

COURSE SYLLABUS
FOR FULL-TIME UNDERGRADUATE PROGRAMS
(Issued under Decision No.1380/QĐ-ĐHKTQĐ on 15/8/2016 by the University President)

1. COURSE NAME: Calculus 3

Code: TOCB 1104

Number of Credits: 03

2. DEPARTMENT IN CHARGE OF INSTRUCTION

Department of fundamental mathematics

Office: 4th floor, Building 7, National Economics University, 207 Giai Phong road,
Hanoi, Vietnam

Office Hours: 8am-5pm, from Monday to Friday

Office Telephone: 084 4 36283007, ext: 5944 or 5798

3. PRE-REQUISITE: Calculus 2 (TOCB1103)

4. COURSE DESCRIPTION

The course includes basic programs about real function and functional analysis. The module provides knowledge on: Metric spaces, Normed linear space, Measure theory, Lebesgue integrals and Stieltjes integrals. This is the advanced calculus to build mathematical foundation for students majoring in Mathematical Economics and Mathematical finance and it is also a useful tool for students to access, analyze, study models in economics by means of complex mathematics in the future.

The module content is divided into five chapters. Chapter 1 outlines the real numbers set theory and algebraic sets; Chapter 2 presents the metric space; Chapter 3 introduces knowledge about measure theory; Chapter 4 presents the basic knowledge on Lebesgue integrals and Stieltjes integrals and last chapter presents the normed linear space.

5. LEARNING OUTCOMES

On successful completion of this course students will be able to:

- * To gain confidence with mathematics
- * To develop analytical skills
- * To develop organizational skills
- * To develop both independent learning and group work skills
- * To develop verbal and non-verbal communication skills
- * To successfully use mathematics in economics and business applications

6. COURSE OBJECTIVES

TOPICS TO BE COVERED

- Sets theory
- Metric spaces
- Measure theory
- Lebesgue integrals and Stieljes integrals
- Normed linear spaces

7. COURSE CONTENT AND LECTURE PLAN

TENTATIVE SCHEDULE

<i>No</i>	<i>Contents</i>	<i>Total hours</i>	<i>In details</i>	
			<i>Theory</i>	<i>Practice, Discussion, Exams</i>
1	Chapter 1. Set Theory	9	6	3
2	Chapter 2. Metric Spaces	9	6	3
3	Chapter 3. Measure Theory	9	6	3
4	Chapter 4. Lebesgue and Stieljes Integrals	12	8	4
5	Chapter 5. Normed Linear Spaces	6	4	2
	Total	45	30	15

Weeks 1-3: CHAPTER 1: SET THEORY

1.1. Sets

1.1.1. Notions

1.1.2. Operations of sets

1.2. Real numbers

1.2.1. Axioms of real numbers

1.2.2. Basic properties of real numbers

1.3. Algebras and σ - Algebras

1.3.1. Notions and example of Algebra

1.3.2. Notions and example of σ –Algebra

References of chapter 1: Chapters A-B [1], Chapter 1 [2], Chapter 1 [3], Chapter 1 [4], Chapter 1 [5], Chapter 1 [11]

Weeks 4-6: CHAPTER 2: METRIC SPACES

2.1. Notions

2.1.1. Definitions of metric space and examples

2.1.2. Convergent sequences

2.2. Open and closed sets

2.2.1. Open set

2.2.2. Closed set

2.2.3. Separable metric space

2.3. Completeness and compactness

2.3.1. Completeness

2.3.2. Compactness

2.4. Continuity

2.2.1. Definitions and examples of continuous functions

2.2.2. Continuous functions on compact sets

References of chapter 2: Chapter C [1], Chapters 1, 2 [2], Chapters 2, 3 [3], Chapter 5 [4], Chapter 2 [5], Chapter 1 [11], Chapter 1 [6]

Weeks 7-9: CHAPTER 3: MEASURE THEORY

3.1. Measure

3.1.1. Notions

3.1.2. Properties of measure

3.2. Extension Theorem

3.2.1. Outer-measure

3.2.2. Extension Theorem

3.3. Lebesgue measure on \mathbb{R}^k

3.3.1. Lebesgue measure on \mathbb{R}

3.3.2. Lebesgue measure on \mathbb{R}^k

3.3.1. Lebesgue-Stieltjes measure

3.4. Measurable functions

3.4.1. Notions

3.4.2. Structure of measurable functions

3.4.3. Equivalent functions and convergence on measure

References of chapter 3: Chapter 7 [3], Chapter 3 [4], Chapter 3 [5], Chapter B [10], Chapter 12 [6].

