GRADUATE COURSE DESCRIPTION
SEMESTER: Spring 2006

COURSE TITLE: Mathematical problems of fluid mechanics
COURSE No.: M 393C (57600) TTH 9:30-11
INSTRUCTOR: Misha Vishik

BRIEF DESCRIPTION:

Navier-Stokes equations is a basic mathematical model to describe motion of a viscous incompressible fluid. In the 1930s Jean Leray proved existence of a weak solution defined globally in time. Uniqueness of weak solutions in 3D remains an open question. At the beginning we will cover the fundamentals of the theory including results of Leray and contributions of the later authors such as E. Hopf, O. Ladyzhenskaya, J.-L. Lions, G. Prodi, and others. In the remaining time we will concentrate on some of the striking recent advances.

1. Variational formulation of the Navier-Stokes equations. Weak solutions.
2. Uniqueness in dimension 2.
3. Nonexistence of self-similar blow-up for 3D Navier-Stokes equation.
5. Littlewood-Paley decomposition and paraproducts.
6. Function spaces (Besov, Morrey-Campanato, Lorentz,...).
7. Uniqueness of mild solutions in $L^3$ and in other function spaces.

PREREQUISITE: Functional analysis as in the Applied Math prelim course or equivalent. PDE's as in the Introduction to PDE's course.

TEXTBOOK: None required. References:
5. M. Cannone, Ondelettes, paraproducts et Navier-Stokes, Diderot.

CONSENT OF INSTRUCTOR: No