

# MS3128: MANAGERIAL DECISION ANALYTICS

## New Syllabus Proposal

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### Effective Term

Semester A 2023/24

## Part I Course Overview

### Course Title

Managerial Decision Analytics

### Subject Code

MS - Management Sciences

### Course Number

3128

### 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

CB2200 Business Statistics and CB2203 Data-driven Business Modeling

### Precursors

CB2240 Introduction to Business Programming in Python

### Equivalent Courses

Nil

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to train students' skills in modelling and optimization that are essential in turning real-world business decision-making problems into mathematical models and developing solution methods using computer packages such as Python and Gurobi. It serves as a foundation course for business analytics, and covers commonly used optimization methods in business applications, including linear programming and nonlinear optimization. It also introduces application of the optimization methods to a wide range of problems, including statistical estimation, machine learning, and business decision making under uncertainty.

### Course Intended Learning Outcomes (CILOs)

CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand quantitative concepts that are important for practicing managers	x		x
2	Define decision problems, formulate and model the problems using quantitative skills studied; apply appropriate methodologies to find solutions and interpret the solutions found		x	x
3	Handle computer software packages to solve the models built		x	x
4	Critically discuss information sources related to quantitative methods	x	x	x
5	Prepare reports integrating textual and numerical material and make effective oral communication; undertake a set of tasks associated with improving their career prospects	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 self-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	Concepts and general knowledge of quantitative decision methods are explained. The relevant techniques are developed and applied in the context of real business situations. Examples are used to emphasize the crucial skills of describing and defining the problem before conducting any analysis. Whenever available, computer software packages are introduced as a tool for solving the model, so that students can actually bring what they learnt to their place of work.	1, 2, 3, 4, 5
2	Class Discussion	Discussions on major issues related to decision models.	1, 2, 3, 4
3	Assignment	Assignments are used to provide training in techniques and coding. A case assignment is used to provide training in analysing complex problem situations and solving business problems, for which students are required to work in groups. They are expected to apply methodologies learned or design their solution to solve problems. Findings are presented in a report or through presentation.	1, 2, 3, 4, 5

**Assessment Tasks / Activities (ATs)**

	ATs	CILO No.	Weighting (%)	Remarks
1	Assignments – Assignments will enhance students' ability to apply optimization tools, particularly with respect to analysing and solving business problems. Dependent on the nature of the assignments, students will be asked to complete assignments individually or in small groups. In addition, a case assignment will require students to present their findings verbally or via a written report.	1, 2, 3, 4	40	

**Continuous Assessment (%)**

40

**Examination (%)**

60

**Examination Duration (Hours)**

2

**Additional Information for ATs**

Examination - The examination will assess the students' ability to select and apply the optimization concepts and methods to solve business problems, and to interpret the implications of optimization concepts in real-world decision making.

**Assessment Rubrics (AR)****Assessment Task**

Assignment

**Criterion**

Core concepts and ideas; use of appropriate quantitative methods

**Excellent (A+, A, A-)**

Strong evidence of understanding the key concepts and definitions of the learned subject; strong evidence of original thinking; capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

**Good (B+, B, B-)**

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; some evidence of original thinking; reasonable understanding of issues; evidence of familiarity with literature.

**Fair (C+, C, C-)**

Student who is profiting from the university experience; understanding of the subject; ability to show some evidence of familiarity with literature.

**Marginal (D)**

Sufficient familiarity with the subject matter to enable the student to progress further.

**Failure (F)**

Little evidence of familiarity with the subject matter; limited or irrelevant use of literature.

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**Assessment Task**

Examination

**Criterion**

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**Good (B+, B, B-)**

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature.

**Fair (C+, C, C-)**

Student who is profiting from the university experience; understanding of the subject; ability to show some evidence of familiarity with literature.

**Marginal (D)**

Sufficient familiarity with the subject matter to enable the student to progress without repeating the course.

**Failure (F)**

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of literature.

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**Part III Other Information****Keyword Syllabus****Introduction**

Introduction to optimization models and methods, and its application in business decision making. Review of elementary calculus, matrices, and probability. Data modeling and decision making under uncertainty.

**Optimization Software and Tools**

Optimization in Python and Gurobi. Use of Numpy and Pandas.

**Linear and Integer Programming**

Modeling techniques, applications, theory, and solution methods. Challenges of integer programming and strategies.

**Convex Optimization and Nonlinear Optimization.**

Convexity and properties. Duality. Methods for convex optimization and challenges of nonlinear optimization.

**Data-driven Applications**

Optimization in statistics: regression, and maximum likelihood estimation.

Decision making under uncertainty: Sample average approximation, and minimax. Statistical/machine learning: supervised learning.

**Reading List****Compulsory Readings**

Title	
1	Nil

**Additional Readings**

	Title
1	Griva, I., Nash, S. G., and Sofer, A. Linear and Nonlinear Optimization. SIAM. 2009.
2	Lee, Wei-Meng. Python® Machine Learning. Wiley. 2019.
3	Gurobi Optimization. Gurobi Optimizer Quick Start Guide. Gurobi Optimization, LLC. 2021.
4	Gurobi Optimization. Gurobi Optimizer Reference Manual. Gurobi Optimization, LLC. 2021.