

SYE2100: ENGINEERING STATISTICS AND EXPERIMENTATION

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Engineering Statistics and Experimentation

Subject Code

SYE - Systems Engineering

Course Number

2100

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

Nil

Precursors

Nil

Equivalent Courses

ADSE2100 Engineering Statistics and Experimentation

Exclusive Courses

Nil

Part II Course Details

Abstract

The aim of this course is to provide students with an understanding of statistical data analysis methods and design, execution and analysis of experiments for engineering application. The principles and techniques of data analysis and experimentation such as systematic data collection, estimation of models using the collected data, and the interpretation and practical implementation of the results are introduced.

Course Intended Learning Outcomes (CILOs)

| CILOs | | Weighting (if DEC-A1 DEC-A2 DEC-A3 app.) | | | |
|-------|--|--|---|---|---|
| 1 | Elaborate on applications of Engineering Statistics and experimentation | 25 | x | | |
| 2 | Design, execute experiments and analyse and interpret the experimental results | 25 | | | x |
| 3 | Understand the basic theory and principles of Engineering Statistics and experimentation | 25 | x | | |
| 4 | Apply software to solve case study and engineering statistics projects | 25 | | 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 | Lectures | Weekly lectures. Lectures will be supplemented by: - Discussions - Cases - Small group exercises to facilitate conceptual understanding and introduction to applications. | 1, 2, 3, 4 | 3 hr / week |
| 2 | Laboratory | Three labs with Q&A and discussion on Week 6, 9, 12 (tentative). Labs are supplemented by: - Cases - Presentation by students - Small group exercises | 1, 2, 3, 4 | 1 hour / session (3 sessions / semester) |

Assessment Tasks / Activities (ATs)

| | ATs | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|---|---------------|------------|---------------|--|
| 1 | Group project | 1, 2, 3, 4 | 25 | The group project evaluates students' quantitative skills, statistical analysis, and their ability to effectively collaborate with others. |
| 2 | Assignments | 1, 2, 3 | 35 | The individual assignments assess student's understanding. |

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Written exam paper at the end of the course.

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**

Group project

Criterion

The group project evaluates students' proficiency in collaboration, and their capability to collect data, analyze data, apply relevant statistical tools, and draw informed conclusions about an experiment.

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

Assignment

Criterion

The assignments assesses students' understanding of statistical engineering and experimental design principles, as well as their proficiency in analyzing data using mathematical or programming approaches.

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

The examination questions serve to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application, mostly through numerical calculation, of the various statistical design and analysis of experiments methodologies.

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 test, assignments, laboratory work and examination will be numerically-marked and grades-awarded accordingly.

Part III Other Information

Keyword Syllabus

- Discrete/Continuous random variables and their probability distributions
- Linear regression model
- Hypothesis testing
- Bayesian data analysis

- Process variability and its relevance to modern statistical engineering
- Engineering statistics

Reading List

Compulsory Readings

| Title | |
|-------|--------------------------|
| 1 | Lecture notes and slides |

Additional Readings

| Title | |
|-------|---|
| 1 | Wackerly, Dennis, William Mendenhall, and Richard L. Scheaffer, Mathematical statistics with applications, 7th ed., Cengage Learning, 2014. |
| 2 | Montgomery, Douglas C., George C. Runger, and Norma F. Hubele. Engineering statistics, 5th ed., Wiley, 2009. |
| 3 | Box, Hunter and Hunter, Statistics for Experimenters, 2nd edition Wiley. |
| 4 | D.C. Montgomery, Introduction to Statistical Quality Control, 7th ed., Wiley, 2012 |
| 5 | D.C. Montgomery, Design and Analysis of Experiments, 8th ed., Wiley, 2012 |
| 6 | Mason, R.L., Gunst, R.F., and Hess, J.L. (2003). Statistical Design and Analysis of Experiments with Applications to Engineering and Science (2nd Edition). New York: John Wiley & Sons |