump Applications

1) To identify types of systems.
2) To understand the operation of a heat pump.
3) To define the advantages and disadvantages of types of heat pump systems.
4) To solve cooling load problems.
5) To identify heat pump efficiency and heating performance.
6) To size and select a heat pump.
7) To determine the C O . P . for a heat pump.
8) To solve economic balance point problems.
9) To determine supplemental heat requirements.
10) To design the air distribution system.
11) To identify the best location for the installation of a heat pump.
12) To identify the various controls of a heat pump system.
13) To identify and relate S.P.F.
14) To identify and relate E.E.R.
15) To identify and relate SEER.
16) To estimate energy consumption.
17) To investigate heat pump theory.
18) To graphically demonstrate the refrigeration cycles.
19) To identify the five heat sources which can be utilized by the heat pump.
20) To compare the cost of a heat pump system to other heating and cooling systems.

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UNIT II - Active Solar Systems

To identify and relate alternate energy forms.

To appreciate energy conservation methods.

To solve simple payback problems related to energy conservation

To solve simple payback problems related to alternate energy systems.

To identify the three basic schools of Solar Design.

To identify and graphically relate the main components of an active solar system.

To understand the problems related to the design and construction of solar collectors.

8 To identify arid to understand the physical characteristics of a flat plate collector.

9 To identify types of storage media.

10 To understand the various storage problems.

11 To identify the difference between "sensible heat" storage and "latent heat" storage.

12 To solve storage problems.

13 To identify types of distribution systems.

14 To identify controls for air and liquid distribution systems.

15 To understand the purpose and contribution of a heat exchanger.

16 To identify the components of an Air Handling System.

17 To identify and know the pros and cons of drain down systems vs. glycol systems vs. air systems.

18 To identify auxiliary heating systems.

19 To identify a differential thermostat.

20 To demonstrate the use of a differential thermostat.

21 To identify and demonstrate the use of an insolation meter.

Unit II - Active Solar Systems Continued . . . . .

22) To identify methods of increasing collector performance.

23) To understand "Atmospheric Attenation".

24) To solve energy flow problems in collector design.

25) To estimate collector performance.

26) To estimate the collector size.

27) To determine the number of BTU/degree day.

28) To estimate annual heating costs.

29) To determine collector efficiencies on lab flat plate collectors

30) To design a complete active solar system including collectors, storage and distribution.

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UNIT III - Passive Solar Systems

1) To identify the basic elements of a passive system.

2) To identify and understand the pros and cons of a "Direct Gain System".

3) To identify and understand the pros and cons of an "Indirect Gain System".

4) To identify and understand the pros and cons of an "attached Greenhouse" system.

5) To identify and understand the pros and cons of an "Isolated Gain System".

6) To understand and relate to others the advantages and disadvantages of passive solar systems.

7) To identify and solve passive solar heating problems utilizing the twenty design patterns.

8) To determine the correct amount of glazing.

9) To determine the correct amount of thermal mass.

10) To identify the "Trombe Wall".

11) To identify the "time lag principles".

12) To identify "heat sink principles".

13) To design a complete passive solar system including building shape, insulation, amount of glazing, orientation and thermal mass.

14) To identify and relate to others the guidelines for energy conservation.