SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title	MECHANICS OF FLUIDS
Code No.:	MCH 225
Program:	MECHANICAL DRAFTING TECHNICIAN
Semester:	FOUR
Date:	JUNE, 1983
Author:	C. RISING

New; Revision

APPROVED: Chairperson Date

MECHANICS OF FLUIDS — Course Name

MCH 225 — Course Number

PHILOSOPHY/GOALS:

To have the student able to recognize and solve problems in various areas of Fluids and associated basic Thermodynamics.

METHOD OF ASSESSMENT (GRADING METHOD):

"A"
"B"
"C"
"X"

Grading will be on logical solutions, layout, sketches or diagrams, and general tidiness of presentation.

TEXTBOOK(S):

REFERENCE TEXTS:

Fluid Mechanics - Binder

Fluid Mechanics - Streeter

Fluid Mechanics - Daugherty & Franzini

Hydraulics - King, Wisler, Woodboon

Basic Engineering Thermodynamics - Joel

Thermodynamic Tables - Haywood

MECNANICS OF FLUIDS
MCH 225

TOPIC NO.	PRTTOD	TOPIC INFORMATION
	2	Introduction: Static Mechanical
	3	Pressure: Gauge and absolute, specific weiqht, volume and density Equation of state for gases
		Fluid Statics:
		Pressure Hydrostatic equation for incompressible fluids dp = dz
		Pressure vs depth (incompressible) Manometry, pressure gauging
		Fluid Kinematics:
	10	Pathlines and streamlines Velocity fields - steady and uniform flow General equation of continuity Steady flow Incompressible flow Two dimensional velocity profiles Laminar Turbulent
		Fluid Dynamics:
		The energy equation Bernouliis equation for incompressible flow Grade lines
		Flow measurement Venturi meter
		Thermodynamics:
		Introductory concepts Work, heat, energy, temperature, pressure, Joules equipment
		Essentials of heat engines, cycle, efficiency

TOPIC NO.	PERIOD	TOPIC INFORMATION
7	6	
8	6	Thermodynamic Relationships
9	10	Generation and properties of steam, use of steam tables
10	10	Gas Laws
11	10	Combustion

UNIT #1 - Fluid Properties

GENERAL OBJECTIVE: The student will be able to solve varied problems dealing with Fluid Properties.

SPECIFIC OBJECTIVES:

1. To be able to define the term fluid.
2. To be able to define the term pressure.
3. To be able to define the term absolute pressure.
4. To be able to define the term gauge pressure.
5. To be able to recall the term force.
6. To be able to recall the term mass.
7. To be able to recall the term vector.
8. To be able to recall the term speed.
9. To be able to recall the term velocity.
10. To be able to recall the term acceleration.
11. To be able to recall the term equation force = mass and acceleration,
12. To be able to define the term density.
13. To be able to define the term specific weight.
14. To be able to define the term specific volume.
15. To be able to state the characteristic gas equation.

UNIT #2 - Fluid Statics

GENERAL OBJECTIVE: The student will be able to solve a number of varied problems dealing with fluid statics.

SPECIFIC OBJECTIVES:

1. To be able to recall the term pressure,
2. To be able to explain in equation.

3. To be able to define the term manometer.
4. To be able to recall the term specific gravity,
5. To be able to derive an expression for the pressure change measure by any manometer.
6. To be able to define the term barometer.
7. To be able to read a barometer.

UNIT #3 - Kinematics of Fluid Flow

GENERAL OBJECTIVE: The student will be able to solve varied problems dealing with the Kinematics of Fluid Flow.

SPECIFIC OBJECTIVES:

1. To be able to define the term pathline.
2. To be able to define the term streamline.
3. To be able to recall normal acceleration.
4. To be able to state the equation of continuity of steady flow.

UNIT #4 - Energy Equation for Steady Flow

GENERAL OBJECTIVE: The student will be able to solve varied problems dealing with the Energy Equation for steady flow.

SPECIFIC OBJECTIVES:

1. To be able to recall the term Work.
2. To be able to recall the term Energy.
3. To be able to recall the term Internal Energy.
4. To be able to define the term Heat.
5. To be able to state the Energy Equation for Steady Flow.
6. To be able to recall the term Horse Power.

7. To be able to recall the Adiabatic Process.
8. To be able to recall Bernoulli's equation.
9. To be able to convert velocity head to pressure head.
10. To be able to describe the Venturi meter.
11. To be able to obtain the formula for flow through a Venturi meter.
12. To be able to describe a flow nozzle.
13. To be able to obtain the formula for flow through a flow nozzle.
14. To be able to obtain the formula for flow through an orifice under a constant head.
15. To be able to obtain the formula for flow through a flow orifice under a varying head.

