Programme syllabus

Degree Programme in Microelectronics
Civilingenjörsutbildning i mikroelektronik
300.0 credits

Valid for students admitted to the education from autumn 08 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

In addition to the Higher Education Ordinance requirements for the Civil Engineering degree, the following specific objectives apply for the Civil Engineering Programme in Microelectronics (ME)

Knowledge and understanding

• to provide thorough knowledge of mathematics and science, as required in applied physics. This is ensured by means of a large scientific and technological base.

• to provide knowledge to be able to model, predict and evaluate events, mathematically, by using a computer or experimentally. This is ensured by means of courses in numerical analysis and several experimental courses.

• to provide good knowledge of the technological sciences and in-depth research that are offered within the programme. This is ensured through a varied range of courses and proximity to KTH's strong research in the field.

For international specialization, a civil engineer who has attended the programme can:

• follow and utilize knowledge development in the field of technology in the respective languages (Spanish, German, French).

• comprehensively follow and utilize knowledge development in the field of technology in the respective languages (Chinese and Japanese).

Skills and abilities

• to be able to realize products, systems, processes, products or services throughout their entire life cycle. This is ensured by the courses providing practical examples.

• to provide the ability to analyze and critically evaluate different technological solutions with a holistic approach, i.e., with an understanding of the context in which they operate. This is ensured through various stages of the course and through specific courses that discuss the engineering methods and the engineer's role in a larger context.

• provides education and ability to lead and collaborate on projects, with groups of different composition. This is ensured through specific project management courses, as well as work on projects in various courses.

• provides the ability to communicate with other individuals, using different media and languages, has the
ability to use the skills in other countries and cultures. This is ensured by internationalization, both domestically and internationally, for example, by the study environment in the higher academic years being very international (Masters international recruitment programme), and through the option to spend part of their education abroad and/or study with international specialization.

For international specialization, a civil engineer who has attended the programme can:

• communicate effectively with colleagues in the language in question (Spanish, German, French)
• operate professionally in countries where the language is spoken (all languages)

**Ability to make judgements and adopt a standpoint**

Ability to make judgments and adopt a standpoint

• to educate Civil Engineers with knowledge of economic, social and environmental conditions and needs of employees, customers and society. This is ensured by the subjects or more specific courses being related to the needs of the group.

• are prepared for lifelong learning to adapt to the changing conditions of work. This is ensured by means of a large fundamental scientific and technological base.

• is provided the capacity to assume responsibility for the consequences of the operations which an engineer may have for the environment as well as health and safety. This is ensured by the different courses highlighting the engineer's professional role.

**Extent and content of the programme**

The education covers five years and **300 credits**. The first three years are at a *foundation level* and the final two at *advanced level*.

The programme's final two years consist of the following Masters programmes.

• Computational and Systems Biology
• Electrophysics
• Photonics
• Nuclear Energy Engineering
• Mathematics
• Medical Engineering
• Nanotechnology
• System-on Chip Design
• Engineering Physics
• Scientific Computing
• Wireless Systems

For some of these Masters programmes it is an entry requirement for students to voluntarily choose some courses in the lower academic years.
KTH's policy is to mainly use Swedish for the first three years of study and English for the subsequent two years. Most courses at the advanced level are thus in English. Some courses at the foundation level may also be in English, depending on the teacher.

**Eligibility and selection**

*Completed upper secondary education including documented proficiency in Swedish corresponding to Swedish B and English corresponding to English A. For students who received/will receive their final school grades after 31 December 2009, there is an additional entry requirement for mathematics as follows: documented proficiency in mathematics corresponding to Mathematics A. And the specific requirements of mathematics, physics and chemistry corresponding to Mathematics D, Physics B and Chemistry A.*

**Implementation of the education**

**Structure of the education**

The academic year is divided into terms, the periods etc. are explained in KTH's intranet, regulations.

**Academic years 1 and 2** are for the most part structured in accordance with a system of obligatory courses of 7.5 credits including two parallel courses per period.

**Academic year 1** begins with a course in basic mathematical and engineering skills. This serves to provide a soft start to the university studies. The course serves the special purpose of providing a smooth transition from upper secondary school to university level through revision of upper secondary school mathematics, experimental methods and skills training through practical problem solving and some programming. Academic year 1 also contains a mathematical base block with a number of courses in basic algebra and analysis and courses in basic physics.

**Academic years 2 and 3** cover detailed mathematical knowledge through courses in vector analysis, complex analysis, transform methods, differential equations and mathematical statistics. Basic knowledge of physics is also built on in the academic years 2-3 with courses in, for example, modern physics, electromagnetic theory and solid state physics. The mathematics and physics are supplemented with a course of chemical concepts as well as more applied courses in numerical methods, project management and courses on electrical circuits and components. In academic year 3 students choose one field of specialization/Master programme. Academic year 3 ends with a degree project at foundation level. After which there is the opportunity to apply for a bachelor’s degree.

**Academic years 4 and 5**

Master programme courses are studied in academic years 4 and 5 and any entry requirement courses for these are studied in academic year 3 in the spring, parallel to the bachelor’s programme.

Obligatory courses on the Master programme are generally obligatory courses for ME. Research methodology and theory of knowledge thus becomes obligatory for all ME students studying in years 4 and 5 (but not for the bachelor’s degree).

Some courses may be excluded if they overlap with obligatory courses on ME. In principle, the entire selected Master programme with the included courses should be studied.

**Language specialization**

Studying the ME programme with a language specialization means that you study a language parallel to other courses and that in years 4 or 5 you have one-year exchange in any country where the respective language is spoken and used as language of instruction at university.
For European languages, in addition to the programme's regular courses, 25.5 credit courses in language and culture are split as 7.5 + 9 + 9 credits over the years. Academic year 4 is studied abroad with 15 language credits and 45 credits within the chosen specialization. In August, the summer between academic years 3 and 4, there is a 4.5 credit cultural course in the country where the student will be staying. The degree project is normally done in Sweden.

For Asian languages, the following is applicable: In addition to the programme's regular courses, there are courses of 30 credits in language and culture split as 6 + 6 + 9 + 9 credits over the years. Academic year 5 is studied abroad with 30 language and culture credits and 30 degree project credits.

Since the courses in language and culture are more than the allotted number for elective courses with 30 credits, an adjustment must be made on the specialization choice to accommodate the 45 respectively 60 credits of language specialization. This is done in the form of an individual study programme.

Courses

The programme is course-based. Lists of courses are included in appendix 1.

The education takes the form of courses. The course lists are presented in Appendix 1.

For students of the international specialization there is no scope for all elective courses. Students in other specializations have elective courses of around 30 credits.

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Courses at KTH are graded in accordance with a criterion-referenced seven grade scale A-F as final grades for courses at the foundation and advanced levels. A - E are pass grades, with A being the highest grade. Grades Pass (P) and Fail (F) are used as final grades under special circumstances.

Conditions for participation in the programme

The study application shall be completed by all students intending to study during the coming term. This application constitutes the term registration and forms the basis for progression to the next term. The study application for the autumn term shall be submitted no later than 15 May and the spring term no later than 15 November.

The choice of courses is generally made in connection with the study application.

The advancement rules for the ME programme are:

- from academic year 1 to academic year 2 - 45 credits from academic year 1.
- from academic year 2 to academic year 3 - 90 credits from academic years 1 and 2, including 50 credits from year 1
- from academic year 3 to academic year 4 - 150 credits from academic years 1, 2 and 3, 110 credits from academic years 1 - 2. Degree project at the foundation level, 15 credits, must be completed.

The choice of specialization is made in academic year 3.

Course registration is done before the third week of the course for the enrolled students who have declared their intention to take the course.

Recognition of previous academic studies

Students who have studied one or more courses at another university or college can apply to receive a credit transfer to the Civil Engineering degree. The courses to be credited may not overlap any courses already studied at KTH.
In order to replace an obligatory course, the documented skills to the same extent as for the corresponding course must be shown.

Application forms for credit transfer or replacement of a course shall be submitted for assessment and decision to the study counsellor by the programme coordinator. The application must include certified copies of grades for the cited course and course descriptions (syllabus). Processing normally takes two weeks from the date of application. A copy of the decision is always sent back to the applicant.

See rules for credit transfer:

http://intra.kth.se/regelveryutbildning-forskning/grundutbildning/prestationer/L27200

**Studies abroad**

To be eligible for exchange studies within the framework of an exchange agreement with foreign universities, the following is applicable:

• a maximum of two unfinished courses if you are in academic year 2
• a maximum of three unfinished courses if you are in academic year 3

For the selection of programme specific locations the KTH’s general selection criteria is applicable. See KTH’s rules for exchange studies:

http://intra.kth.se/regelverk

**Degree project**

For the Civil Engineering degree a degree project of 30 credits *in microelectronics* shall be completed. The degree project is normally carried out at the end of the education and cannot be started until the student has accumulated at least 240 credits from the programme.

The degree project *shall be completed within the specialization* chosen by the student. The choice of degree project is made in academic year 3 in consultation with the dedicated examiner.

The degree project is graded in accordance with the scale A-F, where A-E are pass grades. To be awarded a pass the degree project must be graded a pass in accordance with three assessment criteria: *process, technical/scientific content* and *presentation*.

See KTH’s rules for degree project work:

http://intra.kth.se/regelverk

**Degree**

The conditions for the degree are met, by means of the course requirements being fulfilled.

The title of the degree is the Civil Engineering degree. The degree certificate states the education programme, Microelectronics, which the student has undergone.

The application for the degree is submitted to the education office at the KTH School of Information and Communication Technology.

See KTH’s local degree regulation:

http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Degree Programme in Microelectronics (CMIEL), Programme syllabus for studies starting in autumn 2008

General courses

Year 1

Mandatory courses (60.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID1004</td>
<td>Object-oriented Programming</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IE1204</td>
<td>Digital Design</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IF1611</td>
<td>Engineering Fundamentals</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IF1612</td>
<td>Applied Physics, Thermodynamics and Waves</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1624</td>
<td>Algebra and Geometry</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1625</td>
<td>Calculus in One Variable</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1626</td>
<td>Calculus in Several Variable</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SG1108</td>
<td>Applied Physics, Mechanics</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Optional courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>II1310</td>
<td>Introduction to Computer Studies</td>
<td>1.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1611</td>
<td>Introductory Course in Mathematics I</td>
<td>1.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

Recommended courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1362</td>
<td>Spoken and Written Swedish</td>
<td>6.0</td>
<td>First cycle</td>
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### Year 2

**Mandatory courses (60.0 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN1215</td>
<td>Numerical Methods, Basic Course</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>EH1010</td>
<td>Project Course in Electrical Engineering</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>EI1102</td>
<td>Electrical Circuit Analysis</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>EI1200</td>
<td>Electromagnetic Field Theory</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IH1611</td>
<td>Semiconductor Devices</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1635</td>
<td>Signals and Systems, part I</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1648</td>
<td>Partial Differential Equations</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1649</td>
<td>Vector Analysis and Complex Functions</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

### Year 3

**Mandatory courses (49.5 credits)**

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<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>EQ1100</td>
<td>Signals and Systems, part II</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IE1202</td>
<td>Analog Electronics</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IM2660</td>
<td>Solid State Physics</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IT161X</td>
<td>Degree Project in Microelectronics and Applied Physics, First Cycle</td>
<td>15.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>KD1140</td>
<td>The Concepts of Chemistry</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF1901</td>
<td>Probability Theory and Statistics</td>
<td>6.0</td>
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</table>

**Optional courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DD2400</td>
<td>Cellular and Molecular Biology</td>
<td>15.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>ID1005</td>
<td>Algorithms and Data Structures</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>IF2692</td>
<td>Statistical Physics</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>IS1200</td>
<td>Computer Hardware Engineering</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
</tbody>
</table>

### Supplementary information

Year 4 in the degree programme Information and Communication Technology is equivalent to year 1 in a master’s programme.
For detailed information about the master’s programmes and the courses see Masters programmes (2 yrs).

Master, Beräknings- och systembiologi / Computational and Systems Biology
http://www.kth.se/student/kurser/program/tbsbm

Master, Elektrofysik / Electrophysics
http://www.kth.se/student/kurser/program/telfm

Master, Fotonik / Photonics
http://www.kth.se/student/kurser/program/tphsm

Master, Kärnenergiteknik / Nuclear Energy Engineering
http://www.kth.se/student/kurser/program/tneem

Master, Matematik / Mathematics
http://www.kth.se/student/kurser/program/tmthm

Master, Medicinsk teknik / Medical Engineering
http://www.kth.se/student/kurser/program/tmlem

Master, Nanoteknik / Nanotechnology
http://www.kth.se/student/kurser/program/tntem

Master, Systemkonstruktion på kisel / System on Chip design
http://www.kth.se/student/kurser/program/tskkm

Master, Tekniska beräkningar / Scientific Computing
http://www.kth.se/student/kurser/program/tsccm

Master, Teknisk fysik / Engineering Physics
http://www.kth.se/student/kurser/program/ttfym

Master, Trådlösa system / Wireless Systems
http://www.kth.se/student/kurser/program/ttlsm

**Year 5**

**Supplementary information**

Year 4 in the degree programme Information and Comunication Technology is equivalent to year 1 in a master’s programme.

