ELE1201 INTRODUCTION TO DIGITAL ELECTRONICS

Hours per Semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PH	TH	CH	WTM	WEM	WCM	CU
45	30	00	60	100	60	40	4

Brief Course Description

The course is intended to provide the basics and necessary theoretical background on digital electronics.

Course Objectives

By the end of the course students should be able to:

- Understand Digital Electronics Techniques and their advantages over analogue techniques.
- Analyse and synthesize logic circuits
- To build and test logic circuits and be able to implement application circuits.

Detailed Course Content:

Introduction to electronics: **[10 Hours]**

Milestones in the development of lectronics; thermionic devices, semiconductor devices, distinction between Analogue and Digital electronics; Analogue and Digital Systems, . Advantages of digital electronics over analogue electronics. Application examples in data acquisition, processing, storage, Access and transmission.

Application examples: Instrumentation, Communication, control systems and Computer systems, automobile industry, medicine and consumer electronics. Introudction to analogue and digital conversion

Numbers System: **[4 Hours]**

Representation of physical quantities by different number systems: Decimal, Octal, Hexadecimal, Binary and conversion between number systems; Digital codes:BCD, ASCII, GRAY, EXCESS-3

Digital Logic: **[9 Hours]**

Introduction to Boolean Algebra and Boolean theorems: Logic gates: AND, OR and NOR operating and truth tables; hierarchy of operations. Logic circuit analysis and synthesis using AND, OR, NOT. NOR and NAND operations and path tables. Single and multivariable Boolean theorems: commutative, associative, and distributive laws; De Morgan's theorem. Universality of NAND and NOR gates. Exclusive OR, exclusive NOR and BUFFER gates.Logic functions: POS/SOP expression, manipulation of logic functions using Boolean algebra. Karnaugh Map.

Introduction to Physical Realisation of logic gates and logic families: **[6 Hours]**

Logic ICs and logic families: TTL, ECL, CMOS and interfacing. Merit considerations: cast per gate; propagation delay; threshold voltage; noise margin; fan-in and fan-out; power dissipation. Comparison of TTL, ECL and CMOS.

Combinational Logic Circuits: [8 Hours]

Design procedure of combinational logic circuits: Half and full adder circuits; encoders, decoders , multiplexers, demultiplexers and other application circuits, minimization of logic circuits by Karnaugh map

Sequential Logic circuits: [8 Hours]

Flip-flops, latches, edge triggered flip flops, master slave flip-flops. Multivibrators: one short, A stable : definitions and examples. Flip flop applications; Data storage, Shift registers: SISO, SIPO, PIPO, PISO, other Shift register applications. Counters: Asynchronous and synchronous counters. UP/Down counters. Ring counters. Counter decoding. Waveform/timing diagrams

Mode of Delivery

The course will be taught by using lectures, tutorials, laboratories, and assignments.

Assessment

Assignments, tests and final examination. Their relative contributions to the final grade are :

Requirement	**Percentage contribution**
Course work (Assignments, laboratories, tests)	40%
Final examination	60%
Total	**100%**

Learning Outcomes

- Describe how computer engineering uses or benefits from digital logic.
- Work with binary number systems and arithmetic.
- Derive and manipulate switching functions that form the basis of digital circuits.
- Explain and apply fundamental characteristics of relevant electronic technologies, such as propagation delay, fan-in, fan-out, and power dissipation and noise margin.
- Analyze and design combinational logic networks in a hierarchical, modular approach, using standard and custom logic functions.
- Analyze circuits containing basic memory elements.
- Analyze the behavior of synchronous and asynchronous machines.
- Apply digital system design principles and descriptive techniques

Method of Teaching /Delivery

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Mode of Assessment

Assignments, tests and final examination. Their relative contributions to the final grade are :

Requirement	**Percentage contribution**
Course work (Assignments, tests)	40%
Final examination	60%
Total	**100%**

Recommended and Reference Books

[1] Stephen Brown, Zvonko Vranesic, 2004. *Fundamentals of Digital Logic with VHDL Design*, McGraw-Hill Professional. ISBN 0072499389, 9780072499384

[2] Douglas A. Pucknell, 1990. Fundamentals of Digital Logic Design with VLSI Circuit Applications, Prentice-Hall

[3] Ronald J. Tocci, 1995. Digital Systems: Principles & Applications, 6th ed., Prentice Hall.

Possible Lecturers:
Dr. J. Butime
Mr. D. Nsubuga Mubiru
Mr. P. Bogere