Weeks 10-13: CHAPTER 4: LEBESGUE AND STIELTJES INTEGRALS

4.1. Lebesgue Integrals of nonnegative and simple functions

4.1.1. Notions

4.1.1. Properties

4.2. Lebesgue Integrals of measurable functions

4.2.1. Lebesgue Integrals of nonnegative and measurable functions

4.2.2. Lebesgue Integrals of measurable functions

4.2.3. Properties of Lebesgue Integrals

4.2.4. Limit theorems

4.3. Lebesgue Integrals on \mathbb{R}

4.4. Stieltjes Integral

4.3.1. Notions

4.3.2. Relations between Lebesgue, Stieltjes and Riemann Integrals

Midterm Exam

References of chapter 4: Chapter 5 [2], Chapter 8 [3], Chapter 4 [4], Chapter 4 [5], Chapters C-D [10], Chapters 3, 4, 5, 6 [11], Chapter 2 [7].

Weeks 14-15: CHAPTER 5: NORMED LINEAR SPACES

5.1. Normed linear spaces

5.1.1. Vector spaces

5.1.2. Normed Linear Spaces

5.1.3. Examples of Normed Linear Spaces

5.2. Spaces of integrable p^{th} powers of functions

5.2.1. Holder and Minkowski's inequalities

5.2.2. L^p Spaces

5.3. Linear operators

5.3.1. Notions and examples

5.3.2. Continuous linear operators

5.3.3. Space of operators, $L(X, Y)$ and linear functional

References of chapter 5: Chapter 5 [2], Chapter 4 [3], Chapter 5 [4], Chapter 5 [5], Chapters 5-6 [6], Chapter 1 [7].

Final Examination

8. REQUIRED TEXTBOOK & COURSE MATERIALS

[1] Required: EFA A.OK (2005), *Real analysis with economic applications*, New York University.

9. RECOMMENDED TEXTS & OTHER READINGS

[2] PHẠM KỲ ANH, TRẦN ĐỨC LONG (2001), *Textbook Real function and functional Analysis*, HaNoi National University Publisher.

[3] A. N. CÔNMÔGÔRÔP, X. V. FÔMIN (1971), *Cơ sở lý thuyết hàm và giải tích hàm*, tập 1, 2, NXB Giáo dục.

[4] HOÀNG TUY (2003), *Real function and functional Analysis*, HaNoi National University Publisher.

[5] DUDLEY R. M. (2002), *Real Analysis and Probability*, Cambridge University press.

[6] JOHN K. HUNTER, BRUNO NACHTERGAELE, *Applied analysis*, World Scientific.

[7] HERMANN FLASCHKA, *Principles of Analysis*, University of Arizona.

[8] EFA A.OK (2005), *Probability with economic applications*, New York University.

[9] RICHARD F. BASS, *Real analysis*, University of Connecticut.

[10] MAREK CAPINSKI - EKKEHARD KOPP, *Measure Integral and Probability*, Springer-Verlag.

[11] CARTER M., VAN-BRUNT B. (2000), *The Lebesgue-Stieltjes integral-a practical introduction*, Springer.

10. ASSESSMENT & GRADING POLICY

Your course score will be determined as the following weighted average:

Item	Weight
Attendance	10%
Midterm	20%
Final Exam	70%
Total	100%

Grading Criteria: %		Letter Grade
96%-100%	A+	4,0
91%-95%	A	4,0
85%-90%	A-	3,7
81% - 84%	B+	3,3
7,6%-80%	B	3,0
71%-75%	B-	2,7
66%-70%	C+	2,3
61%-65%	C	2,0
55%-60%	C-	1,7
51%-54%	D+	1,3
46%-50%	D	1,0
40%-45%	D-	0,7
<39%	F/WU/IC	0,0

* Attendance policy:

Attendance is required. You are responsible for everything that happens in the class. If you miss a class, ask your friends about materials covered in the class. The parts of the course are very well related to each other. It is a requirement that a student need to attend at least 80% time of course to have the right to take the final exam.

Hanoi, 2016

HEAD OF DEPARTMENT

(signed)

PhD. Tong Thanh Trung

PRESIDENT

(signed)

Prof.Dr. Tran Tho Dat