MASTER IN SYSTEMS AND NETWORKS

Concentration :
Information Security

Main Language of Instruction:
French ☑ English ○ Arabic ○

Campus Where the Program Is Offered: CST

OBJECTIVES

The Master in Systems and Networks, concentration: Information Security aims to train qualified professionals with strong scientific and practical skills in the field of information security and capable of taking charge of the protection of complex information systems on the local and international market.

PROGRAM LEARNING OUTCOMES (COMPETENCIES)

- Understand the operation of the company's complex digital environment in terms of infrastructure, systems, applications, and data.
- Analyze the security risks of a system, network, or application.
- Design security policies in compliance with international standards.
- Implement and evaluate security mechanisms.
- Collect, investigate, and process digital evidence effectively from a crime scene.
- Understand the legal and ethical issues related to information systems security.

ADMISSION REQUIREMENTS

- Bachelor in Telecommunications, IT, Computer Science or any relevant field.

COURSES/CREDITS GRANTED BY EQUIVALENCE

A student holding an engineering degree in computer science, telecommunications, or any other relevant field may, following a favorable opinion from the Admissions Committee, be granted credits from the first year by equivalence. If all 60 credits are awarded by equivalence, the student may directly enroll in the second year of the master's program.

PROGRAM REQUIREMENTS

120 credits: Required courses (112 credits), Institution's elective courses (8 credits)

Required Courses (112 Cr.)
Advanced Cryptography and Computer Security (6 Cr.). New Technologies in IP Networks (6 Cr.). Cryptography and Secure Applications (4 Cr.). Digital Forensics and Incident Management (4 Cr.). Ethical Hacking (4 Cr.). Information Security: Standards and Best Practices (4 Cr.). Information Systems: Administration and Security (2 Cr.). Information Systems Governance (2 Cr.). Introduction to Entrepreneurship (2 Cr.). Internship (30 Cr.). Mathematics for Cryptography (2 Cr.). Network Architecture and Management (6 Cr.). Network Infrastructure Security (4 Cr.). Network Modeling and Optimization (4 Cr.). Project (6 Cr.). Risk Management (2 Cr.). Secure Corporate Networks (4 Cr.). Unified Communications (4 Cr.). UNIX Administration (6 Cr.). Windows System Administration (4 Cr.). Wireless Networks (6 Cr.).

Institution's Elective Courses (8 Cr.)
8 credits to choose from the 18 credits offered.
Big Data (4 Cr.). Blockchain (4 Cr.). IT Law (2 Cr.). Project Management (2 Cr.). Innovation Management and Design (4 Cr.). Software Defined Data Center (2 Cr.).

SUGGESTED STUDY PLAN

Semester 1

Code	Course Name	Credits
026ADUNM1	UNIX Administration	6
026AGREM1	Network Architecture and Management	6
026GOSIM1	Information Systems Governance	2
026MOREM1	Network Modeling and Optimization	4
026REFIM2	Wireless Networks	6
026WSADM1	Windows System Administration	4
026MACRM1	Mathematics for Cryptography	2
	Total	**30**

Semester 2

Code	Course Name	Credits
026COUNM2	Unified Communications	4
026CRASM2	Cryptography and Secure Applications	4
026GEPRM2	Introduction to Entrepreneurship	2
026NTIPM1	Advanced Technologies in IP Networks	6
026PRJ1M2	Project	6
026SDDCM2	Software Defined Data Center	2
026BIGDM2 026BLCHM2 026INDTM2	Big Data Blockchain Innovation Management and Design	4
026DRINM2 026INENM2	IT Law Project Management	2
	Total	**30**

Semester 3

Code	Course Name	Credits
026DIFOM3	Digital Forensics and Incident Management	4
026GERIM3	Risk Management	2
026ISSPM3	Information Security: Standards and Best Practices	4
026ISASM3	Information Systems: Administration and Security	2
026PIETM3	Ethical Hacking	4
026CSIAM3	Advanced Cryptography and Computer Security	6
026REESM3	Secure Corporate Networks	4
026SEREM3	Network Infrastructure Security	4
	Total	**30**

Semester 4

Code	Course Name	Credits
026STAGM4	Internship	30
	Total	**30**

COURSE DESCRIPTION

026CSIAM3 Advanced Cryptography and Computer Security 6 Cr.

