

## **9ENME 331 Fluid Mechanics**

**Fall 2022**  
**3 credit hours**

**Instructor:** Dr. Julie Wang, Ph.D., P.E.  
**Office:** CSC 102  
**Office Hour:** Webex MW 2:00-3:00 PM, TTh 10:00-11:00 AM.  
You are welcome to send e-mail to make appointment  
**Telephone:** 301-687-3208  
**e-mail:** yjwang@frostburg.edu  
**Class/Lab Hours:** 3:00 – 4:50 p.m., MW  
**Class Room:** CSC 216

**Text Book:** Fundamentals of Fluid Mechanics, by Munson, B.R., T.H. Okiishi; W.W.Huebsch, A.P. Rothmayer, 8<sup>th</sup> edition, 2016.

### **Catalog Description**

Principles of fluid mechanics; Mass, momentum, and energy conservation; Hydrostatics; Control volume analysis; Internal and external flow; Boundary layers. Modern measurement techniques; Computer analysis; Laboratory experiments.

**Prerequisites:** ENES 221 Dynamics, ENME 232 Thermodynamics

**Designation:** Required

### **Learning Outcomes**

Students successfully completing this course will demonstrate the following outcomes:

Students are expected to be able to:

1. Determine pressure distribution, forces, and moments on a submerged surface.
2. Select appropriate control volumes and apply simplifying assumptions to the conservation equations for the selected control volume.
3. Formulate and solve fluid mechanics problems by applying the principles of conservation of mass, linear momentum, and energy in a control volume analysis.
4. Use dimensional analysis to determine prototype flow characteristics from model flow geometries.
5. Apply fluid mechanics principles to the analysis of experimental data.
6. Identify and communicate in written form the important results from fluid mechanics experiments.

### **Relationship of course to program objectives:**

This course develops the fundamentals of fluid mechanics and problem solving skills necessary to mechanical engineers, and develops ability to apply the concepts developed for fluid flow analysis to issues in engineering design.

### **Relationship to program outcomes**

ENME 331 contributes directly to the following specific Mechanical Engineering Program Outcomes from ABET Criteria:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

### **Topics Covered**

- Introduction, definition of a fluid, fluid property
- Hydrostatics (manometers, forces on flat plates, forces on curved surfaces, buoyancy)
- Fluid kinematics, streamlines and stream functions
- Derivation and use of Bernoulli's equation, pitot-static tubes
- Eulerian vs. Lagrangian frame of reference, substantial derivative
- Differential form of the conservation equations
- Control volume analysis
- Laminar and turbulent boundary layer fundamentals
- Exact solutions of the Navier-Stokes equations
- Dimensional analysis
- Pipe flow analysis, turbulent flow
- Flow over immersed bodies, boundary layers, lift and drag

### **Class/Lab Attendance**

Attendance is required. Each student will be responsible for all assignments and material presented. Students are expected to be responsible and submit required work when it is due. During the class, honest discussion of the material is strongly encouraged. Distractions, such as playing on a computer internet or games during class time, will not be tolerated.

### **Homework/Quizzes**

Homework problems will be assigned for each chapter. Homework must be handed in on time; late work will not be accepted. The homework is submitted to CANVAS

There is no make-up for quizzes; a zero grade will be assigned to the missing quizzes. The lowest three scores will be dropped.

Students are expected to develop both personal and professional ethics. Individual work shall be the original work.

### **Exams (in Classroom)**

There will be two tests and final exam. You are expected to take the exams on the scheduled dates.

### **Grading**

Homework	10%
Quizzes	15%
Lab	15%
Tests	40% (20% for each)
Final Exam	20%
Total	100%

### **Grading Scale**

The letter grades will be determined as follows:

A	90-100
B	80-89
C	70-79
D	60-69
F	0-59