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| DRAFT CVEG 563V - Computational Fluid Dynamics in Wind Engineering **Course Description:** The goal of this course is to apply developing CFD method to wind engineering problems. This may be the first time offered not only here but also in the world?. This is a unique class which needs basic fluid mechanics, numerical techniques, computational fluid dynamics (CFD), wind engineering, understanding of turbulence, structural dynamics, fluid structure interaction (FSI) effect etc. Here only introductory attempt is made using 1D, 2D and 3D problems. For further understanding, brief discussion is made in the chapter on advanced topics.**Course Objectives:** Upon completion of this course, students should be able to:1. Introduction to fluid mechanics & Navier-Stokes equations
2. Turbulence & Wind spectrum
3. Finite difference method & iterative solver
4. 1D wave equation solution
5. Introduction to Wind Engineering
6. CFD for flow over 2D hills & cylinder
7. CFD for building aerodynamics-2D & 3D problem

**Textbook:** Computational Fluid Dynamics for Wind Engineering By R. Panneer Selvam |

**Lesson Planning and Schedule:**

| Weekly Lesson | Lesson Level Objectives | Readings/Media | Assessments |
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| Week 1  | * 1.Introduction to fluid mechanics & Navier-Stokes equations
	+ Bernoulli equation derivation
	+ Nonlinear equation: Compressible flow through a nozzle
 | * Lecture videos:1 to 6
* Textbook Readings: Ch-2:up to flow through nozzle
 | * Problem Set #1 (PS#1)- HW#1-Ch.2-p#1 & p#2
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| Week 2  | * 2.Turbulence & Wind spectrum
* 3.Finite difference method & iterative solver
	+ Ch.2-Fourier series
	+ Ch.3-FDM-iterative solver
 | * Lecture videos:7 to 13
* Textbook Readings: Ch2-Turbulence. Ch.3-potential flow
 | * Problem Set #2 (PS#2) –HW#2-Ch.2-p#5 & p#6
* HW#3-Ch3-P#1
* HW#4-Ch.3-P#2 & p#3
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| Week 3 | * 4. 1D wave equation solution
* Solution of NS equations
	+ Explicit & Implicit methods for convection equation
	+ Effect of CFL number
 | * Lecture videos: 14 to 19
* Textbook Readings: Ch3-unstead convection. Solution of NS equations & storage systems
 | * Problem Set #3 (PS#3) –HW#5-Ch.3-P#4 & P#6
* HW#6-Ch.3-P#5
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| Week 4 | * 5. Introduction to Wind Engineering & 6. CFD for flow over 2D hills & building
	+ Wind effects on structures
	+ 2D flow over building & hill
 | * Lecture videos:20 to 25
* Textbook Readings: Ch4 & Ch5-2D-CFD
 | * Problem Set #4 (PS#4) –HW#7-flow over hill-2D
* Exam #1
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| Week 5 | * 7.CFD for building aerodynamics- 3D problem
	+ Peak pressure on a 3D building without inflow turbulence
 | * Lecture videos:26-31
* Textbook Readings: Ch.5-3D building-no inflow
 | * Problem Set #5 (PS#5)Homework –HW#8-3D CFD for building without inflow turbulence
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| Week 6 | * 6.CFD for 2D cylinder
	+ Vortex shedding
 | * Lecture videos:32-37
* Textbook Readings: Ch.5-2D unsteady flow around cylinder
 | * Problem Set #6 (PS#6)Homework –HW#9-CFD for square cylinder
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| Week 7 | * 7. CFD with inflow turbulence for building aerodynamics
	+ Inflow turbulence generation methods
 | * Lecture videos:38-43
* Textbook Reading: Ch.5-Inflow turbulence
 | * Problem Set #7 (PS#7)Exam #2
* HW#10-CFD with inflow turbulence
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| Week 8 | * Advanced applications
 |  | * Final Project-Final Exam
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