The Joint Cybersecurity Master's Programme and Cybersecurity courses offered

Information meeting for students Spring 2024

https://uni.hi.is/helmut/cybersecurity/

Why is cybersecurity important?
or: why to study it!

- Modern society relies heavily on many online services (e-commerce and banking, health sector, transportation, communication).

- Ever increasing amounts of data is collected and processed by various actors (all online transactions, AI and ML, etc.).

- We need to protect private users and companies against data thefts and losses. Sensitive data should be kept safe (and yet usable for legitimate purposes).

- Securely designed systems are also a business enabler. Relevant skills are needed in designing, implementing and validating them!

Persons involved

- Jacky Mallett, RU, jacky

  Use this user name for emailing.
  Email addresses at RU end with @ru.is

- Hans Reiser, RU, hansr

- Esa Hyytiä, UoI, esa

  Use this user name for emailing.
  Email addresses at UoI end with @hi.is

- Helmut Neukirchen, UoI, helmut

- Tom Welsh, UoI, tomwelsh

  + visiting professors and guest teachers!

Joint master's programme in cybersecurity

- Joint programme at University of Iceland and Reykjavik University.

  - New specialisation/emphasis of the existing M.Sc. programmes in Computer Science (not: SE).

    - Intent: add a specialisation/emphasis of the existing M.Sc. programmes in Software Engineering.

    - Planned to become in future a study programme on its own.

    - You can still (now or later) change over into that specialisation/emphasis

- Taught in English to attract as many students as possible.

How does it work?

- Students enroll in the Computer Science M.Sc. programme at the university of their choice.
  - Take "normal" M.Sc. Computer Science courses + mandatory courses specific to Cybersecurity.

  - Can take **cybersecurity-related course** from the other university as well.
    - **This applies only to students who are enrolled in the cybersecurity specialisation/emphasis**!
      - As long as student numbers are low, we can try to get other students in as well (best-effort basis).
      - Of course, students (CS, SE, etc. B.Sc., M.Sc.) can always take the cybersecurity courses from their own university.

  - Import additional distance learning courses from abroad.
    - E.g., Norwegian University of Science and Technology (NTNU Trondheim/Gjøvik).

- As long as student numbers are low, it should be possible that also students who are not in the specialisation/emphasis take these courses from the other university.

Curriculum (Example)

HÁSKÓLINN Í REYKJAVÍK
REYKJAVIK UNIVERSITY

UNIVERSITY OF ICELAND

- 1st semester:
  - Introduction to Information Security (Management) (Reykjavik University, University of Iceland)
  - Network Measurements and Analysis (University of Iceland),
  - Machine Learning in Cybersecurity (Reykjavik University),
  - Lectures from practitioners and from abroad.
    - E.g. Reverse Engineering and Malware Analysis (NTNU).
- 2nd semester:
  - Computer Security: Defence Against the Dark Arts (Reykjavik University) / Fundamentals of Ethical Hacking (University of Iceland),
  - Applied Cryptography (University of Iceland),
  - Privacy and Data Protection Law (University of Iceland, in Icelandic),
  - Governance of the Internet (University of Iceland).
- 3rd semester:
  - Quantum Cryptography (University of Iceland)
  - Cyber Range Lab (both universities together),
  - Lectures from practitioners and from abroad.
    - E.g. Critical Infrastructure Security (NTNU), Internships.
- 4th semester: M.Sc. thesis (2 semester thesis possible as well)

+ non-cybersecurity computer science courses (e.g. artificial intelligence, cloud computing, distributed systems, software testing, software quality management, research methodology)

Courses offered at UoI

Specialisation: Cyber Security (Courses in 2023-2024)

