DOC. 683

SAULT COLLEGE OF **APPLIED ARTS** & TECHNOLOGY

SAULT STE. **MARIE,** ONTARIO

COURSE OUTLINE

| | |
|---|---|
| Course Title | HYDRAULICS |
| Code No.: | WTR 330-5 |
| Program; | WATER RESOURCES/PUL? AND PAPER/CIVIL ENGINEERING TEC: |
| Semester: | III |
| Date: | AUGUST 1989 |
| Author; | SUBHASH C. VERMA |

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**HYDRAULICS** **WTR 330-5**

Course Name Course Number

**PREREQUISITE;** PHY 100

**PHILOSOPHY/GOALS**:

To introduce the basic principles of fluid mechanics and the application o; tnese principles to practical and applied problems. After completing this course the student snould have a firm foundation in the field to continue learning. This course will provide the understanding of basic concepts of fluid mecnanics 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 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 tne 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 wording principles of flow control and flow measuring devices including orifice, venturi, nozzle, rotameters, pitot tubes tor 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 examinacion | 35% |

GRADING:

| | |
|---|---|
| A+ | = 90 - 100 |
| A | = 80 - 89 |
| B | = 70 - 79 |
| C | = 50 - 59 |

- To pass this course a minimum ot 60% 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 arter. 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, Rooert,(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.

NO. OF WEEK

1. Introduction, units and calculations (1)

2. Properties of fluids (1)

3. Fluid pressure and its measurement (2)

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

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, tlumes
- other methods

6. Steaav flow in pressure conduits (2)

- lamiaar and turoulent flow
- friction foriiulas 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

*3.* Series Pipeline System (2)

- 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
5. 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