

Curriculum 2025-2027

Master's programme in Communications Engineering and Data Science

In this document, you can find a preliminary curriculum for the CoDaS programme for academic years 2025-2027. Please note that changes are still possible.

Updated on 21.11.2024.

Aalto University, Finland

| Year | Area | Credits | Course Name | Credits |
|------|-------------------------------|---------|---|---------|
| 1st | General studies | 6 | ELEC-E0110 Academic skills in MSc studies I-IV | 3 |
| | | | Compulsory Language course | 3 |
| | Communications | 10 | ELEC-E7120 Wireless Systems I | 5 |
| | | | ELEC-E7230 Mobile communication Systems II | 5 |
| | Data Science | 10 | CS-C3240 Machine learning I | 5 |
| | | | CS-E4800 Artificial Intelligence D III-IV | 5 |
| | Mathematics and Programming | 5 | MS-C2111 Stochastic processes II | 5 |
| | Project | 6 | ELEC-E7633 Project Course III-V | 6 |
| | Electives – fulfil 60 credits | | Student chooses from the list below | |
| | Specialization | 5 | ELEC-C8201 Control and Automation III-IV (Track-specific specialization course) | 5 |

| Year | Area | Credits | Course Name: | Credits |
|------|-------------------------------|---------|---|---------|
| 2nd | General studies | 3 | Compulsory Language course (if not completed in Entry University) | 3 |
| | Communications | 5 | ELEC-E7140 Networked Systems I | 5 |
| | Data Science | 5 | ELEC-E7261 Ambient Intelligence D I-II | 1-8 |
| | Automation | 5 | ELEC-E8101 Digital and optimal control I-II | 5 |
| | MSc thesis | 30 | M.Sc. Thesis | 30 |
| | Electives – fulfil 60 credits | | Student chooses from the list below | |

Elective Studies:

| Code | Course Name | ECTS | Period/Year |
|------------------|---|------|-------------|
| CS-C3130 | Information Security | 5 | I |
| CS-E4190 | Cloud Software and Systems | 5 | I-II |
| CS-E4300 | Network Security | 5 | I-Summer |
| CS-E4340 | Cryptography | 5 | I-II |
| CS-E4370 | Applied Cryptography | 5 | |
| CS-E4380/MSE1687 | Special course: Advanced Cryptography D | 5 | |
| CS-E4350 | Security Engineering | 5 | III-IV |
| CS-E4650 | Methods of Data Mining | 5 | I-II |
| CS-E4825 | Probabilistic Machine Learning D | 5 | |
| CS-E4715 | Supervised Machine Learning D | 5 | |
| CS-E4890 | Deep Learning | 5 | IV-V |
| CS-E5480 | Digital Ethics | 3-5 | V-Summer |
| CS-E5710 | Bayesian Data Analysis | 5 | I-II |
| ELEC-E4420 | Microwave Engineering | 5 | III-IV |

| | | | |
|------------|--|----|--------|
| ELEC-E5410 | Signal Processing for Communications | 5 | I-II |
| ELEC-E5424 | Convex Optimization D | 5 | |
| ELEC-E5431 | Large Scale Data Analysis | 5 | III-IV |
| ELEC-E5440 | Statistical Signal Processing | 5 | I-II |
| ELEC-E7120 | Wireless Systems | 5 | I |
| ELEC-E7131 | Internet Traffic Measurements and Analysis | 10 | I-II |
| ELEC-E7230 | Mobile Communication Systems | 5 | I |
| ELEC-E7240 | Coding Methods | 5 | III |
| ELEC-E7311 | SDN Fundamentals & Techniques | 5 | III-IV |
| ELEC-E7470 | Cybersecurity | 5 | V |
| ELEC-E8001 | Embedded Real-Time Systems | 5 | I-II |
| ELEC-E8101 | Digital and Optimal Control | 5 | I-II |
| ELEC-E8102 | Distributed and Intelligent Automation Systems | 5 | I-II |
| ELEC-E8103 | Modelling, Estimation and Dynamic Systems | 5 | I-II |
| ELEC-E8740 | Basics of Sensor Fusion | 5 | I-II |
| ELEC-E5810 | Biosignal processing | 5 | |
| ELEC-E7340 | Machine learning for Wireless Communications D | 5 | |
| MS-C1620 | Statistical inference | 5 | III-IV |

Grenoble INP, France

**NOTE: Only second year studies are offered at this university.
This is a preliminary curriculum and is subject to change.**

Students may choose 30 ECTS worth of courses from the following tracks:

- **Applied Artificial Intelligence and Interactive Systems (AAIS)**
 - Natural Language Processing and Information Retrieval (6 ECTS)
 - Computer Vision (6 ECTS)
 - Human – Computer Interaction (6 ECTS)
 - Robotics (6 ECTS)
 - Computer Graphics (6 ECTS)
 - Large Scale Data Management and Distributed Systems (6 ECTS)
 - Information Visualization (6 ECTS)
 - Multi-Agent Systems (6 ECTS)
- **Cloud Computing and Data Infrastructure (CCDI)**
 - Advanced Networking (6 ECTS)
 - Information Security (3 ECTS)
 - Distributed Systems (6 ECTS)
 - DevOps (6 ECTS)
 - Other optional courses

Students will complete their Master's Thesis (M.Sc.) for a total of 30 ECTS.

Students should complete a total of 60 credits.

Técnico Lisboa, Portugal

¹ - The degree is structured by credits in areas, so the students will be able to choose some alternative courses within each area, depending on their choices in the other university. In all cases, the study plan for each student needs to be agreed between the student and the degree coordinator, so that if fulfils the requirements from both home and host universities.

| Year | Area | Credits | Course Name | Credits |
|------------------------------------|-----------------------|-----------------|--|---------|
| 1st | General studies | 6 ² | Engineering Project Management | 6 |
| | | | Entrepreneurship, Innovation and Technology | 6 |
| | Communications | 24 ² | Digital Transmission | 6 |
| | | | Distributed Applications in the Internet | 6 |
| | | | High Speed Networks | 6 |
| | | | Learning-Based Multimedia Processing | 6 |
| | | | Mobile Communications Systems | 6 |
| | | | Mobile Networks and Internet of Things | 6 |
| | | | Multimedia Communication | 6 |
| | | | Network Algorithms and Applications | 6 |
| | | | Network Architecture and Management | 6 |
| | | | Optical Communication Systems | 6 |
| | Programmable Networks | 6 | | |
| | Data Science | 24 ² | Artificial Intelligence and Decision Systems | 6 |
| | | | Computability and Complexity | 6 |
| | | | Computational Statistics | 6 |
| | | | Cryptography and Communications Security | 6 |
| | | | Data Analysis and Integration | 6 |
| | | | Data Coding and Compression | 6 |
| | | | Decision Support Models | 6 |
| Information Systems and Data Bases | | | 6 | |
| Machine Learning | 6 | | | |
| Multivariate Analysis | 6 | | | |

| | | | | |
|----------------------|----------------------|-----------------|--|---|
| | | | Object Oriented Programming | 6 |
| | | | Optimization and Algorithms | 6 |
| | | | Statistical Methods in Data Mining | 6 |
| | Project ⁴ | 6 | Project in Electrical and Computers Eng. | 6 |
| 2 nd 3 | Communications | 18 ² | Digital Transmission ³ | 6 |
| | | | Distributed Applications in the Internet | 6 |
| | | | High Speed Networks | 6 |
| | | | Learning-Based Multimedia Processing | 6 |

| Year | Area | Credits | Course Name | Credits |
|------|------------------------------------|-----------------|--|---------|
| 2nd | Communications | 18 ² | Mobile Communications Systems | 6 |
| | | | Mobile Networks and Internet of Things | 6 |
| | | | Multimedia Communication | 6 |
| | | | Network Algorithms and Applications | 6 |
| | | | Network Architecture and Management | 6 |
| | | | Optical Communication Systems | 6 |
| | | | Programmable Networks | 6 |
| | Data Science | 12 ² | Artificial Intelligence and Decision Systems | 6 |
| | | | Computability and Complexity | 6 |
| | | | Computational Statistics | 6 |
| | | | Cryptography and Communications Security | 6 |
| | | | Data Analysis and Integration | 6 |
| | | | Data Coding and Compression | 6 |
| | | | Decision Support Models | 6 |
| | | | Information Systems and Data Bases | 6 |
| | | | Machine Learning | 6 |
| | | | Multivariate Analysis | 6 |
| | | | Object Oriented Programming | 6 |
| | | | Optimization and Algorithms | 6 |
| | Statistical Methods in Data Mining | 6 | | |
| | M.Sc. Thesis | 30 | M.Sc. Thesis | 30 |

- ² - The student needs to choose courses that satisfy the total in the Area.
- ³ - Track-specific specialization course
- ⁴ - This course can be taken in the 2nd year, as an introduction to the Thesis.