Year of study unspecified	
Fall	**Spring**
Ⓢ TÖL029M Introduction to Information Security 🇬🇧 ♀ 6e	Ⓢ TÖL213M Applied Cryptography 🚩 🏴 🇬🇧 ♀ 6e
Ⓢ TÖL104M Network Measurements and Analysis 🏴 🚩 🇬🇧 ♀ 6e	Ⓢ TÖL606M Seminar 🏴 🇮🇸 ♀ 2e
Ⓢ TÖL431L Final project 🇮🇸🇬🇧 ⚓ 30e ◔	Ⓢ TÖL212F Governance of the Internet 🇬🇧 ♀ 6e
Ⓥ TÖL113F Quantum Cryptography 🚩 🇬🇧 ⊘ ♀ 6e	Ⓢ TÖL431L Final project 🇮🇸🇬🇧 ⚓ 30e ◔
Ⓥ IÐN113F Time Series Analysis 🏴 🇬🇧 ⊘ 🌐 ⚓ 7,5e	Ⓥ TÖL605M Fundamentals of Ethical Hacking 🇬🇧 ♀ 4e
Ⓥ REI503M Performance analysis of computer systems 🏴 🚩 🇬🇧 ⊘ ♀ ⚠ 6e	Ⓥ TÖL113F Quantum Cryptography 🇬🇧 ⚓ 6e
Ⓥ REI504M Cloud Computing and Big Data 🏴 🇬🇧 ⊘ ♀ 6e	Ⓥ HBV204M Software Quality Management 🏴 🚩 🇬🇧 ⊘ ♀ ⚠ 6e
Ⓥ REI505M Machine Learning 🏴 🚩 🇬🇧 ♀ 6e	Ⓥ HBV205M Software Testing 🏴 🚩 🇬🇧 ⊘ ♀ ⚠ 6e
Ⓥ TÖL022F Internship in Cybersecurity 🇬🇧 ♀ 6e	Ⓥ LÖG283F Privacy and Data Protection Law 🗓 🏴 🇮🇸 ♀ 6e
Ⓥ TÖL103M Programming Projects on Internet of Things 🚩 🇬🇧 ♀ 6e	Ⓥ TÖL022F Internship in Cybersecurity 🇬🇧 ♀ 6e
Ⓥ TÖL106M Security Engineering for Critical Information Infrastructures 🇬🇧 ♀ 6e	Ⓥ RAF617M Fundaments of the Internet 🇮🇸 ♀ 6e
Ⓥ TÖL107M Cyber Conflicts, Cyber Security Threats and Engineering, National Information Infrastructures (NII) 🇬🇧 ♀ 6e	
Ⓥ TÖL503M Distributed Systems 🏴 🚩 🇬🇧 ⊘ ♀ ⚠ 6e	
Ⓥ TÖL506M Introduction to deep neural networks 🚩 🇮🇸 ♀ 6e	
Ⓥ VON001F Thesis skills: project management, writing skills and presentation 🇬🇧 ♀ 🖥 4e	

Fall and Spring (whole year courses)
Ⓥ GKY001M Mentor in Sprettur 🏴 🇮🇸 ♀ ⌂ 5e

Students can choose other unlisted electives with the approval of the Chair of the Department or the Supervisor of Teaching before signing up for the course.

If 90 credits are taken solely in courses it is recommended that at least one semester is taken in exchange studies at another university.

Cybersecurity MSc Programme

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- TÖL605M Fundamentals of Ethical Hacking
  - 4 ECTS, elective.

M = M.Sc. students and 3rd year B.Sc. students

- TÖL213M Applied Cryptography
  - 6 ECTS, mandatory for UoI Cysec students.

F = M.Sc. students only

- TÖL212F Governance of the Internet
  - 6 ECTS, mandatory for UoI Cysec students.

- TÖL113F Quantum cryptography
  - 6 ECTS, elective. Reading course! – Will be offered as full course in autumn 2024.

- RAF617M Foundations of the Internet
  - 6 ECTS, elective. Electrical engineering course taught in Icelandic.

Not sure whether this courses outsides the UoI Computer Science department can be taken by RU students.

- LÖG283F Privacy and Data Protection Law
  - 6 ECTS, elective. Law department course is taught in Icelandic.

