Embedded Systems 2017-2018

Bas Luttik (program manager)

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The ES programs: special features

- Multi-disciplinary program (contributions from CS and EE)
  - Electronic Systems group headed by prof. Basten
  - System Architecture and Networking group headed by prof. Lukkien
  - Formal System Analysis group headed by prof. Groote

- 3TU collaboration
  - Delft University of Technology
  - Eindhoven University of Technology
  - University of Twente

- Two variants: a local and an EIT Digital variant

- International and diverse intake
3TU collaboration

• Side registration with TU Delft and UTwente
• Common core courses
  – System Validation
  – Embedded Computer Architecture
  – Quantitative Evaluation of Embedded Systems
  – Real-time Systems
  – Embedded Systems Laboratory
• Tele lectures (one compulsory course, several electives)
• Choose electives from Delft and Twente (but ask permission from study advisor first!)
• Yearly 3TU student event
• We stimulate 3TU presence in graduation committees
Two variants

1. Regular ES program
   - enrolled directly with TU/e, for two years
   - only technical courses
   - 4 streams

2. EIT Digital track
   - enrolled via EIT Digital (one year at TU/e, one year at university in other country)
   - technical courses and courses on innovation and entrepreneurship
   - all sorts of extra activities, organized by EIT Digital
**Structure of the (local) ES program**

**Mandatory for all ES students (25 EC):**
- System Validation
- Quantitative Evaluation of Embedded Systems
- Real-time Systems

**Homologation/Free electives/Internship (20 EC):**
- Embedded Computer Architecture
- Embedded Systems Lab

**Mandatory stream courses (15 EC):**

**Stream electives (20 EC):**

**Preparation MSc thesis (10 EC):**

**MSc thesis project (30 EC):**
- Great variety of suitable projects:
  - theoretical or practical
  - at university, in company
  - in NL, outside NL
  - associated with EE or CS research group

**Four streams:**
1. Systems on Chip
2. Embedded Software
3. Embedded Networks
4. Cyber-Physical Systems

/Mathematics and Computer Science
Streams

The main purpose of the four streams is to help you compose a coherent study program.

See the education guide for lists of mandatory and elective stream courses.

You may switch streams until you hand in your final study program (but note that switching streams may have consequences for your study planning).
Prerequisites

General prerequisites:
• logical reasoning and formalization skills
• programming experience in C/C++

Stream prerequisites:
• Systems on Chip:
  circuit analysis, digital logic, digital IC design
• Embedded Software:
  algorithms, complexity, formal languages, automata theory, UML
• Embedded Networking:
  operating systems, UML, computer networks
• Cyber-Physical Systems:
  DSP, linear algebra, control theory
Homologation modules

Available homologation modules (all 2.5 EC):

<table>
<thead>
<tr>
<th>Quartile Code</th>
<th>Course title</th>
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<tbody>
<tr>
<td>1</td>
<td>5LFK0 Circuit analysis</td>
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<tr>
<td>1</td>
<td>5LIS0 Computer Architecture and C progr.</td>
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<tr>
<td>1 or 2</td>
<td>2IHT10 Logic and set theory</td>
</tr>
<tr>
<td>2</td>
<td>5LIQ0 Linear Systems, signals and control</td>
</tr>
<tr>
<td>2</td>
<td>5LIP0 Digital integrated circuits: fundamentals</td>
</tr>
<tr>
<td>3</td>
<td>2IHS10 Software specification</td>
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</tbody>
</table>

Remarks:
- Students with an EE background should probably do 2IHT10.
- Students with a CS background may have to do 5LIS0.
- Evaluate for yourself, also depending on your choice of stream, which homologation modules you need (use our tool!).
Grad. project (local program)

The graduation project for ES consists of two parts:
1. Preparation (10 EC)
2. MSc thesis project (30 EC)

There is a great variety of suitable projects:
- theory, practice or design
- at the university or in a company
- at home or abroad (several agreements and contacts with other universities)

Always associated with a research group in the EE or CS department.
### Structure of the EIT Digital track

#### TU/e entry-point program

<table>
<thead>
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<tr>
<td>System Validation</td>
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<tr>
<td>Real-time Systems</td>
<td>Technical electives</td>
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<tr>
<td>Technology entrepreneurship</td>
<td>Winter school (1 EC)</td>
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<tr>
<td>Innovation Space project (10EC)</td>
<td>Summer school (4 EC)</td>
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<td></td>
<td>I&amp;E elective</td>
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#### TU/e exit-point program

<table>
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<tr>
<td>Networked Embedded Systems</td>
<td>Technical elective</td>
</tr>
<tr>
<td>Architecture of Distributed Systems</td>
<td>Technical elective</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>I&amp;E study (6 EC)</td>
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</tbody>
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The graduation project must be done in a company, with a TU/e supervisor involved. Preferably, there is a link between the I&E minor thesis and the MSc thesis. We shall provide a list of suitable projects towards the end of Q1.
Grad. project (EIT Digital track)

The graduation project for the EIT Digital track has no (mandatory) preparation phase.

Graduation project is always with a company (preferably an EIT partner) and takes the form of an internship.

We will distribute a list of suitable project proposals with an associated supervisor (staff member of an EE or CS research group).

A staff member of the IE&IS department will take care of the I&E supervision.
Planning your studies

Aim for 15 EC per quartile; count on 42+ hrs. per week!

Note: courses may have overlapping schedules!
   So: carefully check the feasibility of your schedule and also take into account the scheduling of examinations!

Lecturers expect you to be present and available during both lecture and examination periods!

EIT Digital entry point students: make sure that your summer school does not clash with activities (exams, resits) at the TU/e!
You will be prepared for a career in industry, but academic education is supposed to do more than that (and also industry requires this).

Learning to work with innovative tools (prototypes!) is an important part of the program.

MSc thesis project should involve a research component.
Help us improve the program!

Study Program Committee

Current student members:
• Tijmen van Dien (t.v.dien@student.tue.nl)
• Emma van de Vreugde (e.e.v.d.vreugde@student.tue.nl)

Please fill out course evaluations

Taken seriously by the program management and lecturers.

Discussed in the study program committee.
Program-related issues?

Study Counsellor of the CS graduate program

Dr. Natasha Stash (n.v.stash@tue.nl)

Always first ask your questions regarding the program to her. She will forward you to me if she cannot help you.

Program manager Embedded Systems and EIT Digital Embedded Systems

Dr. Bas Luttik
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Administrative issues?

All general administrative issues (e.g., problems with registration, digital systems, etc.) should be addressed to STU (STU@tue.nl) or the International Office (io@tue.nl).

All program-specific administrative issues (e.g., problems with registration, digital systems, etc.) should be addressed to the student administration of Mathematics and Computer Science (studadm.win@tue.nl).

EIT Digital related administrative questions:

Mrs. Inge Adriaans (G.E.R.I.Adriaans@tue.nl)
Where to look for information:

Education Guide: educationguide.tue.nl and find

• **Embedded Systems program** or
• **EIT Digital special track on Embedded Systems**
  (depending on your program)

Program guide of the CS Graduate Program (**pdf** available from educationguide.tue.nl)

Program and Examination Regulations

(The latter document is leading, but the info in the education guide or the CS GP guide are more comprehensible.)
Embedded Questions