Course Description

Department of Mathematics

Nature of the course: Elective		Area: 代數與數論, 論文研討			
Course number		Section number		Number of credits	3
Course title	算術幾何專題 Topics in Arithmetic Geometry				
Instructor	余正道				

Lectures: Likely Tuesdays and Thursdays, 1:30 – 3:00 PM

I. ＊**Contents**：

Stationary phase principle, Witten's proof of Morse inequality, Laumon's proof of Weil conjecture, Fourier transform in other theories.

II. **Course prerequisite**：

Familiarity with algebra, algebraic topology

III. ＊**Reference material**：

[L] Laumon, Transformation de Fourier, constantes d'équations fonctionnelles et conjecture de Weil. 1987.

IV. ＊**Grading scheme**：

Homework and presentation

V. ＊**Course Goal**：

The theme of this course is the Fourier transform in arithmetic and algebraic geometry. We plan to start from the general idea of stationary phase principle in differential equations and then go through Witten's approach to Morse theory. We then move to study the paper [L] where we use the theory of geometric Fourier transform to obtain some arithmetic results, including a product formula and a new proof of the Weil conjecture. We will review the necessary language of l-adic étale sheaves.

After the paper [L], the concepts of the local Fourier transform, the stationary phase principle and the product formula have been extended as useful tools to other theories in algebraic geometry, e.g. the D-module theory and p-adic cohomology theory. We plan to discuss some of these further developments too.