



CYBERSECURITY

FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MASTER'S PROGRAM IN CYBER SECURITY

FROM DESIGN TO OPERATIONS



Why

- ✓ **A thriving job market**
 - ♦ predicted growth:
172 billion USD (2023) -> 424 billion USD (2030)
 - ♦ 300.000 skilled workers needed in Europe
 - ♦ 3.4 million unfilled position globally
- ✓ **An appealing career**
 - ♦ ranked 5th in the U.S. News and World Report's list of the 100 best jobs (up from 8th in 2022)
 - ♦ continuous, stimulating challenges
 - ♦ huge variety of employment opportunities, both in terms of roles and of application fields



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Who

Academic faculty

- ♦ Bologna University  Cybersecurity National Lab
- ♦ King's College London

Committed industrial partners

- ♦ financial support
- ♦ experienced trainers
- ♦ engaging internship positions



MASTER'S PROGRAM IN
CYBER SECURITY
 FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
 UNIVERSITÀ DI BOLOGNA

When

- ✓ lectures
 - 12 hours each weekend
 - Friday afternoon
 - Saturday all day
- ✓ internship
 - to be decided with host
- ✓ project work
 - self-organized

November – December, lectures only



Winter Break

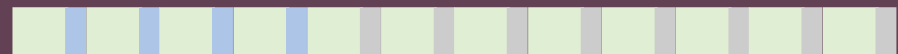
January – April, lectures + internship



Spring Break

May – June, lectures + internship

July, internship only



Summer Break

September, report and presentation writing

Early October, final exam



MASTER'S PROGRAM IN CYBER SECURITY FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

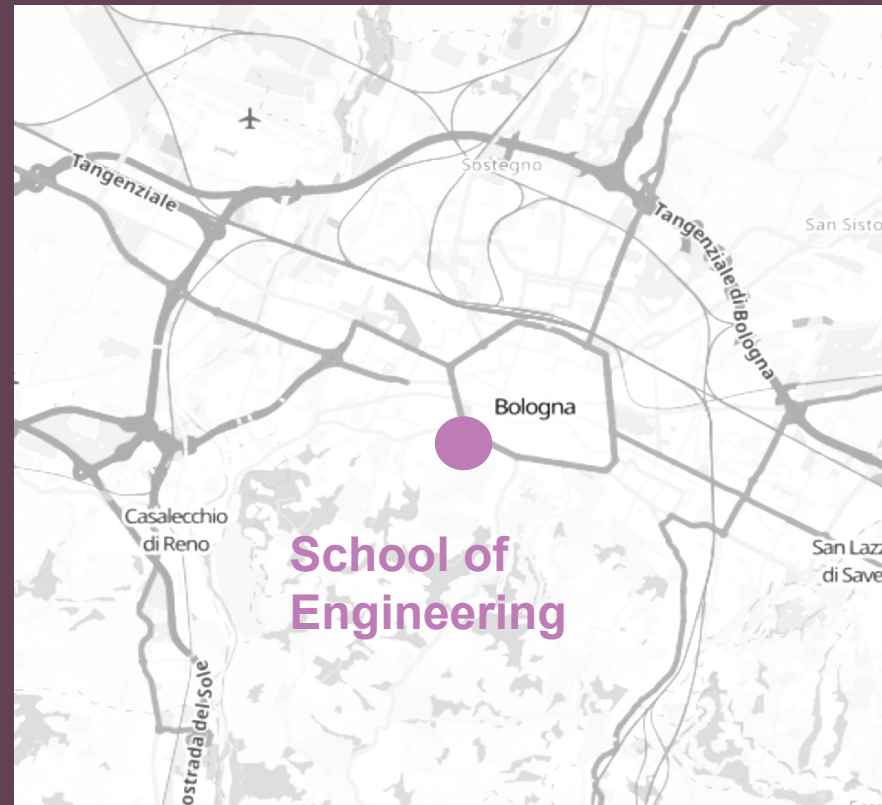
Where

- ✓ **IN PRESENCE BY DEFAULT**

School of Engineering
Viale del Risorgimento 2
40136 Bologna

- ✓ **OPTIONALLY ONLINE**

**ONLY FOR STUDENTS
RESIDING MORE THAN
1 HOUR AWAY**





MASTER'S PROGRAM IN CYBER SECURITY FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

