SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE: Combustion and Mechanical Support Systems

CODE NO. : **MCH** 675 **SEMESTER:** Block 4 AS I

PROGRAM: The Block 4 program in the Algoma Training Schedule

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DATE: February 1995 **PREVIOUS OUTLINE DATED:** none

APPROVED

DEAN DATE

COURSE NAME | COURSE NO
Combustion and mechanical support systems | **MCH 675**

TOTAL CREDITS:

PREREQUISITE(S): None

I. PHILOSOPHY/GOALS:

Instrumentation and Process Control are applied to processes in industry that combust or flow or move mechanisms. It is essential that a control specialist understand the nature of the processes including the characteristics that allow us to sense and measure. This course is about the characteristics of heat and temperature, flow and viscosity, and the mechanical systems that service the control function.

II. STUDENT PERFORMANCE OBJECTIVES (OUTCOHES):

At the conclusion of this course the successful student will be able to:

FLUIDS

1. Differentiate between non compressible and compressible fluids
2. Differentiate between velocity energy (head) and pressure energy (head) in flowing non-compressible fluids.
3. Differentiate between various kinds of flow measuring devices
4. Explain an energy gradient line drawn to illustrate how flow losses detract from transmitted energy and power
5. Calq^ate pressure due to d^h in a liquid.
6. Explain how a barometer works.
7. Differentiate between absolute pressure and gauge pressure
8. Read and calculate the pressure in a duct in terms of inches of water.
9. Relate pressures given in inches of water, and in units of psig.
10. Calculate the change in the rate of flow due to changes in pipe diameter.
11. Perform a lab requiring that the characteristics of a centrifugal pump be determined.

OIL HYDRAULICS

1. Make calculations based on the Pascals law of equal forces applied to equal areas

2 Apply the formula Pressure = Force/Area

3. Name and differentiate between output and input fluid power components.

4. Compare the pressures on either side of an orifice.

5. State the formula relating the pressure and force available from a cylinderunder aknown load.

6. Expain how a relief valfife works.

7. Explain how a simple hydraulic circuit is designed.

8. Using proper, symbols sketch a simple hydaulic circuit.

9- List some results from using the wrong Hydraulic fluid in acircuit.

10. Differentiate between the symptoms a system might display if viscosity of the working fluid is either too high or too low.

11. List the functions of a proper filter.

12. State the result when a particle lodges in the hole of a balanced piston relief valve.

13. Explain the workings of a common type of solenoid operated directional control valve.

14. Draw the block diagrams represnting a Servo Valve sustem

15. Identify all the components of the Askania control system

16. Draw a schematic of a typical Askania installation.

17. Differentiate between pumps and motors

18. Explain the purpose for having accumulators in a hydraulic system.

19. Perform several labs requiring the development of circuits from schematic instructional materials

PNEUMATICS

1. Compare a pressure regulator with any pid controller .
2. Given values for pressure temperature and volxime ' determine unknown values from the gas law equations.
3. Differentiate between gasses and vapours
4. List the reasons that air must be conditioned for use in pneumatic systems
5. List the hazards presented by compressed air and the procedures to be followed in order to avoid injury
6. Compare the differences in the manner in which oil and air cylinders expand and retract.

BASIC THERMODYNAMICS

1. Differentiate between temperature, heat and internal energy.
2. Differentiate between Btu's of heat energy and Kilojoules
3. State the heating value of coke-oven gas and compare it to the heating value of heating oil
4. Differentiate between the amount of heat energy required to warm water compared to the amount required to boil water.
5. Differentiate between wet steam and superheated steam
6. Extractthe value for the enthalpy of steam from a set of steam tables.
7. Compare the values of the specific heat of water, ice and steam with the specific heat of a metal like steel.
8. Follow an explanation of how a steam generating plant works
9. Differentiate between the three mechanisms of Heat Transfer
10. Apply the formulae for conductive Heat Transfer

Thermodynamics Outcomes cont'd

11. Explain why still air is an effective way of reducing heat transfer and state how this principle is applied in insulating materials.

12. Show by calculations, how the temperature of a hot object effects its rate of heat loss.

COMBUSTION

1. Use chemical symbols to write a combustion equation.

2. Determine the amounts of each of the products of combustion if a fuel is completely constomed producing water, carbon dioxide and Heat.

3. Describe incomplete combustion by detailing a chemical reaction equation showing Cardon monoxide in the terms.

4. Calculate the amount of air needed to support complete combustion of a fuel.

5. Determine how much Nitrogen is present in one pound of air.

6. Determine from an analysis of flue gas, what is happening in the burning of a known fuel.

7. Explain how natural draft is created by a chimney or stack.

8. State the safety hazards involved near process which combusts fuels.

9. Analyse an X bar and R chart chart for the control of flue gas characteristics.

10. Learn the principle of the workings of the Orsat apparatus.

11. Explain how various flue gas analyzing equipment works.

12. State the reasons why sampling probes should be positioned in specific locations in a flue line.

Ill, TOPICS TO BE COVERED **APPROXIMATE HOURS**

PAGE HEADER (EDIT) **COURSE NO**

1.	The Basics of Fluids	4
2.	Oil Hydraulics	10
3.	Pneumatics	2
4	The Basics of Thermodynamics	6
5	Combust i on	10
		32

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES:

1.0 STUDENT ACTIVITIES

In all of the topics, information will be provided in lecture style with ample time to add extra information to the provided notes. Some materials will be presented in hands-on laboratory exercises with the students participating either in small groups ior observing demonstrations. Videos are made avilable to reinforce principles of Oil Hydraulics.

2,0 RESOURCES

All learning resources are provided to the student

V, EVALUATION METHODS:(INCLUDES ASSIGNMENTS, ATTENDANCE

REQUIREMENTS, ETC.)

1.0 GRADING SYSTEM

2.0 ATTENDANCE

The policies regarding attendance are the responsibility of the individual professor, and will be issued as supplementary documentation.

3.0 REWRITES

The policies regarding rewrites are the responsibility of the individual professor, and will be issued as supplementary documentation.

4.0 LATE ASSIGNMENTS AND MISSED TESTS

The policies regarding late assignments and missed tests are the responsibility of the individual instructor, and will be issued as supplementary documentation.

VI. REQUIRED STUDENT RESOURCES

VII. ADDITIONAL RESOURCE MATERIALS

VIII. SPECIAL NOTES: