Course Title	Digital Systems I				
Course Code	ECE200				
Course Type	Compulsory				
Level	Bachelor (1st Cycle)				
Year / Semester	1st Year / 2nd Semester				
Teacher's Name	TBA				
ECTS	6	Lectures / week	3 hours / 14 weeks	Laboratories / week	N/A
Course Purpose and Objectives	The objective of this course is to provide a comprehensive introduction to the fundamental axioms, theories and conventions underlying the operation of digital systems, and to equip students with the necessary skills which will allow them to analyse, design, test, and simulate the operation of basic digital circuits. The course follows an embedded laboratory approach, where students are required to utilize a variety of digital logic design and simulation tools during the implementation of lectures.				
Learning Outcomes	Upon successful completion of this course, students should be able to: • Identify a digital system and its main characteristics, and differentiate between digital and analogue systems • Describe the concepts of binary numbers and binary encoding, and perform conversions between binary, decimal, and hex numbers and between binary codes • Perform basic mathematical operations using binary numbers, and design digital systems capable of performing such operations. • Describe theorems and axioms of Boolean Algebra, and utilize them effectively in the process of designing digital systems • Model, analyse, design, test, and simulate the operation of combinational and sequential circuits using analytic and modular methodologies and tools • Explain the concept of memory in digital systems, and design basic memory modules				
Prerequisites	ECE105 or CSE105	Co-requisites	None		
Course Content	History and Overview: History, overview and applications of digital systems, digital signals and analogue signals, basic concept of a digital system and its main characteristics, electrical representation of binary states, implementation of digital systems through digital logic				

	circuits, advantages and disadvantages of using digital systems, interface between digital and analogue systems. Number Systems and Encoding: The binary number system, binary counting, the hexadecimal number system, integer and fixed-point conversions between binary, hexadecimal and decimal numbers, utilization of binary quantities, binary encoding schemes, encoding and decoding using BCD, Grey, ASCII and Unicode binary codes. Boolean Algebra fundamentals: Axiomatic definition of Boolean algebra, the AND, OR, NOT logic operations, representation of Boolean operations using logic gates. Logic gate characteristics, IEEE / ANSI standards and conventions, derived Boolean algebra operations (NAND, NOR, XOR, XNOR), implementation and conversion between standardized Boolean function expression forms and conventions, description and effective utilization of Boolean algebra theorems, DeMorgan's Theorem. Logic Circuits: Mathematical modelling of logic circuits using Boolean functions and truth tables, implementation of logic circuit from given Boolean function expression (logic circuit design), derivation of Boolean function from given logic circuit (logic circuit analysis), derivation of truth table from given logic circuit (simulation) Hardware Description Language: Introduction to Hardware Description Language (HDL), necessity of using HDL in modern digital systems design, standard HDLs (VHDL / Verilog), description of the logic synthesis process using HDLs, modelling logic circuits using HDL. Combinational Circuit Design: Basic definition of combinational circuits, description and implementation of the analytic process followed for the design of generic combinational circuits, optimisation of combinational circuits using the Boolean function manipulation methodology and the Karnaugh Map methodology (2, 3, and 4-variable cases), combinational circuit design examples. Integrated Circuits: Description of an Integrated Circuit (IC), history and types of ICs, the TTL and CMOS logic families, technical characteristics of ICs. Digital Arithmetic: Signed and unsigned binary numbers, representing signed binary numbers using the 2's complement method, performing basic mathematical operations using binary numbers (addition, subtraction, multiplication, division), analytic design of adder circuits, modular design of adder circuits, carry-look ahead circuit, subtractor circuit, magnitude comparator circuit, precision and overflow issues. Standardized Logic Circuits: Description and design of standardised circuits such as decoders / encoders, multiplexers / demultiplexers, code converters, magnitude comparators and digital displays. Use of standardised logic circuits as building blocks for modular design purposes.

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<tr><td></td><td>Sequential Circuit Design: Introduction to circuits with memory, sequential circuits as a special type of circuits with memory, clocked operation of circuits, description and operation of basic latches (D, SR) and flip-flops (D, JK, T), propagation delay, setup time, and hold time in latches and flip-flops. Fundamental applications of circuits with memory, including serial registers, parallel register, shift registers, asynchronous (ripple) counters and synchronous counters. The synchronous counter design process.

Memory: Introduction to digital memory terminology, basic operation of a memory, RAM memory and types (SRAM and DRAM), ROM memory and types.</td></tr>
<tr><td>Teaching Methodology</td><td>Face- to- face</td></tr>
<tr><td>Bibliography</td><td>“Digital Systems: Principles & Applications” by Ronald J. Tocci, Neal S. Widmer, and Greg Moss

“Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog” by M. Morris R. Mano, and Michael D. Ciletti

“Fundamentals of Digital Logic with VHDL Design”, by Stephen Brown and Zvonko Vranesic

“Digital Fundamentals”, by Thomas L. Floyd

“Digital Logic Design”, by B. Holdsworth</td></tr>
<tr><td>Assessment</td><td><table><tr><td>Examinations</td><td>70%</td></tr><tr><td>Assignments/Lab</td><td>20%</td></tr><tr><td>Class Participation and Attendance</td><td>10%</td></tr><tr><td></td><td>100%</td></tr></table></td></tr>
<tr><td>Language</td><td>English</td></tr>
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