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## **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: OPTIMIZATION 1**

Code: TOKT1112

Number of Credit: 03

#### **2. DEPARTMENT IN CHARGE OF INSTRUCTION:**

**Office:** \*Location

**Office Hours:** \*Times & Days

**Office Telephone:** \*Phone Number

#### **3. PRE-REQUISITE:**

Calculus 3, Probability Theory

#### **4. COURSE DESCRIPTION:**

This course involves the following topics: Optimization and basic structures of optimization problems; Classes of optimization problems in economics; Fundamental of Convex Analysis; Basic concepts and theorems of solution methods for classes of linear optimization problems (with or without parameters); Solution methods and analysis of linear programming problems.

#### **5. COURSE OBJECTIVES:**

This course provides knowledge in optimization, basic theory of convex functions, convex sets; providing background for Optimization 1 and Optimization 2 courses. It also introduces methods to approach and solve classes of models of linear optimization problems. Using specialized softwares for classes of linear optimization problems with well-known solution methods.

## 6. COURSE CONTENTS:

### TENTATIVE SCHEDULE

<i>No</i>	<i>Contents</i>	<i>Total hours</i>	<i>In details</i>		<i>Notes</i>
			<i>Theory</i>	<i>Practice, Discussion, Exams</i>	
1	Chapter 1	5	4	1	
2	Chapter 2	15	10	5	
3	Chapter 3	10	6	4	
4	Chapter 4	15	10	5	
	<b>Total</b>	<b>45</b>	<b>30</b>	<b>15</b>	

### CHAPTER 1– INTRODUCTION ABOUT MATHEMATICAL PROGRAMMING

This chapter presents basic concepts used in mathematical programming, situations in economics which lead to programming problems; and classification of mathematical programming problems.

- 1.1. Situations in economics leading to mathematical programming problems
- 1.2. Classification of problems
- 1.3. Basic concepts

#### References:

- 1- Ngo Van My, 2011, *Lecture notes in Optimization for Mathematical Economics and Financial Mathematics*, Chapter 1.
- 2 - Vu Thieu, 1999, *Nonlinear Programming and Dynamic Programming*.
- 3 - Tran Tuc, 1990, *Linear programming*.
- 4 - Nguyen Thi Bach Kim, 2008, *Optimization Methods, Theory and Algorithms*, Encyclopedia,, Hanoi, Chapter 2.
- 5 - Chiang Alpha.C, 2006, *Fundamental Methods of Mathematical Economics*, 4th edition, McGraw-Hill.

### CHAPTER 2– PRELIMINARIES

This chapter aims to recall basic background in multivariable functions and set theory in the space  $\mathbb{R}^n$ . It includes two main parts: Sets and convex sets; Functions, convex (concave) functions, quasi-convex (quasi-concave) functions.

These two parts are not only important in optimization theory but also are widely used in studying economics. This chapter focuses only on the very important results and neglect complicated ones. It will provide illustrations in  $\mathbb{R}^2$  for results in each case.

2.1. Sets

2.2. Convex sets and related theorems

2.3. Directions and directional derivatives

2.4. Convex functions, quasi-convex functions and related theorems

2.5. Conditions for convex and quasi-convex

References:

1- Ngo Van My, 2011, *Lecture notes in Optimization for Mathematical Economics and Financial Mathematics*, Chapter 1.

2 - Vu Thieu, 1999, *Nonlinear Programming and Dynamic Programming*.

3 - Tran Tuc, 1990, *Linear programming*.

4 - Nguyen Thi Bach Kim, 2008, *Optimization Methods, Theory and Algorithms*, Encyclopedia, Hanoi, Chapter 2.

5 - T.V. Thieu, B.T. Tam, 1998, *Optimization Methods*, Transport Publishing House, Chapter 1.

6 - Chiang Alpha. C, 2006, *Fundamental Methods of Mathematical Economics*, 4<sup>th</sup> edition, McGraw-Hill, Chapter 2, 11.

## **CHAPTER 3– LINEAR PROGRAMMING PROBLEMS**

This chapter presents concepts and algorithm of simplex method for solving linear programming problems.

3.1. Classes of problems – basic concepts

3.2. Extreme directions

3.3. Properties of linear programming problems

3.4. The fundamental of simplex methods

3.5. Algorithm

3.6. Two-phase simplex methods – an extension of simplex method

References:

1- Ngo Van My, 2011, *Lecture note in Optimization for Mathematical Economics and Financial Mathematics*, Chapter 3

2 - Tran Tuc, 1990, *Linear Programming*.

- 3 - Tran Tuc, 2000, *Linear Programming Exercises*, Science and Technics Publishing House.
- 4 - Nguyen Thi Bach Kim, 2008, *Optimization Methods, Theory and Algorithms*, Encyclopedia, Hanoi, Chapter 3 .
- 5 - T.V. Thieu, B.T. Tam, 1998, *Optimization Methods*, Transport Publishing House, Chapter 2
- 6 - Chiang Alpha. C, 2006, *Fundamental Methods of Mathematical Economics*, 4th edition, McGraw-Hill, Chapter 19.

## **CHAPTER 4– DUAL PROBLEMS**

This chapter considers a different approach to linear programming: dual problems. The nature of this approach is that for each linear programming problem, a second problem which is also a linear programming problem is set up. The original problem is called primal problem, while the new one is called the dual problem of the first problem. The dual theory studies the two problems together with their relationships. Results from the dual theory have a huge impact on mathematical and practical points of views of linear programming.

- 4.1. Definitions, formulation of dual problems
- 4.2. Properties, theorems and corollaries
- 4.3. Dual simplex method
- 4.4. Exercises

### References:

- 1- Ngo Van My, 2011, *Lecture note in Optimization for Mathematical Economics and Financial Mathematics*, Chapter 3
- 2 - Tran Tuc, 1990, *Linear Programming*.
- 3 - Tran Tuc, 2000, *Linear Programming Exercises*, Science and Technics Publishing House.
- 4 - Nguyen Thi Bach Kim, 2008, *Optimization Methods, Theory and Algorithms*, Encyclopedia, Hanoi, Chapter 3 .
- 5 - T.V. Thieu and B.T. Tam, 1998, *Optimization Methods*, Transport Publishing House, Chapter 2
- 6 - Chiang Alpha. C, 2006, *Fundamental Methods of Mathematical Economics*, 4th edition, McGraw-Hill, Chapter 20.

## 7. REQUIRED TEXTBOOKS & COURSE MATERIALS

Ngô Văn Mỹ, 2011, *Lecture notes in Optimization for Mathematical Economics and Financial Mathematics*, NEU.

## 8. RECOMMENDED TEXTS & OTHER READINGS

- 1 - Vu Thieu, 1999, *Nonlinear Programming and Dynamic Programming*.
- 2 - Tran Tuc, 1990, *Linear Programming*.
- 3 - Tran Tuc, 2000, *Linear Programming Exercises*, Science and Technics Publishing House.
- 4 - Hoang Tuy, 1978, *Convex Analysis*, Vietnam Education Publishing House.
- 5 - Nguyen Thi Bach Kim, 2008, *Optimization Methods, Theory and Algorithms*, Encyclopedia, Hanoi, Chapter 3.
- 6 - T.V. Thieu, B.T. Tam, 1998, *Optimization Methods*, Transport Publishing House.
- 7 - Chiang Alpha. C, 2006, *Fundamental Methods of Mathematical Economics*, 4th edition, McGraw-Hill.

## 9. ASSESSMENT & GRADING POLICY:

- Grading scale: 10 scale
- Grading measure:
  - + Teachers' qualification: 10%
  - + Test: 20%
  - + Final exam: 70%
- Conditions of attending the final exam
  - + Attending at least 80% of the course
  - + Having taken the test

Hanoi, 2016

**HEAD OF DEPARTMENT**

**PRESIDENT**

(signed)

(signed)

**PhD. Nguyen Manh The**

**Prof.Dr. Tran Tho Dat**