## **School of Mathematics**

Cource 415 - Topics in Analysis (harmonic analysis)	2005-06
(JS & SS Mathematics)	

Lecturer: Dr. Hyung Ju Hwang

**Requirements**/prerequisites:

Duration: 21 weeks

Number of lectures per week: 3

Assessment: Homework: 20%, Presentation: 30%, Paper: 50%

End-of-year Examination: One 3-hour examination in May/June.

## **Description**:

**Fourier Series:** Basic properties, Convergence, Applications

- **Fourier Transform on**  $\mathbb{R}$ : Basic properties, Applications to heat equations, Heat and Poisson kernels
- Fourier Transform on  $\mathbb{R}^d$ : Basic properties, Applications to wave equations, Radon transform
- **ODE models in Biology:** Linear stability, Population dynamics, Molecular events, Limit cycles, Oscillations, Excitable systems
- PDE and Diffusion in Biology: Convection, Diffusion, Attraction
- **PDE models in Biology:** Population model, Steady states, Traveling waves, Transport model, Do-It-Yourself model

Pattern formation in Biology: Aggregation, Diffusive instability, Morphogenesis

Survey paper & Presentation: Article survey project (perhaps in collaboration with another student) which arises during the second semester. At the end of the course each team will be expected to give a short presentation on their research and write a survey paper on it. Submission of a survey paper is due on May, 1, 2006, Monday.

## Textbooks:

- 1. Fourier Analysis. An introduction. By Elias M. Stein & Rami Shakarchi. Princeton Lectures in Analysis I.
- 2. *Mathematical models in Biology.* By Leah Edelstein-Keshet. SIAM Classics in Applied mathematics.

## **References:**

- 1. Introduction to Fourier Analysis on Euclidean spaces. By Elias M. Stein & Guido Weiss. Princeton University Press.
- 2. Mathematical Biology. By James D. Murray. Springer-Verlag.

October 11, 2005