UNIT #5 - Introductory Concepts

GENERAL OBJECTIVE: The student will acquire a sound fundamental knowledge of Work, Heat, Energy, Temperature, Pressure and the Thermodynamic Laws.

SPECIFIC OBJECTIVES:

1. To be able to define the term closed system.
2. To be able to define the term open system.
3. To be able to define the term boundary.
4. To be able to differentiate between positive and negative work.
5. To be able to define the term internal energy,
6. To be able to state the Zero'th Law of Thermodynamics.
7. To be able to convert from degrees Centigrade to degrees Kelvin.
8. To be able to convert from degree Farenheit to degrees Rankine.
9. To be able to define the term conduction.
10, To be able to define the term convection.
11. To be able to define the term radiation.

12. To be able to state Joule's Equivalent.
13. To be able to define the term British Thermal Unit.
14. To be able to define the term Centigrade Heat Unit.
15. To be able to define the principle of Conservation of Energy.
16. To be able to state the First Law of Thermodynamics.
17. To be able to define Calorific Value.
18. To be able to define Power.
19. To be able to define Horsepower.
20. To be able to define Horsepower hour.

UNIT #6 - Heat Engine, Cycles and Efficiency

GENERAL OBJECTIVE: The student will have a fundamental knowledge of Heat engines, engine cycles and efficiencies.

SPECIFIC OBJECTIVES:

1. To be able to define the term Heat Engine.
2. To be able to define the term source.
3. To be able to define the term sink.
4. To be able to recall the first Law of Thermodynamics.
5. To be able to recall the Law of Conservation of Energy.
6. To be able to explain the operation of a reciprocating steam engine
7. To be able to explain the operation of a team turbine.
8. To be able to explain the operation of a four stroke cycle.
9. To be able to explain the operation of a two stroke cycle.
10. To be able to explain the operation of a four stroke compression greater cycle.
11. To be able to explain the operation of a turbo jet engine.
12. To be able to explain the operation of a ram jet engine.

UNIT #7 - The Gas Laws

GENERAL OBJECTIVE: The student will be able to solve varied problems dealing with the Laws of Compressible Gases.

SPECIFIC OBJECTIVES:

1. To be able to state Boyle's Law.
2. To be able to state Charles[1] Law.
3. To be able to state the combined Boyle's.
4. To be able to state the characteristic Gas Equation.
5. To be able to state Avogadro's Law.

UNIT #8 - Thermodynamic Relationships

GENERAL OBJECTIVE: The student will be able to solve varied problems dealing with thermodynamic relationships.

SPECIFIC OBJECTIVES:

1. To be able to recall the Gas Laws from Unit #3.
2. To be able to derive the formula for the work done during the expansion of a gas according to the Law $PV^n = C$.
3. To be able to develop the relationship between pressures, temperature and volumes of a gas obeying the Law $PV^n = C$.
4. To be able to define the term reversible process.
5. To be able to define the term irreversible process.
6. To be able to define the term Isothermal Expansion.
7. To be able to derive an expression for the work donw during an Isothermal Expansion.
8. To be able to define the term Adiabatic Expansion.
9. To be able to derive an expression for the work done during an adiabatic expansion.
10. To be able to define the term Internal Energy.

11. To be able to state Joule's Law. - J.

12. To be able to define the Specific Heat (C_p) of a gas at constant pressure.

13. To be able to define the Specific Heat (C_v) of a gas at a constant volume.

14. To be able to develop the relationship $C_p - C_v = R.$, where R is the gas constant.

UNIT #9 - Measurement of Work, Power, Consumption and Efficiency

GENERAL OBJECTIVE: The student will be able to solve problems dealing with work, power, consumption and efficiency.

SPECIFIC OBJECTIVES:

1. To be able to recall SO #4, Unit #1.

2. To be able to define mechanical work done by a fluid expanding in a cylinder.

3. To be able to define swept volume.

4. To be able to define clearance volume*

5. To be able to define indicated horsepower.

6. To be able to define brake horsepower.

7. To be able to calculate brake horsepower.

8. To be able to calculate friction horsepower.

9. To be able to define thermal efficiency.

10. To be able to define mechanical efficiency.

UNIT #10 - Properties of Steam

GENERAL OBJECTIVE: The student will be able to deal correctly with various problems dealing with the properties and generation of steam.

SPECIFIC OBJECTIVES:

1. To be able to define the term vapour.
2. To be able to define the term saturation temperature.
3. To be able to define the term absolute pressure.
4. To be able to construct the pressure - temperature curve for steam.
5. To be able to define the term sensible heat.
6. To be able to define the term latent heat.
7. To be able to define the term evaporation.
8. To be able to define the term wet steam.
9. To be able to define the term dry steam.
10. To be able to define the term super heated steam.
11. To be able to define the term enthalpy.
12. To be able to define the term flow work.
13. To be able to recall the term internal energy.
14. To be able to define the term dryness fraction.
15. To be able to recall the term specific heat.
16. To be able to obtain the dryness factor from the steam tables.
17. To be able to explain the operation of a combined separating and throttling calormeter.
18. To be able to obtain the dryness fraction using the combined separating and throttling calormeter.

UNIT #11 - Combustion

GENERAL OBJECTIVE: The student will be able to solve a variety of problems dealing with the combustion of fuels.

SPECIFIC OBJECTIVES:

1. To be able to recall from PHY 109-3 what is meant by elements, compounds, molecules and atoms.
2. To be able to recall from PHY 109-3 the atomic and molecular weight

of elements commonly found in fuels.

3. To be able to determine the molecular weights of compounds commonly found in fuels and the products of combustion.

4. To be able to state the chemical symbols for various fuels and their products of combustion.

5. To be able to state the chemical composition of air by mass and by volume.

6. To be able to develop basic combustion equations and balance such.

7. To be able to develop and balance combustion equations by use of Avagadros' Law.

8. To be able to recall Avagadros' Law.

9. To be able to solve combustion equations for complete combustion of various fuels.

10. To be able to solve combustion equations for incomplete combustion of various fuels.

11. To be able to determine the amount of air required for complete combustion of certain fuels and also determine the amounts of the various products of combustion by weight and percentage.

MECHANICAL DRAFTING TECHNICIAN

MCH 225

Fluid Mechanics:

The course will cover -

- Principles of Hydrostatic pressure
- Fundamentals of Fluid Flow
- Continuity Equation
- Bernoulli
- Flow Measurement (venturi and onifice)
- Pipe Friction
- Gas Laws
- Steam
- Combustion

Tests:

Will be given at a maximum of two weeks after the completion of the necessary work on the relevant topics.

Test Topics -

- Principles of Hydrostatic Flow
- Fluid Flow and Continuity Equation combined
- Bernoulli and Flow Measurement combined
- Pipe Friction
- Gas Laws and Steam combined
- Combustion

Marking System:

A
B
C
I

Grading will be on logical solutions, layout, sketches or diagrams and general tidiness of presentation.

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1983/01/20

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MECHANICS OF FLUIDS — MCH 225

Course Name — Course Number

PHILOSOPHY/GOALS:

To have the student able to recognize and solve problems in various areas of fluids and associated basic Thermodynamics.

METHOD OF ASSESSMENT (r^inTMr, *r?*'i'nn):

Grading wi: sketches [– presoni 11 :

TESTS:

a) There will be a :i:;,i.!iin of one '^ek's notice for tests.

b) Tests will be held at intervals throughout the semester.

c) In the event of a student being absent for a test, he/she will be given an opportunity to write a test of similar content at a time suitable to the teacher.

d) If a student fails a test, an opportunity will be given to that student to write a make-up test at a time designated by the teacher.

e) An 80% attendance record is required in order for a student to be eligible to write a make-up test.

f) The maximum grade that a student will be given for a make-up test will be a "C".

ASSIGNMENTS:

A) All assignments must be handed in for marking on the specified date and I imo.

b) Grades for assiqnmon' "rl^d in late will be reduced according to tho -: ss.

c) Late assignmen L> ,u i i not » icroptr' r t.hoy <ir& submitted af lor Mm - ^ore bu; , - M i d on time have been marked.

d) The marking of as[v:]nn^nl3 nay be on a random basis.

DISTRIBUTION OF MARKS:

Tests	70%
Assignments	20%
Attitude	10%

REFERENCE TEXTS:

Fluid Mechanics - Binder
Fluid Mechanics - Streeter
Fluid Mechanics - Daugherty & Franzini
llydraul ics - King Wilier
Basic Engineering ...ermodynamics - Joel
thermodynamic Tables - Haywood

TOPICS:

Principles of llydrostji ic Pressure
Fundamentals of Fluid Flow
Continuity Equation
Berroul1i
Flow Measurement (Venturi & orifice)
Pipe Friction
Gas Laws
Steam
Combustion