MENG555 Computational Fluid Dynamics (CFD)

Year and Semester:  Graduate  
Credit Hour:  (3,0) 3  
Pre/Corequisite(s):  - 

Catalog Description:  

Prerequisite by Topic:  
The student will be expected to have a good background in heat transfer and fluid dynamics and should have some programming experience with FORTRAN 90, or C or C++.

Textbooks:  

References:  

Course Objectives:  
1. To introduce the basic principles in computational fluid dynamics  
2. To develop methodologies which facilitate the application of the subject to practical problems

COURSE OUTLINE

Week 1  Introduction: (1 week)  
What is CFD? How does a CFD code work? Problem solving with CFD.

Week 2-3  Conservation laws of fluid motion and boundary conditions: (2 weeks)  

Week 4-5  The finite volume method for diffusion problems: (2 weeks)  

Week 6  The finite volume method for convection-diffusion problems: (1 weeks)  

Steady one dimensional convection and diffusion. The central difference, upwind, hybrid, power law, QUICK and other higher order schemes. Stability problems of the schemes. TVD schemes; flux limiter functions.

**Week 7**  
**Solution algorithms for pressure-velocity coupling in steady flows: (1 week)**  
The staggered and non-staggered grids. The momentum equations. The SIMPLE, SIMPLER, SIMPLEC and PISO algorithms.

**Week 8**  
**The finite volume method for unsteady flows: (1 week)**  

**Week 9-11**  
**Turbulence and its modeling: (3 weeks)**  

**Week 12-13**  
**Methods for dealing with complex geometries: (2 weeks)**  

**Computer Usage:**  
Students are required to write simple computer programs for solving simple one-dimensional convection-diffusion and two-dimensional diffusion problems. CFD assignments will be given to be solved by using ANSYS CFX.

**Teaching Techniques:**  
Over-head projector is used in the classroom.

**GRADING POLICY**

- Mid-term Examination: 20%
- Computer projects: 50%
- Final Examination: 30%

**Instructor:** İbrahim Sezai