SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE, ON

COURSE OUTLINE

COURSE TITLE; **HYDROLOGY**

CODE NO.; **WTR 210-5** **SEMESTER;**

PROGRAM; **WATER RESOURCES/ENVIRONMENTAiyCIVIL ENGINEERING TECHNOLOGY**

AUTHOR; **SUBHASH VERMA; P. Eng.**

DATE; **November 1997** **PREVIOUS OUTLINE DATED; JUNE 1997**

APPROVED: _-/f• Qj^L^^jhc^_____ /Lj .^y/fy

DEAN ^ **DATE'** ^

TOTAL CREDITS; **5**

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PREREQUISITE(S); **WTR330**

LENGTH OF COURSE;_____ **TOTAL CREDIT HOURS;**

L PHILOSOPHY/GOALS:

Recognize and identify the processes in the hydrologic cycle which are important for a variety of watersheds and watershed conditions. Measurement and instruments required for common hydrological data both from quantity as well as quality point of view. Basic calculation/computation techniques, including simple deterministic modeling and stochastic analysis for the solution of common hydrological problems.

n. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:

Upon successful completion of this course the student will demonstrate the following:

1. Identify various storage and transport processes in the hydrologic cycle.
   - describe the components of hydrologic cycle
   - express depth as volume both in SI and customary units
   - define watershed and relate time and spatial scales
   - apply the hydrologic budget equation

2. Describe the process of precipitation and the methods of measurement.
   - distinguish between convective and cyclonic storms
   - describe various types of rain gauges and snow gauges
   - calculate the water equivalent of a snow pack
   - estimate the precipitation for missing records

3. Recognize the factors affecting rainfall distribution and analyze rain gauge data.
   - prepare a rainfall hyetograph
   - read isoplvrial maps
   - develop a depth-area-duration curve
   - calculate rainfall intensity using empirical relationships

4. Recognize the importance of stream flow measurement and make stream discharge measurement and calculations.
   - convert stage hydrograph into a discharge hydrograph
   - compute stream discharge from hydrometric measurements
   - calculate flood flow using slope-area method
   - fit a rating curve to a given flow gauge data

5. Apply the concepts of probability to hydrologic events.
   - relate probability and return period
   - use binomial formula to find return period for a ^ e n risk
   - apply the concepts of normal distribution
   - test for non-normalcy

n. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE CONT'D:

6. Identify watershed characteristics affecting rainfall runoflF relationships.
   - define parameters of form factor, compact ratio and drainage density
   - develop a hypsometric curve
   - calculate gross slope and mean slope of a stream channel
   - calculate basin slope using topographic map

7. Describe various hydrologic abstractions.
   - apply infiltration equation to estimate infiltration capacity
   - calculate infiltration index
   - apply infiltration index to calculate storm runoflF volume
   - estimate lake evaporation fi-om pan-evaporation data

8. Analyze a streamflow hydrograph.
   - define components of streamflow
   - describe various elements of a flow hydrograph
   - predict base flow
   - evaluate time of concentration and lag time

9. Calculate storm runoflF volume based on storm and watershed characteristics.
   - determine runoflF volimie for a given flow hydrograph
   - apply curve number method
   - apply the principle of flow mass curve
   - calculate storage capacity of a reservoir

10. Compute peak flow rates for small watershed.
   - apply the rational method
   - computer peak flow for composite catdmients
   - apply SCS triangular method to calculate peak flow

11. Apply unit hydrograph method.
   - describe the concept of unit hydrogr^h
   - construct a unit hydrograph
   - construct principle of superposition
   - apply unit hydrograph to predict streamflow
   - develop a synthetic unit hydrograph

HL TOPICS:

	TOPIC	CHAPTER IN TEXT	NO. OF WEEKS
1.0	INTRODUCTION 1.1 Hydrologic Cycle 1.2 Hydrologic Data 1.3 Time and Space Scales in Hydrology 1.4 Water Balance 1.5 Hydrologic Budget	10 Pages 3-12	2
2.0	PRECIPITATION 2.1 Types of Precipitation 2.2 Measuring Precipitation 2.3 Snow Surveys 2.4 Rainfall Data 2.5 Missing Data	2 Pages 15-25 7-9 (Part)	1
3.0	STORM ANALYSIS AND SYNTHESIS 3.0 Storm Analysis and Synthesis 3.1 Temporal Rainfall Distribution 3.2 Spatially Rainfall Distribution 3.3 Storm Depth, Duration and Frequency (DDF) 3.4 Storm Depth and Catchment	2 Pages 27-36	1
4.0	STREAMFLOW MEASUREMENT 4.1 Measurement of Stage 4.2 Measurement of Velocity 4.3 Discharge Measurements 4.4 Stage Discharge Relationship	6 Pages 111-115	3
5.0	PROBABILITY CONCEPTS IN HYDROLOGY 5.1 Definition of Probability 5.2 Return Period 5.3 Rules of Probability 5.4 Binomial Process 5.5 Probability Distribution 5.6 Normal Distribution 5.7 Non-Normal Distribution	26 Pages 671-6	2