Info for cysec students at UoI

- TÖL606M Seminar
  - 2 ECTS (=good to be combined with the 4 ECTS TÖL605M Fundamentals of Ethical Hacking course).
  - Mandatory – this is the "normal" seminar that other students take as well: take care to take a cysec topic.

- TÖL022F Internship in Cybersecurity
  - 6 ECTS, elective.
  - Will be offered first in autumn 2024 (idea: first gained some knowledge in courses, then apply at companies).

- M.Sc. thesis (1 or 2 semesters duration)
  - 30 or 60 ECTS. Needs to be about a cysec topic

Courses offered at RU (12 week + 3 week)

Legend

- ✅ Mandatory course on major
- ➕ Optional course on major
- 🇮🇸 Teaching language
- 🟠 Prerequisites for course

Haustönn/Fall 2023

Course		Code	ECTS	Lang
Mathematical Programming	🟠➕	E-402-STFO	ECTS 6	🇬🇧
Operation Research	🟠➕	T-403-ADGE	ECTS 6	🇮🇸
Effective Programming and Problem Solving	🟠➕	T-414-AFLV	ECTS 6	🇮🇸
Computer Security	🟠➕	T-417-TOOR	ECTS 6	🇮🇸
Simulation	🟠➕	T-502-HERM	ECTS 6	🇮🇸
Introduction to Machine Learning	🟠➕	T-504-ITML	ECTS 6	🇬🇧
Computer Graphics	🟠➕	T-511-TGRA	ECTS 6	🇬🇧
Theory of Computation	🟠➕	T-519-STOR	ECTS 6	🇬🇧
Cyber Physical Systems	🟠➕	T-535-CPSY	ECTS 6	🇬🇧
Compilers	🟠➕	T-603-THYD	ECTS 6	🇮🇸
Computer Game Design & Development	🟠➕	T-624-CGDD	ECTS 6	🇮🇸
Software Engineering II - Testing	🟠➕	T-631-SOE2	ECTS 6	🇮🇸
Digital Health	➕	T-702-MDGH	ECTS 8	🇬🇧
Applied Statistics for Data Science	➕	T-705-ASDS	ECTS 8	🇬🇧
Machine Learning in Cyber Security	➕	T-710-MLCS	ECTS 8	🇬🇧
Applications of Digital Health	➕	T-712-MADH	ECTS 8	🇬🇧
Empirical Reasoning Systems	✅	T-713-MERS	ECTS 8	🇬🇧
FINTECH	🟠➕	T-714-FINT	ECTS 6	🇬🇧
Virtual Environments	🟠➕	T-723-VIEN	ECTS 8	🇬🇧
Natural Language Processing	➕	T-725-MALV	ECTS 8	🇬🇧
Introduction to Embedded Systems and the Internet of Things	🟠➕	T-732-ISIT	ECTS 6	🇬🇧
Software Project Management	✅	T-740-SPMM	ECTS 8	🇬🇧
AI Seminar	➕	T-744-AISE	ECTS 2	🇬🇧
Cyber Security Seminar	➕	T-745-CSSS	ECTS 2	🇬🇧
Reinforcement Learning	➕	T-747-RELE	ECTS 8	🇬🇧
Reverse Engineering and Malware Analysis	➕	T-748-REMA	ECTS 6	🇬🇧
Independent Study 1	➕	T-749-INDS	ECTS 6	🇬🇧
Informed Search Methods in AI	➕	T-768-SMAI	ECTS 8	🇬🇧
An exploration to the ethical issues of emerging technology through the lens of Black Mirror	➕	T-777-BLMR	ECTS 6	🇬🇧
Applied Data Science	🟠➕	T-786-APDS	ECTS 6	🇬🇧
Data Mining and Machine Learning	➕	T-809-DATA	ECTS 8	🇬🇧
Optimization Methods	🟠➕	T-810-OPTI	ECTS 8	🇬🇧
Applied Probability	🟠➕	T-811-PROB	ECTS 8	🇬🇧
Managing Research and Development - Methods and Models	➕	T-814-PROD	ECTS 8	🇬🇧
MSc Research	➕	T-879-MSRS	ECTS 30	🇬🇧
MSc Thesis Defense	✅	T-891-MSTD	ECTS 6	🇬🇧
MS Thesis	✅	T-899-MSTH	ECTS 30	🇬🇧
Thesis Project Defense	➕	T-991-TPDE	ECTS 6	🇬🇧
Exchange Studies	➕	X-699-EXCH	ECTS 30	🇮🇸

