King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT

ME 532 : ADVANCED FLUID MECHANICS I

Spring Semester 2007-2008 (072)

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

Textbook: White. F. M. **VISCOUS FLUID FLOW**. McGraw-Hill Publishing Co 3rd Edition, 2006.

References: 1) Schlichting, H. **Boundary Layer Theory**.
2) Batchelor, G. K. **Introduction to Fluid Dynamics**.

Course Description: Conservation equations for viscous fluids. Boundary layer concept. Navier-Stokes equations and some exact solutions. Stokesian flow. Laminar boundary layer equations and methods of solution. Von Karman momentum integral equation. Theory of stability of laminar flows. Introduction to turbulence.
Prerequisites: ME 311, MATH 513.

Goals: This course is designed to introduce the basic principles of the viscous flow theory and carry out an in-depth analysis of the various forms of transport (of mass, momentum and energy etc.) in different flow processes. Upon completion of the course, the student should be able to formulate and simplify the governing equations and boundary conditions and also obtain analytical and numerical solutions for a wide range of fluid flow problems.

Material to be covered:

Week (2 classes)	Topics
1	Introduction and review of fundamentals.
2,3	Fluid flow conservation equations.
4,5,6	The Navier-Stokes equations. Turbulent flow equations and modeling.
7,8	Simplification for various flows and dimensional analysis.
9,10,11,12	Solution methods - Exact and numerical solutions.
13,14	Boundary layer theory. Momentum integral equation and applications.
15	Stability of laminar flows.

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

Evaluation:

Major Exam 1	20%
Major Exam 2	25%
Term Paper	10%
Homeworks	15%
Final Exam	30%

Homework: Homeworks will be regularly assigned in order to enhance the understanding of concepts discussed in the class.