Marshall University Syllabus
College of Engineering and Computer Sciences

Course

ENGR 318 / Fluid Mechanics

Course Description

Fluid properties, hydrostatic forces, stability of floating bodies, equations of fluid acceleration and motion (continuity, momentum, energy, Euler's Bernoulli's), dynamic similitude, internal flow, and computer solutions in ideal fluids. 3 credits, undergraduate. (PR: ENGR 214; CR: CE 319)

Credits
3 credit hours / undergraduate

Prerequisites
PR: ENGR 214; CR: 319

Term/Year

Fall 2022

Class Meeting Days/Times

TR, 11:00 am – 12:15 pm

Location

WAEC 1101

Academic Calendar

For beginning, ending, and add/drop dates, see the Marshall University Academic Calendar (URL: https://www.marshall.edu/academic-calendar/).

Instructor

Sungmin Youn, Ph.D.

Contact Information

- Office: WAEC 2207
- Office Hours: TR 9-11 am, 12:30 - 2 pm, and W 11 am - 1 pm, 2 - 3 pm. Office hours will be held virtually or face-to-face following the University COVID protocol.

- Office Phone: (304) 696-6475
- Marshall Email: youns@marshall.edu

COVID-19 Related Information

Marshall's official COVID-19 protocols are online at https://www.marshall.edu/coronavirus (URL: https://www.marshall.edu/coronavirus/). Policies and protocols may change over time as we respond to changing conditions. The website will always contain the most recent information – check it frequently for the most current information.

Key policies and practices at the start of the Fall 2022 semester include the following:

- **Wear a mask inside university buildings, *when required*.** To see the campus current masking status, visit Marshall's COVID-19 Dashboard (www.marshall.edu/coronavirus). Masks are not required in personal residence hall rooms or workspaces.

- **Students will disinfect their personal workspaces and virtual learning hubs** with disinfectant wipes provided nearby.

- **All members of the Marshall University community are expected to observe all COVID-19 protocols at all times. Students who are unable to follow University requirements due to a disability** should seek reasonable accommodations from the Office of Disability Services (ODS; disabilityservices@marshall.edu) during the first week of class.

Required and/or Recommended Texts and Materials

Required Texts and Materials

Fluid Mechanics: Fundamentals and Applications, 4th edition by Yunus A. Çengel, John M. Cimbala, McGraw-Hill Education, 2017, ISBN : 9781259921902

Recommended/Optional Texts and Materials

N/A

Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course student learning outcomes	How students will practice each outcome in this course	How student achievement of each outcome will be assessed in this course
1. Apply basic concepts associated with properties of fluids to solving engineering problems, including: pressure, specific weight, specific volume, mass density, vapor pressure, and viscosity.	Homework assignments	Exam 1, Final Exam
2. Analyze the magnitude and effective location of lines of action of forces on surfaces due to pressure from static fluids.	Homework assignments	Exam 1, Final Exam
3. Solve problems related to fluid flow, including classification of flow type (uniform vs. non-uniform, steady vs. unsteady, laminar vs. turbulent, etc.), analyses using control volumes and conservation of mass and momentum.	Homework assignments	Exam 2, Final Exam
4. Compute forces, torque, and power due to steady flow of fluids over both stationary and moving vanes and through pressure conduits.	Homework assignments	Exam 2, Final Exam
5. Solve problems involving steady incompressible flow in pressure conduits, including pressure loss, discharge, introduction to pumps, and sizing problems with consideration of pipe friction and local losses.	Homework assignments	Final Exam

Course Requirements/Due Dates

Please see the acccompnyaing "Course Schedule" for assignment due dates and exam dates.

Grading Policy

Grading Basis (Total = 100%)

- Attendance: 10%
- Assignment: 20%
- Exam 1: 20 %
- Exam 2: 20%
- Final Exam: 30%

Grading Scale

- A: Total ≥ 90%
- B: 80% ≤ Total < 90%
- C: 70% ≤ Total < 80%
- D: 60% ≤ Total < 70%
- F: Total < 60%

All paper copies of homework assignments must be physically submitted at the

beginning of the class period on the due date; no emailed or electronically submitted homework will be accepted or graded. **Late submittals will not be accepted.** Homework assignments must be solved neatly and in an organized manner. Submissions that are sloppy, disorganized, or otherwise unprofessional will have points deducted, and may not be graded at all if they are illegible. **The one lowest homework assignment scores will be dropped** when calculating grades.

