

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY
SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

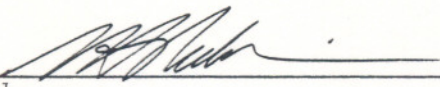
COURSE TITLE: GROUNDWATER HYDROLOGY

CODE NO: GEO 222-3 SEMESTER: IV

PROGRAM: WATER RESOURCES ENGINEERING TECHNOLOGY

AUTHOR: SUBHASH C. VERMA

DATE: APRIL 1990 PREVIOUS OUTLINE DATED: JANUARY 1989

APPROVED: 
DEAN

DATE Apr 22/90.

GROUNDWATER HYDROLOGY

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TOTAL CREDIT HOURS: 45

PREREQUISITE(S):

I. PHILOSOPHY/GOALS:

On completion of this course, the student will have sufficient knowledge about the occurrence and movement of the ground water in the hydrologic cycle as well as the properties of water related to municipal and industrial water supplies. Well hydraulics as related to well design and testing water wells for evaluating drawdown and aquifer yield will be stressed.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will develop/understand:

1. An appreciation of the origin, occurrence and distribution of groundwater in the earth's crust.
2. Properties and parameters of the aquifers as they relate to municipal and industrial well water supplies.
3. An introduction to Darcy's Law and its application in groundwater movement.
4. Application of the principles of hydraulics to develop theoretical relationships of discharge rate versus drawdown for wells in confined and unconfined aquifers.
5. Use of well equations, both equilibrium and non-equilibrium equations, to estimate the aquifer storage and transmission parameters as well as efficiency.
6. A thorough discussion of the principles and procedures of testing water wells for drawdown and estimating well yield.

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II. STUDENT PERFORMANCE OBJECTIVES (CONT'D):

7. An understanding of the importance of chemical characteristics of water as related to its use for municipal and industrial purposes.
8. A familiarity with various methods of groundwater exploration and analysis of sand samples.
9. An introduction to groundwater quality.
10. Groundwater pollution and sanitary landfill sites.
11. Groundwater sampling techniques.

III. TOPICS TO BE COVERED:

SEQUENCE OF TOPICS

<u>TOPIC</u>	<u>NO. OF WEEKS</u>
1. INTRODUCTION	1
1.1 Definition and related disciplines	
1.2 History	
1.3 Use and significance	
1.4 Groundwater occurrence and distribution	
2. OCCURRENCE AND MOVEMENT OF GROUNDWATER	3
2.1 Hydrologic Cycle	
2.2 Types of Aquifers	
2.3 Properties of Aquifers Including Porosity and Permeability	
2.4 Darcy's Law	
2.5 Groundwater Movement	

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TOPIC	NO. OF WEEKS
3. WELL HYDRAULICS	5
3.1 Definitions of Terms	
3.2 Equilibrium Well Formulas	
3.3 Determining Aquifer Permeability	
3.4 Relation of Drawdown to Yield	
3.5 Introduction to Non-Equilibrium Formula	
3.6 Time drawdown curves	
3.7 Well efficiency	
4. GROUNDWATER EXPLORATION	1
4.1 Geologic and Hydrologic Studies	
4.2 Methods of Sampling	
4.3 Electric and Gamma Ray Logging	
3.4 Surveying Methods	
5. ANALYZING SAND SAMPLES	1
5.1 Grain Size Analysis	
5.2 Soil Classifications	
5.3 Particle Size Distribution Curves	
5.4 Effective Size and Uniformity Coefficient	
6. TESTING WATER WELLS	2
6.1 Definition of Terms	
6.2 Measuring Pumping Rates	
6.3 Water Level Measurements	
6.4 Aquifer Test Data	
6.5 Estimating Well Yield	
7. CHEMICAL CHARACTER OF GROUNDWATER	2
7.1 Chemical Properties	
7.2 Water Quality	
7.3 Groundwater Pollution	
7.4 Sanitary landfill	
7.5 Groundwater Sampling	

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

Final mark in the course will be based on:

Mid-Term Examination I	25%
Mid-Term Examination II	25%
End Term Examination	50%

GRADING:

A+	=	90-100%
A	=	80-89%
B	=	70-79%
C	=	60-69%

- NOTE:
1. The above distribution is subject to change.
 2. To secure a passing grade, a student must score greater than equal to 60%.
 3. Students obtaining a score less than 60% but greater than 55% may be considered for a supplementary examination.

VI. REQUIRED STUDENT RESOURCES:

Johnson Division, Groundwater and Wells, Johnson Division, UOP Inc., St. Paul, Minnesota, 1985.

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

Hammer, Mark J. and K. A. MacKichan, Hydrology and Quality of Water Resources, John Wiley and Sons, Inc. Toronto, 1981.

Todd, D. K., Groundwater Hydrology. John Wiley & Sons, Inc., New York, 1980.

American Water Works Association, Ground Water, Manual M21. AWWA. 6666 West Quincy Avenue, Denver, Colorado 80235.