

HYDRAULICS

WTR 330-5

COURSE NAME

CODE NO.

TOTAL CREDIT HOURS: 7 5

PREREQUISITE: PHY100

I. 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.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will 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 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.

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II. STUDENT PERFORMANCE OBJECTIVES: (CONT'D)

- 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.

III. TOPICS TO BE COVERED:

	NO. OF WEEKS
1. <u>Introduction, units and calculations</u>	(1)
2. <u>Properties of fluids</u>	(1)
3. <u>Fluid pressure and its measurement</u>	(2)
- fluid pressure	
- absolute and gauge pressure	
- relationship between pressure and elevation	
- manometers, barometers and pressure gauges	

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TOPICS TO BE COVERED: (CONT'D)

4. Fundamentals of fluid flow (3)
- 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
5. Fluid measurements (2)
- general methods of local velocity measurements
 - orifices, nozzles and tubes
 - weirs, flumes
 - other methods
5. Steady flow in pressure conduits (2)
- laminar and turbulent flow
 - friction formulas for laminar and turbulent flow
 - energy gradient and hydraulic gradient
7. Minor Losses (1)
- sources
 - loss coefficient
 - estimation for contraction, expansion, and valves
 - equivalent length technique
8. Series Pipeline System (2)
- system classification
 - Class I,II,III systems
 - empirical equations for determining flow capacity
(Hazen William)

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TOPICS TO BE COVERED: (CONT'D)

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

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

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IV. EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS ETC.)

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%
3 Unit Tests (each 25%)	75%

GRADING:

A+	=	90	-	100
A	=	80	-	89
B	=	70	-	79
C	=	50	-	69

- To pass this course a minimum of 50% is required in the weighted average provided a pass grade is obtained in at least one of the tests.
- This method of evaluation is subject to change. However, students will be notified prior to any changes.

V. REQUIRED STUDENT RESOURCES:

Mott, Robert, (1990), Applied Fluid Mechanics, Third Edition, Charles E. Men Publishing Company, Toronto.

Verma, S.C. (1992), LABORATORY MANUAL, HYDRAULICS - WTR330, Sault College

VI. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

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.

Gramet, Irving, (1989), Fluid Mechanics for Engineering Technology, Prentice Hall Canada Inc., Toronto.

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

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VII. SPECIAL NOTES:

- 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.

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

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.