EE2302: FOUNDATIONS OF INFORMATION ENGINEERING

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Foundations of Information Engineering

Subject Code
EE - Electrical Engineering
Course Number
2302

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
EE1001 Foundations of Digital Techniques
and
EE1004 Foundations of Information Systems and Data Analysis
and
(MA1201 Calculus and Basic Linear Algebra II or MA1301 Enhanced Calculus and Linear Algebra II)

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The aims of this course are to introduce students to the areas of discrete mathematics that are fundamental in information engineering, and to develop their ability to apply mathematics to solve engineering problems. The course emphasizes fundamental concepts and their applications to cryptography and coding theory.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate a working knowledge of sets, relations, and functions.		x	x	
2	Manipulate numbers and apply the techniques to cryptographic systems.		x	x	
3	Demonstrate an understanding of vector space and apply linear algebra to solve problems.		x	x	
4	Apply techniques of linear algebra to error-correction coding.		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	Key concepts are described and illustrated. Key concepts are worked out based on examples or problems.	1, 2, 3, 4	3

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4	35	
2	#Assignments (min.: 3)	1, 2, 3, 4	15	

Continuous Assessment (%)

50

Examination (%)
50

Examination Duration (Hours)
2

Additional Information for ATs
Remark:
To pass the course, student are required to achieve at least 30% in the coursework and 30% of the examination.

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

Assessment Rubrics (AR)

Assessment Task
Examination

Criterion
Achievements in CILOs covered by the course

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
Tests

Criterion
Achievements in CILOs up to the tests

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
Assignments

Criterion
Ability to demonstrate their grasp of course concepts

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

Set Theory and Infinity
Basic properties of sets, Russell's paradox, infinite sets; Definition of functions, injection, surjection, bijection, inverse functions, composition of functions, countable and uncountable sets, infinite cardinalities; Relations on sets, equivalence relations, partial orders.

Number Theory and Cryptography
Prime numbers, divisibility, unique factorization, greatest common divisor, Euclidean algorithm, modular arithmetic, Chinese Remainder Theorem, applications to cryptography, RSA cryptosystem, use of mathematics software systems (e.g. SageMath).

Linear Algebra and Error-Correction Coding
Vectors, norm, inner product, Cauchy-Schwarz inequality, matrix multiplication, linear mapping, line fitting, vector space, span, basis, dimension, matrix rank; Linear block codes, Hamming codes, generator matrices, parity-check matrices, syndrome decoding.

Selected Topics (optional)
More advanced topics from discrete mathematics and linear algebra.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	S. S. Epp, Discrete Mathematics with Applications, 5th edition, Brooks Cole, 2019.
2	K. Rosen, Discrete Mathematics and its Applications, 8th edition, McGraw Hill, 2018.
3	G. Strang, Linear Algebra for Everyone, Wellesley-Cambridge Press, 2020.