This course covers the following topics: Definition of cryptography, basic terminology, basic attacks - Difference between asymmetric and symmetric schemes - Important and famous encryption schemes (RSA, AES) - Hash functions and MAC - Cloud technology: Definition, importance, and challenges - Homomorphic encryption: Definition, importance, and properties - Well-known symmetric homomorphic encryption schemes (MORE, PORE, and Domingo Ferrer) - Well-known asymmetric homomorphic encryption schemes (RSA, Paillier, DGHV) - Introduction to network-based cryptography and learning with errors - Brakerski, Gentry, and Vaikuntanathan (BGV): A well-known asymmetric homomorphic encryption scheme - Definition of IoT and security challenges - Types of attacks and threats - Elliptic curve for IoT security - Link layer security (IEEE 802.15.4) - IoT network layer security (IPSec) - Integrated security for the Internet of Things - Lebanese Law 81/2018 on electronic transactions and personal data - General Data Protection Regulation (GDPR) - Cyber crisis management - Projects: The course includes two projects. The first is a technical project where students spend several weeks designing an information system security model using the various knowledge taught in this course (e.g., a secure electronic voting application using Homomorphic Encryption and Blockchain Technology, hardware implementation of a secure IoT scenario or application). As for the second project, students will spend the last week of the semester investigating one of the topics listed above related to regulations, laws, and policies.

026NTIPM1 Advanced Technologies in IP Networks 6 Cr.

This course allows for the analysis of network interconnection on the Internet and the evolution of protocols. It covers the interconnection of autonomous systems, transit and peering agreements, Internet exchange points, principles of external routing, the BGP protocol, BGP routing strategies, routing security on the Internet, MPLS architecture - MPLS VPN, traffic engineering, transition to IPv6, IPv6 auto-configuration, and dual-stack implementation.

026BIGDM2 Big Data 4 Cr.

This course presents various theoretical and practical aspects related to managing massive data: distributed computing with MapReduce and HPFS, graph link analysis, PageRank, searching for similar sets and subsets, community identification in graphs, data stream processing, recommendation and classification systems, and separable set detection (clustering).

026BLCHM2 Blockchain 4 Cr.

This course delves into the fast-evolving realm of blockchain technology, showcasing its versatility beyond the realm of Fintech. Through this course, students gain a comprehensive understanding of blockchain and its practical applications, covering distributed ledger technology, bitcoins, keys and addresses, wallets, transactions, advanced transaction methods, the Bitcoin network, blockchain mining and consensus, business applications, cryptocurrency, Ethereum, smart contracts, decentralized applications, blockchain applications outside finance, Hyperledger, other distributed ledger technologies, advanced blockchain topics, and blockchain security.

026CRASM2 Cryptography and Secure Applications 4 Cr.

This course provides the necessary knowledge for securing information using cryptography. It covers topics such as security services, mechanisms, and techniques; symmetric, asymmetric, and hash algorithms; certificates; authentication mechanisms; non-repudiation; confidentiality; integrity; key exchanges; and smart cards.

026DIFOM3 Digital Forensics and Incident Management 4 Cr.

This course explores digital forensics and incident management, encompassing the collection, analysis, and presentation of digital data and events for legal admissibility. It aids in detecting and preventing digital and cyber-crime, as well as resolving disputes involving digitally stored evidence. Topics covered include the investigation process, relevant laws, seizing digital evidence, types of digital evidence, rules of evidence, examination

processes, electronic crime considerations by category, roles of first responders, securing electronic crime scenes, conducting interviews, documenting scenes, evidence collection and preservation, packaging and transport, incident investigation (e.g., hacking, e-fraud, data leakage), and log capturing techniques and tools for digital evidence management.

026PIETM3 Ethical Hacking 4 Cr.

This course teaches how to identify weaknesses in the network using the same methods as hackers: fingerprinting, enumeration, exploitation, and privilege escalation. Students will also learn countermeasures to take, such as patches, to mitigate risks. The topics covered in this course include pirate classes, attack anatomy, intrusion testing, passive reconnaissance, scanning (discovering active machines, port scanning, detecting operating systems, vulnerability testing), password cracking, enumeration, system attacks (gaining access, post-attack), network attacks (denial-of-service attacks, network sniffing, identity usurpation), and web application attacks, as well as social engineering.

026ISSPM3 Information Security: Standards and Best Practices 4 Cr.

This course introduces key security and risk analysis concepts, various computer security standards, best practices, and guidelines. It covers topics such as security policies and procedures, human resource security, physical and logical security of systems and networks, incident management, and business continuity planning. Notable standards covered include ISO 27001-2 2013, PCI DSS, OWASP, and SANS-CIS top 20 cybersecurity controls.

026ISASM3 Information Systems: Administration and Security 2 Cr.

This course aims to give a comprehensive view on the world of Information System Security.
In this course we cover a multitude of technologies that comprise the modern concept of cloud computing, business continuity and disaster recovery techniques. Students will also gain a deeper understanding of containerization standards, a technological revolution that is just beginning to significantly impact numerous enterprise systems and is set to reshape computing in the coming years. Along with current concepts applied to public and hybrid cloud platforms, such as IaaS, PaaS, SaaS, RPO, RTO, SAN, NAS, DAS, FC, FCOE, iSCSI, and FCIP, the course will also cover containers, Kubernetes, and backup.

