Università degli Studi
di Napoli Parthenope

COMPLETE INFORMATION PACKAGE OF THE DEGREE COURSE IN

COMPUTER ENGINEERING AND SCIENCE FOR CYBERSECURITY

The Bachelor's degree Program in Computer Engineering and Sciences for Cybersecurity aims to provide future graduates with knowledge and skills in the field of system, data, and application security . Specifically, the study path is designed to train graduates who can address and manage cybersecurity issues by adopting a multidisciplinary approach that includes theoretical, methodological, and technological skills. The degree program guarantees both a solid foundational knowledge in the fields of mathematics and physics, and a strong methodological and experimental background in the disciplines of engineering and computer science. The aforementioned competencies are specialized in the context of cybersecurity of networked systems and infrastructures

Unique in its organization, the new three-year course of study is an interclass, L-8 Information Engineering and L-31 Computer Science and Technology, which allows students who wish to continue their studies to be able to choose whether to enroll in a master's degree course in Computer Engineering or one in Computer Science.

Classes will be delivered in mixed mode, i.e. one third of the lessons online and two thirds in presence at the Nola campus. Lectures could be recorded and made accessible in e-learning for a limited period of time through the University's IT platform.

THE STUDY PLAN

Computer Engineering and Science for Cybersecurity / L-8/L-31
2025-2026

YEAR	COURSE TITLE	SSD	CFU	SEMESTER	TAF (L8/L31)
I	Legal Aspects of Cybersecurity	IUS/01	6	I	C/C
I	Maths I	MATH-03/A	6	I	A/A
I	Computer Programming	INFO-01/A	12	Annual	A/B
I	Computer Architecture	IINF-05/A	9	II	B/B
I	Cybersecurity Management and Organization	IEGE-01/A	6	II	B/C
I	General Physics	PHYS-01/A	6	II	A/A
I	English Language	L-LIN/12	3	II	E/E
I	Mobile Devices Programming	INFO-01/A	6	II	A/C
II	Operating Systems	INFO-01/A	9	I	C/A
II	**Algorithms and Data Structures (MOD I)**	INFO-01/A	9	I	C/A
II	**Numerical Calculation (MOD II)**	MATH-05/A	6	II	C/A
II	Maths II	MATH-03/A	6	I	A/A
II	**Computer Networks (MOD I)**	IINF-05/A	6	I	B/B
II	**Cryptography (MOD II)**	IINF-05/A	6	II	B/B
II	Databases	IINF-05/A	6	II	B/B
II	Secure Software Design	IINF-05/A	6	II	B/B
II	Fundamentals of Telecommunications	IINF-03/A	6	II	B/C
III	**Network Security (MOD I)**	IINF-05/A	9	I	B/B
III	**Operating System and Cloud Security (MOD II)**	IINF-05/A	6	II	B/B
III	Industrial Control System Security	IINF-04/A	6	I	B/C
III	Fundamentals of Electromagnetic Fields	IINF-02/A	6	I	B/C
III	**Application Security (MOD I)**	INFO-01/A	6	I	C/C
III	**Artificial Intelligence for Cybersecurity (MOD II)**	INFO-01/A	6	II	C/C

III	Elective course		6	I	D/D
III	Elective course		6	II	D/D
III	Internship		9	II	F/F
III	Final Exam		6	II	E/E

Suggested Elective Courses					
III	Integrated and Sustainable Production Systems	IIND-04/A	6	I	D
III	Electronics	IINF-01/A	6	I	D
III	Computer Science and Information Law	IUS/09	6	II	D

THE FIRST YEAR

Title	Maths I
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Notes on vector spaces. Matrices and linear transformations. Linear systems. Eigenvalues and eigenvectors, diagonalization. Outline of analytic geometry in plane and space. Real and complex numbers. Real functions of a real variable. Differential calculus for functions of a variable, numerical iterative methods for nonlinear equations. Integral calculus for functions of a single variable. Basics of cryptography.
Recommended books	- M.Bramanti, C.D.Pagani, S.Salsa, Analisi Matematica I con elementi di geometria e algebre lineare, Zanichelli Ed. - M. Bramanti, Esercitazioni di Analisi Matematica 1, Editore: Esculapio - P. Marcellini, C. Sbordone, Analisi Matematica I, Liguori Ed. - P. Marcellini, C. Sbordone, Esercitazioni di Matematica, Vol I, Liguori Ed.

