

# SYE6104: THEORETICAL UNDERPINNINGS OF DECISION MAKING UNDER UNCERTAINTY

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## Effective Term

Semester A 2025/26

## Part I Course Overview

### Course Title

Theoretical Underpinnings of Decision Making Under Uncertainty

### Subject Code

SYE - Systems Engineering

### Course Number

6104

### Academic Unit

Systems Engineering (SYE)

### College/School

College of Engineering (EG)

### Course Duration

One Semester

### Credit Units

3

### Level

P5, P6 - Postgraduate Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

University level mathematics or mathematical maturity

### Precursors

One or more courses in probability and statistics is highly desirable and strongly recommended

### Equivalent Courses

SEEM6104 Theoretical Underpinnings of Decision Making Under Uncertainty (offered until 2021/22) / ADSE6104 Theoretical Underpinnings of Decision Making Under Uncertainty (offered until 2023/24)

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to introduce students and other interested professionals in business, engineering, mathematics, social sciences (economists) and statisticians to the foundational & philosophical issues underlying the quantification of uncertainty via probability, its relationship to utility, and to decision making under uncertainty. The course will focus on the theoretical underpinning, and a historical perspective on some of the most commonly used methodologies, like significance tests, odds ratios, hypotheses testing, Bayes' factors, etc.

### Course Intended Learning Outcomes (CILOs)

| CILOs |                                                                                                                   | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|-------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|
| 1     | Describe the use of statistical methods in science, engineering, business, and finance.                           | 25                  | x      |        |        |
| 2     | Explain the theoretical underpinning of probability and statistics in the quantification of uncertainty and risk. | 25                  |        | x      |        |
| 3     | Apply the commonly used probability and statistics techniques in the quantification of uncertainty and risk.      | 30                  |        |        | x      |
| 4     | Develop new methodologies/techniques to evaluate risks and uncertainties in real world problems.                  | 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    | Lecture                | Absolutely mandatory to attend lectures | 1, 2, 3, 4 | 26 hours/sem               |
| 2    | Office Hours/ Tutorial | Required of all participants            | 1, 2, 3, 4 | 13 hours/sem               |
| 3    | Self-Assignment        | Self reading of assigned papers.        | 1, 2, 3, 4 | 69 hours/sem               |

### Assessment Tasks / Activities (ATs)

| ATs |            | CILO No.   | Weighting (%) | Remarks ("- " for nil entry) | Allow Use of GenAI? |
|-----|------------|------------|---------------|------------------------------|---------------------|
| 1   | Assignment | 1, 2, 3, 4 | 25            | -                            | No                  |

**Continuous Assessment (%)**

25

**Examination (%)**

75

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

30

**Minimum Examination Passing Requirement (%)**

30

**Assessment Rubrics (AR)**

**Assessment Task**

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

**Criterion**

25%

**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

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**Assessment Task**

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

**Criterion**

75%

**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

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**Assessment Task**

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

**Criterion**

25%

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Significant

**Marginal**

(B-, C+, C) Moderate/Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

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

**Criterion**

75%

**Excellent**

(A+, A, A-) High

**Good**

(B+, B) Significant

**Marginal**

(B-, C+, C) Moderate/Basic

**Failure**

(F) Not even reaching marginal levels

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## Part III Other Information

**Keyword Syllabus**

Probability, possibility, chance, information, inference, Bayesian statistics, utility.

**Reading List**

**Compulsory Readings**

| Title |     |
|-------|-----|
| 1     | NIL |

**Additional Readings**

| Title |                                    |
|-------|------------------------------------|
| 1     | Making Decision by LINDLEY         |
| 2     | Reliability & Risk by SINGPURWALLA |