For detailed information about the master’s programmes and the courses see Masters programmes (2 yrs).

Master, Beräknings- och systembiologi / Computational and Systems Biology
http://www.kth.se/student/kurser/program/tbsbm

Master, Elektrofysik / Electrophysics
http://www.kth.se/student/kurser/program/telfm

Master, Fotonik / Photonics
http://www.kth.se/student/kurser/program/tphsm

Master, Kärnenergiteknik / Nuclear Energy Engineering
http://www.kth.se/student/kurser/program/tneem

Master, Matematik / Mathematics
http://www.kth.se/student/kurser/program/tmthm
Master, Medicinsk teknik / Medical Engineering
http://www.kth.se/student/kurser/program/tmlem

Master, Nanoteknik / Nanotechnology
http://www.kth.se/student/kurser/program/tntem

Master, Systemkonstruktion på kisel / System on Chip design
http://www.kth.se/student/kurser/program/tskkm

Master, Tekniska beräkningar / Scientific Computing
http://www.kth.se/student/kurser/program/tscm

Master, Teknisk fysik / Engineering Physics
http://www.kth.se/student/kurser/program/ttfym

Master, Trådlösa system / Wireless Systems
http://www.kth.se/student/kurser/program/ttslsm

**Individual (IND)**

**Year 1**
**Year 2**
**Year 3**
**Year 4**
**Year 5**

**International Profile, Japanese (INJA)**

**Year 1**

Mandatory courses (6.0 credits)

<table>
<thead>
<tr>
<th>Course code</th>
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<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DS1380</td>
<td>Elementary Japanese and Japanese Studies</td>
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**Year 2**

Mandatory courses (6.0 credits)

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<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DS1383</td>
<td>Japanese, Advanced Beginners Level I</td>
<td>6.0</td>
<td>First cycle</td>
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### Year 3

**Mandatory courses (9.0 credits)**

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<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>DS1384</td>
<td>Japanese, Advanced Beginners Level II</td>
<td>9.0</td>
<td>First cycle</td>
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### Year 4

**Mandatory courses (9.0 credits)**

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<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>DS1386</td>
<td>Japanese, Intermediate Level</td>
<td>9.0</td>
<td>First cycle</td>
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</table>

### Year 5

**International Profile, Chinese (INKI)**

### Year 1

**Mandatory courses (6.0 credits)**

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<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DS1391</td>
<td>Elementary Chinese and Chinese Studies</td>
<td>6.0</td>
<td>First cycle</td>
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### Year 2

**Mandatory courses (6.0 credits)**

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<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>DS1393</td>
<td>Chinese, Advanced Beginners Level I</td>
<td>6.0</td>
<td>First cycle</td>
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### Year 3

**Mandatory courses (9.0 credits)**

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<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DS1394</td>
<td>Chinese, Advanced Beginners Level II</td>
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### Year 4

**Mandatory courses (9.0 credits)**

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<th>Edu. level</th>
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<tbody>
<tr>
<td>DS1396</td>
<td>Chinese, Intermediate Level</td>
<td>9.0</td>
<td>First cycle</td>
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### Year 5

**International Profile (INT)**

#### Year 1

**Conditionally elective courses**

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<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>DS1323</td>
<td>German, Advanced Beginners Level</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>DS1339</td>
<td>French, Advanced Beginners Level</td>
<td>7.5</td>
<td>First cycle</td>
</tr>
<tr>
<td>DS1343</td>
<td>Spanish, Advanced Beginners Level</td>
<td>7.5</td>
<td>First cycle</td>
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</table>

#### Year 2

**Conditionally elective courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS1324</td>
<td>Technical German, Intermediate Level</td>
<td>9.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>DS1334</td>
<td>Technical French, Intermediate Level</td>
<td>9.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>DS1348</td>
<td>Technical Spanish, Intermediate Level</td>
<td>9.0</td>
<td>First cycle</td>
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#### Year 3

**Conditionally elective courses**

<table>
<thead>
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<th>Course name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>DS2326</td>
<td>Technical German, Advanced Level</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DS2336</td>
<td>Technical French, Advanced Level</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DS2349</td>
<td>Technical Spanish, Advanced Level</td>
<td>9.0</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

### Year 4

### Year 5
Appendix 2: Specialisations

Degree Programme in Microelectronics (CMIEL), Programme syllabus for studies starting in autumn 2008

Individual (IND)

International Profile, Japanese (INJA)

International Profile, Chinese (INKI)

International Profile (INT)