How

11 BASE MODULES (LECTURES+LABS)

- Every topic will be illustrated in theory and demonstrated in practice

2 HOT TOPIC WORKSHOPS

- Application security testing
- Cloud security

BYOD

- Students need to bring their own laptop, suitable for the execution of virtual machines provided by instructors

KEEPING TABS ON PROGRESS

- Attendance of at least 80% of lecture hours is **mandatory**
- At the end of each module, an exam will measure its effectiveness
- Skipping or failing a few intermediate exams is not critical, **but**
- Admission to the final exam is judged on the overall positive performance



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MASTER'S PROGRAM IN CYBER SECURITY

FROM DESIGN TO OPERATIONS



What 1/11

Fundamentals of Security and Cryptography

- Prof. Rebecca Montanari (UniBO)
Prof. Marco Prandini (UniBO)
- 24 hours

Outcomes:

- Knowledge of the main different aspects of security as a process, and of the technical language used to describe threats, vulnerabilities, and countermeasures.
- Security requirements: confidentiality, integrity, authenticity, and how to achieve them in presence of different adversaries.
- Analysis of the main cryptographic building blocks to design security countermeasures. Tips on correct implementation of cryptographic mechanisms.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

**What
2/11**

Network security and administration

- Prof. Franco Callegati (UniBO)
Prof. Walter Cerroni (UniBO)
- 40 hours

Outcomes:

- Basic ability to program network devices to implement segmented layer-2 and layer-3 internetworks.
- Knowledge of security issues in telecommunication and of protocols (e.g. IPSec, TLS) for their mitigation.



MASTER'S PROGRAM IN CYBER SECURITY FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What 3/11

Computer security and administration

- Linux
 - Prof. Gabriele D'Angelo (UniBO)
 - Prof. Angelo Di Iorio (UniBO)
 - Prof. Marco Prandini (UniBO)
- Windows/AD
 - Dr. Mattia Masella (Cyberloop)
 - Dr. Davide Ciandrini (Cyberloop)
- 40 hours

Outcomes:

- Knowledge of the basic steps of system configuration, from boot to service management. Basic ability to manage software installation, update and configuration in a production environment.
- Knowledge of the different categories of vulnerabilities in a system and of the corresponding attack vectors. Basic ability to use tools for proactive security assessment and centralized monitoring.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What
4.1/11

Security engineering I - secure coding

- Avv. Andrea Baldrati (Privacy Network)
Dr. Matteo Navacci (Privacy Network)
Dr. Matteo Meucci (IMQ Minded Security)
- 16 hours

Outcomes:

- Security-by-design and Privacy-by-design, and practical applications of the GDPR in secure systems development
- Knowledge of design patterns and best practices for the whole process of secure software development.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What
4.2/11

Seminar - Cloud Security

- ♦ Prof. Marco Prandini (UniBO)
- ♦ 8 hours

Contents:

- ♦ Threats, vulnerabilities and attacks specific of the cloud computing environment
- ♦ Cloud-oriented application development methodologies (image preparation, deployment, management)



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What
4.3/11

Workshop - Static Application Security Testing

- Dr. Andrea Pagani (Crif)
- 8 hours (5 theory + 3 practical teamwork)

Contents:

- CyberSec Fields and TradeOffs
- What is Source Code Analysis?
SAST, OSS & Dependency, DAST & IAST Considerations
- Top Application Security Risks; OWASP Top 10 2021
Detection
- Lab 1 – Demo of a SAST tool: Running Fortify scans
- Remediation: High level fixing strategies
- Industrialization of SCA: Distributing SAST on large scale
- Lab 2 – Corporate SAST: Scenarios for building SAST
architectures



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

**What
5/11**

Security engineering II - web app security and testing

- Dr. Giuseppe Porcu (IMQ Minded Security)
- Ph.D. Andrea Melis (UniBO)
- 24 hours

