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

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
CONS322 - HYDRAULICS

Created by: JFR

Updated by: JFR

Canino School of Engineering Technology

Department: CIVIL AND CONSTRUCTION TECHNOLOGY DEPARTMENT

Semester/Year: F/2018

A. **TITLE**: HYDRAULICS

B. **COURSE NUMBER:** CONS322

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

 # Credit Hours: 4
 # Lecture Hours: 3 **per week**
 # Lab Hours: (1) three-hour laboratory **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☒ **Yes:** GER
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☒ **Fall & Spring** ☐

G. **COURSE DESCRIPTION:**

The basics of fluid mechanics and their application to civil engineering technology are considered. The course focuses on water as the fluid. Major topic areas covered are: fluid properties, buoyancy, hydrostatic pressure, resultant force and center of pressure on submerged surfaces, application of the continuity equation to flow in a closed conduit, pressure measurement, flow measurement and flow control in open channels, use of the rational method in determination of peak discharge and storm sewer design.

H. **PRE-REQUISITES: None** ☐ **Yes** ☒ **If yes, list below:**

Pre-requisites: CONS 172 or ENGS201 (Statics) or permission of instructor.

CO-REQUISITES: None ☒ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
solve problems pertaining to fluid mechanics in both US Customary and SI units.	1a, 2ac, 6a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
calculate pressure as a function of depth and the resultant force from water pressure and its point of application on fully and partially submerged surfaces.	2abc, 6ab		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
solve problems related to buoyancy	2abc, 3ab, 5b, 7bc		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
prepare written instructions for use of pressure or flow devices based on calibration data derived from lab activities	2abc, 3ab, 5b, 7bc		1-Comm Skills 5-Ind, Prof, Disc, Know Skills ISLO	W Subsets Subsets Subsets
solve for discharge, velocity and/or pressure in closed piping systems with friction losses by applying the continuity equations	1a, 2ab, 6ab		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
interpret hydraulic and energy grade lines for a simple hydraulic system	1a, 2ab, 6ab		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets

conduct labs and calculate flow through hydraulic devices such as venturis, orifices and weirs	2abc, 3ab, 5b, 7bc		5-Ind, Prof, Disc, Know Skills 2-Crit Think ISLO	Subsets IA Subsets Subsets
calculate discharge in open channels	1a, 6a		5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets
design a sanitary or storm sewer for a small residential development	1a, 4ab, 7b, 8b		2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	PS Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets Subsets Subsets Subsets

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**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

Gribbin, J. E. (2007). Introduction to Hydraulics and Hydrology, 3rd Edition. Clifton Park, NY: Thomson Delmar Learning. ISBN: 1418032956.

L. REFERENCES:

Instructor prepared lab manual.
Department/School communications manual.

M. EQUIPMENT: None ☐ **Needed:** Student provided engineering "tool kit."

N. GRADING METHOD: A - F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

- **Exams (60%)**
- **Quizzes (5%)**
- **Homework (20%)**
- **Lab Processing and Reports (15%)**

P. DETAILED COURSE OUTLINE:

I. Hydraulics and hydrology in engineering
A. Historical perspective
B. Hydraulic applications in Civil engineering
1. Flood control
2. Water resources
3. Water quality
C. Environmental and legal issues
II. Engineering computations
1. Significant figures
2. Accuracy and precision
3. Units and conversions
III. Fluid Mechanics
A. Solids, liquids and gasses
B. Properties of water

1. Density
2. Specific weight
3. Specific gravity
4. Viscocity
5. pressure

IV. Hydrostatics

A. Hydrostatic force
B. Pressure as a function of depth
C. Buoyancy
D. Pressure measurement devices
1. Gauges
2. Piezometers
3. Manometers
4. Transducers
E. Resultant force from pressure on a partially submerged surface
1. Vertical
2. Inclined
3. Curved
F. Resultant force from pressure on a fully submerged surface
1. Vertical
2. Inclined
3. Curved

V. Hydrodynamics

A. Flow rate and the continuity equation
B. Commercially available piping
C. Conservation of energy and Bernoulli's Equation
D. Reynolds number and laminar and turbulent flow
E. Friction losses and the energy equation
1. Calculation of losses per unit length of pipe
2. Losses from fittings, entrances and exits
a) Loss factors
b) Equivalent pipe method
F. Hydraulic and energy grade lines

VI. Hydraulic devices

A. Flow measurement in closed conduits
1. Flow meter
2. Venturi meter
3. Orifice
B. Flow measurement and control in open channels
1. Weirs
a) Sharp crested
(1) Rectangular
(2) Vee Notch
(3) Cipoletti
b) Broad Crested
2. Gates
3. Pitot tube
4. Current Meter
C. Siphons

VII. Open channel flow

A. Channel geometry
1. Slope or grade

2. Cross section
a) Depth
b) Area
c) Wetted perimeter
d) Hydraulic radius
B. Manning's equation
C. Normal and critical depth
D. Uniform flow
1. Normal depth
a) Prismatic channels
b) Streams and overbank areas
2. Use of design charts
E. Varied flow
1. Identification of water surface profiles
2. Backwater profile computation
3. Channel entrances
4. Hydraulic jump
VIII. Runoff Calculations
A. Hydrologic Cycle
B. Watersheds/Drainage areas
C. Identifying the divide line
D. Estimating land area
E. Determining slope from topographic maps
F. Rainfall and Runoff
G. The rational method for determination of discharge
IX. Design of storm sewers
A. Storm Sewer Components
B. Pipe capacity charts
C. Selection of pipes
1. Flow depth
2. Minimum velocity
3. Minimum depth

Q. <u>LABORATORY OUTLINE</u>: None ☐ Yes ☒

Lab	Topic
1	Specific weight and density of water
2	Calibration of a pressure gauge
3	Piezometers and manometers
4	Resultant force from pressure on a vertical surface
5	Resultant force from pressure on an inclined surface
6	Buoyancy and Archimedes's Principle
7	Calibration venturi meter
8	Calibration of sharp crested weirs
9	Friction losses in pipe
10	Toricelli's Theorem
11	Field trip
12	Flow measurement in a natural stream
13	Design of storm sewer part 1
14	Design of storm sewer