Title	General Physics
CFU	6
Hours of lectures	48
Semester	Second semester
Contents	Scientific method and physical quantities. Kinematics and dynamics of a point particle. Conservation laws: mechanical energy, momentum. Universal gravitation. Fluids. Thermodynamics. Electromagnetism. Introduction to Modern Physics: atomic structure, semiconductors and superconductors, fusion and plasma physics.
Recommended books	- “Fondamenti di Fisica”, D. Halliday, R. R. Resnick, J. Walker, Casa Editrice Ambrosiana (Vol. 1 e 2). “Fisica Moderna”, D. Halliday, R. R. Resnick, J. Walker, Casa Editrice Ambrosiana Per approfondimenti: - “The Feynman Lectures on Physics”, Vol. 1, R.B. Leighton, M. Sands, R.P. Feynmann, Ed. Paperback. - L. Colombo: Fisica dei semiconduttori, Zanichelli

Title	Computer Architecture
CFU	9
Hours of lectures	72
Semester	Second semester
Contents	Logic circuits. Basic processing units. Software level, machine instructions, and programs. CISC and RISC instruction sets with real examples. Organization and management of Input/Output. Organization and management of memory. Pipelining. Fundamentals of Hardware Security. Hardware-assisted Security: Intel SGX, ARM TrustZone, and AMD SEV technologies.
Recommended books	- Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization and Embedded Systems,Sixth Edition, McGraw-Hill Higher Education, 2011, ISBN-10: 0073380652. - Specifiche tecniche di estensioni hardware: - Intel SGX (https://www.intel.com/content/www/us/en/developer/tools/software-guard-extensions/overview.html) - ARM TrustZone (https://www.arm.com/technologies/trustzone-for-cortex-a/tee-reference-documentation) - AMD SEV (https://developer.amd.com/sev/)

Title	Computer Programming
CFU	12
Hours of lectures	96
Semester	Annual
Contents	Fundamentals of Computer Science. Procedural programming. Control and iteration constructs. Variables, types, pointers. Arrays. Structures. Recursion. Array sorting. Object-oriented programming. C++ language classes. Program lifecycle. Memory allocation. Polymorphism. Inheritance. Exception handling. Encapsulation mechanisms. Operator overloading. Templates.
Recommended books	- KELLEY, I. POHL; “C: didattica e programmazione”, Pearson Education Italia, 2004. - Programmazione in C - Kim N. King - Apogeo, 2009. - Bjarne Stroustrup, “Il linguaggio C++”

Title	**Cybersecurity Management and Organization**
CFU	6
Hours of lectures	48
Semester	First Semester
Contents	Corporate innovation processes, technological, managerial, and organizational change in cybersecurity projects. Principles of risk management, cyber resilience, and business continuity. Analysis and evaluation tools for managing innovation projects and digital innovation processes. Position of companies in cybersecurity processes at national and international levels. Organizational and managerial planning of a cybersecurity project.
Recommended books	- Melissa A. Schilling, Francesco Izzo, La gestione dell'innovazione, V edizione, McGraw-Hill Education, 2022, ISBN-10: 8838699984.