TU Braunschweig, Germany

| Year | Area | Credits | Course Name | Credits |
|--|-------------------------------------|--------------------------------|---|---------|
| 1st | General studies | 5 | Seminar: Computer Science | 5 |
| | Communication | 10 | Computer Networks 2 | 5 |
| | | | Mobile Communications | 5 |
| | Data science | 10 | Introduction to Machine Learning | 5 |
| | | | Pattern Recognition | 5 |
| | Mathematics and Algorithms | 10 | Student chooses from the elective studies "Mathematics and Algorithms" list below | 10 |
| | Project course | 6 | Project course "Communication Engineering and Data Science Project" | 6 |
| | Electives – fulfil 60 credits | 13 | Student chooses from the elective studies "all" list below | |
| Specialization (remote preparation for 2 nd year) | 6 | Health-Enabling Technologies A | 6 | |
| 2 nd | Communications | 5 | Recent Topics in Computer Networking | 5 |
| | Medical informatics and biomedicine | 10 | Biomedical Image and Signal Analysis | 5 |
| | | | Network Biology | 5 |
| | Data and Information | 5 | Student chooses from the elective studies "Data and Information" list below | 5 |
| | MSc thesis | 30 | MSc Thesis | 30 |
| | Electives – fulfil 60 credits | 10 | Student chooses from the elective studies "all" list below | 10 |

Elective Studies:

| Course Name | Credits |
|---|---------|
| Elective Studies "all" | |
| Seminar: Computer Science (for year 2; only possible if no other seminar has been taken before in year 1) | 5 |
| Elective studies "Networking" | |
| Practical Course Computer Networks | 5 |
| Practical Course Computer Network Administration | 5 |
| Mobile Computing Lab | 5 |
| Wireless Networking Lab | 10 |
| Advanced Networking 1 | 6 |
| Advanced Networking 2 | |
| Elective studies "Data Science and Health" | |
| Python Lab | 5 |
| Computer Lab Pattern Recognition | 5 |
| Health-Enabling Technologies B | 5 |
| Elective studies "Mathematics and Algorithms" | |
| Mathematical Foundations of Data Science | 10 |
| Computational Geometry | 5 |
| Approximation Algorithms | 5 |
| Online Algorithms | 5 |
| Elective Studies "Data and Information" | |
| Warehousing and Data Mining Techniques | 5 |
| Information retrieval and web search engines | 5 |
| Knowledge based systems and deductive database systems | 5 |

| |
|---|
| Module: Communication Theory |
| Information Theory |
| Network Information Theory |
| Physical Layer Security I |
| Physical Layer Security II |
| Optimization and Game Theory for Communications |

| |
|-------------------------------------|
| Machine Learning for Communications |
|-------------------------------------|

| |
|--------------------------------|
| Quantum Communication Networks |
|--------------------------------|

UPC, Spain

| Year | Area | Credits | Course Name | Credits |
|---------------------------------------|-----------------------------|---|---|---------|
| 1st | General studies | 12 | ICT-Based entrepreneurship | 3 |
| | | | Project on ICT based business model | 3 |
| | | | Service Engineering | 3 |
| | | | Creativity and engineering | 3 |
| | Communications | 8 | Next generation wireless communications and IoT | 3 |
| | | | Advanced topics in wireless communications | 3 |
| | | | Software-Defined Radio | 3 |
| | Data science | 14 | Machine learning from data | 5 |
| | | | Big data and data mining | 6 |
| | | | Federated and distributed learning | 3 |
| | Mathematics and programming | 6 | Software Architecture | 5 |
| | | | Network Engineering | 3 |
| | | | Advanced topics in Network Science | 2 |
| | | | Optimization for applied engineering design | 3 |
| Advanced topics on Optimization | | | 2 | |
| Project course | 6 | Project course | 6 | |
| Elective courses | 5 | At least 5 ECTS from the 2 nd year courses | 5 | |
| Specialization (2 nd year) | 6 | Levelling course on communications and electronics | 6 | |
| 2nd | Communications | 6 | Network support for 5G | 3 |
| | | | 5G mobile network planning | 3 |
| | | | Next-generation optical network for future cloud-based services | 3 |
| | | | Network security: authentication and authorization | 3 |
| | | | Applied image processing | 3 |

| | | | |
|--------------------|----|--|----|
| | | Augmented reality and smart objects | 3 |
| Internet of things | 12 | Sensors and interfaces | 3 |
| | | Low-power systems with energy harvesting | 3 |
| | | IoT and ubiquitous IP | 3 |
| | | Body sensor nodes | 3 |
| MSc thesis | 30 | MSc thesis | 30 |