



Master of Science in Technology, Communications and Systems Engineering

The Master's Programme in Communications and Systems Engineering is an international Master's programme focusing on the most popular telecommunication networks of both the present and the future. The emphasis of the programme is on wireless communications and mobility issues. The programme also addresses the areas of telecommunication architecture evolution, digital communication and radio technology. Key subject areas in mobile networks are wireless communication, quality of service, mobility and security. Students have the opportunity to take courses in both general telecommunications and in specific fields of mobile communication.

The Aim of Communications and Systems Engineering Program

Energy and sustainable development is the focus technical area at the University of Vaasa. Energy systems have been dramatically deviating from their old conventional structure. There are many crucial reasons motivating these changes, for example the expected reduction in the natural unrenovable resources (e.g., oil) due to the large consumption, the huge accelerated global demand for electrical energy, and climate change. Therefore, some of the main objectives for the future energy systems are to

1. Achieve the highest possible efficiency
2. Be based on renewable resources as much as possible (sustainability)
3. Minimize pollution
4. Create self-healing and reconfigurable power networks
5. Have the highest reliability and security systems

The above objectives require information gathering (technical and non-technical) as well as information processing, communication, and optimum automated actions. This whole process is called a smart system. One core of smart or intelligent energy systems is known as a smart grid. Telecommunication engineering is an essential part in the loop of smart grids as it enables the accommodation of distributed renewable energy generation and it provides the platform for monitoring, operating, control, and protecting both renewable energy generators and power systems. Telecommunication can be considered as the connecting tie between all technical aspects of energy systems. It is the mean for achieving the distributed intelligence. Therefore, the failure of telecommunication in smart grid leads to the absolute failure for the whole system.

Communication platform could be described to have four major layers: Physical, Multiple access control (MAC), Network, and Application layers. Every layer consists of sublayers, nevertheless, the application layer is what the system designer deals with. However, the lower three layers are the basis of the whole communication process. Those lower layers determine the communication capabilities (e.g., data speed, throughputs, delay, outage, losses, reliability, part of the security, etc.). Therefore, the Comsys study program provides several important courses to cover a wide range of topics related to the communication layers.

The Comsys unit provides the required knowledge as well as research activities in many related areas such as: wireless automation with application in energy systems, wireless sensor networks, Internet of things (IoT), wireless platforms with strict QoS requirements, advanced communication techniques and its industrial applications, data fusion and data analysis, networked control and optimization of smart grids, etc. ComSys is a part of the multidisciplinary picture for energy research and development at the University of Vaasa.

Learning outcomes

After completing the Master's Programme in Communications and Systems Engineering you will:

- Have strong knowledge and general picture about communication engineering and its roles in smart systems and applications in energy systems and industry.
- Understand different advanced wireless communication systems, their structures, performance, applications, and theories behind them.
- Understand how the communication systems are integrated with automation and computer systems and how they are utilized in different data transfer situations, e.g. controlling energy production and transfer, in electrical payments systems and e-business etc.
- Evaluate, compare and select between communication systems or modify or even develop new ones when needed for some special purposes.
- Design communication systems/networks/platforms after some training in industry.



- Work efficiently in groups as well as individually.
- Use high-level computer packages such as Matlab to make simulations for systems.
- Write up-to-date and high-level scientific reports in different related areas such as wireless communication, wireless sensor networks, embedded systems, automation, distributed energy production information systems etc.
- Present ideas publicly and defend them in a scientific way.
- Understand and be able to analyze future communication systems.
- Have strong scientific research skills; hence, you will be able to continue smoothly into PhD studies in any technical university as well as research institutes.

Supplementary Studies

Students who have a B.Sc. degree from a polytechnic / university of applied sciences or from some other major subject than telecommunications, automation engineering or electrical engineering must do supplementary studies. The exact amount of the required supplementary studies (maximum of 60 ECTS) depends on the contents of the degree, and is defined by the Head of the Programme. They are marked in the student's personal study plan (PSP) which is a compulsory document all students create with the guidance of Coordinator of International Education in the beginning of their studies. The supplementary studies will be added on top of the total of 120 ECTS of the M.Sc. degree. The supplementary courses are important since they help those whose background in analytical analysis is not sufficient enough to integrate and proceed smoothly in the advanced-level courses.

For example: Supplementary studies (14 ECTS) to students holding B.Sc. degree from a Finnish polytechnic/University of Applied Sciences:

MATH1240	Linear Algebra II	3
MATH1070	Integral Transforms	3
ICAT1010	C Programming	3
MATH1170	Probability and Statistics	5

MASTER OF SCIENCE (TECHNOLOGY), MASTER'S PROGRAMME IN COMMUNICATIONS AND SYSTEMS ENGINEERING 120 ECTS

Head of the Program: Mohammed Elmusrati

COMPLEMENTARY STUDIES 30-31 ECTS

Mandatory courses (unless completed in the previous degree)

OPIS0039	Personal Study Plan	0
KENG9212	Writing Academic English	5
KSUO5111	Finnish for Foreigners I	5
<i>(those who already master the basics of Finnish choose Finnish for Foreigners II or III, native Finnish speakers choose another course)</i>		
OPIS0025	Information Skills I (unless completed earlier)	1
TLTE2090	Wireless Networks	5
TLTE2100	Computer Architectures	5
STAT3120	Probability and Stochastic Processes	5

Additional courses, enough courses to reach a total of 30 ECTS must be chosen (in case mandatory courses make less than 30)

TLTE2010	Mobile Communication Services and Systems	5
TLTE2040	Telecommunication Software	5
TLTE2050	Telecommunication Electronics	5
MATH2030	Numerical Methods	5
MATH2040	Advanced Optimization	5
<i>or separately agreed courses</i>		

MAJOR STUDIES 40 ECTS

Note that you can quite freely select your major courses but many of them require prerequisites. So you should select your complementary studies, major studies and optional studies so that you have passed the courses needed as prerequisites to your major courses.

Mandatory Courses (13 ECTS)

TLTE3170	Embedded C-Programming	3
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TLTE3150	Advanced Course in Signals and Systems	5
TLTE3010	Digital Communication	5

Major courses, enough courses to reach a total of 40 ECTS must be chosen

TLTE3050	Radio Resource Management	5
TLTE3160	Telecommunication Architectures	5
TLTE3030	Broadband Wireless Communication	5
TLTE3070	Special Topics in Communications and Systems Engineering	1–10
TLTE3080	Project Work in Communications and Systems Engineering	3–15
TLTE3090	Communications and Systems Engineering Seminar	3–10
TLTE3060	Introduction to Radio Technology	5
TLTE3120	Computer Simulation in Communication and Systems	5
AUTO3310	Digital Signal Processors	5
AUTO3290	Sound Processing	5
AUTO3110	Machine Vision	5
TITE3070	Analysis and Design of Human Computer Interaction	5
SATE3130	Smart Grid Communication	6

TLTE3990 MASTER'S THESIS, THESIS PRESENTATION AND MATURITY EXAM 30 ECTS

TLTE3990	Master's Thesis	30
TLTE3991	Presentation	0
KNÄY300x	Maturity Exam	0

BUSINESS STUDIES (LIIKETOIMINTAOSAAMINEN) 14 ECTS

Mandatory for Finnish Students, recommend for others.

Choose at least 14 ECTS from the following courses (in Finnish only):

AUTO3350	Tuotekehitys ja IPR	5
ENER3070	Energiatekniikan projektityö 1-3	enintään 20
ORMS2020	Päätöksenteko epävarmuuden vallitessa	5
TITE3300	Ohjelmistoliiketoiminta	5
TITE2220	Introduction to E-business	5
TITE3270	Tietojenkäsittelytoiminnan johtaminen	5

Furthermore, such business studies, which are not included in another degree or in another module in the M.Sc. degree, can be included in the Business Studies module, for example management, organisational, marketing, accounting, finance, business law, economics, industrial management, business, international business or energy-related business studies.

Business studies can be completed in the abovementioned programmes at the University of Vaasa (note that there may be programme-specific entry restrictions) or as open university studies (the open university announces the selection of course units offered free of charge for degree students annually on their website).

The Business Studies module does not have to be completed if the M.Sc. degree includes a minor in business studies (for example management, marketing, accounting, finance, business law, economics, industrial engineering, business, business development, international business, energy-related business studies or other related minor).

OPTIONAL STUDIES (5–20 ECTS)

The students may choose these optional courses from any study program of the University of Vaasa or from other universities

For Example:

TLTE3950 Practical Training 1–5 ECTS (The degree may include practical training / internship improving the student's professional expertise. A two-week (á 40 hours) training period is equivalent to 1 ECTS. The student must also write a report about the training.)

Recommended optional courses

KSUO5112	Finnish for Foreigners II	5
KSUO5113	Finnish for Foreigners III	3
SATE2020	Energy Production	5
OPIS0026	Information Skills II	1



TITE2220 Introduction to E-business 5
Or other Mathematical, Automation, Energy, or Communications and Systems Engineering courses