

## Basic details

|                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                      |                                    |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------|------------------------------------|
| UID                                                                             | <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Cohorts covered | Earliest cohort <input type="text"/> | Latest cohort <input type="text"/> |
| Long title                                                                      | <input type="text" value="Hardware and Software Verification"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                      |                                    |
| New code                                                                        | <input type="text" value="ELEC70056"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | New short title | <input type="text"/>                 |                                    |
| Brief description of module<br>(approx. 600 chars.)                             | <input "always="" "does="" "implements="" (dafny)."="" (isabelle),="" a="" aims="" and="" behaviour",="" certain="" checkers,="" crash",="" guarantee="" hang",="" hardware="" hardware:="" has="" include:="" interactive="" introduce="" languages="" microseconds".="" might="" model="" module="" not="" of="" or="" piece="" process="" programming="" properties="" properties.="" refers="" responds="" so-many="" software="" specified="" techniques="" that="" the="" theorem-provers="" these="" this="" to="" type="text" used="" value="           " verification"="" verification-oriented="" verify="" will="" within="" you=""/> |                 |                                      |                                    |
| Available as a standalone module/ short course? <input type="text" value="No"/> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                      |                                    |

469 characters

## Statutory details

|              |                                 |                                 |                                |                      |
|--------------|---------------------------------|---------------------------------|--------------------------------|----------------------|
|              | ECTS                            | CATS                            | Non-credit                     | HECOS codes          |
| Credit value | <input type="text" value="5"/>  | <input type="text" value="10"/> | <input type="text" value="N"/> | <input type="text"/> |
| FHEQ level   | <input type="text" value="L7"/> |                                 |                                | <input type="text"/> |

## Allocation of study hours

|                   | Hours                              |                                                                                |
|-------------------|------------------------------------|--------------------------------------------------------------------------------|
| Lectures          | <input type="text" value="10"/>    |                                                                                |
| Group teaching    | <input type="text" value="10"/>    | <i>Incl. seminars, tutorials, problem classes.</i>                             |
| Lab/ practical    | <input type="text" value="0"/>     |                                                                                |
| Other scheduled   | <input type="text" value="0"/>     | <i>Incl. project supervision, fieldwork, external visits.</i>                  |
| Independent study | <input type="text" value="105"/>   | <i>Incl. wider reading/ practice, follow-up work, completion of assessment</i> |
| Placement         | <input type="text" value="0"/>     | <i>Incl. work-based learning and study that occurs overseas.</i>               |
| Total hours       | <input type="text" value="125"/>   |                                                                                |
| ECTS ratio        | <input type="text" value="25.00"/> |                                                                                |

## Project/placement activity

|                                |                                |
|--------------------------------|--------------------------------|
| Is placement activity allowed? | <input type="text" value="0"/> |
|--------------------------------|--------------------------------|

## Module delivery

|               |                                             |       |                      |
|---------------|---------------------------------------------|-------|----------------------|
| Delivery mode | <input type="text" value="Taught/ Campus"/> | Other | <input type="text"/> |
| Delivery term | <input type="text" value="Autumn"/>         | Other | <input type="text"/> |

## Ownership

|                                 |                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------|
| Primary department              | <input type="text" value="Department of Electrical and Electronic Engineering"/> |
| Additional teaching departments | <input type="text" value="0"/><br><input type="text"/><br><input type="text"/>   |
| Delivery campus                 | <input type="text" value="South Kensington"/>                                    |

## Collaborative delivery

Collaborative delivery? **N**

External institution  
External department  
External campus

N/A  
N/A  
N/A

## Associated staff

| Role          | CID    | Given name | Surname   |
|---------------|--------|------------|-----------|
| Module Leader | 569344 | John       | Wickerson |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |
|               |        | 0          | 0         |

## Learning and teaching

### Module description

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Learning outcomes                           | <p>On successful completion of the module you will be able to:</p> <ol style="list-style-type: none"> <li>1. Validate the properties of small programs through an automated software verification tool.</li> <li>2. Argue how an interactive theorem prover works.</li> <li>3. Validate the properties of small programs through an interactive theorem prover.</li> <li>4. Consider the principles of formal verification of hardware.</li> <li>5. Validate the properties of a small RTL module through a formal verification tool.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                    |
| Module content                              | <ul style="list-style-type: none"> <li>- Introduction to software verification. What it is, where it is used, how it compares to testing, what are its fundamental limits.</li> <li>- Live demonstration of an automatic software verification tool being used to verify properties of a small program.</li> <li>- Coursework: Using automatic software verification tool to verify properties of another small program.</li> <li>- Live demonstration of an interactive theorem prover being used to verify properties of a small program.</li> <li>- Coursework: Using an interactive theorem prover to verify properties of another small program.</li> <li>- Introduction to hardware verification and its importance in the development cycle. Formal methods for hardware verification. Demonstration of a formal methods tool.</li> <li>- Coursework: Using a formal verification tool to prove properties of a small RTL module.</li> </ul> |
| Pattern of learning and teaching activities |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Learning and Teaching Approach              | This module is taught through lectures supported by some problem classes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Assessment Strategy                         | <p>You will be given small programs to verify using two different tools (that embody two different verification techniques).</p> <p>Regarding the specific learning outcomes:</p> <p>L1 will be assessed by your ability to use an automatic verification tool to verify properties of a small program.</p> <p>L2 and L3 will be assessed by your ability to use an interactive theorem prover to verify properties of a small program.</p> <p>L5 will be assessed by your ability to use a formal hardware verification tool to prove properties of a small RTL module.</p>                                                                                                                                                                                                                                                                                                                                                                        |
| Feedback                                    | <p>Summative feedback will be provided through comments on your submitted coursework.</p> <p>Formative feedback will be provided during lab sessions, during which you can discuss your verification work with the module leaders and expert teaching assistants.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Reading list

The reading list will be provided in session

Quality assurance

|                        |               |
|------------------------|---------------|
| Date of first approval | February 2022 |
| Date of last revision  | June 2026     |
| Date of this approval  |               |

|               |               |
|---------------|---------------|
| Module leader | John Wckerson |
|---------------|---------------|

Notes/ comments

Office use only

|                    |  |
|--------------------|--|
| QA Lead            |  |
| Department staff   |  |
| Date of collection |  |
| Date exported      |  |
| Date imported      |  |

## Assessment details

|                |           |
|----------------|-----------|
| Grading method | Numerical |
|----------------|-----------|

Pass mark

50%

## Assessments

[illegible]

100%