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

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
ENGS 341 – THEORETICAL FLUIDS

Created by: Dr. Lucas Craig

Updated by:

Canino School of Engineering Technology

Department: MKTX

Semester/Year: Spring 2019

A. **TITLE**: Theoretical Fluids

B. **COURSE NUMBER:** ENGS 341

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

 # Credit Hours: 3
 # Lecture Hours: 3 **per week**
 # Lab Hours: **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:**

Students in this course develop knowledge of fluid mechanics under static and dynamic applications. Properties of fluids, pressure, fluid statics, Bernoulli's, fluid kinematics, differential representation of conservation of mass and momentum, dimensional analysis, flow rate, minor losses in piping systems, and an introduction to the Navier-Stokes equations are addressed.

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

ENGS 201 and MATH 364

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***	
Analyze hydrostatic forces acting on planar and curved surfaces.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Apply Bernoulli's equation to engineering problems.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Distinguish between streamlines, streaklines, pathlines, and timelines.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Formulate the conservation of mass principle and apply to engineering systems.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Determine the forces acting on a control volume and apply them to Newton's 2nd law.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Apply Reynolds and other non-dimensional numbers in the solution of fluid problems.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets

Determine Reynolds number and differentiate between laminar and turbulent flow. Use Darcy's equation to calculate the friction losses of pipes and fittings.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
Discriminate when to simplify the Navier-Stokes equations and demonstrate its proper use.			2-Crit Think ISLO ISLO	PS Subsets Subsets Subsets
			ISLO ISLO ISLO	Subsets 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:

Cengel, Yunus A. and Cimbala, John M. Fluid Mechanics (3rd edition). New York: McGraw-Hill, 2014.

L. REFERENCES:

N/A

M. EQUIPMENT: None ☒ Needed:

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Homework	**25%**
Exams (3)	**60%**
Final Exam / Project	**15%**

P. DETAILED COURSE OUTLINE:

I. Basic fluid mechanics
- **A. Fluid mass & weight**
  - **1. Density**
  - **2. Specific weight**
- **B. Ideal gas laws**
- **C. Viscosity**
- **D. Compressibility of fluids and speed of sound**
- **E. Pressure**
  - **1. Vapor**
  - **2. Surface tension**

II. Fluid Statics
- **A. Pressure**
  - **1. Incompressible**
  - **2. Compressible**
- **B. Pressure measurement**
  - **1. Manometry**

2. Gauges
3. Electronics

C. Hydrostatic forces
D. Archimedes' Principles (Buoyancy)

III. Fluid Kinematics
A. Newton's Second Law
B. Flow patterns and flow visualization
C. Vorticity and rotationality
D. Reynolds Transport Theorem

IV. Mass and energy analysis of flow systems
A. Continuity equation
B. Mechanical energy and efficiency
C. Bernoulli equation
D. Energy equation

V. Momentum analysis of flow systems
A. Linear and angular momentum
B. Application of momentum equations

VI. Dimensionless analysis
A. Buckingham Pi Theorem
B. Dimensionless groups

VII. Internal flows
A. Characteristics of laminar and turbulent flow, wall friction, and pressure drop
B. Flow rate and velocity measurements

VIII. Differential analysis
A. Continuity equation
B. Stream function
C. Navier-Stokes equations
D. Flow between parallel plates
E. Steady flow in round tube

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