026GOSIM1 Information Systems Governance 2 Cr.

How can businesses improve efficiency and productivity? How can Information Technology align with organizational goals? How can IT investments be optimized? How can information systems evolve effectively? This course addresses these questions by presenting a continuous improvement approach to IT production, enriched with practical experience and European market references. It covers information systems governance, including concepts, challenges, best practices, process methods, tools, ITIL (overview, organization, detailed industrialization approach for environments, practical implementation of processes, infrastructure, and tools within companies), COBIT (structure, domains, processes, practical application, and complementarity with other standards such as ITIL and CMMI), and integration of IS governance into the overall enterprise security approach.

026INDTM2 Innovation Management and Design 4 Cr.

This course on innovation management and design is essential in today's fast-paced and complex world, particularly for professionals in engineering. It emphasizes the leader's role as both an innovator and a facilitator of innovation. Students will develop fundamental skills in innovation and creative problem-solving, with a focus on finding innovative solutions to everyday social challenges. Innovation involves the practical transformation of ideas into new products, services, processes, systems, and social interactions, generating added value that satisfies various stakeholders and drives sustainable growth while enhancing quality of life and fostering a sustainable society. Innovation extends beyond technology to encompass all dimensions of the economy and society. Originating in the 1980s at Stanford University, the concept of innovation, inspired by designers, architects, and artists, centers on the needs of users and employs tools such as observation, inquiry, experimentation, and visual thinking to effectively understand and communicate ideas. While often associated with product design, innovation and design thinking are applicable to a wide range of problem-solving contexts, including business modeling and process improvement.

026GEPRM2 Introduction to Entrepreneurship 2 Cr.

This course introduces entrepreneurship fundamentals including innovation, ideation, and strategy. It explores the DNA canvas, encompassing design, needs, and aspirations, as well as visualizing business through the Business Model Canvas. Additionally, it delves into understanding the entrepreneurial environment and identity within the Lebanese ecosystem, covering legal registration and business identity such as SAL and SARL. The syllabus also includes digital entrepreneurship topics like e-commerce and virtual marketplaces, along with payment gateways. Furthermore, it examines the pricing strategies crucial for the sustainability and scalability of entrepreneurial ventures, concluding with insights into export opportunities.

026STAGM4 Internship 30 Cr.

4-month professional internship in a company on a security-related theme.

026DRINM2 IT Law 2 Cr.

This course covers essential themes and key issues in contemporary legislation, offering a comparative perspective between Lebanese and European laws. It includes the following topics: Context and general concepts - Legal developments in Lebanon - Our position relative to Europe - Intellectual property in the context of computer creations - Contracts: negotiation and drafting - Legal protection and criminal law related to cybercrime - Electronic signatures: challenges and applications - The CNIL (French data protection authority): why and how? - Prospects for information technology law in the coming years.

026MACRM1 Mathematics for Cryptography 2 Cr.

This course provides an in-depth introduction to the mathematical foundations of cryptography. It focuses on the mathematical principles and methods necessary to understand and create cryptographic schemes and protocols. The course covers various arithmetic operations and their applications in cryptographic systems, including modular arithmetic, finite fields, number theory, and an introduction to elliptic curve theory.

026AGREM1 Network Architecture and Management 6 Cr.

This course introduces the architecture of communication networks and related basic concepts. It covers the following topics:
Overview of the OSI model and the functionalities of each layer - Recap of technologies used at levels 2 and 3 in LAN, MAN, and WAN networks (Ethernet/VLAN, WiFi, Frame Relay, ATM, IP, VPN, etc.) - Enterprise network architecture at the LAN and WAN levels - Interworking unit architectures - Interconnection techniques at levels 2 and higher - Network evolution towards broadband - Gigabit networks and bandwidth management techniques - Data center architecture - Storage networks - Network access control and filtering - Security zones - Challenges in network management - Abstract syntax and management data coding - CMIS/CMIP and SNMP protocols - Structure of management information (SMI) - Standard MIBs and RMON.

026SEREM3 Network Infrastructure Security 4 Cr.

This course introduces security techniques offered by network equipment. It covers security provided by market-available network equipment such as hubs, switches, routers, firewalls, and address translation. Specific aspects of intranet security, classic telephony/PABX security, security for radio-mobile networks, wireless networks, and multimedia over IP are discussed. Additionally, topics include network availability (redundancy functions, physical and/or logical protection against attacks), VPN service offerings, practical exercises on router filtering, and implementation of an IPSec VPN between routers

026MOREM1 Network Modeling and Optimization 4 Cr.

