STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

CIVL 421– Advanced Hydraulics

CIP Code: 14.0805

Created by: Adrienne C. Rygel
Updated by:

School: Canino School of Technology
Department: Civil and Construction Technology
Implementation Semester/Year: Fall 2026

A. TITLE: Advanced Hydraulics

B. COURSE NUMBER: CIVL 421

C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

# Credit Hours per Week	**3**
# Lecture Hours per Week	**2**
# Lab Hours per Week	**2**
Other per Week	

D. WRITING INTENSIVE COURSE:

Yes	
No	x

E. GER CATEGORY:

Does course satisfy a GER category(ies)? If so, please select all that apply.

[1-2] Communication	
[3] Diversity: Equity, Inclusion & Social Justice	
[4] Mathematics & Quantitative Reasoning	
[5] Natural Science & Scientific Reasoning	
[6] Humanities	
[7] Social Sciences	
[8] Arts	
[9] US History & Civic Engagement	
[10] World History & Global Awareness	
[11] World Languages	

F. SEMESTER(S) OFFERED:

Fall	
Spring	x
Fall and Spring	

G. COURSE DESCRIPTION:

This course examines advanced topics of hydraulics, building upon theory and design concepts presented in Fluid Mechanics and Hydraulics. Students will learn additional theory, practice, and operation of storm sewer systems and detention systems in order to design more complex water management systems. Flood routing and spillways will also be examined and designed. Pump theory and design will be introduced, along with design of pipe distribution systems. Students will be introduced to coastal engineering concepts and practice. Sediment transport and accumulation will be studied in both river and coastal systems, along with impacts

and procedure associated with decommissioning of dams and similar structures. The impact of climate change on natural processes and engineered systems will be discussed.

H. PRE-REQUISITES: CIVL 321 Fluid Mechanics and Hydraulics and CIVL 322 Hydrology & Hydrogeology, or permission of the instructor
CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

Course Student Learning Outcome [SLO]	Program Student Learning Outcome [PSLO]	GER	ISLO & Subsets
a. Explain and apply pipeline network theory to analyze and design simple pipe systems.	SO1, SO2		ISLO 5
b. Explain and apply steady-state theory of pumps in order to design pumping systems.	SO1, SO2		ISLO 5
c. Apply design principles and hydraulic concepts to design a hydraulic system (e.g. water detention system, distribution system, storm sewer system).	SO1, SO2		ISLO 5
d. Use hydraulic software to simulate, analyze, or design a hydraulic system.	SO1, SO2		ISLO 5
e. Design a flood routing or spillway system.	SO1, SO2		ISLO 5
f. Explain concepts, theory, and practice of coastal engineering.	SO7		ISLO 5
g. Discuss the impact of climate change on rainfall events, flooding, and coastal activity and its impact on civil engineering practice and hydraulic systems.	SO4		ISLO 5, ISLO 4 (GL)

KEY	Institutional Student Learning Outcomes [ISLO 1 – 5]
ISLO #	ISLO & Subsets
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA], Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit, /Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL],* *Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

J. APPLIED LEARNING COMPONENT:

Yes	x
No	

If yes, select [X] one or more of the following categories:

Classroom / Lab	x	Community Service	
Internship		Civic Engagement	
Clinical Practicum		Creative Works/Senior Project	
Practicum		Research	
Service Learning		Entrepreneurship [program, class, project]	

K. TEXTS:

Jayawardena, A.W. (2021) Fluid Mechanics, Hydraulics, Hydrology and Water Resources for Civil Engineer2, 1st edition, CRC Press, ISBN 9780429423116.

L. REFERENCES:

Chadwick, Andrew, Morfett, John, and Borthwich Martin, (2021). Hydraulics in Civil and Environmental Engineering, CRC Press, ISBN 9781003026839.

Gribbin, J. E. (2007). *Introduction to Hydraulics and Hydrology, 4rd Edition*. Clifton Park, NY: Thomson Delmar Learning. ISBN: 978-1-133-69183-9.

M. EQUIPMENT:

computer, calculator, engineering scale

N. GRADING METHOD:

A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Exams
Homework Assignments
Laboratory Assignments

P. DETAILED COURSE OUTLINE:

I. Review of Fundamental Hydraulic Concepts
II. Advanced Storm Sewer and Detention Systems
    A. Review of flood frequency analysis and streamflow modeling
    B. Impoundments
    C. Outlet structures and design
    D. Catchment systems and design
    E. Emergency spillway design
    F. Flood/reservoir routing
    G. Design of flood routing systems
    H. Onsite and regional detention systems
    I. Impact of climate change on flood hydrology
    J. Sediment transport and accumulation design considerations
    K. Dam decommissioning (approach, impact, and practice)

III. Pipeline Distribution Systems
   A. Design of simple systems
   B. Series, parallel, and branched systems
   C. Distribution systems
   D. Design of pumping mains
   E. Surge protection

IV. Hydraulic machines
   A. Pump theory
   B. Use of pumps in hydraulic systems
   C. Pump design

V. Wave Theory and Coastal Engineering
   A. Wave motion
   B. Linear wave theory
   C. Wave transformation and attenuation processes
   D. Surf zone processes
   E. Wave analysis and prediction
   F. Sediment transport
   G. Impact of climate change on coasts and hydraulic coastal systems

Q. LABORATORY OUTLINE:

The 2 hour lab session will be used to engage the student in lengthy problem solutions associated with current lecture topics.

1. Design of Advanced Storm Sewer and Detention Systems
2. Design of Different Pipeline Distribution Systems and Pumping Systems
3. Pump Design
4. Wave Theory and Coastal Engineering problems