MID TERM TEST

in. TOPICS CONT'D

	TOPIC	CHAPTER IN TEXT	NO. OF WEEKS
6.0	WATERSHED CHARACTERISTICS 6.1 Drainage Area 6.2 Basin Shape 6.3 Compactness CoefiBcient 6.4 Stream order 6.5 Drainage Density 6.6 Relief Features 6.7 Channel Slope/Gradient 6.8 Basin Slope	10 Pages 153-16	1
7.0	HYDROLOGIC ABSTRACTIONS 7.1. Interception Storage 7.2 Depression Storage 7.3 Infiltration Storage 7.4 Evaporation and Transportation	3,4,5 Pages 90-103	1
8.0	STREAMFLOW HYDROGRAPH 8.1 Components of Streamflow 8.2 Hydrograph Shape 8.3 Elements of the Hydrograph 8.4 Streamflow Recession 8.5 Hydrograph time Characteristics	11	
9.0	RUNOFF VOLUME 9.1 Runoff Volume Computation 9.2 SCS-Curve Number Method 9.3 MassA'^olume Balance 9.4 Storage Reservoirs	4,9	
10.0	PEAKFLOW 10.1 Peakflow versus Watershed Areas 10.2 Rational Method 10.3 SCS Method	15 Pages 309-344	

in. TOPICS CONT'D

	TOPIC	CHAPTER BSf TEXT	NO. OF WEEKS
11.	UNIT HYDROGRAPH METHOD 11.1 Derivation of Unit Hydrograph 11.2 Unit Hydrographs of Other Durations 11.3 Application of UH 11.4 Synthetic Unit Hydrograph	12	2

END TERM TEST

IV. EVALUATION PROCESS/GRADING SYSTEM (Includes assignments, attendance requirements)

Final mark in the course will be based on:

Mid Term Test	**25%**
Short Tests	**25%**
Final Test	**50%**

GRADING:

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

A passing grade will be based on a composite grading of 60%. A student obtaining a composite grading of 55 to 59% may be allowed to complete a supplementary examination. A satisfactory attendance is required to be eligible for a supplementary examination.

REQUIRED STUDENT RESOURCES

Viessman, Warren Jr., and G.L. Lewis (1996). Introduction to Hydrology. 4th Edition, Harper Collins College Publishers, New York.

Verma, S. (1997), Hydrology Course Manual, Sault College

VL ADDITIGNAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY BOOK SECTION:

McCuen, Richard H. (1997), Hydrologic Analysis and Design, Prentice Hall Canada Inc., Toronto

Linsley, R.K. Jr., M.A. Kohler and J.L.H. Paulhus (1982). Hydrology for Enginners. 3rd Edition, McGraw-Hilll Book Company, Toronto.

Gray, D.m. (Editor-in-Chief) (1970). Handbook on the Principles of Hydrology Water Information Center, Inc., Huntington, New York.

Singh, V.P. (1992). Elementary Hydrology, Prentice Hall, Toronto, Canada.

Chow, V.T., David R. Maidment, Larry W. Mays (1988). Applied Hydrology. McGraw-Hill.

Ponce, Victor M. (1989), Engineering Hydrology. Prentice Hall.

Hammer, Mark J. and K.A. Mackichan (1981). Hydrology and Quality of Water Resources. John WUey and Sons, Inc., Toronto.

Vn. SPECIAL NOTES:

Eighty percent attendance is required for anyone to be considered for supplementary examination.

Home assignments are due one week after they are assigned. Late submissions will be penalized.

Special Needs - If you are a student with special needs (eg. physical limitations, yisual impairments, hearing impairments, leammg disabilities), you are encouraged to discuss requu-ed accommodations with the instructor and/or contact the Special Needs OfiBce, Room E1204, Ext. 493, 717, 491 so that support services can be arranged for you.

- Retention of Course Outlines - It is the responsibihty of the student to retain all course outlines for possible fiiture use in acquiring advanced standing at other institutions

Substitute Course Information is available at the Registrar's Office.

vm. PRIOR LEARNING ASSESSMENT

Students who wish to apply for advanced credit in the course should consult the instructor.