EE1001: FOUNDATIONS OF DIGITAL TECHNIQUES

Effective Term
Semester A 2023/24

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	Apply symbolic logic to determine the validity of arguments.		x	x	
2	Apply methods of proof to determine and demonstrate the truth or falsity of mathematical statements.		x	x	
3	Analyze the structures of sequences and series.		x	x	
4	Explain the basic concepts of sets and functions.		x	x	
5	Manipulate numbers in binary form for digital systems.		x	x	
6	Use combinatorial methods to solve counting problems.		x	x	
7	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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Large group in-class activity involving the entire class. Discussion and demonstration activities.	1, 2, 3, 4, 5, 6	13 weeks of 3 hrs Lecture
2	Laboratory	Apply and practise the skills for circuit implementation	7	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, 5, 6	30	
2	#Assignments (min.: 3)	1, 2, 3, 4, 5, 6	10	
3	Lab Exercises/Reports	7	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 1-6 (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 1-6 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 1-6 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 7 (i.e., the ability to implement simple combinatorial logic circuits)

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Siginificant

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.