**SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY**

**SAULT STE. MARIE, ONTARIO**

# COURSE OUTLINE

**Course Title:** MECHANICS OF FLUID

**Code No.:** MCH 203

**Program:** MECHANICAL TECHNOLOGY

**Semester:** FOUR

**Date:** JUNE 8, 1983

**Author:** W. JENKINS

**New:** **Revision:** X

APPROVED: ^^Z /%**&*%&
Chairperson ly Date

**MECHANICS OF FLUIDS** — Course Name

**MCH 203** — Course Number

**PHILOSOPHY/GOALS:**

This is the basic course in fluid statics and dynamics. It gives the student the tools necessary for the understanding and design of fluid flow systems.

**METHOD OF ASSESSMENT (GRADING METHOD):**

SEE ATTACHED SHEET

**TEXTBOOK(S):**

Fluid Mechanics - Daugherty and Franzini

Flow of Fluids - Crane - Tech Paper #410-C

**REFERENCES:**

Fluid Mechanics - Binder - (Prentice-Hall)

Fluid Mechanics - Streeter

**MTY 4 - MCH 203**

The course will cover chapters 1, 2, 3, 4, 6, 8, 11, 12 in Fluid Mechanics by Daugherty and Franzini.

You will be tested on chapters 1, 2, 3, two weeks after completion of these chapters.

You will be tested on chapters 4, 6, 12 two weeks after completion of these chapters.

You will be tested on chapters 8, 11 at the end of the course.

The marking system will be A, B, C and I and tests will be graded on logical solutions, layout, sketches and tidiness.

It is expected that the student will be a regular, diligent, and punctual attender in class.

| TOPIC NUMBER | TOPIC INFORMATION |
|---|---|
| 1 | **Introduction - Static Mechanical**<br><br>**Pressure - gauge and absolute specific weight, volume, density. Surface tension, capilliarity Equation of state for gases.** |
| 2 | Fluid Staiics<br><br>**-pressure**<br>**-Hydrostatic equation for incompressible fluids dp = - dz**<br>**-Pressure vs depth (incompressible)**<br>**-Maomentry pressure gauging**<br>**-Location and magnitude of pressure forces on submerged bodies, plane and curved surfaces.**<br>**-Buoyant forces and static stability of submerged bodies**<br>**-Static stability of floating bodies metacentric height, restoring couples**<br>**-Pressure vs height for compressible fluids - isothermal**<br>**- adiabatic**<br>**- polytropic**<br>**-The atmosphere - topo, strato, ionosphere convective stability, lapse rates, weather** |
| 3 | Fluid Kinematics<br><br>**-Pathlines and streamlines**<br>**One, two, three dimensional flows**<br>**Velocity fields - steady and uniform flow**<br>**General Equation of Continuity**<br>**-steady flow**<br>-incompressible flow<br>-two dimensional velocity profiles<br>-laminar flow<br>-turbulent flow |
| 4 | Fluid Dynamics<br><br>-The energy equation<br>Bernoulli's Equation for incompressible flow<br>Grade lines |

## MECHANICS OF FLUID MCH 203-5

Course Textbook: - FLUID MECHANICS - Binder

### UNIT #1 FLUID PROPERTIES

General Objectives: - 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 vector.
7. To be able to recall the term speed.
8. To be able to recall the term velocity.
9. To be able to recall the term acceleration.
10. To be able to recall the term equation force=mass and acceleration.
11. To be able to define the term density.
12. To be able to define the term specific weight.
13. To be able to define the term specific volume.
14. To be able to state the characteristic gas equation.
15. To be able to define the term visosity.
16. To be able to define the term dynamic viscosity.
17. To be able to define the term kinematic viscosity.
18 With the aid of the slide rule the above specific objectives the student will solve correctly the following problems for the textbook: 1-1 to 1-21 inclusive.

### UNIT #2 FLUID STATICS

General Objectives: 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 an 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.
8. To be able to explain the operation of a Bourdon Tube.
9. To be able to obtain the force on a plane submerged surface.

10. To be able to obtain the location of the force on plane submerged surface.
11. To be able to recall the term resultant.
12. To be able to obtain the location of the force on a submerged irregular surface.
13. To be able to obtain the location on a submerged irregular surface.
14. To be able to define the term buoyancy.
15. To be able to define the term stable equilibrum.
16. To be able to define the term neutral equilibrum.
17. To be able to define the term metacentre.
18. To be able to obtain the expression for the isothermal pressure-height relationship for compressible fluids.
19. To be able to obtain the expression for the adiabatic pressure-height relationship for compressible fluids.
20. To be able to obtain the expression for the polytropic pressure-height relationship for compressible fluids.
21. With the aid of the slide rule and the above specific objectives, the student will be able to solve correctly the following problems from the textbook:
**2-1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 24, 26, 28, 32, 42, 44, 46, 48, 49, 60, 62. 69,**

## UNIT # 3 Kinematics of fluid flow

General Objectives: the student will be able to solve varied problems dealing with the Kinematics of Fluid Flow.

Specific Objectives:

1. To be able to describe the Langrangian Method of Fluid Motion.
2. To be able to describe the Euler method of Fluid Motion.
3. To be able to define the term pathline.
4. To be able to define the term streamline.
5. To be able to recall the term normal acceleration.
6. To be able to state the equation of continuity of steady flow
7. To be able to state the equation of continuity for unsteady flow.
8. With the aid of the slide rule and the above specific objectives, the student will be able to solve correctly the following problems from the textbook: 3-1 to 3-9 inclusive.

## UNIT # 4 - MOMENTUM EQUATION

General Objective - The student will be able to solve varied problems dealing with the Dynamic or Momentum Equation.

Specific Objective:

1. To be able to recall the Newton[1] three equations of motion.
2. To be able to state the Momentum Equation.
3. To be able to state the Euler's Equation of Motion.
4. To be able to state the Bermoulis Equation of Flow.
5. To be able to state the D'Alembert's Principle.

6. To be able to recall the equation for normal acceleration.
7. To be able to derive the equation for a free vortex.
8. To be able to derive the equation for a forced vortex.
9. With the aid of the slide rule and the above specific objectives, the student will be able to solve correctly the following problems from the textbook: 3-10, 12, 13, 14, 16, 21, 25, 26, 28, 32, 33, 42, 44, 52.

## UNIT # 5 - ENERGY EQUATION FOR STEADY FLOW

General Objective - The student will be able to solve varied problems dealing with the Energy Equation for steady flow.

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 term Adlabatic Process.
8. To be able to recall the term enthalpy.
9. With the aid of the slide rule and the above specific objectives, the student will be able to solve correctly the following problems from the textbook: 3-63, 64, 71, 74, 76, 79, 82.

## UNIT # 6 - FLOW MEASUREMENT

General Obectives: The student will be able to solve varied problems dealing with Flow Measurement.

Specific Objectives:

1. To be able to recall the Bernoull's equation.
2. To be able to describe a Pi trot tube.
3. To be able to convert velocity head to pressure head.
4. To be able to describe a Venturi meter.
5. To be able to obtain the formula for flow through a Venturi meter.
6. To be able to describe the flow nozzle.
7. To be able to obtain the formula for flow through a flow nozzle.
8. To be able to obtain the formula for flow through an orifice under a constant head.
9. To be able to obtain the formula for flow through a flow orifice under a varying head.
10. With the aid of the slide rule and the above specific objectives, the student will be able to solve correctly the following problems from the textbook: 7-1, 2, 4, 5, 6, 7, 8, 13, 14, 16, 21, 22.