



Jordan University of Science and Technology
Faculty of Computer and Information Technology
Department of Network Engineering and Security

Study Plan of Bachelor Degree in Network Engineering and Security

(2021)

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Vision:

To be a distinguished program in network engineering and security in Jordan and the region that is recognized for high-quality education and research.

Mission:

The mission of the Department of Network Engineering and Security is to produce best quality Network Engineering and cybersecurity professionals by offering a broad-based education, encouraging life-long learning, fostering teamwork and leadership and promoting creativity and competitiveness. Furthermore, we support technological development and innovation and we deliver high-quality state-of-the-art research both theoretical and applied that meet the needs of industry and the local community.

Objectives:

The program educational objectives (PEOs) of the NES program at JUST are to produce engineers who are:

- A. [Professionalism] Productive and practitioner-oriented professionals, researchers and future leaders who contribute to the development and innovation of computer networking fields.
- B. [Community Support] Citizens that support economic and social development of the local community.
- C. [Lifelong Learning] Lifelong learners who can always improve the professional knowledge.

Outcomes:

The graduates of the program of Network Engineering and Security will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Numbering and coding system of courses of the study plan.

Course Coding

The following codes are used to designate courses:

Department			Level/year	Field	Sequence
A	B	C	x	y	z

The Department codes (A, B, C) are as follows:

Code	Department
NES	Network Engineering and Security
CPE	Computer Engineering
CS	Computer Science
CIS	Computer Information Systems
SE	Software Engineering

CY	Cyber Security
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Course Numbering

- The Network Engineering and Security courses are tabled and numbered in such a manner to recognize each course regarding its subject area, year or level, and semester offered.
Ex. **NES xyz**: The **NES** symbol in the course number denotes **Network Engineering and Security** and (xyz) is a 3-digits number:

A. The first digit denotes the year level of the course according to student's study plan as follows:

Code	Level/year
1	First
2	Second
3	Third
4	Fourth
5	Fifth

B. The second digit denotes the course field subject as follows:

Number	Specialization
0	Supporting
1	General
2	-
3	-
4	Wireless
5	Security
6	Multimedia
7	Network management

8	Others
9	Graduation projects, training, and special topics

C. The third digit denotes sequence of semester during which the course is offered according to the study plan. In way that odd numbers are given to the first and summer semesters while even numbers are given to second semesters.

Example: NES 454: Computer Network Defense means:

NES	4	5	4
Network Engineering and Security	Level (Fourth year)	Field (Security)	Sequence (Second semester)

A Bachelor of Science (B.Sc.) degree in Network Engineering and Security at JUST is awarded in accordance with the statute stated by JUST regulations for B.Sc. awarding issued by the Dean’s Council for awarding scientific degrees and certifications at JUST after completing (160) credit hours successfully.

The study plan composed of the following:

Table 1: Credit Hours Distribution for Network Engineering and Security Major

Classification	Credit hours		
	Compulsory	Elective	Total
University requirement	16	9	25
Faculty requirement	24	0	24
Department requirement	105	6	111
Total	145	15	160

1.University Requirements (25 CHs):

1-a) University Mandatory Courses (16 CHs).

1-b) University Elective Courses (9 CHs).

2. Faculty Requirements (24 CHs):

Table 2: Mandatory Faculty Requirements

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
MATH 101	Calculus (I)	3	3	0	-	Face To Face
MATH 102	Calculus (II)	3	3	0	Passing MATH 101	Face To Face
MATH 241	Discrete Mathematics	3	3	0	-	Face To Face
CS 101	Introduction to Programming	3	2	0	CIS 99 or Concurrent	Face To Face
SE 103	Introduction to Information Technology	3	3	0	Concurrent with CS101	Online (Synchronous)
SE 112	Introduction to Object-Oriented Programming	3	2	0	Passing CS 101	Hybrid
CS 211	Data Structures	3	3	0	MATH 241+ passing SE 112	Hybrid
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211	Face To Face

3. Department Requirements (111 CHs):

3-a) Department Mandatory Courses from other Departments (50 CHs):

3-a1) Mandatory Courses from the Department of Computer Engineering (17 CHs):

Table 3: Mandatory Courses from the Department of Computer Engineering

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
CPE 231	Digital Logic Design	3	3	0	SE 112	Face To Face
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231	Hybrid
CPE 252	Computer Organization and Design	3	3	0	CPE 231	Face To Face
CPE 351	Microprocessor Systems	3	3	0	CPE 252	Hybrid
CPE 352	Computer Architecture	3	3	0	CPE 252	Hybrid
CPE 354	Microprocessor Systems Lab	1	0	3	CPE 232 + passing CPE 351	Face To Face
CPE 473	Operating Systems	3	3	0	CPE 352	Hybrid

