



Institiúid Teicneolaíochta Chorcaí
Cork Institute of Technology

ELTR6005: Digital Systems 1

Module Details

Short Title:	Digital Systems 1	APPROVED
Full Title:	Digital Systems 1	
Module Id:	4829	
Official Code:	ELTR6005	NFQ Level: 6
		ECTS Credits: 5

Coordinator:	JOSEPH CONNELL
---------------------	----------------

Description:	This module introduces the learner to the basic building blocks of modern digital electronics. Assuming no prior knowledge, it begins with the basic logic gates from which all digital and computer systems are built, dealing with simple binary numbers processed by these systems, and goes on to develop and refine more advanced circuits as the module progresses.
---------------------	---

Learning Outcomes:

On successful completion of this module the learner will be able to...

1. Convert between binary, BCD, decimal, and hexadecimal number systems and perform simple operations on numbers in these formats.
2. Draw logic symbols, truth tables, and Boolean expressions for all basic logic gates, use these to construct logic circuits and identify suitable SSI chips to implement these circuits.
3. Minimise simple 3 and 4-variable Boolean expressions using algebraic and Karnaugh mapping techniques.
4. Perform all elements of a design cycle for simple combinational logic circuits from a given specification to an efficient implementation with universal NAND/NOR logic.
5. Work alone and in groups to construct simple logic circuits on breadboard, measure and analyse the performance of these circuits using standard laboratory test equipment, and verify correct operation using truth tables and timing diagrams.

Pre-requisite learning

Module Recommendations

This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named CIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).

No recommendations listed

Incompatible Modules

These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.

No incompatible modules listed

Module Requirements

This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.

No requirements listed



Module Content & Assessment

Indicative Content

Digital Concepts

Digital and analogue quantities. Logic levels. Typical voltages encountered. Digital waveforms: clock and pulse. Practicalities of IC chips.

Number Systems

Pure binary counting system, binary to decimal conversion, decimal to binary conversion, addition of binary numbers, signed binary numbers: sign-magnitude, 1's complement, 2's complement, subtraction using 8-bit 2's complement addition, hexadecimal number system, binary coded decimal (BCD) system.

Basic Logic Gates

AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gates: distinctive-shape and rectangular symbols, truth tables. Boolean expressions for associated logic functions. Timing diagrams for pulsed operation. Pinout diagrams of SSI chips.

Simple Logic Circuits

Precedence of logic functions. Draw logic circuits given Boolean equations. Derive Boolean equations from logic circuits. Determine output levels for input combinations. Construct truth tables for complete logic circuits. Draw timing diagrams for complete logic circuits.

Minimisation

State and prove (by truth table or algebraically) the laws and rules of Boolean algebra. Minimisation of simple expressions using Boolean algebra. Use of De Morgans Laws. Standard SOP formulation. Use of Karnaugh maps to minimise 3-variable and 4-variable expressions.

Universal NAND/NOR Logic

Implementation of any logic gate using all-NAND/all-NOR circuits. Conversion of complete logic circuits to all-NAND/all-NOR formats to minimise chip-count. Elimination of redundant inverter-pairs. Selection of ICs for above circuits.

Design cycle for simple circuits

Circuit specification. Block diagram. Truth table. Boolean expression. Minimisation. AND-OR-NOT implementation. Optimisation using universal NAND/NOR logic.

Assessment Breakdown	%
Course Work	30%
End of Semester Formal Examination	70%

	Outcome addressed	% of total	Assessment Date
Formal End-of-Semester Examination	1,2,3,4	70%	Semester End

Coursework Breakdown				
Type	Description	Outcome addressed	% of total	Assessment Date
Performance Evaluation	A week-by-week assessment of practical competency through laboratory-based assignments with reports.	5	20	Every Week
Open-book Examination	A one-hour open-book assessment comprising a number of short quiz-type questions.	1,2,3	10	Week 6

The institute reserves the right to alter the nature and timings of assessment



Module Workload & Resources

Workload		Full-time mode		
Type	Description	Hours	Frequency	Average Weekly Learner Workload
Lecture	Three one-hour lectures on basic theory	3	Every Week	3.00
Lab	A two-hour laboratory-based session covering practical construction, testing, troubleshooting and analysis of relevant logic circuits	2	Every Week	2.00
Independent & Directed Learning (Non-contact)	Review of lecture notes and recommended material and preparation of reports for selected laboratory sessions.	2	Every Week	2.00
Total Weekly Learner Workload				7.00
Total Weekly Contact Hours				5.00

Workload		Part-time mode		
Type	Description	Hours	Frequency	Average Weekly Learner Workload
Lecture	Lecture(s) on basic theory	3	Every Week	3.00
Lab	A laboratory-based session covering practical construction, testing, troubleshooting and analysis of relevant logic circuits	2	Every Second Week	1.00
Independent & Directed Learning (Non-contact)	Review of lecture notes and recommended material and preparation of reports for selected laboratory sessions	3	Every Week	3.00
Total Weekly Learner Workload				7.00

Resources

Recommended Book Resources

- Thomas L. Floyd 2006, *Digital Fundamentals*, 9th Ed. Ed., Chapters 1 to 6, Pearson Prentice Hall: Upper Saddle River, NJ USA [ISBN: 0131972553]

Supplementary Book Resources

- Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss 2004, *Digital systems : principles and applications*, 9th Ed. Ed., Pearson/Prentice Hall: Upper Saddle River, N.J. USA. [ISBN: 0131219316]

Other Resources

- Various websites for relevant data sheets and other material as recommended during the module.: NA