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SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title:	BUILDING SCIENCE IV
Code No.:	PHY 228
Program:	ARCHITECTURAL TECHNICIAN
Semester:	IV
Date:	JANUARY, 1993
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New Revision: x

APPROVED:

Chairperson Date

BUILDING SCIENCE IV — PHY 228

Course Name — Course Number

PHILOSOPHY/GOALS:

To understand the theory of, and the applications of heat pumps.

To design and layout an active solar heating system.

To design and layout a passive solar system.

To solve life cycle cost and energy conservation problems manually and with the aid of the microcomputer.

METHOD OF ASSESSMENT (GRADING METHOD):

SEE ATTACHED SHEET.

TEXTBOOK(S):

Fundamentals of Solar Heating - by Ryan

Heat Pump Applications Manual

METHOD OF ASSESSMENT (all courses):

The following grades will be assigned:

A - 75 - 100%	consistently above average achievement
B - 6 6 - 74%	average achievement
C - 55 - 65%	satisfactory achievement
I - incomplete	
R - Repeat	the student has failed to achieve the objectives of the course and must repeat the course

The "I" grade (incomplete) designation indicates that the student has not completed the objectives required in specific course areas.

Semester work will be made up of four tests and assignments. All tests and assignments must be completed when assigned. Late assignments or projects will not be tolerated.

Attendance is also mandatory in all classes.

Tests and assignments will be given on a regular basis throughout the semester. The weighted grade between practical theoretical work will depend on the type of course. Final examinations are also mandatory for any student that does not maintain an "A" average in the course or who has not completed all assignments by their due date.

NOTE: Chronic absenteeism by any student will result in the student not being admitted to class and ultimately his failure to receive an acceptable grade in the course.

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TEXT:

Mechanical and Electrical Equipment for Buildings - by Mr. Guiness and S
- publisher: John Wiley, 6th Edition

REFERENCE TEXTS:

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

The Solar Home Book - by Anderson and Riondom

SOLARTECH Design Handbook - Solar Tech Corp.

The Passive Solar Energy Book - by Edward Mazria

Applied Solar Energy - by Meinel

Harvest the Sun - by Nick Nicholson

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GENERAL OBJECTIVES

Heat Pump Applications

Packaged and split heat pump systems as well as all electric and heat pump/ fossil fuel furnace combination with an emphasis on the air-to-air heat pump as they dominate the market at present.

Active Solar Systems

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

Passive Solar Systems

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

TOPIC NO	PERIODS	TOPIC DESCRIPTION	REFERENCE
Unit 1		Heat Pump Application	
1.	1	Types of Systems	
2.	1	Heat pump, principles of	
3.	1	Operation	
4.	1	Heat Pump Efficiency	
5.	2	Sizing and Selecting the Heat Pumps	
6.	1	Heat Pump Theory	
7.	1	Heat Pump Cycle	
8.	1	CO.P., S.P.F., E.E.R. & S.E.E.R.	
Unit 2		Active Solar Systems	
1.	1	Introduction	
2.	1	Design Concepts	
3.	1	Siting and Orientation	
4,	1	Envelope characteristics	
5.	3	Solar Insolation characteristics and design	
6.	2	Flat plate collector design	
7.	1	Storage medium and sizing	
8.	1	Distribution systems and Controls	
9.	1	Economics of solar heating	

TOPIC NO.	PERIODS	TOPIC DESCRIPTION	REFERENCE
Unit 3		Passive Solar Systems	
1.	1	Design concepts	
2.	1	Direct gain and indirect gain systems	
3.	2	Thermal starage	
4.	1	Attached greenhouse	
5.	4	Climate design data and design calcualtions	
6.	1	Material applications and details	
7.	2	Energy conservation	

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SPECIFIC OBJECTIVES:

UNIT *1_* - Heat Pump Applications

1. To identify the basic principles of operation of a domestic air-to-air heat pump.
2. To identify the various heat sources, such as: air, water, ground and solar,
3. To identify the CO.P.
4. To solve C.O.P, problems.
5. To identify and relate to others the different types of metering devices.
6. To solve heat gain and loss problems for a residence.
7. To construct a heat gain sheet as per Manual "J" of the National Warm Air Association.
8. To identify the different types of heat pump systems.
9. To understand the principles of refrigeration.
10. To select a heat pump and peripheral components for a residence.
11. To layout a heating and cooling duct system for a residence,
12. To identify the factors that affect heat gain and heat loss.
13. To calculate heat transfer multipliers.

UNIT 2^ - Active Solar Systems

1. To understand the term alternate energy.
2- To identify various types of alternate energy forms,
3. To know man's inputs and outputs.
4. To identify and relate to others three schools of solar design,
5. To understand the importance of energy conservation.
6. To understand the insulation requirements for a dwelling unit.

7. To understand the variables that affect solar gain on a surface.
8. To identify the components of an active solar system.
9. To understand and relate to others the types of solar collectors.
10. To understand the properties required of a solar collector surface such as, absorbtance and low emittance.
11. To identify various type of selective collector surfaces.
12. To understand and relate to others the factors that affect solar collector efficiencies.
13. To determine proper storage size.
14. To identify types of storage media.
15. To identify latent heat storage.
16. To identify sensible heat storage.
17. To identify phase charge materials.
18. To know the factors pertaining to presure drop in a rock storage bin.
19. To solve energy problems related to energy consumption.
20. To solve problems related to life cycle costing.
21. To solve problems comprising the payback of active solar systems to a conventional system.
22. To identify the various distribution mediums such as: air, water, glycol, etc.
23. To draw a schematic for an active solar system.
24. To identify and relate to others the use of auxiliary heating in-an active solar system.
25. To identify the major control elements of an active solar system.
26. To understand the function and application of a defferential thermo-stat.
27. To know the five different control modes.
28. To solve collector performance problems manually.
29. To solve collector performance problems by use of the microcomputer.

30. To estimate the collector size utilizing the microcomputer.

31- To solve problems manually and with the aid of the computer in other energy related problems.

32. To design and draw a schematic layout for residential active solar system.

UNIT 2 Z Passive Solar Sytem

1. To identify and relate to others the types of passive solar systems.
2. To investigate the economics and design variables for each type of system.
3. To identify the proper design patterns such as: location, shape, location of spaces and appropriate materials.
4. To investigate the factors involved in the design of a direct gain system.
5. To size and detail a thermal storage wall.
6. To size an attached greenhouse system.
7. To identify the pros and cons of a roof pond.
8. To determine average indoor temperature.
9. To calculate auxiliary space heating requirements.
10. To identify and understand the functions of insolation tables.
11. To understand the principles of time lag of heat flow through walls and roofs.
12. To determine heat gain through various glazing and other structural materials•
13. To design a passive solar system of the direct gain type.
14. To layout a schematic of a passive solar system.
15. To analyze an existing passive solar design so as to determine the seasonal solar component as a percentage of the total sesonal heating load.