

Master Curriculum

I NFORMATION AND **C** OMMUNICATION **E** NGINEERING

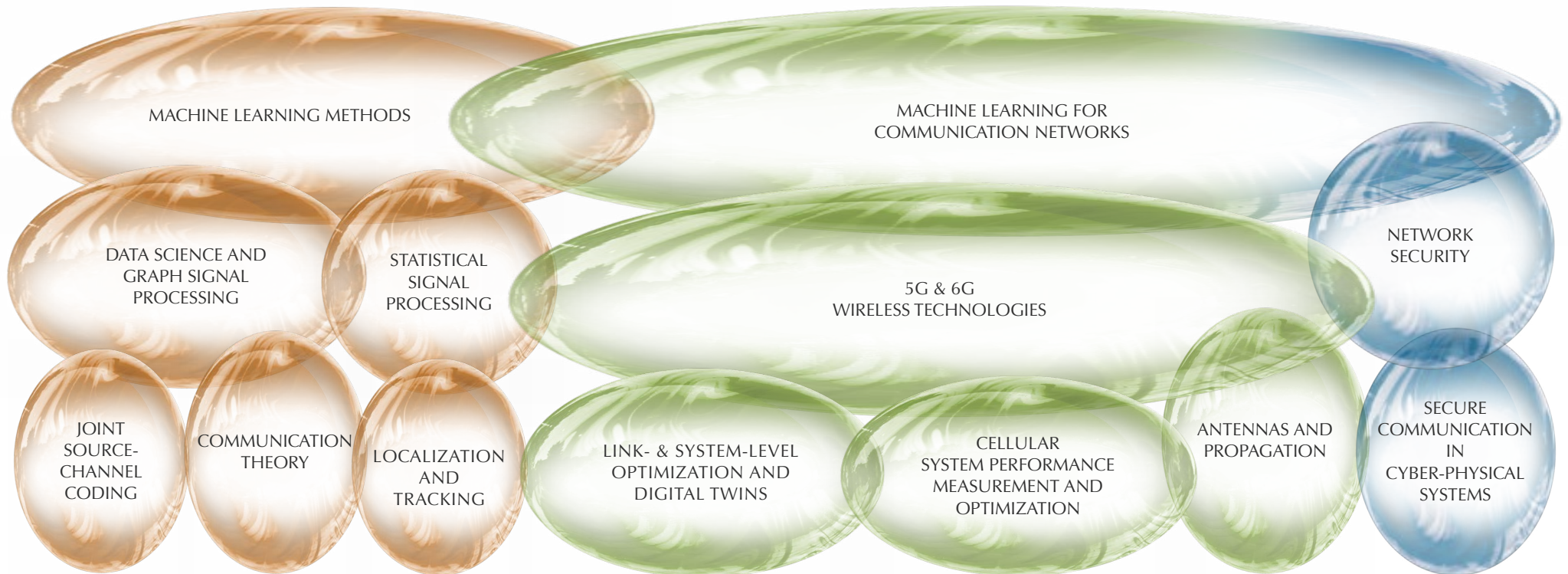


institute of
telecommunications

SIGNAL PROCESSING

WIRELESS COMMUNICATIONS

NETWORKS





TECHNISCHE
UNIVERSITÄT
WIEN

Bachelor

Master

Doktorat

Universitäts-
lehrgang

Studienplan (Curriculum)
für das

Masterstudium
Information and Communication Engineering
UE 066 507

Technische Universität Wien
Beschluss des Senats der Technischen Universität Wien
am 17. Juni 2024

