SYE4103: DECISION ANALYSIS AND RISK MANAGEMENT

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Decision Analysis and Risk Management

Subject Code
SYE - Systems Engineering
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
SYE2100 Engineering Statistics and Experimentation / ADSE2100 Engineering Statistics and Experimentation

Precursors
Nil

Equivalent Courses
SEEM4103 Decision Analysis and Risk Management or
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. In this course, the students will learn the principles and tools for making good decisions. They include principled approaches to formulating and solving decision problems, 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.

Learning and Teaching Activities (LTAs)

	LTAs	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	39 hours/semester

2	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

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

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

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

Additional Information for AR
The grading is assigned based on students' performance in assessment tasks/activities.

The 2-hour examination (60%), homework (15%) and mini-project (25%) will be marked numerically and grades will be awarded accordingly.

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.