

EE1001: FOUNDATIONS OF DIGITAL TECHNIQUES

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Foundations of Digital Techniques

Subject Code

EE - Electrical Engineering

Course Number

1001

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 aimed at providing students with an understanding of the basic mathematical and fundamental concepts required for Foundations of Digital Techniques.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain abstract mathematical concepts (e.g., logic, sets, and functions) fundamental to digital technologies.		x	x	
2	Apply inference rules and/or methods of proof to determine and demonstrate the truth or falsity of propositions.		x	x	
3	Describe how numbers are represented in binary form and demonstrate how digital systems perform arithmetic operations.		x	x	
4	Apply combinatorial methods to solve counting problems.		x	x	
5	Implement simple combinatorial logic circuits.		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.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will engage in formal lectures to gain fundamental knowledge of digital techniques.	1, 2, 3, 4	13 weeks of 3 hrs Lecture
2	Laboratory	Students will engage in lab activities to implement simple combinatorial logic circuits.	5	3 weeks of 2 hrs Lab

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4	30	
2	#Assignments (min.: 3)	1, 2, 3, 4	10	
3	Lab Exercises/Reports	5	10	

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 the coursework and 30% in the examination. Also, 65% laboratory attendance rate must be obtained.

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

Assessment Rubrics (AR)

Assessment Task

Examination

Criterion

Achievements in CILOs 1-4 (including the ability to apply discrete mathematics to solve problems)

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 1-4 covered up to the tests (including the ability to apply discrete mathematics to solve problems)

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Below marginal

Assessment Task

Assignments

Criterion

Achievements in CILOs 1-4 covered up to the assignments (including the ability to apply discrete mathematics to solve problems)

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Below marginal

Assessment Task

Lab Exercises / Reports

Criterion

Achievements in CILO 5 (i.e., the ability to implement simple combinatorial logic circuits)

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Below marginal

Part III Other Information

Keyword Syllabus

Numbers

Number Systems: Integers, rational numbers, real numbers; Number representation methods: signed and unsigned binary numbers, hexadecimal, binary coded decimal, fixed-point numbers, floating-point numbers; binary arithmetic, floating-point arithmetic.

Sets

Sets, subsets, cardinality, set operations: union, intersection, complement; Venn diagrams, Cartesian product, power sets.

Logic

Logic connectives, truth tables, conditionals, necessary and sufficient conditions, validity and soundness of arguments, rules of inference, universal and existential quantifiers, nested quantification, De Morgan's Laws, logic gates, simple logic circuits.

Functions

Definition of functions, injection, surjection, bijection, inverse functions, composition of functions; polynomial and rational functions, exponential and logarithmic functions, graphs of functions, growth of functions, big-O notation.

Methods of Proof

Direct proof methods, counter-examples, indirect proof methods: contradiction and contraposition, mathematical induction.

Sequences and Series

Explicit formula for sequences, summation and product notation, arithmetic series, geometric series, recursive definition of sequences, solving simple recurrence relations.

Counting

Combination, permutation, the Binomial Theorem, the inclusion-exclusion principle, the pigeon-hole principle.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Brooks Cole, ISBN 978-1111775780, 2011.
2	Rowan Garnier and John Taylor, Discrete Mathematics for New Technology, 2nd ed., Taylor & Francis, 2001.
3	Alan B. Marcovitz: Introduction to Logic Design, Third Edition, ISBN 978-0-07-016490-1 (McGraw-Hill Higher Education 2010).
4	Tom Jenkys and Ben Stephenson, Fundamentals of Discrete Math for Computer Science: A Problem-Solving Primer, 2nd ed., Springer, 2018.