Gültig ab 1. Oktober 2024
~~2024 bis 2025~~

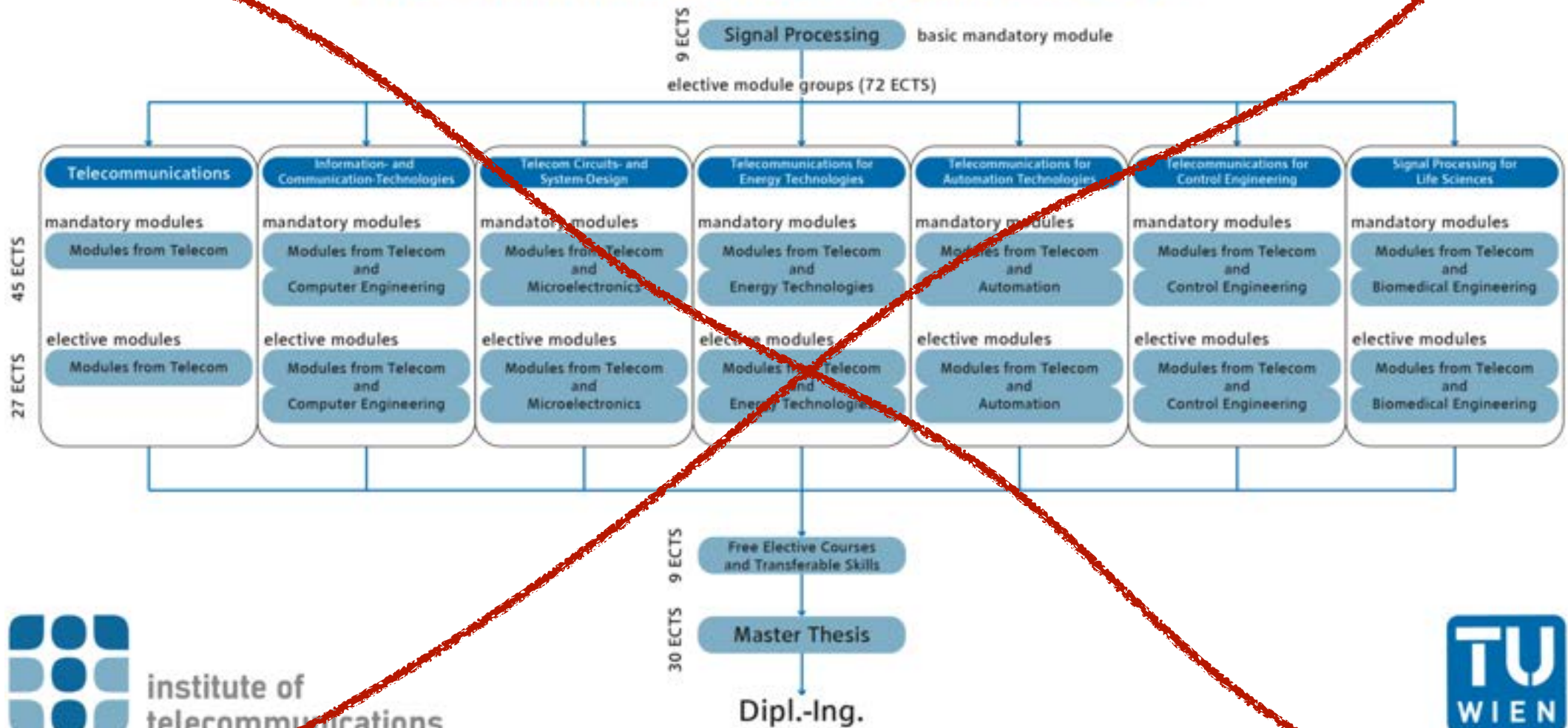
Curriculum

The legal document governing your journey to the master (Dipl.-Ing.) degree

... can be found on TISS

... replaces curriculum “Telecommunications” (2013 – 2024)

Telecommunications Master Program (120 ECTS)



Main Changes Telecom → ICE

- simpler structure (7 study paths are gone)
- huge flexibility
- more focus on machine learning
- Digital Communications module no longer exists
- multiple all-English tracks

ICE Curriculum Elements



- 4 semesters
- 9 ECTS credits for all modules (1 ECTS ~ 25 work hours)
- (E) indicates modules in English

Overall Structure (120 ECTS)

Information and Communication Engineering Foundations (18 ECTS)

Advanced Information and
Communication Engineering
(36 ECTS)

Adjacent Areas (27 ECTS)

Optional Courses and
Transferable Skills (9 ECTS)

Master Thesis (30 ECTS)

ICE Foundations (18 ECTS)

Signal Processing (E)

Signal Processing 1 (4.5)

Signal Processing 2 (4.5)

Machine Learning Basics (E)

Convex Optimization (3)

Machine Learning Algorithms (6)

- **mandatory** for all students
- deterministic and stochastic signal processing
- optimization theory and algorithms
- ML: regression, classification and clustering etc.

