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SADLT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title:	BUILDING SCIENCE
Code No.:	PHY 226
Program:	ARCHITECTURAL TECHNICIAN
Semester	III
Date	AUGUST 1992
Author:	M. URSELL

New Revision:

APPROVED ^fM,U ^1M\^ 9<^^c/9-cS^^

Chairperson Date

CALENDAR DESCRIPTION

BUILDING SCIENCE III	PHY 226
Course Name	Course Number

PHILOSOPHY/GOALS:

To design and layout a hydronic heating system manually and with the aid of the microcomputer.

To design and layout a forced air heating system manually and with the aid of the microcomputer.

To select electrical heating components.

To understand basic plumbing terminology.

METHOD OF ASSESSMENT (GRADING METHOD):

SEE ATTACHED SHEET.

TEXTBOOK(S);

Mechanical &_ Electrical Equipment for Buildings - by McGinness

METHOD OF ASSESSMENT (all courses)

The following grades will be assigned:

A+-	90-100%	
A -	76- 89%	consistently above average achievement
B -	66- 75%	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 formal 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. 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.

The student will be expected to complete three major projects. Each project will be worth 20%, for a total semester value of 60%. Projects that are submitted late will be deducted 20% the first week and will not be accepted after that.

Tests and assignments will be assigned on a weekly basis and will be valued at 30% of the final semester grade.

NOTE: Attendance 10%

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.

SPECIAL NOTES:

Students with special needs (e.g. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor .

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.

BUILDING SCIENCE III

PHY 226

THIRD SEMESTER

TEXTS:

1. Mechanical & Electrical Systems for Construction - Riley Shuttleworth - McGraw-Hill Publishers
2. The Trane Heating Manual - Trane Company Canada Ltd.
3. Residential System Design Manual for Air Heating & Cooling Systems - HRA Institute of Canada
4. Westinghouse Design Handbook

REFERENCE TEXTS:

1. Mechanical & Electrical Equipment for Buildings - McGuinnes, Stein, Gay & Fawcett - John Wiley & Sons Publisher
2. Acoustics in Modern Practice - Fritz Ingerslev - Architectural Press
3. Design of Good Acoustics - J.E. Moore - Architectural Press
4. Practical Electricity - McPartland & Novak - McGraw-Hill
5. Design for Noise Reduction - J.E. Moore - Achitectural Press
6. Lighting in Architectural Design - Derek Phillips - McGraw-Hill
7. Piping Handbook - Sabin Crocicer - McGraw-Hill Book Co.
8. Plumbing - Harold E. Babbitt - McGraw-Hill
9. Fundamentals of Pipe Drafting - Charles H. Thompson - John Wiley & Sons
10, Metric Pracatice Guide - H.R.A.
11- Applied Solar Energy - Addison Wesley
12, National Research Council - Solar Publications & Reports

BUILDING SCIENCE III

PHY 226

Heating installations design and layout, types of heating systems, heat loss calculations, components and operations of different heating systems such as hudronic, forced air and electric heating,

TOPIC INFORMATION

Introduction and Hydronic Heating Design

PART *!*

a) terminology
b) base temperature
c) types of heating systems
d) heat loss calculation
e) infiltration
f) exposure
g) calculation of "U" - Factor for a composite wall
h) hot water heating design
i) conductivity and resistance of various materials
j) use of multipliers
k) to construct the radiation sheet
1) selection of proper radiation
m) types of boilers and selection
n) types of hot water heating system
0) layout of a heating system
p) gallonage temperature drop and head calculations
q) pipe sizing
r) components of a hot water heating system

PART *2* - FORCED WARM AIR HEATING

a) introduction
b) purpose and scope
c) specifications
d) general design recommendations
e) equipment selection
f) supply outlet selection and location
g) return air intake selection and location
h) symbols
i) layout procedure
j) supply branch and outlet sizing
k) return branch and inlet sizing
1) supply and return trunk duct sizing
m) sample register and diffuser tables
n) equivalent lengths of fittings and intakes
o) charts and tables
p) sample layout and work sheets
r) specifications for forced warm air heating as applied to existing homes

PART 3 - ELECTRIC HEATING

a) terminology
b) components
c) design and layout
d) advantages and disadvantages

PART £ - PLUMBING INSTALLATIONS

a) terminology
b) residential requirements
c) hot and cold water supply
d) waste pipes and systems
e) sewage vent stacks
f) storm drainage
g) pipe sizes
h) components
i) practical installations

PERFORMANCE OBJECTIVES FOR BUILDING SCIENCE III

The general objective of this course is to give the Architectural student an insight into heating and mechanical design for buildings. The student will study design procedures for hot water and forced air heating along with their applications. The student will also investigate plumbing regulations and the various types of sanitary and storm systems used in residential and commercial buildings.

