

MODULE SPECIFICATION FORM

Module Title:	Further Digital Electronics	Level:	5	Cedit Value:	10
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Module code: (if known)	ENG578	Cost Centre:	GAEE	JACS2 code:	H651
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Semester(s) in which to be offered:	2	With effect from:	July 2015
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Office use only: To be completed by AQSU:	Date approved:	July 2015
	Date revised:	
	Version No:	1

Existing/New:	new	Title of module being replaced (if any):	N/A
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Originating Academic area:	Engineering and Applied Physics	Module Leader:	B Birmingham
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Module duration (total hours)	100	Status: core/option/elective (identify programme where appropriate):	Free-standing 10-credit component comprising second half of ENG560 (Embedded Systems).
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	0%
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Programme(s) in which to be offered:	Pre-requisites per programme (between levels):	None
Enginerig European Programme (Non Award Bearing)		

Module Aims:
To develop previous studies into a knowledge and understanding of combinational and sequential circuit analysis and design using a range of current techniques, including modelling via VHDL (computer-based modelling using a Hardware Description Language).

Expected Learning Outcomes		
<u>Knowledge and Understanding:</u> At the completion of this module, the student should be able to:		
<ol style="list-style-type: none"> Design sequential and combinational logic systems using a range of established methods; Apply circuit design to digital programmable devices technology; Write VHDL programs and thus design digital systems using VHDL and EDA tools. (KS 4, 3) 		
<u>Key skills for employability</u>		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> Written, oral and media communication skills, Leadership, team working and networking skills Opportunity, creativity and problem solving skills Information technology skills and digital literacy Information management skills Research skills </td> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> Intercultural and sustainability skills Career management skills Learning to learn (managing personal and professional development, self management) Numeracy </td> </tr> </table>	<ol style="list-style-type: none"> Written, oral and media communication skills, Leadership, team working and networking skills Opportunity, creativity and problem solving skills Information technology skills and digital literacy Information management skills Research skills 	<ol style="list-style-type: none"> Intercultural and sustainability skills Career management skills Learning to learn (managing personal and professional development, self management) Numeracy
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Assessment: Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).

Assessment is by means of a portfolio of practical exercises in the use of hardware programming, including a major programming exercise using VHDL. For example, to design a hardware multiplier. It will cover all outcomes.

(This corresponds to Assessment 2 of ENG560.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Portfolio	100%		2000

Learning and Teaching Strategies:

The module will be delivered through lectures, tutorials, and practical laboratory exercises. Case studies will be used to illustrate applications in the module content.

Syllabus outline:

Digital system design process: Combinational simplification: tabular method. Sequential system design and analysis for components and circuits.

D/A and A/D conversions

Introduction to FPGA/CPLD:

Hardware description language (HDL): VHDL basic concepts, main elements, top-down design, data types, subprograms, vhd operators, concurrent and sequential assignments, etc.

Hardware: structural description, behavioural description, design organization and parameterization

Practical examples of VHDL design of digital systems

Practical/IT session includes: comparison types of FPGA/CPLD, introduction to EDA software, VHDL coding practices, further programs, working towards digital system design assignment.

Bibliography:

Essential reading:

Kafig, W. (2011) *VHDL 101: Everything you Need to Know to Get Started*, Newnes.

Wakerly, J.F. (2005) *Digital Design: Principles and Practices*, 4th Edn., Prentice-Hall.

Recommended reading:

Nilsson, J.W. & Riedel, S. (2010) *Introduction to Multisim for Electric Circuits*, 9th Edn., Prentice-Hall.

Navabi, Z. (2007) *VHDL Modular Design and Synthesis of Cores and Systems*, McGraw-Hill.

Yalamanchili, S. (2003) *Introductory VHDL From Simulation to Synthesis*, Prentice-Hall.

Key Website References:

Microchip Technology Inc: <http://www.microchip.com/>;

PIC Microcontrollers – Free online Book – mikroElektronika:

<http://www.mikroe.com/eng/products/view/11/book-pic-microcontrollers/>;

Xilinx, Inc: <http://www.xilinx.com/university/index.htm>.

IEEE Xplore Digital Library (<http://ieeexplore.ieee.org/Xplore/guesthome.jsp>) including: IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems.