Course Description

Department of mathematics

Nature of the course ☐ required ☑selective	Area ☐ Algebra ☑ Analysis ☐ Geometry ☐ Applied Mathematics ☐ Statistics ☐ Others				
Calculus ☐ Calculus A ☐ Calculus B					
Course number	221 U3900	Section number		Number of credits	3
Course title	FUNCTIONAL ANALYSIS (I)				
Instructor	李志豪				

I. Contents：

Chapter 1. Metric Spaces

1. Locally compact and compact Sets.

2. Baire Category

3. The Ascoli- Arzela' theorem

Chapter 2. Hilbert Spaces

1. Orthogonal projections. Orthonormal basis. Bessel inequality. Fourier expansion.

2. Riesz representation theorem.

3. Spectral theory for positive operators and Sturm-Liouville problem.

4. Spectral theory for compact self-adjoint operators and integral equations of Fredholm type.

5. Spectral theory for self-adjoint operators.

Chapter 3. Banach spaces

1. Normed vector spaces. Hahn-Banach theorem.

2. Uniform boundedness principle. Open mapping principle. Closed graph theorem. Closed operators.

3. Compact operators. Fredholm alternative theorem.

4. Spectral theorem for bounded linear operators.

Chapter 4. Frechet Space, Introduction to Theory of Distribution---

Definitions and Examples, Operations on Distributions, Fourier Transform,Wavelet Analysis,

Applications to Partial Differential Equations.(Some part will be covered in 2nd semester.)

II. Course prerequisite：
預備知識為「高等微積分」、「線性代數」，最好曾修過「實變函數論」或相當課程。

III. Reference material (textbook(s))：

1. H. L. Royden, Real Analysis (3rd ed.)

2. Peter Lax, Functional Analysis, 2002 Wiley-Interscience.

3. Fon-Che Liu:實分析課程講

義 http://www.math.sinica.edu.tw/www/file_upload/maliufc/maliufc-c.htm

4. Douglas N. Arnold, Functional Analysis, http://www.math.psu.edu/dna/

IV. Grading scheme：20% 習題，40% 期中考，40% 期末考。

V. Others：Course Goal：

1. Learning some basic abstract spaces：Metric Spaces, Hilbert Spaces, Banach Spaces, Frechet Spaces, etc.

2. Knowing some example, e.g. L^P Space, Sobolev Space, Schwartz Space, etc.

3. Knowing the theory and examples of the transformation of the Spaces as above.