The specific objectives follow:

PART *1* - INTRODUCTION *&* HYDRONIC HEATING DESIGN

1. To identify the terminology used in hot water heating design.
2. To compare the various types of heating systems.
3. To review the physics of heat - eg: how heat travels, types of heat, etc-
4. To identify the purpose of any heating system.
5. To review the mechanical and heating symbols used on technical drawings.
6. To determine the base temperatures for various localities.
7. To determine the U-factors for various wall types, floors and ceilings
8. To solve heat loss problems for specific conditions by means of the electronic calculator and independently on the microcomputer.
9. To construct a radiation sheet.
10. To construct a job data sheet.
11. To determine the effects on total heat loss due to exposure.
12- To determine the effects on total heat loss due to infiltration.
13. To solve infiltration problems.
14. To develop the air change factor.
15. To identify the "K" factor.
16. To identify the "C" factor.
17. To identify the "R" factor.
18. To develop the "U" factor for a given wall using the above factors and the proper formulas.
19. To calculate the total heat loss for a given residential structure manually and with the aid of the microcomputer.

20. To identify and select a boiler for given design situations.

21. To select convector radiation and cast iron radiation.

22. To determine temperature drop and g.p.m. requirements.

23. To select an expansion tank.

24. To identify and select a one pipe hot water heating system.

25. To identify and select a two-pipe reverse return system,

26. To identify and select a two-pipe direct return system.

27. To identify and select a series loop system.

28. To identify and select a one-pipe zoned system.

29. To layout to scale and by employing proper graphic symbols the above mentioned piping systems.

30. To determine the "milinch" and its use in hot water design.

31. To select a hot water circulating pump.

32. To determine the required pump head in milinches.

33. To size the piping by use of the pipe sizing tables,

34. To identify and be able to relate to others the use of the following hot water heating components:
    - one pipe fitting
    - air vents
    - altitude gauge
    - flow control valve
    - pressure relief valve
    - make-up water line
    - automatic feed valve
    - globe valve
    - air charging valve
    - balancing valves, etc.

35. To identify and relate to others methods of automatically controlling hot water heating systems.

36. To identify various types of thermostats that are used for hot water heating control.

NOTE: The main objective of Part 1 of this course is for the student to design a complete hot water heating system for a small residential type building. Design is to be completed independently on the microcomputer by each student.

PART 2 - FORCED AIR HEATING

37. To identify the terminology used in the design of a forced warm air heating system.

38. To select the proper air furnace.

39. To identify the various warm air heating system components such as:
    a) diffusers
    b) dampers
    c) register
    d) end boots
    e) supply and return trunks
    f) zones, etc.

40. To identify and layout the basic types of warm air heating systems such as:
    a) loop system
    b) radial system
    c) perimeter

41. To identify and draw the symbols required for warm air and ventilation system.

42. To identify the characteristics of the various forced air heating systems.

43. To identify the ventilation requirements for various building uses and occupancies.

44. To identify static head.

45. To determine methods of measurement of air pressure in ducts.

46. To identify the manometer tube.

47. To determine the function of the manometer tube.

48- To design the supply outlets and location for a residential forced air system.

49. To determine diffuser locations.

50. To design the return inlet sizes and location for a residential forced air system.

51. To layout the supply outlets on plan,

52. To layout the return outlets on plan.

53. To select the furnace size and type,

54. To locate furnace on plan.

55. To indicate all risers, elbows and fittings on heating plan.

56. To design the supply branches.

57. To draw the supply branches on plan to scale.

58. To measure actual duct length from plan from bonnet of furnace to supply outlet.

59. To determine the total equivalent length of all fittings.

60. To determine the total equivalent length of all fittings.

61. To record the cfm requirements per outlet.

62. To determine the supply and return plenum pressures.

63. To determine the duct size, round and/or rectangular.

64- To determine the outlet sizes and record on plan and data sheets.

PART 2 r ELECTRICAL HEATING

65. TO define a degree day.

66. To determine the number of watts of electrical power required for a given total heat loss in MBH.

67. To identify the various types of electrical heating components.

68. To layout the system on plan.

69. To investigate the costs of the various types of heating systems both for initial installation and for fuel costs.

70. To identify the components of a refrigeration system.

71. To be able to list the factors which influence air conditioned environments.

72. To identify a heat pump.

73. To identify the various factors involved in selecting refrigerants.

74. To identify the components of a complete year-round air conditioning machine.

75. To draw the various elements of the system schematic.

PART ^ - PLUMBING INSTALLATIONS

76. To identify the terminology used for sanitary and storm drainage systems.

77 - To investigate the code regulations governing domestic sanitary drainage system.

78. To draw a schematic showing the components for a building sanitary system.

79. To identify the schematic for a hot and cold water supply.

80. To determine the components required for a sanitary and storm drainage system.

81. To layout riser diagrams for sanitary and storm systems to code regulations.

82. To identify the fixture units and determine their use in pipe sizing.