Title	**Mobile Devices Programming**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Introduction to mobile computing. Hardware/software and communication limitations in mobile systems. Wireless communication networks (operational overview): WPAN, WWAN. Mobile application architectures. Introduction to Kotlin language. Advanced Kotlin programming. Programming on Google Android: components and resources. Widgets and layouts. Event handling. I/O mechanisms. Embedded database management. Services in Android. Location-based services. Web services.
Recommended books	- Bill Phillips, Chris Stewart, and Kristin Marsicano. Android Programming: The Big Nerd Ranch Guide. Addison-Wesley Professional; - RAJ KAMAL: “Mobile Computing”, Oxford University Press. - MARTYN MALLICK: “Mobile and Wireless Design Essentials”, Ed. John Wiley & Sons. - BRUCE ECKEL: “Thinking in Java”

SECOND YEAR

Title	**Algorithms and Data Structures (MOD I)**
CFU	9
Hours of lectures	72
Semester	First Semester
Contents	Analysis of Computational Complexity of Algorithms, Euclidean Algorithm and complexity. Classical cryptosystems, Divide and Conquer paradigm, Merge-Sort and Quicksort. Heap Data Structure, Heapsort, Binary Tree Traversal Algorithms. Laboratory activities on classical cryptosystems. Cryptanalysis, Dynamic Programming, Greedy Techniques. Laboratory activities on cryptanalysis. RSA cryptosystem. Graph Algorithms. Hash Tables, Cryptographic Hash Functions, P and NP Problems. Laboratory activities on RSA cryptosystems.
Recommended books	- Thomas Cormen, Charles Leiserson, Ronald Rivest, Clifford Stein, Introduzione agli Algoritmi e Strutture Dati, Terza Edizione, McGraw-Hill Education, 2010, ISBN-10: 883866515X - J. Katz, Y. Lindell, Yehuda, Introduction to modern cryptography, Second edition, Chapman & Hall/CRC Cryptography and Network Security, 2015.
Title	**Numerical Calculation (MOD II)**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Scientific computing and MATLAB. Graphics in MATLAB. Integer numbers, floating-point numbers, precision, accuracy. Random and pseudorandom numbers. Generation of simple cryptographic codes. Computations with integers and prime numbers. Applications in cryptography. Basic tools for data analysis. Iterative methods for determining zeros, fixed points, minima and maxima of a function. Numerical linear algebra. Applications to automatic ranking systems.
Recommended books	- A.QUARTERONI, C. SALERI, P. GERVASIO: “Calcolo Scientifico Esercizi e problemi risolti con MATLAB e Octave”, Springer, 2017.

Title	**Operating Systems**
CFU	9
Hours of lectures	72
Semester	First Semester

Contents	Introduction to Operating Systems. Process-based systems. Cooperation and synchronization. Threads. CPU scheduling algorithms. Memory management. Process synchronization. Deadlock. File system architecture. I/O systems and secondary memory. Operating System security. Access control to resources, Formal models of secure systems. Authentication. The UNIX Operating System. System Programming.
Recommended books	- S. Tanenbaum, H. Bos, I moderni Sistemi Operativi, 4 Ed., Pearson, 2019 - W.R. Stevens, S.A. Rago, Advanced Programming in the Unix Environment, Addison Wesley, 3rd Ed., 2013

Title	**Computer Networks (MOD I)**
CFU	6
Hours of lectures	48
Semester	First Semester
Contents	ISO/OSI model. Network types and architectures. The Data Link layer: LLC and MAC. The Network layer. The IP protocol. Subnetting. Routing algorithms. Control protocols. IPv6. The transport service. TCP and UDP protocols. Application protocols for IP network operation. Internet applications and services. Distributed programming.
Recommended books	- J. Kurose, K. Ross, "Computer Networking: A Top down Approach". Eigth Edition. Pearson
Title	**Crittografia (MOD II)**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Classical cryptography techniques. Symmetric cryptography (e.g., AES, DES), principles of block ciphers. Asymmetric cryptography (e.g., RSA), principles of public-key cryptosystems, elliptic curve cryptography. El-Gamal cryptosystem. Hash functions and authentication. MD4. MD5. SHA-1. Message Authentication Code. Digital signature, PKI. Key management and exchange: Diffie-Hellman.
Recommended books	William Stallings, CRYPTOGRAPHY AND NETWORK SECURITY PRINCIPLES AND PRACTICE SEVENTH EDITION GLOBAL EDITION

Title	**Databases**
CFU	6

Hours of lectures	48
Semester	Second Semester
Contents	Introduction to databases. Data models. Types of database languages. Relational model. Relational algebra. SQL language. Database design. Entity-Relationship model. Transaction management. ACID properties. Distributed databases. Transactions in distributed databases. SQL for Applications. Databases and web applications. Web Information Systems (WIS). Introduction to NoSQL approaches. Secure information systems. Data mining. Classification. Clustering. Big data analytics.
Recommended books	- Paolo Atzeni, Stefano Ceri, Piero Fraternali, Stefano Paraboschi, Riccardo Torlone, Basi di dati 5/ed, 2018, ISBN: 9788838694455

Title	**Secure Software Design**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Principles of Software Engineering. Software properties. Software lifecycle. Security in the software lifecycle within the Agile model. Software modeling. Threat modeling. Security Patterns. Defensive Coding. Guidelines for secure programming. Typical programming errors. Secure programming in C/C++/Python. V&V (Verification & Validation). Static Analysis. Dynamic analysis and software testing. Principles of Symbolic Analysis and formal validation techniques. OWASP Secure Coding checklist.
Recommended books	- Ingegneria del software, 10/Ed. Ian Sommerville, Pearson. - Larman, C. (2002). Applying UML and Patterns: An Introduction to Object-oriented Analysis and Design and the Unified Process. Englewood Cliff, NJ: Prentice Hall.

Title	**Maths II**
CFU	6
Hours of lectures	48
Semester	First Semester
Contents	Numerical series and power series. Differential equations. Vector functions of one variable. Functions of multiple variables and differential calculus for functions of multiple variables. Vector functions of multiple variables. Double integrals. Vector fields. Surface integrals.
Recommended books	- M. Bramanti - C.D. Pagani - S. Salsa, Analisi Matematica 2, Zanichelli Editore

	- N.Fusco - P.Marcellini - C.Sbordone, Elementi Di Analisi Matematica Due, Liguori Ed. P.Marcellini - C.Sbordone, Esercitazioni Di Matematica 2, Zanichelli Ed.

Title	**Fundamentals of Telecommunications**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Elements of Signal Theory. Signal transformation operations. Fourier Series and Transform. Analysis in time and frequency domains. Signal bandwidth, A/D Conversion. Probability Theory and Random Phenomena. Introduction to Estimation and Detection. Detection Theory. Likelihood test, Neyman-Pearson approach, ROC, Prior information, Bayesian risk. Telecommunication Systems and their description. Historical overview of Telecommunications (TLC), Analog and digital TLC Systems.
Recommended books	- Claudio Prati, "Segnali e Sistemi per le Telecomunicazioni", McGraw-Hill, 2003. - Sheldon Ross, "Probabilità e Statistica per l'Ingegneria e le Scienze", APOGEO Editore.

THIRD YEAR

Title	**Network Security (MOD I)**
CFU	9
Hours of lectures	72
Semester	First semester
Contents	Introduction to network security. Review of the ISO/OSI stack and security issues in the TCP/IP stack. ARP Poisoning, ARP Spoofing, DNS Tunneling, DNS Amplification, DNS Flood Attack, DNS Spoofing, NXDOMAIN Attack. Email security. Communication security protocols. Authentication protocols NSPK and Kerberos. Transport layer security, TLS and SSH. IP layer security, IPsec and VPN. In-depth security: perimeter security and intrusion detection. Network Management for security. Malware. Security of wireless communications and IoT. Case study of LoRaWAN.
Recommended books	- William Stallings, Cryptography And Network Security Principles And Practice Seventh Edition Global Edition
Title	**Operating System and Cloud Security (MOD II)**

CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Authentication and access control. File system security. Kernel-level security. Application sandboxing. Protection based on trusted computing. OS monitoring through host-based Intrusion Detection System. Fundamentals of Cloud Platforms. Defense techniques for data-in-transit. Solutions for data-at-rest security. Solutions for data-in-use security. Security monitoring on the Cloud. Case study of Google Cloud Platform.
Recommended books	- Operating System Security, Trent Jaeger, Morgan & Claypool

