STUDENT AND ACADEMIC SERVICES

MODULE SPECIFICATION

Part 1: Information			
Module Title	Digital Principles		
Module Code	UFMFF8-30-1	Level	Level 4
For implementation from	2020-21		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Educational Aims: In addition to the Learning Outcomes, the educational experience may explore, develop, and practise but not formally discretely assess the following:
Develop competence in problem identification, analysis, design and implementation (D4, D6).
Understanding of the need for a high level of professional and ethical conduct (S5).

Outline Syllabus: Combinational Logic:

Number systems (decimal, binary, Hexadecimal, conversion, 1's complement and 2's complement representations).

Combinational logic design principles (Truth tables, Basic Logic gates (AND, OR, XOR, NAND, NOR, NOT), Boolean algebra, circuit analysis, circuit synthesis), Basic characteristics of digital ICs.

Minimisation (from Venn diagrams to 2D maps, Karnaugh maps, the Quine-McCluskey algoritms, don't care in Karnaugh maps).

Static and dynamic hazards.

Implementation using discrete gates, multiplexers, ROMs, PLAs, PLDs, CPLDs, FPGAs.

Sequential Logic:

Basic latches and flip-flops (RS, D, JK), clocking and evolution of flip-flops.

Counters (synchronous counters, up-down counters, analysing synchronous counters).

Shift registers (serial in parallel out, cyclic, pseudorandom sequence generator).

Finite state machines, State diagrams, tables and equations.

State reduction. Structured state assignment. Incompletely specified state tables.

Design process of synchronous sequential circuits.

Implementation using decoders, multiplexers and programmable devices.

Introduction to VHDL:

Setting the context.

Design flow for hardware description languages (capture, implementation, functional simulation, timing simulation, hardware verification).

VHDL structure (interface, implementations and components).

Design approaches in VHDL.

Microcontrollers:

Review of the design flow in micro-controllers based applications.

Review of basic functional parts a microcontroller, including internal architecture, programming model, op-codes, addressing modes, memory mapping and address decoding.

Use of digital electronics CAD tools, and simple system simulations.

Design and implementation of single-chip microcontroller-based embedded system.

Simple assembly language and high-level language software design and implementation.

Teaching and Learning Methods: While the first part of the module covers the basic principles of digital systems, the second part covers the basic principles of micro-controllers and related development environments. The theoretical concepts are formally introduced in lectures. These are supported by directed reading and well detailed worked examples. The practical content exposes the students to the practical aspect of the module. The laboratory exercises complement the theoretical aspect of the module. In the first semester, the lab activity involves the familiarisation with an integrated development environment (IDE). The real time implementation focuses on an FPGA hardware platform. In relation to the second semester, the entire detailed syllabus is addressed in the context of specific devices and development environments to be used in the laboratory work, as exemplars of the more generic issues. Students will gain hands-on knowledge in an experimental project-based environment. Relevant ethical issues will be highlighted and students will be encouraged to consider these further through directed reading.

Approximate time in hours
Contact: 72
Assimilation and skill development: 140
Undertaking coursework: 40
Exam preparation: 48
Total: 300

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Part 3: Assessment			3

A formal exam that contributes 50% towards the final mark of the module. The examination is summative and assesses the students' understanding of concepts and techniques, and their ability to apply them in relatively straightforward problems.

A coursework that contributes 50% towards the final mark of the module. The coursework consists of a logbook and a small scale lab project.

First Sit Components	Final Assessment	Element weighting	Description
Examination (Online) - Component A	✓	50 %	Online Exam
Project - Component B		50 %	The coursework consists of lab reports of four practical sessions and a small scale project report.
Resit Components	Final Assessment	Element weighting	Description
Examination (Online) - Component A	✓	50 %	Online exam
Project - Component B		50 %	The coursework consists of lab reports of four practical sessions and a small scale project report.

Part 4: Teaching and Learning Methods	

Learning Outcomes	On successful completion of this module students will achieve the following learning outcomes:

Module Learning Outcomes	Reference
Knowledge and understanding of the basic mathematical principles as applied to the description and analysis of digital systems (US2)	MO1
An understanding of engineering principles as applied to digital systems and the ability to assess their performances (E1, E2)	MO2
An understanding of and an ability to apply top-down digital design methods in the synthesis of digital systems (E4)	MO3
The ability to use integrated development environments to describe, simulate, implement and verify the correctness of digital designs (E3)	MO4
Competence in using specific Electronic Design Automation tools (P1)	MO5
An understanding of basic microcontroller structure and internal architecture (E1)	MO6
The ability to understand and use development tools to design, program, implement and test example applications (E3)	MO7
Competence in using technical literature and the ability to obtain documentation from various sources (P4)	MO8

Contact Hours	**Independent Study Hours:**	
	Independent study/self-guided study	228
	Total Independent Study Hours:	228

	Scheduled Learning and Teaching Hours:	
	Face-to-face learning	72
	Total Scheduled Learning and Teaching Hours:	72
	Hours to be allocated	300
	Allocated Hours	300
Reading List	*The reading list for this module can be accessed via the following link:* https://uwe.rl.talis.com/modules/ufmff8-30-1.html	

Part 5: Contributes Towards
This module contributes towards the following programmes of study: