MS5216: DECISION ANALYTICS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Decision Analytics

Subject Code
MS - Decision Analytics and Operations
Course Number
5216

Academic Unit
Decision Analytics and Operations (DAOS)

College/School
College of Business (CB)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course provides a comprehensive introduction to decision analytics, focusing on optimization models and methods critical for business decision-making. Utilizing the textbook "Spreadsheet Modeling & Decision Analysis: A Practical

Introduction to Business Analytics," students will explore the foundational principles and practical applications of optimization. Key topics include the formulation and solution of optimization problems using Excel spreadsheets, with an emphasis on linear and integer programming. The course also covers advanced techniques in convex and nonlinear optimization, ensuring a robust understanding of various optimization scenarios. Furthermore, students will engage with data-driven applications, learning to harness data for improved decision-making processes. Through a combination of theoretical instruction and hands-on exercises, this course equips students with the analytical skills necessary to address complex business challenges and make informed decisions grounded in quantitative analysis.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand and apply key quantitative concepts essential for effective management.			x	
2	Formulate and build models for decision problems by using quantitative skills. Apply appropriate methodologies to find solutions and interpret the results.			x	x
3	Utilize computer software packages to effectively solve the models developed in the course.			x	x
4	Evaluate and discuss academic literature and other information sources related to quantitative methods.		x	x	
5	Prepare and present comprehensive reports that integrate textual and numerical material and communicate findings effectively using both traditional and electronic media.			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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture and Discussion Engagement	Students will attend lectures to comprehend key quantitative concepts essential for effective management and participate in discussions to apply these concepts to real-life decision-making scenarios.	1, 2	

2	Case Study Analysis	Students will analyze and discuss case studies to formulate and model decision problems using quantitative skills, apply appropriate methodologies to find solutions, and interpret the results.	2, 4	
3	Group Project	Students will collaborate in group projects to utilize computer software packages for solving quantitative models, prepare comprehensive reports integrating textual and numerical material, and communicate findings effectively using both traditional and electronic media.	3, 5	
4	Practical Exercises and Workshops	Students will participate in hands-on exercises and workshops to apply appropriate quantitative methodologies to various decision problems, interpret the results, and develop a critical understanding of quantitative methods through practical application.	2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment/Test	1, 2, 4	40	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Assessment Rubrics (AR)

Assessment Task

Assignment/Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

The accuracy and depth in problem formulations and application of methodologies, reflecting a thorough understanding of quantitative concepts and their practical implementations.

Excellent

(A+, A, A-) Strong evidence of understanding the key concepts and definitions of the learned subject; 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; 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 (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

The comprehensiveness and accuracy in demonstrating understanding and application of course concepts, showcasing the ability to integrate and critically evaluate information across various topics.

Excellent

(A+, A, A-) Strong evidence of original thinking; good organization, 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; 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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Assessment Task

Assignment/Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The accuracy and depth in problem formulations and application of methodologies, reflecting a thorough understanding of quantitative concepts and their practical implementations.

Excellent

(A+, A, A-) Strong evidence of understanding the key concepts and definitions of the learned subject; capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base

Good

(B+, B) Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature

Marginal

(B-, C+, C) Ability to show some evidence of familiarity with literature 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 (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The comprehensiveness and accuracy in demonstrating understanding and application of course concepts, showcasing the ability to integrate and critically evaluate information across various topics.

Excellent

(A+, A, A-) Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base

Good

(B+, B) Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature

Marginal

(B-, C+, C) 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

1. Introduction
Introduction to optimization models and methods, and its application in business decision making. Review of elementary calculus and probability. Random variables, data modeling, and decision making under uncertainty.

2. Optimization Software and Tools
Optimization in Excel spreadsheet and Python.

3. Linear and Integer Programing
Modeling techniques, applications, theory and solution methods, LP relaxation for integer programing.

4. Convex Optimization and Nonlinear Optimization.
Convexity and properties. Duality. Methods for convex optimization. Methods for nonlinear optimization.

5. Data-driven Applications
Optimization in statistics: linear regression, maximum likelihood estimation, and methods of moments. Optimization in statistical/machine learning: supervised learning, gradient descent methods. Applications in finance: portfolio optimization.

Reading List

Compulsory Readings

	Title
1	Ragsdale, C. T. Spreadsheet Modeling & Decision Analysis: A Practical Introduction to Business Analytics, Cengage Learning. 2015.
2	Griva I., Nash, S. G., and Sofer A. Linear and Nonlinear Optimization. SIAM. 2009.

Additional Readings

	Title
1	Bradley, S. P., Hax A. C., and Magnanti T. L. Applied Mathematical Programming, Addison-Wesley, 1977.