Title	**Application Security (MOD I)**
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Architectural frameworks of modern applications with a focus on Web applications. Vulnerability Assessment techniques. Penetration Testing. Common Vulnerability Scoring System. Defenses against XSS attacks. Protections for Remote & Local File Inclusion. Cross-Site Request Forgery. Content Security Policies (CSP).
Recommended books	- Web Application Security. Andrew Hoffman. 2020. Publisher(s): O'Reilly Media, Inc.
Title	**Artificial Intelligence for Cybersecurity (MOD II)**
CFU	6
Hours of lectures	48
Semester	Second Semester
Contents	Fundamentals of Artificial Intelligence (AI) and practical lessons on the Python programming language for implementing AI algorithms. Optimization with Evolutionary Computation; Learning Systems: Neural Networks; Fuzzy Logic; related Python implementation examples. AI and Machine Learning (ML) for Cybersecurity.

	Development of intelligent systems capable of detecting unusual and suspicious patterns and attacks. Testing the effectiveness of AI algorithms and tools for information security.
Recommended books	- Parisi, A., Hands-On Artificial Intelligence for Cybersecurity: Implement smart AI systems for preventing cyber attacks and detecting threats and network anomalies, 2019. - Freeman, D., Machine Learning and Security: Protecting Systems With Data and Algorithms. Editor Clarence Chio. 2018 - Sebastian Raschka, Vahid Mirjaili(2017). Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow, 2nd Edition.

Title	**Industrial Control System Security**
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Introduction to industrial automation. Architecture of industrial control systems. Analysis of dynamic systems in time and frequency domains. Systems for local control (field level). Industrial sensors and actuators. Programmable Logic Controllers (PLCs). Automation networks. Supervision, integration, and security systems. Cybersecurity model.
Recommended books	- P. Bolzern, R. Scattolini, N. Schiavoni, Fondamenti di Controlli Automatici, 4 ed., Mc Graw Hill Italia, 2015. - P. Chiacchio, F. Basile, Tecnologie informatiche per l'automazione, Mc Graw Hill, 2004.

Title	**Fundamentals of Electromagnetic Fields**
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Mathematical foundations. Maxwell's equations. Power and energy associated with the Electromagnetic field. Fundamentals of free space propagation. Elementary antennas and antenna parameters. Vulnerabilities of free space propagation. Fundamentals of guided propagation. Vulnerabilities of guided propagation.
Recommended books	- G. Franceschetti, Electromagnetics, Plenum Press - G.Franceschetti, Campi Elettromagnetici, Boringhieri.

Title	**Integrated and Sustainable Production Systems**
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Strategies for integrated production. Enabling technologies for smart manufacturing. Automation in cyber-physical systems. Methodologies for designing and developing reliable safety-critical applications. Reliability, availability, safety, confidentiality, integrity, and maintainability of systems. Mathematical models of reliability. Mathematical models of availability. Simulation and optimization of integrated smart and sustainable systems.
Recommended books	- D. Falcone, F. De Felice, T.L. Saaty. Il Decision Making ed i sistemi decisionali multicriterio. Ed. HOEPLI, 2009 - F. De Felice, A.Petrillo. Effetto Digitale. Ed. McGrawHill, 2021 - F. De Felice, D. Falcone, A. Petrillo. World class manufacturing: origine, sviluppo e strumenti. McGraw Hill.
Title	**Electronics**
CFU	6
Hours of lectures	48
Semester	First semester
Contents	Strategies for integrated production. Enabling technologies for smart manufacturing. Automation in cyber-physical systems. Methodologies for designing and developing reliable safety-critical applications. Reliability, availability, safety, confidentiality, integrity, and maintainability of systems. Mathematical models of reliability. Mathematical models of availability. Simulation and optimization of integrated smart and sustainable systems.
Recommended books	The Art of Electronics, Paul Horowitz, Winfield Hill, Cambridge University Press, 2015, ISBN: 0521809266