UNIVERSITY OF GHANA
DEPARTMENT OF COMPUTER SCIENCE

COURSE OUTLINE: 2023/2024 ACADEMIC YEAR

COURSE TITLE:	DIGITAL AND LOGIC SYSTEMS DESIGN
COURSE CODE:	DCIT 203
COURSE CREDIT:	3 CREDITS
COUSE LEVEL :	LEVEL 2OO
PRE-REQUISITE:	FUNDAMENTALS OF HARDWARE AND CIRCUIT INTRODUCTION TO COMPUTER SCIENCE

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COURSE DESCRIPTION

This course provides a modern introduction to logic design and the basic building blocks used in digital systems, in particular digital computers. The course will provide an overview of principles and Techniques of modern digital systems. It exposes students to a wide array of classic as well as state of the art digital electronics technology. The course will further explore the theories and operations of the fundamental building blocks of digital electronics. The course will also expose students to the design process and construction of combinational and sequential logic. Emphasis will be placed on Technologies and Application of wide array of digital components used within state-of-the-art IT Systems. An understanding of the applications of such digital devices embedded within telecommunications systems, storage systems, computing systems, multimedia systems, and computer networks.

COURSE GOAL

The goal of this course is to introduce students to basic techniques and principles employed in the design and implementation of modern digital systems.

LEARNING OUTCOMES

By the end of the course, students will be able to:

- Demonstrate a basic understanding of digital terminology, digital components, and systems.
- Apply digital circuit theory in a laboratory setting as it is applied to a work situation.
- Formulate and employ a Karnaugh Map to reduce Boolean expressions and logic circuits to their simplest forms.
- Evaluate logic circuit outputs, describe the operation of logic gates, write truth tables for logic gates, logic gate simplification.
- Appreciate different circuit types (combinational and Sequential circuit) and their design principles.
- Understand the differences in synchronous and asynchronous logic circuits.
- Illustrate the operation of encoders, decoders, multiplexers, shift registers, and wave generating circuits.
- Explain the operation of flip flops, D-Flip-Flop, J-K Flip-Flop, Flip-Flop used as a shift register.
- Design and evaluate a solution to a digital design problem.
- Understand the design and operations of Finite State Machine/ Automaton
- Synthesize a circuit using a logic compiler software on a personal computer.

COURSE CONTENTS

Key topics include; number systems and codes, Boolean logic, logics gates & circuits, minimization techniques, combinational logic: Adders, subtractors, comparators, encoders, decoders, multiplexers, demultiplexers, Programmable Logic devices, Sequential circuits: synchronous and asynchronous sequential circuits, Laches, flip-flops, counters, registers, and random access memories, Finite State Machines: Moore and Mealy models, classification of finite state machines (deterministic and non-deterministic finite state automata, sequence detector.

MODE OF DELIVERY

This course will be delivered through face-to-face lectures. All resources and lecture materials for the course will be made available on the Sakai platform.

REFERENCE MATERIAL

1. S. Salivahanan & S. Arivazhagan (2018), Digital Circuits and Design.
2. Roth, C.H. (2014), Fundamentals of Logic Design (7th Edition), West Publishing
3. A. Anand Kumar (2016), Fundamentals of Digital Circuit, 4th Edition
4. Coughlin, T. M. (2010). Digital Storage in Consumer Electronics: The Essential Guide (Embedded Technology) (1st Edition). Burlington: Elsevier.

SUPPLEMENTARY READING

1. Patterson, D. A., & Hennessy, J. L. (2012). Computer Organization and Design: The Hardware/Software Interface (The Morgan Kaufmann Series in Computer Architecture and Design). Amsterdam: Morgan Kaufmann.
2. Tocci, R. J., Widmer, N. & Moss, G. (2010). Digital Systems: Principles and Applications (11th Edition). Englewood Cliffs, NJ: Prentice Hall.

COURSE SCHEDULE

Topic	Assignments (Homework & Quizzes)
Session I: • Introduction to number systems and Codes • Introduction to Digital Logic Design • Introduction to Boolean algebra • Introduction to Logic gate • Boolean expression simplification	**Assignment I**
Session II: • Introduction to combinational Logic Circuit • Classification of combination Logic • Adders, subtractors, encoders, decoders, multiplexer, demultiplexer, comparators.	**LAB I** Introduction to Logisim Simulator Design and implementation of simple combinational circuit: adders, subtractors, comparators, 7-segment display etc.
Session III: • Introduction to Sequential Logic circuit • Introduction to Latches ; gated and transparent Latches (SR Latch, D Latch J K Latch etc.) • Introduction to Flip Flops • Synchronous vs asynchronous Sequential circuit • Types of Flip Flops (SR , D, JK , T) • Flip Flop conversion	**Assignment II** **Quiz I**

Session IV • Introduction to Finite State Machine • Design of Synchronous Sequential Circuit • Mealy vs Moore Models	**Assignment III**
Session V: • Classification of Finite State Machine • Deterministic Finite State Automata (DFA) • Non-deterministic Finite state automata (NFA) • Epsilon NFA • Conversion of Finite state machines • Introduction to Sequence/ pattern detector	**Assignment IV** Design and implement Finite state machines: microwave , elevator system, washing machine
Session VI	**END OFSEMESTER EXAMINATION**

COURSE EVALUATIONS AND GRADING SYSTEM

The assessment of students on this course will be made up of the following components:

- Assignments
- Labs
- Quiz
- Mid-semester exams
- End-of-semester exams

Coursework/Continuous Assessment: Students registered on this course will be required to do several coursework / continuous assessments made up of: Assignments, Class Tests, Quizzes, and Labs. The coursework/continuous assessment cumulative scores obtained by students on the course will constitute a percentage of the final course grade.

Class Participation: Students registered on this course are strongly encouraged to actively participate in the online classes. Students are not under obligation to actively participate in class, but if they do participate, it will be to their own advantage.

Mid-semester exam: This course will be assessed by a mandatory mid-semester exam, which will cover all the materials covered on the course up to the week before the exam. The score obtained from the mid-semester exam will constitute a percentage of the final course grade.

End-of-semester exam: This course will be assessed by a mandatory end-of-semester exam, which will cover the course syllabus delivered during the entire course. The score obtained at the end-of-semester exam will constitute a percentage of the final course grade.

COMPONENTS OF THE GRADING SYSTEM	
Grading component	**Percentage (%)**
Assignments	**10%**
Quizzes / Labs	**10%**
Mid Semester Examination	**20%**
End-of-Semester Examination	**60%**
	100%

Class Policies

Homework and Quizzes: *Unless otherwise announced by the lecturer, the submissions of the assignments are bounded by a deadline after which date any submission will be disregarded.*

Makeup Exams: There will be no make-up for mid-semester and end of semester exams*. In case of medical / or other disabling emergencies, the instructor should be notified* ***before*** *the mid-semester or end of semester exams and his/her approval for missing the exam should be obtained before the exams.*

Grading Corrections*: Ask the instructor for any grading correction requests* ***within a week of returning the exam/quiz scores****. After that, your grade will not be adjusted. If you find any mistake in grading, please let the instructor know. Your grade will not be lowered.*