Vorönn/Spring 2024

Course		Code	ECTS	Lang
Engineering Optimization	🟠➕	T-423-ENOP	ECTS 6	🇬🇧
Programming Languages	🟠➕	T-501-FMAL	ECTS 6	🇮🇸
Mechatronics II	🟠➕	T-535-MECH	ECTS 6	🇬🇧
Artificial Intelligence	🟠➕	T-622-ARTI	ECTS 6	🇬🇧
Software Engineering II - Testing	🟠➕	T-631-SOE2	ECTS 6	🇮🇸
Advanced Game Design & Development	🟠➕	T-634-AGDD	ECTS 6	🇮🇸
Game Engine Architecture	🟠➕	T-637-GEDE	ECTS 6	🇬🇧
Research Methodology	✅	T-701-REM4	ECTS 8	🇬🇧
Modeling and Verification	🟠➕	T-707-MOVE	ECTS 8	🇬🇧
Speech Synthesis	➕	T-717-SPST	ECTS 6	🇬🇧
Advanced Topics in Artificial Intelligence	➕	T-720-ATAI	ECTS 8	🇬🇧
Computer Security: Defence Against the Dark Arts	🟠➕	T-742-CSDA	ECTS 8	🇬🇧
Independent Study 1	➕	T-749-INDS	ECTS 6	🇬🇧
Big Data Management	🟠➕	T-764-DATA	ECTS 8	🇬🇧
Creating a Complete Business Plan for a Technical Idea - Entrepreneurship and the Innovation Process	➕	T-814-INNO	ECTS 8	🇬🇧
MSc Research	➕	T-879-MSRS	ECTS 30	🇬🇧
MSc Thesis Defense	✅	T-891-MSTD	ECTS 6	🇬🇧
MS Thesis	✅	T-899-MSTH	ECTS 30	🇬🇧
Thesis Project Defense	➕	T-991-TPDE	ECTS 6	🇬🇧
Entrepreneurial Finance	➕	V-733-ENTR	ECTS 7,5	🇬🇧
Entrepreneurship and Starting New Ventures	➕	X-204-STOF	ECTS 6	🇮🇸
Exchange Studies	➕	X-699-EXCH	ECTS 30	🇮🇸

Note: 12 weeks + 3 weeks semester at RU: 1 all-day course in the last three weeks at (overlapping with UoI exam period).

https://en.ru.is/course-catalogue/ →Department of Computer Science→MSc in CS

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Notable spring 2024 cysec courses at RU

- T-742-CSDA Computer Security: Defence against the Dark Arts
    - 8 ECTS, M.Sc./3rd year B.Sc., mandatory for RU students.
    - Practical course in defensive cyber security with research project.

- Individual projects

Summary

- Check course catalogue of the two universities:
  - UoI: https://ugla.hi.is/kennsluskra/index.php?tab=nam&chapter=namsleid&id=080705_20236&kennsluar=2023&lina=10233
  - RU: https://en.ru.is/course-catalogue/

- For general questions contact your university's staff (see slide 2).

- If you want to take a course at the other university:
  - RU student taking course at UoI: contact Helmut at UoI.
  - UoI student taking course at RU: contact Jacky at RU.

Outlook

- Start of spring teaching:
  - UoI: 8.1.2024 (i.e. today),
  - RU: 15.1.2024 (next week).

- Download these slides: via QR code or https://uni.hi.is/helmut/cybersecurity/

- If you as UoI student took last semester a course at RU:
  - Helmut is currently working on getting this into your record at UoI.

- Rannís student innovation fund:
  - We intend to apply to be able to offer summer job positions.

- Questions? / Comments?