

SEEM4103: DECISION ANALYSIS AND RISK MANAGEMENT

Effective Term

Summer Term 2023

Part I Course Overview

Course Title

Decision Analysis and Risk Management

Subject Code

SEEM - Systems Engineering and Engineering Management

Course Number

4103

Academic Unit

Systems Engineering (SYE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

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

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

MA2172 Applied Statistics for Sciences and Engineering or MA2177 Engineering Mathematics and Statistics

Precursors

Nil

Equivalent Courses

ADSE4103 Decision Analysis and Risk Management

Exclusive Courses

Nil

Part II Course Details

Abstract

Decision making, uncertainty and risk are inherent to almost all man-made systems. Good decisions lead to success and bad decisions lead to failure. This course aims to present principles and tools for making good decisions. This includes a principled approach to formulating and solving a decision problem, by accounting for uncertainties in the system or environment and incorporating risk attitudes.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the principles of decision making under risk and uncertainty.	20		x	
2	Formulate real decision making problems with risk and uncertainty as mathematical models.	30			
3	Apply appropriate tools and methodologies for solving decision and risk analysis problems.	30		x	
4	Demonstrate reflective practice in an engineering context.	20	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	Large Class Activities	Delivery of the course will be achieved through a series of formal lectures supported by practical case studies. A series of lectures will introduce basic elements of decision analysis and risk management to help students to appreciate how to address important decisions and manage risk in a formal and scientific manner.	1, 2, 3, 4	26 hours/semester

2	Laboratory Activities	Laboratory activities will mainly teach the students the use of software tools for decision analysis and risk management.	1, 2, 3, 4	14 hours/semester
3	Mini- Project	Students will be asked to solve a real decision problem. This learning activity will be mainly student-led but with some structural guidance from the teacher. At the end of the learning activity, a presentation session will be organized for all the students to present their solutions for the given problem.	1, 2, 3, 4	10 hours/semester
4	Consultation Hours	Consultation hours will be used to facilitate discussion of various issues related to the lecture materials	1, 2, 3, 4	1 hour/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Homework	1, 2, 3, 4	15	
2	Mini-Projects	1, 2, 3, 4	25	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Assessment Rubrics (AR)**Assessment Task**

Homework

Criterion

Homework is assigned each week and is graded by the course leader.

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

Mini-Projects

Criterion

Project is completed in groups and is graded by the course leader.

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

Examination

Criterion

2-hour examination

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

Modeling decisions: elements of decision problems, structuring decisions, decision trees, decisions under certainty

Modeling uncertainty: probability basics, expected value, Bayes rule, subjective probability, use of data

Modeling preferences/risk: risk attitudes, utility

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Clemen, Robert T. and Reilly, Terence (2004) Making Hard Decisions with Decision Tools, Duxbury Press. ISBN 978-0-495-01508-6.
2	Marshall, Kneale T. and Oliver, Robert M. (1995) Decision Making and Forecasting: with Emphasis on Model Building and Policy Analysis, McGraw-Hill, ISBN 978-0-070-48027-8.
3	Smith, J.Q. (1988) Decision Analysis: A Bayesian Approach, Chapman and Hall, ISBN 978-0-412-27520-3.
4	Skinner, David (2009) Introduction to Decision Analysis, 3rd ed., Probabilistic Publishing. ISBN 978-0-964-79386-6.
5	Edwards, Ward , Miles, Ralph F., von Winterfeldt, Detlof (2007) Advances in Decision Analysis: From Foundations to Applications. Cambridge University Press, ISBN 978-0-521-68230-5.
6	Powell, Stephen G. and Baker, Kenneth R. (2010) Management Science: The Art of Modeling with Spreadsheets, 3rd ed., John Wiley & Sons, 978-0-470-53067-2.