

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

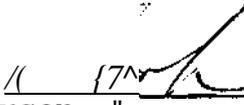
SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: HYDRAULICS  
Code No.: HYD 220-5  
Program: WATER RESOURCES/PULP AND PAPER ENGINEERING TECHNOLOGY  
Semester: III  
Date: AUGUST 1988  
Author: SUBHASH C. VERMA

New: Revision: X

APPROVED:

Chairperson 

Date CULLJ / (j/\$S

HYDRAULICS  
Course Name

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HYD 220-5  
Course Number

PREREQUISITE; PHY 100

PHILOSOPHY/GOALS;

To introduce the basic principles of fluid mechanics and the application of these principles to practical and applied problems. After completing this course the student should have a firm foundation in the field to continue learning. This course will provide the understanding of basic concepts of fluid mechanics and application of these concepts to solve real world problems in the area of specialization including hydrology, water supply and process control.

On completion of this course, the student should be able:

- To work with both English and SI Units and modification of mathematical equations from one system of units to the other.
- To have a clear understanding of the properties of fluids, factors affecting, and their role in influencing the hydraulic design.
- To measure and estimate gauge and absolute pressure using gauges and *M* manometers.
- To estimate the forces acting on vertical retaining walls.
- To apply the energy equation to a given hydraulic system to derive the answer for the unknown parameter.
- To apply the principles of fluid mechanics to the computation of energy, power, and pressure within fluid in given system.
- To apply the principles of hydraulics to understand the operation and working principles of flow control and flow measuring devices including orifice, venturi, nozzle, rotameters, pitot tubes for pipe flow and weirs, and flumes for open channel flow.
- To calculate water and power requirements and select such components as pumps and valves.
- To determine head loss due to friction and other accessories, and thus, pressure drop.
- To analyze open channel and pipe flow to such systems as water supply, water distribution, sanitary and storm sewers.

- To maintain a laboratory notebook.
- To interpret and analyze the data.
- To classify the flow based on Reynold's number and Froude's number.
- To determine the velocities hence flow rate in open channels based on shape of the channel, roughness and hydraulic slope.

#### METHOD OF ASSESSMENT AND EVALUATION

The final mark will be assigned which is higher of either

- a) final examination mark
- b) weighted mark calculated as follows:

Problem assignments and Laboratory reports	25%
Interim examination (2) @ 20%	40%
Final examination	35%

#### **GRADING:**

A+ =	85%+
A =	75-84%
B =	65-74%
C =	55-64%

- To pass this course a minimum of 55% is required in the weighted average provided a pass grade is obtained in at least one of the tests.
- Eighty percent attendance is required for anyone to be considered for supplementary examination.
- Home assignments are due one week after. Late submissions will be penalized.
- This method of evaluation is subject to change. However students will be notified prior to any changes.

#### TEXTBOOK(S);

Mott, Robert, (1979), Applied Fluid Mechanics, Second Edition, Charles E. Merrill Publishing Company, Toronto.

#### REFERENCES:

Daugherty, R.L., and J.B. Franzini (1977), Fluid Mechanics With Engineering Applications, 7th Edition, McGraw-Hill Book Company, Toronto.

Douglas, J.F. (1980), Solutions to Problems in Fluid Mechanics, Pitman Publishing Company, London, England.

King, H.W., C.O. Wisler and J.G. Woodburn (1980), Hydraulics, 5th Edition, Robert E. Krieger Publishing Company, Huntington, New York.

Introduction, units and calculations

Properties of fluids

Fluid pressure and its measurement

- fluid pressure
- absolute and gauge pressure
- relationship between pressure and elevation
- manometers, barometers and pressure gauges

Fundamentals of fluid flow

- types of flows
- continuity equation
- energy and head
- Bernoulli's equation
- applications of Bernoulli's equation
- energy loss and gain
- general energy equation
- application of general energy equation

Fluid measurements

- general methods of local velocity measurements
- orifices, nozzles and tubes
- weirs, flumes
- other methods

Steady flow in pressure conduits

- laminar and turbulent flow
- friction formulas for laminar and turbulent flow
- energy gradient and hydraulic gradient

Minor Losses

- sources
- loss coefficient
- estimation for contraction, expansion, and valves
- equivalent length technique

Series Pipeline System

- system classification
- Class I,II,III systems
- empirical equations for determining flow capacity  
(Hazen William)

9. Pumping Systems

(1)

- parameters involved in pump selection
- types of pumps
- static head and dynamic head
- cavitation (NPSH)

10. Open Channel Flow

(2)

- open channel flow defined
- equations of uniform flow (Manning's Equation)
- efficient cross-section
- specific energy and critical flow
- hydraulic jump

Laboratory work is an important component of this course. The concepts discussed in the theory class will be reinforced by performing laboratory experiments.

The list of experiments is as follows:

1. Calibration of a pressure gauge
2. Venturi meter as a flow measuring device
3. Flow through an orifice
4. Discharge over a rectangular weir
5. V-notch weir
6. Head loss in a fluid flow system
7. Uniform flow in laboratory channel (Flume)
8. Critical flow study
9. Broad-crested weirs
10. Pump characteristics