Outcomes:

- Knowledge of the OWASP methodology for web applications.
- Tools to verify web app security according to the OWASP methodology.
- Specific challenges of web application security testing
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Client side attacks, Server side attacks
- Tools and techniques



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MASTER'S PROGRAM IN CYBER SECURITY FROM DESIGN TO OPERATIONS



What 6/11

Security engineering III - mobile security and testing

- Dr. Luca Capacci (Cryptonet Labs)
Dr. Alfonso Solimeo (Cryptonet Labs)
- 24 hours

Outcomes:

- Knowledge of the design patterns and security testing methodology for mobile applications.
- Tools to verify mobile app security according to the presented methodology.
- Specific challenges of mobile application security testing
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Testing authentication, cryptography, code quality.
- Android, iOS and hybrid applications anatomy
- Tools and techniques



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

**What
7/11**

Security engineering IV - Industrial Control Systems

- Ph. D. Andrea Melis (UniBO)
- Dr. Edoardo Montrasi (Cryptonet Labs)
- 16 hours

Outcomes:

- Understanding of the structure of an ICS and of challenges posed by its peculiar differences with respect to IT systems.
- Knowledge of security issues and possible countermeasures
- Specific challenges of industrial control systems
- Intelligence gathering and threat modeling
- Vulnerability analysis
- Embedded systems and fieldbus protocols anatomy
- Tools and techniques



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

**What
8/11**

Security monitoring I - Malware analysis and detection

- ♦ Ph.D. Fabio Pierazzi (King's College London)
Dr. Luigi Martire (Yoroi)
- ♦ 32 hours

Outcomes:

- ♦ Knowledge of the CERT operations to detect threat trends and ongoing attacks.
- ♦ Tools for static and dynamic analysis of code to identify malware.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What 9/11

Security monitoring II - Information correlation

- ♦ Dr. Federico Foschini + staff (Certego)
Dr. Tommaso di Donato (Crif)
Dr. Massimiliano Pinto (Crif)
- ♦ 24 hours

Outcomes:

- ♦ Knowledge of network-based intrusion detection systems and other kinds of probe-based systems to collect and correlate traces of malicious activity in progress.
- ♦ Critical (industrial, infrastructural, etc) system architectures and methods for their protection from attacks.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

What 10/11

Incident response

- Dr. Luca Losio (4n6)
- 16 hours

Outcomes:

- Knowledge of the methods to identify ongoing incidents and restore normal operations after a security breach.
- Ability to draw an incident response plan and policy



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

**What
11/11**

Digital Forensics

- ♦ Prof. Alessandro Amoroso (UniBO)
Dr. Luca Losio (4n6)
- ♦ 32 hours

Outcomes:

- ♦ Knowledge of the issues and challenges of forensics, from a technical and legal viewpoints, such as chain of custody.
- ♦ Ability to use the main forensics tools to analyze data and to write the final report.



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

APPROXIMATE DATES - TBC

Key steps

- ✓ Apply by **30 September 2022**
 - Look for the call (opening soon) on <https://www.unibo.it/en/teaching/professional-master/2022-2023>
- ✓ Pass selections on **10 October 2022**
 - Basic operating systems, network and programming skills are needed
 - Verified during interview if you acquired them on the field
 - Automatically satisfied by holding an IT-related degree (but interview is mandatory nonetheless: strong motivation is essential!)
- ✓ Enrollment: **19 October - 3 November 2022**
 - Law requirement: holding a bachelor degree by the time of enrollment

APPROXIMATE DATES - TBC



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

How much

- ✓ € 4.900 to be paid in two installments of equal amount
 - ♦ at the enrolment
 - ♦ spring 2024
- ✓ Companies can directly pay for their employees upon communication of their intent



MASTER'S PROGRAM IN
CYBER SECURITY
FROM DESIGN TO OPERATIONS



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Director: Prof. Marco Prandini
Dept. of Computer Science and Engineering

master.cybersecurity@unibo.it

<https://master.unibo.it/cybersecurity/>

