King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
Fall Semester 2006-2007 (061)

ME 496 : Computational Fluid Dynamics and Heat Transfer

Instructor: **Dr. S. Z. Shuja** *Office:* **22-216** *Phone:* **4465**

Catalog Data:

Introduction to computational fluid dynamics as an engineering tool for the analysis and design of thermal-fluid systems. Fundamental equations of fluid mechanics in differential and integral form and common approximations. Discretization and solution methods for incompressible flow. Application of numerical techniques to the solution of some practical fluid flow and heat transfer problems. Turbulence models and their implementation in CFD. Application of commercial CFD codes to illustrative fluid flow and heat transfer problems. **Prerequisite :** ME 315

Textbook:

Apsley D. D. **Computational Hydraulics: Course notes**. 2005. (available through WebCT)

References:

1) Patankar, S. V. **Numerical Heat Transfer and Fluid Flow,** Taylor and Francis 1980.
2) Versteeg, H. K. and Malalasekera, W. **An Introduction to Computational Fluid Dynamics: The Finite Volume Method**, Longman 1995.

Course Breakdown:

Classes (50 min)	**Topics**
2	Introduction to CFD and its applications.
4	Review of the governing equations and common approximations
12	The finite volume method and discretization of the 1D advection diffusion equation
6	The general scalar transport equation
3	Time –dependent calculations.
3	Special treatment of the Navier-Stokes equation and the pressure-corrections method.
3	Introduction to Turbulence Modeling.
10	Commercial CFD codes and their application to practical problems.

Evaluation:

Exam 1	**Oct. 30, 2006**	**7-9 pm**	15%
Exam 2	**Dec. 10, 2006**	**7-9 pm**	20%
Quizzes			10%
Homework			10%
Final Exam			30%
Design Projects			15%

ME Dept. mission statement: The Department is committed to providing highest quality education in mechanical engineering, conducting world-class basic and applied research, addressing the evolving needs of industry and society, and supporting the development of more competitive and new industry in the Kingdom of Saudi Arabia.

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Objectives and Outcomes of the course:

Objectives:	***Outcomes***
To improve the students understanding of the application of conservation principles in fluid mechanics and heat transfer.	The student will demonstrate an ability to recognize the type of fluid flow and choose the appropriate conservation principles needed to analyze a complete fluid-flow system.
To provide the student with a basic understanding of the theory and principles used in computational fluid dynamics.	The student will demonstrate the ability to couple his understanding of basic fluid dynamics with numerical methods in order to obtain solutions to engineering problems.
To provide the student with some experience in using commercial CFD software for the analysis of complex fluid flow and heat transfer systems.	The student will be able to use modern CFD software for the analysis of complex fluid-flow and heat transfer systems.

HW Assignments:

Homeworks will be due a week from the date of assignment. Late homework will not be accepted.

Attendance:

Attendance will be strictly observed and each absence will result in a deduction of 0.5 point of the final grade.

Design Projects:

Projects will be assigned to use the commercial CFD software. Team work is allowed provided each member shows his contribution.

Computer usage:

Students will use the computer for homework assignments and design problems.

Dr. S. Z. Shuja ***9th Sept. 2006***