

2024 / 25

School of Science and Computing

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🌐 [www.wit.ie/schools/science\\_computing](http://www.wit.ie/schools/science_computing)



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Technological  
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## Module Descriptor

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## Formal Specification (Computing and Mathematics)

# Formal Specification (A14142)

**Short Title:** Formal Specification  
**Department:** Computing and Mathematics  
**Credits:** 5  
**Level:** Advanced

## Description of Module / Aims

Having examined the software development process in detail, the student is now introduced to a more formal way to treat systems. Using mathematics, the student learns how to precisely specify computer systems. This exposes the student to rigorous and critical thinking skills. This module will also help the student to prioritise needs in a system, e.g. correctness, usability so that appropriate methodologies are chosen. An overview of the formal life-cycle is presented.

## Programmes

			stage/semester/status
COMP-0216	BSc (Hons) in Applied Computing (WD_KACCM_B)		4 / 8 / E
COMP-0216	BSc (Hons) in Applied Computing (WD_KCOMP_B)		4 / 8 / E
COMP-0216	BSc (Hons) in Computer Forensics and Security (WD_KCOFO_B)		4 / 8 / E
COMP-0216	BSc (Hons) in Computer Science (WD_KCMSC_B)		4 / 8 / E

## Indicative Content

- Introduction to Formal Methods
- Mathematics of Formal Specification
- Formal Specification notation (e.g. Z, B)
- Modelling using notation, writing system states and operations using chosen notation

## Learning Outcomes

*On successful completion of this module, a student will be able to:*

1. Choose when formal methods are applicable in software development.
2. Read and write formal specifications and explain them clearly using informal means.
3. Choose the mathematical model underlying the formal specification language in this context.
4. Write consistent specifications and be able to explain why they are consistent.
5. Assess a complex system, distill an understanding of it into an abstracted view, and model this view using appropriate abstract data models and mathematical description.
6. Formally specify part of a real world system (e.g. substantial student project) with appropriate narrative text.

## Learning and Teaching Methods

- As this module requires a strong mathematical foundation, it is important that the student be presented with these foundations in a lecture context and that these concepts practiced on specification examples in tutorials.
- Lectures and tutorials will be interleaved, with small examples regularly being attempted in class.
- When the student has learned the necessary component skills, s/he will practice these skills on part of a substantial project.
- This will enliven his/her understanding of the notation as well as demonstrating to him/her the advantages of rigour in software development.

## Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	24	
Tutorial	24	
Independent Learning	87	

## Assessment Methods

	Weighting	Outcomes Assessed
Final Written Examination	50%	1,2,3,4
Continuous Assessment	50%	
In-Class Assessment	10%	2,3
Assignment	40%	1,5,6

## Assessment Criteria

- <40%: Inability to understand the basics of mathematical concepts or notation. Inability to write simple specifications of parts of a system, e.g. simple operations.
- 40%–49%: Able to write simple (familiar) formal specifications. Able to write simple, robust operations. Understands the role of formal methods in software development.
- 50%–59%: In addition, show the ability to choose appropriate data models and types. Able to write complete specifications for simple systems.
- 60%–69%: In addition, be able to write complete specificationsl for limited systems with increased complexity. Able to scope an unfamiliar system.
- 70%–100%: All previous to an excellent level. Able to reflect on the structure of a consistent specification and write a clearer, more elegant specification with the same functionality.

## Essential Material(s)

- W.I.T.. *Student's Final Year Project Preliminary Report* W.I.T.. curr academic year.

## Supplementary Material(s)

- "http://formalmethods.wikia.com/wiki/Z\_notation." Formal Methods Wiki. [http://formalmethods.wikia.com/wiki/Z\\_notation](http://formalmethods.wikia.com/wiki/Z_notation).