



Institiúid Teicneolaíochta Chorcaí  
Cork Institute of Technology

## Embedded Software Co-Design

### Module Details

<b>Short Title:</b>	Embedded Software Co-Design <b>DRAFT</b>		
<b>Full Title:</b>	Embedded Software Co-Design		
<b>Module Id:</b>	4632		
<b>Official Code:</b>		<b>NFQ Level:</b> 9	<b>ECTS Credits:</b> 5

<b>Coordinator:</b>	DONAL O DONOVAN
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<b>Description:</b>	Embedded microprocessor-based systems form the cornerstone of most modern 'intelligent' devices, from the ubiquitous MP3 player to more complex systems such as automotive navigation and control systems. The objective of this module is to introduce the student to software development and design techniques necessary in the development of such embedded, real-time systems using a hardware/software co-design approach.
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### Learning Outcomes:

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

1. Model the architecture of an embedded system based on common system requirements and specifications.
2. Design, and coordinate the implementation of, an embedded software solution using co-design principles.
3. Analyse and verify the feasibility of proposed software/hardware architectures. Explain the effect of system design decisions on the behaviour of an embedded system.
4. Apply embedded programming techniques using the C/C++ language to implement a software solution

### 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 &amp; Assessment

**Indicative Content**

- **Models and Problem Definition**

Process and control modelling techniques for single and multi-processor systems.

- **Software Standards**

Safety-critical standards such as DO-178B, IEC 61508 part 3, ISO 26262 part 6

- **RTOS concepts**

Multitasking, kernels, single and multiprocessor scheduling, interrupts, semaphores, deadlock, intertask communications and drivers. Overview of commercially available embedded RTOSs

- **Process Scheduling**

Clock-driven scheduling, static and dynamic priority scheduling of periodic, aperiodic and sporadic tasks

- **Microprocessor/Hardware Selection**

Review of industrially-relevant, embedded processor architectures

**Assessment Breakdown**

	<b>%</b>
Course Work	60%
End of Semester Formal Examination	40%

	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
<b>Formal End-of-Semester Examination</b>	1,2,3,4	40%	Semester End

**Coursework Breakdown**

<i>Type</i>	<i>Description</i>	<i>Outcome addressed</i>	<i>% of total</i>	<i>Assessment Date</i>
Written Report	Design project 1	1,2,4	20	Week 4
Non-CIT Exam	Cousework to Date	2,3	20	Week 7
Reflective Journal	Design project 2	1,2,3,4	20	Week 11

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



## Module Workload &amp; Resources

Workload		Full-time mode			
Type	Description	Hours	Frequency	Average Weekly Learner Workload	
Lecturer-Supervised Learning (Contact)	Delivery of module material as per indicative content	3	Every Week	3.00	
Independent & Directed Learning (Non-contact)	Review of module material and laboratory preparation	4	Every Week	4.00	
Total Weekly Learner Workload				7.00	
Total Weekly Contact Hours				3.00	

Workload		Part-time mode			
Type	Description	Hours	Frequency	Average Weekly Learner Workload	
Lecturer-Supervised Learning (Contact)	Delivery of module material and coordination of laboratory exercises as per indicative content	3	Every Week	3.00	
Independent & Directed Learning (Non-contact)	Review of course material and laboratory preparation	4	Every Week	4.00	
Total Weekly Learner Workload				7.00	

Resources	
<i>Recommended Book Resources</i>	
• Jane W. S. Liu 2000, "Real-Time Systems, Prentice- Hall [ISBN: 0130996513]	
<i>Supplementary Book Resources</i>	
• Staunstrup, Jørgen, Wolf, Wayne 1997, Hardware/Software Co-Design: Principles and Practice, Springer [ISBN: 978-0-7923-8013-9]	