Advanced ICE (36 ECTS)

A Catalogue

Communication Networks (E)

Photonic & Optical Communication

RF Techniques (E)

Wireless Communications (E)

Special Topics in Machine Learning (E)

B Catalogue

Network Security (E)

Advanced Photonics

Advanced RF Techniques (E)

Advanced Wireless Communications (E)

Advanced Machine Learning (E)

Advanced Signal Processing (E)

- **some flexibility**, most modules in English
- choose 2 modules from A Catalogue and 2 modules from B Catalogue
- some B-modules coupled to A-modules

Adjacent Areas (27 ECTS)

circuits	Bauelemente und Systeme	Bauelemente und Systeme Vertiefung
	Analoge und Digitale Schaltungen	Analoge Schaltungen / Mixed Signal Vertiefung
	Design hochintegrierter Schaltungen	Integrierte Schaltungen Vertiefung
control	Automation	Optimale Systeme
	Nichtlineare dynamische Systeme & Regelungen	Grundlagen Robotik und Regelungstechnik
	Human-centered Robotics (E-)	Robot Vision (E)
CS	Machine Learning und Autonome Systeme (E)	Grundlagen der Informatik
	Algorithmik (E)	Artificial Intelligence (E)
energy	Energiewirtschaft	Energie konomie und Umwelt
	Informationstechnik in Smart Grids	Smart Grids aus Netzperspektive
life science	Basics of Biology for Information Engineering (E)	Basics of Physiology (E)
	Biomedizintechnik (E-)	

huge flexibility: choose 3 modules from this list **or** from A and B Catalogues

Optional Courses and Transferable Skills (9 ECTS)

- **all courses** from Austrian universities eligible
- at least 4.5 ECTS **transferable skills**:
 - communication and rhetoric
 - management and leadership
 - teamwork
 - analytical and critical reasoning
 - writing and presentation

Master Thesis (30 ECTS)

- typically during last semester
- duration ~6 months
- scientific work (27 ECTS)
 - “independent” with help of advisor(s)
 - **result**: code, hardware, algorithms, theorems etc. + scientific text
 - what are the **topics** you are interest in?
 - do you prefer math & theory?
 - ... programming & simulation?
 - ... hardware & experiments?
 - **who** do you want to work with?
- **final exam** (“defense”, 3 ECTS): thesis presentation and questioning

Choices and Semester Plan – Example 1

Advanced ICE

A Catalogue: Wireless Communications
Communication Networks
B Catalogue: Advanced Wireless Communications
Network Security

Adjacent Areas

RF Techniques
Advanced Machine Learning
Special Topics in Machine Learning

First Semester (30 ECTS)

4.5 VU Signal Processing 1
4.5 VU Signal Processing 2
6.0 VU RF Techniques
3.0 LU Labor RF Techniques
4.5 VO Communication Networks 1
3.0 VO Wireless Communications 2
4.5 Optional Courses and Transferable Skills

Second Semester (30 ECTS)

3.0 VO Convex Optimization for ICE
6.0 VU Machine Learning Algorithms
4.5 VU Graph Information Processing
4.5 VO Communication Networks 2
3.0 VU Network Security
3.0 SE Communication Networks Seminar
6.0 VU Wireless Communications 1

Third Semester (30 ECTS)

4.5 VU Statistical Reinforcement Learning
3.0 VO Probabilistic Machine Learning
6.0 LU Machine Learning Laboratory
3.0 VU Network Security Advanced Topics
3.0 VO Advanced Wireless Communications 1
3.0 VO Advanced Wireless Communications 2
3.0 VO Advanced Wireless Communications 3
4.5 Optional Courses and Transferable Skills

Fourth Semester (30 ECTS)

30.0 Diploma Thesis

All courses in English!