3-a2) Mandatory Courses from the Department of Electrical Engineering (13 CHs):

Table 4: Mandatory Courses from the Department of Electrical Engineering

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
EE 204	Introduction to Linear Systems	3	3	0	MATH 201	Face To Face
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent	Face To Face
EE 213	Electrical Circuits Lab	1	0	3	EE 212	Face To Face
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + EE 204 or Concurrent	Face To Face
EE 321	Fundamentals of Electronics (<i>for Non-EE Students</i>)	3	3	0	EE 212	Face To Face

3-a3) Mandatory Courses from the Department of Mechanical Engineering (4 CHs):

Table 5: Mandatory Courses from the Department of Mechanical Engineering

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
ME 200	Engineering Drawings (A)	1	0	3	CIS 99 or Passing the Computer Skills Exam with a grade of 50% or more	Face To Face
ME 215	Engineering Mechanics	3	3	0	PHY 101	Face To Face

3-a4) Mandatory Courses from the Department of Mathematics (6 CHs):

Table 6: Mandatory Courses from the Department of Mathematics

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
MATH 201	Intermediate Analysis	3	3	0	Passing the MATH 102	Face To Face
MATH 203	Ordinary Differential Equations	3	3	0	Passing the MATH 102	Face To Face

3-a5) Mandatory Courses from the Department of Applied Physics (7 CHs):

Table 7: Mandatory Courses from the Department of Applied Physics

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
PHY 101	General Physics (1)	3	3	0	-	Face To Face
PHY 102	General Physics (2)	3	3	0	Passing the PHY 101	Face To Face

PHY 107	General Physics (GENERAL PHYSICS LABORATORY (FOR NON-PHYSICS STUDENTS))	1	0	3	Passing the PHY 102	Face To Face
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3-a6) Mandatory Courses from the Department of Chemistry (3 CHs):

Table 8: Mandatory Courses from the Department of Chemistry

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
CHEM 103	General Chemistry	3	3	0	-	Face To Face

3-b) Department Mandatory Courses from the Department of Network Engineering and Security (55 CHs):

Table 9: Department Mandatory Courses from the Department of Network Engineering and Security

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
NES 201	Communication Skills and Professional Ethics	2	2	0	-	Online (Synchronous)
NES 202	Introduction to UNIX	3	3	0	CS 211	Online (Synchronous)
NES 301	Probability and Queuing Theory	3	3	0	MATH 241	Face To Face
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent	Face To Face
NES 312	Fundamentals of Computer Networks	3	3	0	NES 311 + NES 301	Face To Face
NES 352	Cryptography and Information Security	3	3	0	NES 301	Hybrid
NES 413	Computer Networks Laboratory	1	0	3	NES 312	Face To Face
NES 415	Networking Protocols	3	3	0	NES 312	Hybrid

NES 416	Network Programming	3	3	0	NES 202 + NES 312 + CPE 473	Hybrid
NES 441	Wireless Networks	3	3	0	NES 312	Face To Face
NES 442	Wireless Networks Laboratory	1	0	3	NES 441 + NES 413	Face To Face
NES 453	Network Security	3	3	0	NES 312 + NES 352	Face To Face
NES 454	Computer Network Defense	3	3	0	NES 453	Hybrid
NES 455	Information Security Laboratory	1	0	3	NES 352	Face To Face
NES 456	Network Security Laboratory	1	0	3	NES 453 + NES 455	Face To Face
NES 460	Multimedia Networking	3	3	0	NES 415	Hybrid
NES 470	Network Management	3	3	0	NES 415	Hybrid
NES 490	Practical Training	3	0	0	Completion of 115 CHs	Face To Face
NES 545	The Internet-of-Things	3	3	0	NES 441	Face To Face
NES 555	Ethical Hacking Laboratory	1	0	0	NES 456	Hybrid
NES 556	Digital Forensics	3	3	0	NES 453	Face To Face
NES 591	Graduation Project (1)	1	0	0	Completion of 115 CHs	Face To Face
NES 592	Graduation Project (2)	2	0	0	NES 591	Face To Face

3-c) Department Elective Courses (6 CHs): (*)

- Student selects (6 CHs) from the List Shown in Table 10

Table 10: Department Elective Courses

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Tyep
NES 510	Network Simulation and Modeling	3	2	1	NES 416	Online (Synchronous)
NES 540	Wireless Networking Protocols	3	3	0	NES 441	Online (Synchronous)

(*) Students who are trained in academy or professional training programs in the Faculty of Computer and Information Technology and pass the corresponding international certification exam are exempted from (3 CHs) after department approval.

