EE1004: FOUNDATIONS OF INFORMATION SYSTEMS AND DATA ANALYSIS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Foundations of Information Systems and Data Analysis

Subject Code
EE - Electrical Engineering
Course Number
1004

Academic Unit
Electrical Engineering (EE)

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
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course is designed to introduce the students to concepts, impacts, and basic principles of data and information systems. Applied examples will be introduced, analysed, solved. The laboratories of this course will cover introductory probability problems and statistics of real-life data, geometric transformation, and applications of eigenvalues and eigenvectors to data analysis.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain mathematical concepts on topics of linear algebra, including vectors, matrices, linear equations, etc in engineering applications.		x	x	
2	Describe basic statistical methods in engineering applications.		x	x	
3	Describe engineering data modeling and random variables		x	x	
4	Analyze data using basic statistics and probability theories		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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Lectures on various fundamental knowledge and concepts in information systems	1, 2, 3, 4	3 hrs/wk
2	Tests	To test the students' understanding on lecture materials.	1, 2, 3, 4	
3	Laboratories	Computational labs to reinforce key concepts covered in lectures and tutorials	1, 2, 3, 4	2 hrs/wk (3 weeks)

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min. 2) and short tests	1, 2, 3, 4	30	
2	# Assignments and Lab Assignments (total: 5)	1, 2, 3, 4	20	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark:
To pass the course, students are required to achieve at least 30% in coursework and 30% in the examination.

#may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task

Examination

Criterion

Achievements in CILOs

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

Coursework

Criterion

Achievements in CILOs

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

Introduction to Data and Information Systems
Numerical and non-numerical data; Signals and images; Graphs: nodes, edges, adjacency matrix.

Basic Computational Engineering and Linear Algebra
Introduction to computational engineering and modeling of physical systems; Vectors: inner and outer products; Matrices: matrix multiplications, determinants, inverse of a matrix; System of linear equations; Eigenvector and Eigenvalues; Application to geometric image transformations.

Information System and Data Statistics and Probability
Introduction to modeling of information and engineering systems using basic statistics and probability; Summarizing data sets: measures of center and measures of variation; Sample space and events, basic laws of probability, conditional probability; Application to engineering problems.

Engineering Data Modeling and Random Variables
Introduction to Information and engineering systems data modeling; The ideas of summation and integration; probability mass function, probability density function, common random variables (e.g., binomial, Poisson, Gaussian), expectation and variance; Joint distribution functions, independent random variables, covariance, and correlation; Application to data modeling.

Basic Engineering Statistical Methods
Sampling distributions and basic point estimates, confidence intervals for a population mean; Hypothesis testing: the null and the alternative hypotheses, two types of errors, p values; Application to engineering data analysis.

Reading List

Compulsory Readings

	Title
1	Erwin Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley, 2011

Additional Readings

	Title
1	Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 5th ed., Academic Press, 2014.
2	Stephen Boyd and, Lieven Vandenberghe, Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares, Cambridge University Press, 2018.

3	Ernest Davis, Linear Algebra and Probability for Computer Science Applications, CRC Press, 2012.
4	Steven J. Leon, Linear Algebra with Applications, 9th ed., Pearson, 2014.