PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title:	**Microprocessor Systems**	Level:	**5**	Credit Value:	**10**

Module code: (if known)	**ENG513**	Cost Centre:	**GAEE**	JACS2 code:	**H611**

Semester(s) in which to be offered:	**2**	With effect from:	**July 2015**

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

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **B Birmingham**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising first 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%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

To demonstrate knowledge and awareness of microprocessor capabilities both as the central processing element in a computer system and as an embedded element in an electronic system;

Expected Learning Outcomes

Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Demonstrate knowledge and awareness of microprocessor capabilities both as the central processing element in a computer system and as an embedded element in an electronic system;
2. Design appropriate hardware interfacing;
3. Design, test and evaluate assembly-level programs. *(KS 3, 4)*

Key skills for employability

1. Written, oral and media communication skills,
2. Leadership, team working and networking skills
3. Opportunity, creativity and problem solving skills
4. Information technology skills and digital literacy
5. Information management skills
6. Research skills
7. Intercultural and sustainability skills
8. Career management skills
9. Learning to learn (managing personal and professional development, self management)
10. Numeracy

Assessment: *Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).*

Assessment is by means of writing a correctly documented assembly-language programme to enable a microprocessor to respond to inputs from and control outputs to external hardware, for example to control a stepper motor speed and direction, including acceleration and deceleration profiles. It will cover all outcomes. (This corresponds to Assessment 1 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	Coursework	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 conventions: Bit, byte, word; binary, hexadecimal, octal; binary arithmetic, logical operations; Gray code, BCD, ASCII.

System architecture: Clock, CPU, memory, interfaces, bus systems and controlling logic; CPU internal architecture; Van Neumann model - fetch/execute cycle; instruction set, timing. Pipeline and multi-processing architectures.

Memory structures: Main memory address, access and structures; device types and parameters, memory map.

Interfaces: Functional treatment of parallel ports, serial ports - UARTs etc, ADC/DACs. Dedicated interfaces eg to drive 'power' equipment. Memory-mapped I/O and I/O-mapping. Communication: polling and interrupts. Bus systems e.g. VME, STE, I²C.

Design, writing and testing: of assembly language programs for a microcontroller (eg PIC) or a personal computer processor. Development tools (editor, assembler, ICE), use of subroutines, functions, to carry out an engineering task.

Bibliography:

Essential reading:

Bates, M. (2011) *The PIC Microcontroller: An Introduction to Microelectronics*, 3rd Edn., Newnes.

Recommended reading:

Wilmshurst, T. (2009) *Designing Enbedded Systems with PIC Microcontrollers: Principles and Applications*, 2nd Ed., Newnes.

Morton, J. (2005) *The PIC Microcontroller: Your Personal Introductory Course*, 3rd Edn., Newnes.

Katzen, S. (2005) *The Quintessential PIC Microcontroller;* 2nd Edn., London: Springer-Verlag.

Smith, D.W. (2006) *PIC In Practice: A Project –based Approach,* Elsevier.

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.