This course teaches students how to design and analyze network topology and performance using mathematical modeling tools from graph theory, operations research, and stochastic processes. It also introduces the fundamentals of network modeling and dimensioning, utilizing theoretical tools such as graphs, operations research, and queues. It covers graph theory basics, graph representation and traversal, classical graph

problems like minimum-weight spanning trees, shortest paths, and transportation networks, as well as network manipulation and analysis using graph libraries. The course also introduces teletraffic theory, probability-based modeling of multiplexing and traffic, Markov chains and their application to networks, arrival processes, M/M queues, optimization, linear programming, and numerical tools for solving optimization problems.

026PRJ1M2 Project 6 Cr.

A project to apply the knowledge acquired in the first year of the Master's program.

026INENM2 Project Management 2 Cr.

This course enables students to understand the essential phases of project management. These phases include planning, schedule development, and control. Additionally, the course covers various management concepts recognized as best practices for successful project management. Topics include an introduction to project management, project planning, project scheduling, project communication management, project cost, and project control.

026GERIM3 Risk Management 2 Cr.

This course aims to introduce information systems security risk management to raise awareness about risk management, demonstrate that risk management can be controlled, show that there are methods to analyze risks, and outline the implementation of a risk management plan. It covers the following topics: Risk management concepts, risk management processes, best practices for risk management, principles of information systems risk management, culture and communication, alignment with strategy and business objectives, risk identification, risk scenarios, risk management awareness, concepts of "capacity, appetite, tolerance," various phases of risk assessment, risk analysis methods, definition and implementation of solutions, and risk control.

026REESM3 Secure Corporate Networks 4 Cr.

This course enables mastery of the operation and deployment of secure corporate networks. It covers various firewall technologies, including packet filtering, application filtering (proxy), dynamic filtering, and session filtering. Additionally, it addresses content analysis (spam prevention, virus protection), intrusion detection systems, and revisits enterprise network architecture. The course explores technology choices and equipment sizing for security, including centralized authentication, single sign-on (SSO), access control, network access control (NAC), security zones, unified threat management (UTM), and VPNs (L2TP, IPsec, SSL). Practical exercises involve setting up a firewall with rule writing, port scanning before and after firewall implementation, implementing a Squid proxy, deploying VPN servers, and studying real-world cases.

026SDDCM2 Software-Defined Data Center 2 Cr.

This course explains extending virtualization benefits across data center infrastructure components (networking, processing, storage) for improved service provisioning efficiency, availability, and security. It covers Traditional Data center technologies, Cloud computing, and Virtualization (Concepts, Models, Technologies, Security), including Systems virtualization, Storage virtualization, Network virtualization, Virtual network devices, and SDN, along with Converged and Hyper-Converged Infrastructures.

026COUNM2 Unified Communications 4 Cr.

This course covers audio and video compression standards, which form a major part of multimedia streams, along with the transmission and control protocols for these streams. It is complemented by three key applications: IP telephony, video conferencing, and video streaming.

026ADUNM1 UNIX Administration 6 Cr.

This course introduces administration and security techniques for a network of workstations running UNIX as the operating system. It covers local administration topics such as the role of an administrator, startup and shutdown procedures, user management, process management, disk management, backup and compression, printer

management, periodic tasks, and log files. Additionally, it delves into UNIX workstation network administration, including configuring a network server, using basic tools, understanding DNS (Domain Name System), NIS (Network Information Service), NFS (Network File System) and Automount, managing mail services, setting up a web server and proxy, configuring DHCP (Dynamic Host Configuration Protocol), implementing PPP (Point-to-Point Protocol), ensuring security measures, and optimizing system parameters. The course also touches on trusted operating systems like Trusted Solaris and SELinux.

026REFIM2 Wireless Networks 6 Cr.

This course introduces the principles of radio communication, Aloha and CSMA multiple access, IEEE 802.11 and IEEE 802.15.4 standards, and the security of 3G, 4G, and 5G mobile networks. During practical sessions, students will set up various Wi-Fi network configurations. The following aspects will be covered: SSID, Association, Repeater, Analyzer, Redundancy, VLAN, Routing, NAT, and Security

026WSADM1 Windows System Administration 4 Cr.

This course delves into the Microsoft Windows architecture and hones the skills needed to effectively manage a Microsoft Windows Server. Through hands-on experience with the products and tools, participants gain proficiency in server features, roles, and services. It covers fundamental concepts such as PC and Server hardware architecture, Operating System, and Networking, as well as advanced topics including: - Windows Server architecture - Installation and Configuration - Configuring Network Services (DHCP, DNS, Routing, Remote Access, VPN) - Backup and Recovery - Security and Identity Management (Active Directory, Group Policy Management, Certificate Services, Federated Services, Network Access Control and Policy Management, Server Hardening) - Virtualization (Hyper-V) - Overview of the Microsoft Ecosystem - Setting up a Web presence using Internet Information Services (IIS): Web Site (HTTP, HTTPS), FTP, SMTP.