NES 541	Wireless Networks Security	3	3	0	NES 441 + NES 452	Online (Synchronous)
NES552	Reverse Engineering and Malware Analysis	3	3	0	CPE351+NES451+CPE473	Hybrid
NES 557	Software Security	3	3	0	NES 453	Hybrid
CPE 560	Distributed Systems and Middleware	3	3	0	CPE 473	Hybrid
NES562	Applications of Multimedia Networking	3	3	0	NES 460	Online (Synchronous)
NES 580	Emerging Networking Technologies	3	3	0	NES 415	Hybrid
NES 581	Artificial Intelligence and Machine Learning	3	3	0	NES 441 + NES 453	Hybrid
CPE 585	Cloud Computing	3	3	0	NES 312	Online (Synchronous)
NES 595	Special Topics in Network Engineering & Security	3	3	0	Department approval	Face To Face

Study Plan

First Year

First Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 101	Calculus I	3	3	0	-
CS 101	Introduction to Programming	3	2	0	CIS 99 or Concurrent
PHY 101	General Physics (I)	3	3	0	-
LG 101	Communication Skills in English	3	3	0	LG 099 or Passing the English Skills Exam with a grade of 50% or more
SE 103	Introduction to Information Technology	3	3	0	Concurrent CS 101
HSS 119	Entrepreneurship and Innovation	2	2	0	-
Total		17	16	2	

Second Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 102	Calculus II	3	3	0	MATH 101
ARB 102	Communication Skills in Arabic	3	3	0	-
LG 102	Life Skills	2	2	0	-
PHY 102	General Physics (2)	3	3	0	Passing the PHY 101
SE 112	Introduction to Object-Oriented Programming	3	2	0	Passing CS 101
HSS 110	Leader and Social Responsibility	3	2	1	-
Total		17	15	3	

Second Year

First Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 203	Ordinary Differential Equations (1)	3	3	0	Passing the MATH 102
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent
MATH 241	Discrete Mathematics	3	3	0	-
MATH 201	Intermediate Analysis	3	3	0	Passing the MATH 102
PHY 107	General Physics (GENERAL PHYSICS LABORATORY (FOR NON-PHYSICS STUDENTS))	1	0	3	Passing the PHY 102
ME 200	Engineering Drawings (A)	1	0	3	CIS 99 or Passing the Computer Skills Exam with a grade of 50% or more
CPE 231	Digital Logic Design	3	3	0	SE 112
Total		17	15	6	

Second Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
EE 204	Introduction to Linear Systems	3	3	0	MATH 201
EE 213	Electrical Circuits Lab	1	0	3	EE 212
NES 201	Communication Skills and Professional Ethics	2	2	0	-
ME 215	Engineering Mechanics	3	3	0	PHY 101
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231
CPE 252	Computer Organization and Design	3	3	0	CPE 231
CS 211	Data Structures	3	3	0	Passing SE 112 + MATH 241
Total		16	14	6	

Third Year

First Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + EE 204 or Concurrent
EE 321	Fundamentals of Electronics (for Non-EE Students)	3	3	0	EE 212
NES 301	Probability and Queuing Theory	3	3	0	MATH 241
CPE 351	Microprocessor Systems	3	3	0	CPE 252
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent
NES 202	Introduction to UNIX	3	3	0	CS 211
Total		18	18	0	

Second Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211
NES 312	Fundamentals of Computer Networks	3	3	0	NES 311 + NES 301
NES 352	Cryptography and Information Security	3	3	0	NES 301
CPE 352	Computer Architecture	3	3	0	CPE 252
CPE 354	Microprocessor Systems Lab	1	0	3	CPE 232 + CPE 351
CHEM 103	General Chemistry	3	3	0	-
Total		16	15	3	

Fourth Year
First Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 473	Operating Systems	3	3	0	CPE 352
NES 413	Computer Networks Laboratory	1	0	3	NES 312
NES 415	Networking Protocols	3	3	0	NES 312
NES 453	Network Security	3	3	0	NES 312 + NES 352
NES 455	Information Security Laboratory	1	0	3	NES 352
NES 441	Wireless Networks	3	3	0	NES 312
MS 100	Military Science	3	3	0	-
Total		17	15	6	

Second Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 442	Wireless Networks Laboratory	1	0	3	NES 441 + NES 413
NES 454	Computer Network Defense	3	3	0	NES 453
NES 456	Network Security Laboratory	1	0	3	NES 453 + NES 455
NES 460	Multimedia Networking	3	3	0	NES 415
NES 470	Network Management	3	3	0	NES 415
NES 416	Network Programming	3	3	0	NES 202 + NES 312 + CPE 473
-	University Elective	3	3	0	-
Total		17	15	6	

