Curriculum 2024-2026

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 202-2026. Please note that changes are still possible.

Updated on 17.4.2024.

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/MS-E1687	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

Year	Area	Credits	Course Name	Credits
1st	General studies	11	Research Methodology	3
			Technical Writing and Speaking in English	3
			French as a Foreign Language (elective)	0
			Python (MOOC)	0
			Control and Automation (from Aalto)	5
	Communications	12	Principles of Internet	6
			Digital Transmission (from Técnico Lisboa)	6
	Data science	12	Statistical learning and applications	6
			Foundations of data science	6
	Programming	10	Data Base Foundations	5
			Algorithmic Problem Solving	5
	Security	6	Introduction to Cybersecurity (Track-specific specialization course)	6
	Project	9	Project Course	6
			Internet measurement project	3
2nd	Communications	8	Cellular Networks	3
			Advanced Networking	5
	Data Science	15	Mathematical Foundations of Machine Learning	5
			From Basic Machine Learning Models to Advanced Kernel Learning	5
			Advanced Machine Learning: Applications to Vision, Audio and Text	5
	Security	7	Network Security	7
	MSc thesis	30	M.Sc. Thesis	30

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
2nd [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 2nd year)	6	Health-Enabling Technologies A	6
2nd	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 2nd year courses	5
	Specialization (2nd 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