ES2C4-15 Computer Architecture and Systems

24/25

Department
School of Engineering
Level
Undergraduate Level 2
Module leader
Daciana Iliescu
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The Computer Architecture and Systems module is core for electrical, electronics and systems and option for all the other streams. It covers basic architecture and programming knowledge of selected digital computer systems and microcontrollers.

Module web page

Module aims

To provide theoretical and practical knowledge of how digital computing systems are organised, how they function, and how to program them.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Basic C: Data types, operators, loops, pointers, bitwise operations.
Data Representation: Binary numbers, Boolean algebra, unsigned and signed integers, fixed and

floating point, ASCII.
Logic and Digital Arithmetic: Basic function truth tables, Karnaugh maps, combinational circuits: multiplexers, decoders, half and full adders, sequential circuits : latches, flip flops, finite state machines.
Instruction Set Architecture: Assembly language, machine instructions including memory , branch and data processing, addressing modes, program flow.
Processor Microarchitecture: Memory, ALU, program counter, register file, control unit, single-cycle and pipelined processors.
Input/Output: GPIO, UART, SPI, I2C, timers, interrupts, PWM, A/D & D/A conversion.
Microcontroller Programming: Loops, registers, interrupts, timers, accessing peripherals.

Learning outcomes

By the end of the module, students should be able to:

- Solve combinational and sequential circuit problems. Implement logic functions using these building blocks [M1,M6]
- Decompose complex programs into low-level instructions corresponding to the operation of a processor microarchitecture and how complex programs can be decomposed into such instructions. [M2]
- With the aid of technical literature, compare a variety of interfaces between external peripherals, memory and processor or microcontroller [M4]
- Synthesise C programs and C programs for Microcontrollers. Create structured microcontroller programs in C, taking advantage of interrupts and timers, and communicating with external peripherals [C3(D),M3(D),M12]

Indicative reading list

- S. Harris and D. Harris. Digital Design and Computer Architecture: ARM Edition. Publisher: Morgan Kaufmann, 2016, 732 pages, Ebook ISBN: 9780128009116
- W. Stallings, Computer organization and architecture: designing for performance, 2022, 892 pages, Ebook ISBN: 9781292420080
- J. Purdum, Beginning C for Arduino, Learning C Programming for the Arduino, 215, 388 pages, Ebook ISBN: 978148420940-0

Subject specific skills

Plan and manage the design process, including cost drivers, evaluating outcomes, and working with technical uncertainty.
Ability to apply relevant practical and laboratory skills.
Ability to conceive, make and realise a component, product, system or process.

Transferable skills

Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions.
Apply problem-solving skills, information retrieval, and the effective use of general IT facilities.

Communicate (written and oral; to technical and non-technical audiences) and work with others.
Plan self-learning and improve performance, as the foundation for lifelong learning/CPD.
Exercise initiative and personal responsibility, including time management, which may be as a team member or leader.
Overcome difficulties by employing skills, knowledge and understanding in a flexible manner.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (13%)
Practical classes	8 sessions of 2 hours (11%)
Other activity	2 hours (1%)
Private study	112 hours (75%)
Total	150 hours

Private study description

112 hours of guided independent learning

Other activity description

2 x 1hr Revision Classes

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B1

	Weighting	Study time
Online Examination 2hr QMP ~Platforms - AEP,QMP	100%	

	Weighting	Study time

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

- Support through advice and feedback hours.
- Cohort-level feedback on final exam.

Past exam papers for ES2C4

Availability

Post-requisite modules

If you pass this module, you can take:

- ES3B2-15 Digital Systems Design

Courses

This module is Core for:

- Year 2 of UESA-H63W BEng Electronic Engineering
- Year 2 of UESA-H63X MEng Electronic Engineering
- Year 2 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 2 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng

This module is Option list A for:

- Year 2 of UESA-H161 BEng Biomedical Systems Engineering
- Year 2 of UESA-H216 BEng Civil Engineering
- Year 2 of UESA-H113 BEng Engineering
- Year 2 of UESA-HH75 BEng Manufacturing and Mechanical Engineering
- Year 2 of UESA-HH35 BEng Systems Engineering
- UESA-H112 BSc Engineering
    - Year 2 of H112 Engineering
    - Year 2 of H112 Engineering
- Year 2 of UESA-HN11 BSc Engineering and Business Studies
- Year 2 of UESA-H163 MEng Biomedical Systems Engineering
- Year 2 of UESA-H217 MEng Civil Engineering
- Year 2 of UESA-H114 MEng Engineering
- Year 2 of UESA-HH76 MEng Manufacturing and Mechanical Engineering

- UESA-HH31 MEng Systems Engineering
    - Year 2 of HH31 Systems Engineering
    - Year 2 of HH35 Systems Engineering