MS3601: OPTIMIZATION METHODS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Optimization Methods

Subject Code
MS - Management Sciences
Course Number
3601

Academic Unit
Management Sciences (MS)

College/School
College of Business (CB)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA 2001 Multi-variable Calculus and Linear Algebra Or subject to instructor’ s approval

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aims to introduce students to the theory, algorithms, and applications of optimization. The optimization methodologies include linear programming, nonlinear optimization, integer programming, robust optimization, and

dynamic programming. Topics include the simplex method, duality, integer programming formulation, convex analysis, optimality conditions for nonlinear optimization, and optimal control methods. Applications to finance will be emphasized.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain clearly basic concepts of linear, integer, non-linear, and dynamic programming.		x		
2	Solve problems of linear, integer, non-linear and dynamic programming with appropriate methods in optimization.		x	x	
3	Formulate real-world problems by appropriate optimization models.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Learning through teaching primarily based on lectures.	1, 2, 3	3
2	Assignments	Learning through take-home assignments helps students understand techniques of basic methods in optimization as well as their applications in solving real-world problems.	1, 2, 3	2

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3	20	
2	Mid-term test	1, 2, 3	10	
3	End-of-term test	1, 2, 3	10	

Continuous Assessment (%)
40

Examination (%)
60

Examination Duration (Hours)
2

Assessment Rubrics (AR)

Assessment Task
Assignments

Criterion
To demonstrate techniques of applying optimization methods in a diversity of problems.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Mid-term test

Criterion
How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student’ s versatility in basic methods of mathematical programming.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
End-of-term test

Criterion
How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student’ s versatility in basic methods of mathematical programming.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Exam

Criterion
How far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student’ s versatility in basic methods of mathematical programming.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Examples of Optimization Problems. Simplex Method for Linear Programming Problems. Duality Theory of Linear Optimization. Integer Programming formulation. Convexity, optimal conditions, quadratic programming with applications in finance. Robust portfolio optimization. Dynamic programming and optimal control with applications in trading strategies.

Reading List

Compulsory Readings

	Title
1	Dimitri Bertsimas and John Tsitsiklis. Introduction to linear programming. Athena Scientific.1997
2	Dimitri Bertsekas, Angelia Nedi# and Asuman Ozdaglar. Convex analysis and Optimization. Athena Scientific. 2003.

Additional Readings

	Title
1	Dimitri Bertsekas. Dynamic programming and optimal control. Athena Scientific. 2007
2	Frank J. Fabozzi. Robust portfolio optimization and management. Wiley. 2007