United States Naval Academy

Mechanical Engineering Department

Catalog Description: EM324 Fluid Mechanics Credit: 4 (3-2-4)
Designation: Required, engineering sciences

An introductory course in fluid dynamics stressing both the integral and differential forms of the conservation laws of fluid flow. Engineering applications are made to hydrostatics and to ideal and real fluid flows. Laboratory experiments and problems sessions complement the lectures.

Prerequisites: None
Co-requisites: EM319 - Thermodynamics or equivalent.

Textbooks: Fundamentals of Fluid Mechanics by Munson, Young, Okiishi and Huebsch; John Wiley & Sons, 7th Edition (2013).

Course Director: Associate Professor Luksa Luznik

Course Content:

No.	**Topic or Subtopic**	**hrs.**
1.	Mathematics	4
2.	Fluid Properties	4
3.	Hydrostatics, Hydraulics	7
4.	Buoyancy and Stability	1
5.	Fluid Kinematics	3
6.	Bernoulli Equation	6
7.	Integral Conservation Equations, Mass and Momentum	5
8.	Viscous Flow, Navier-Stokes Equations	5
9.	Computational Fluid Dynamics	3
10.	Dimensional Analysis	5
11.	Pipe Flow	8
12.	Boundary Layers	3
13.	Lift and Drag	3
14.	Turbomachinery	6
15.	Open channel flow/potential flow	2

Assessment Methods:		YES	NO
A	Quizzes	X	
B	Homework	X	
C	Exams	X	
D	Laboratory Reports	X	
E	Oral Presentations	X	
F	Design Reports/Notebooks	X	
G	Prototypes/Demonstrations		X
H	Projects		X
I	Other		X

Course Outcomes:

1. Students will demonstrate an understanding of fluid properties including the measurement of the property and its dependence on pressure and temperature. (A,B,C,D)
2. Students will demonstrate the ability to solve hydrostatic problems involving manometers, hydrostatic forces on planar and curved surfaces, and hydraulics. (A,B,C,D)
3. Students will demonstrate the ability to solve fluid dynamic problems involving conservation of mass, momentum, and energy for viscous and inviscid flow. (A,B,C,D)
4. Students will demonstrate the understanding the naval related topics of ship stability, aerodynamics, turbomachinery and fluid transport. (A,B.C,D)
5. Students will demonstrate and understanding dimensional analysis used in fluids experiments. (A,B,C,D)
6. Students will demonstrate the ability to collect data and analysis of experimental results. (D,E)
7. Students will demonstrate the ability to use differential and vector calculus to solve fluids problems. (A,B,C)
8. Students will demonstrate the ability to clearly present laboratory results and design projects in written and oral reports.(D,E,F)
9. Students will demonstrate the ability to contribute to laboratory and design teams. (D,E,F)

Letters in parenthesis refer to the assessment methods listed in previous section.

	Course Outcomes								
Program outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(a)	X	X	X	X	X	X	X	X	
(b)						X		X	X
(c)									
(d)									
(e)	X	X	X	X	X	X	X		
(f)									
(g)								X	X
(h)									
(i)									
(j)									
(k)						X		X	X

Date of Latest Revision: March 2017, Associate Professor Luksa Luznik