Attendance/Participation Policy

Students are expected to attend all class sessions. Attendance will be taken at the beginning of each lecture; late arrivals (10 minutes or more) will count as half an absence. The information covered in each class is pertinent to the understanding of the required material. Students are required to participate in class discussions.

- Talk only to participate in class discussions.
- All cell phones and mobile communication devices should be turned off during class.
- Do not work on other assignments during class.
- Any student missing class is responsible for any material covered and any assignments made. In the event of an excused absence (e.g., illness, death in the family, school activity, etc.) notify the instructor as soon as possible.
- If you are sick or not feeling well, please **do NOT come** to class. Seek your medical attention from your doctor or at Student Health Services.
- For excused absences, please contact Student Affairs at Marshall University's Wellness Center (https://www.marshall.edu/student-affairs/) and complete the University Excused Absence Form.

University Policies

By enrolling in this course, you agree to the University Policies. Please read the full text of each policy (listed below) by going to MU Academic Affairs: University Policies. (URL: https://www.marshall.edu/academic-affairs/policies/)

- Academic Dishonesty Policy
- Academic Dismissal Policy
- Academic Forgiveness Policy
- Academic Probation and Suspension Policy
- Affirmative Action Policy
- Dead Week Policy
- D/F Repeat Rule
- Excused Absence Policy for Undergraduates
- Inclement Weather Policy
- Sexual Harassment Policy
- Students with Disabilities (Policies and Procedures)
- University Computing Services Acceptable Use Policy

Tentative Schedule for Fall 22

Week	Date	Lecture Topic (ENGR 318)	Chapter	Lab session (CE 319)
1	8/23	Lecture 1: Fluid Properties, Viscosity, Units	CH 1.1-4, 6, CH 2.1-2, 4, 6	Safety and overview
	8/25			
2	8/30	Lecture 2: Pressure, Barometers, Manometers, Other Pressure Measurement Devices	CH 3.1-2	1- Fluid Properties
	9/1			
3	9/6	Lecture 3: Hydrostatic forces on plane surfaces	CH 3.3-4	2 - Hydrostatic Force
	9/8			
4	9/13	Lecture 4: Hydrostatic forces on curved surfaces, buoyancy, stability	CH 3.5-6	3 - EPANET
	9/15			
5	9/20	Lecture 5: Conservation of Mass, Continuity Equation, Euler and Bernoulli Equations	CH 5.1-2, 4	4 - Buoyancy
	9/22			
6	9/27	Lecture 6: Dimensional Analysis, Similitude, Flow Rate Measurement - Orifice & Venturi Meters	CH 7.1-3, CH 8.8	5 - Metacentric Height & Stability of Floating Bodies
	9/29	**Exam 1: Lecuture 1-5**		
7	10/4	Lecture 6: Dimensional Analysis, Similitude, Flow Rate Measurement - Orifice & Venturi Meters	CH 7.1-3, CH 8.8	6 - Flow Visualization / Osborne Reynolds
	10/6	Lecture 7: Reynolds Number, Laminar Flow in Pipes, Turbulent Flow in Pipes, Minor Losses	CH 8.1-6	
8	10/11			7 -Venturi Meter & Bernoulli's Equation
	10/13	Lecture 8: Linear Momentum, Drag, Lift	CH 6.1-4, CH 11.1-5, 7	
9	10/18			8 - Orifices
	10/20	Lecture 9: Energy and Hydraulic Grade lines, Pitot Tubes, Series and Parallel Flows	CH 5.4, 8.7	
10	10/25			9 - Pipe Friction & Hazen-Williams
	10/27	Lecture 10: Turbomachinery - Pumps, Pump Performance and System Curves, Turbines, Affinity Laws	CH 14.1, 4	
11	11/1			Lab 9, continued
	11/3	Lecture 11: Principles of Open Channel Flow; Manning's Equation	CH 13.1-4	
12	11/8	**Exam 2: Lecture 6-10**		10 - Jet Impact & Momentum
	11/10	Lecture 11: Principles of Open Channel Flow; Manning's Equation	CH 13.1-4	
13	11/15	Lecture 12: Uniform Flow, Specific Energy, Critical and Normal Depths	CH 13.5-6	11 - Local Losses
	11/17			
-	11/22	Thanksgiving Break		
	11/24			
14	11/29	Lecture 13: Make-up topics, and Final Review	N/A	No Lab
	12/1			
		Final Exam: 10:15 AM - 12:15 PM on Dec 8		