Choices and Semester Plan – Example 2

Advanced ICE

A Catalogue: Special Topics in Machine Learning
Communication Networks
B Catalogue: Advanced Machine Learning
Network Security

Adjacent Areas

Advanced Signal Processing
Artificial Intelligence
Algorithmics

First Semester (30 ECTS)

4.5 VU Signal Processing 1
4.5 VU Signal Processing 2
3.0 VU Generative AI
4.5 VO Communication Networks 1
6.0 VO Algorithmics
3.0 VU Heuristic Optimization Techniques
4.5 Optional Courses and Transferable Skills

Second Semester (30 ECTS)

3.0 VO Convex Optimization for ICE
6.0 VU Machine Learning Algorithms
4.5 VU Graph Information Processing
4.5 VO Communication Networks 2
3.0 SE Communication Networks Seminar
3.0 VU Network Security
3.0 VO Signal Detection
3.0 VO Parameter Estimation

Third Semester (30 ECTS)

4.5 VU Statistical Reinforcement Learning
3.0 VO Probabilistic Machine Learning
3.0 SE Signal Processing Seminar
6.0 LU Machine Learning Laboratory
3.0 VU Applied Deep Learning
3.0 VU Seminar in AI
3.0 VU Network Security Advanced Topics
4.5 Optional Courses and Transferable Skills

Fourth Semester (30 ECTS)

30.0 Diploma Thesis

All courses in English!

Choices and Semester Plan – Example 3

Advanced ICE

A Catalogue: Photonic and Optical Communication
Communication Networks
B Catalogue: Advanced Photonics
Network Security

Adjacent Areas

Special Topics in Machine Learning
Advanced Machine Learning
Grundlagen Robotik und Regelungstechnik

First Semester (30 ECTS)

4.5 VU Signal Processing 1
4.5 VU Signal Processing 2
4.5 VU Grundlagen Robotik
3.0 VO Regelungssysteme
4.5 VO Communication Networks 1
3.0 VO Optische Nachrichtentechnik
3.0 VU Photonik 2
3.0 Optional Courses and Transferable Skills

Second Semester (30 ECTS)

3.0 VO Convex Optimization for ICE
6.0 VU Machine Learning Algorithms
4.5 VU Communication Networks 2
4.5 VU Graph Information Processing
3.0 VO Optical Systems
3.0 SE Seminar Photonik
3.0 VU Network Security
3.0 SE Communication Networks Seminar

Third Semester (30 ECTS)

6.0 VU Photonik Vertiefung
3.0 VU Network Security - Advanced Topics
4.5 VU Statistical Reinforcement Learning
3.0 VO Probabilistic Machine Learning
6.0 LU Machine Learning Laboratory
1.5 LU Regelungssysteme
6.0 Optional Courses and Transferable Skills

Fourth Semester (30 ECTS)

30.0 Diploma Thesis

Job Profile 1: TelCo

Profile

- wireless/optical/cable transmission
- network planning and security
- RF circuits and antenna design
- all modules chosen from A/B catalogues

Jobs

- R&D with device manufacturers
- network operators
- telco systems architect
- antenna and RF engineer
- academia



Job Profile 2: ICE

Profile

- machine learning
- autonomous systems/robotics
- data & computer science
- modules: ML, CS foundations, algorithmics

Jobs

- robotics
- autonomous vehicles
- cloud services
- data analytics
- cyber security
- academia



Job Profile 3: Circuits & Systems

Profile

- analog/digital circuits
- chip design
- HW system design
- modules: circuits, IC

Jobs

- RF chip design
- TelCo embedded systems
- SoC
- TelCo components
- academia



Job Profile 4: ICE & Energy

Job Profile 5: ICE & Automation

Job Profile 6: ICE & Life Sciences

Jobs

- smart grid
- charging infrastructure
- smart factory
- medical imaging
- machine learning in life sciences
- academia

FREQUENTIS

TTTech

e.on

Verbund

e-vo

EnBW

SMATRIC

SIEMENS

ABB

 **GE HealthCare**

ottobock.

MED⁹EL

Todo's

- check out all modules
- think about your interests and career perspective
- choose modules from A/B catalogue
- choose modules from adjacent areas
- design a semester plan (which courses in which semester)
- work hard and actively participate in the courses

Advice

- use the know-how of your **teachers** as a resource
- **understanding** = theory $\cup$ practice $\cup$ communication
- wherever possible, engage in **team work**
- be confident, don't worry
- **self-care** (eat, sleep, exercise, socialize)
- **enjoy student life**

