United States Naval Academy
Mechanical Engineering Department

Catalog Description: EM486A Computational Fluid Dynamics **Credit:** 3 (3-0-3)
Designation: Elective, mechanical engineering major

An introduction to computational fluid dynamics (CFD) and computational aerodynamics. Review of Navier-Stokes equations for incompressible and compressible flows. Includes use of locally generated and Department of Defense CFD codes. Co-listed as EA428.

Prerequisites: EM324 Fluid Dynamics
Corequisites: None

Textbooks: Cebeci, T., Shao, J.P., Kafyeke, F. and Laurendeau, E.
Computational Fluid Dynamics for Engineers
Springer

Course Director: CAPT Murray Snyder, USN

Course Content:

No.	**Topic or Subtopic**	**hrs.**
1	Conservation Equations	8
2	Numerical Methods	2
3	Linux and Fortran	6
4	Shocks	4
5	Unstructured Grid Generation	9
6	Parallel Processing Flow Solver	6
7	Post Processing & Flow Visualization	3
8	CFD Project	10

Assessment Methods *(Use capital letters)***:**

		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

EM486A Computational Fluid Dynamics

Course Outcomes[1]

1. Describe equations that govern fluid flow (Conservation of Mass, Momentum and Navier Stokes). (B,C)
2. Generate analytical and numerical solutions to the Navier Stokes equation. (B,C)
3. Describe basic properties of fluid turbulence. (B,C)
4. Describe laminar and turbulent Boundary Layers. (B,C)
5. Use common LINUX commands. (B,F,H)
6. Perform basic FORTRAN programming. (B,C)
7. Describe and apply basic numerical stability concepts (e.g. CFL). (B,C,E,F,H)
8. Perform geometry definition and grid generation using GRIDTOOL and VGRID. (E,F,H)
9. Use of NASA USM3d flow solver with parallel processing. (E,F,H)
10. CFD Post Processing using EnSight software. (E,F,H)

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

	Course Outcomes									
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(a)	X	X	X	X	X	X	X	X	X	X
(b)	X	X	X	X	X	X	X	X	X	X
(c)								X	X	X
(d)								X	X	X
(e)	X	X	X	X	X	X	X	X	X	X
(f)										
(g)								X	X	X
(h)										
(i)										
(j)										
(k)								X	X	X

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