Summer Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 490	Practical Training	3	0	0	Completion of 115 CHs
Total		3	0	0	

**Fifth Year
First Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 545	The Internet-of-Things	3	3	0	NES 441
NES 555	Ethical Hacking Laboratory	1	0	3	NES 456
NES 591(*)	Graduation Project (1)	1	0	0	Completion of 115 CHs
-	Department Elective	3	3	0	-
-	University Elective	3	3	0	-
Total		11	9	3	

Second Semester

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 556	Digital Forensics	3	3	0	NES 453
NES 592	Graduation Project (2)	2	0	0	NES 591
-	Department Elective	3	3	0	-
-	University Elective	3	3	0	-
Total		11	9	-	

(*) Students must register "NES 591" before the graduation semester (Semester 1 or Semester 2).

Course Description

NES 201: Communication Skills and Professional Ethics (2C, 2H, 0L)

Prerequisite: None

Verbal and nonverbal forms of communication such as speaking, listening, and technical writing, are the information necessary to practice effective communication in various work environments. The course also includes topics related to professional and ethical responsibility when analyzing and designing systems, as well as professional and ethical responsibility in ensuring safety in the work environment, risks, legal responsibilities in computerized systems, intellectual property, computer crimes and economic issues in computing.

NES 202: Introduction to UNIX (3C, 3H, 0L)

Prerequisite: CS 211

Basic concepts of Unix, such as processes, files and directories, pipes, input/output redirection, and shells, basic Unix commands and programs, and how to get help, when needed, standard program development tools: editors (EMACS, nano editor), compilers, debuggers, and the “make” facility, automated common system tasks using shell scripts and Perl, basic system administration.

NES 301: Probability and Queuing Theory (3C, 3H, 0L)

Prerequisite: MATH 241

Probability principles and sets theory, random variables, operations on random variables, distribution functions, introduction to random processes, Poisson processes and Markov chains, queuing analysis.

NES 311: Data Communication (3C, 3H, 0L)

Prerequisite: CPE 231, EE 260 or Concurrent

Analog and digital transmission, modulation and demodulation, transmission media, data encoding, synchronous and asynchronous transmission, digital carriers, error control, multiplexing, circuit and packet switching, open system standards.

NES 312: Fundamentals of Computer Networks (3C, 3H, 0L)

Prerequisite: NES 311, NES 301

Network architectures, Application layer protocols: HTTP and FTP, Transmission layer protocols: TCP and UDP, Network Layer services: routing protocols, IPV4 and IPV6, Data link layer services: Error detection and correction, Multiple access Control, Principles of Wireless Networks, Principles of Network Security.

NES 352: Cryptography and Information Security

(3C, 3H, 0L)

Prerequisite: NES 301

Security and Cryptography Concepts, Classical Cryptography, Number Theory and Finite Fields, Symmetric Cryptography (block ciphers and stream ciphers) and modes of operation, Asymmetric cryptography and Diffie-Hellman Key Exchange, Hash Functions, message authentication and Digital Signatures.

NES 413: Computer Networks Laboratory

(1C, 0H, 3L)

Prerequisite: NES 312

A set of experiments to design, apply, analyze, and evaluate computer network protocols. Evaluation of static and dynamic routing protocols: RIP, OSPF, and BGP. Evaluation and analysis of TCP and UDP protocols. DHCP and NAT configuration. Analysis of network traffic using sniffing tools.

NES 415: Networking Protocols

(3C, 3H, 0L)

Prerequisite: NES 312

Essential Internet protocols: ARP, IP, ICMP, IGMP, UDP, TCP, routing protocols such as RIP, OSPF and BGP, multicasting and multicast routing protocols such as DVMRP, MOSPF and PIM, application protocols such as DNS, DHCP, FTP and HTTP.

NES 416: Network Programming

(3C, 3H, 0L)

Prerequisite: NES 202, NES 312, CPE 473

Introduction to Network Programming, Transport Layer Protocols, TCP, UDP, and SCTP, Client-Server Model, TCP Sockets, UDP Sockets, SCTP Sockets, I/O Multiplexing, DNS and Address Conversion, Threads Programming, RPC, Raw Sockets and Datalink Access. One or more of the following Internet Application Protocols and Case Studies: TELNET, HTTP, Authd, SMTP, POP, IMAP, FTP, and Web Programming (CGI, Servlets, and XML).

NES 441: Wireless Networks

(3C, 3H, 0L)

Prerequisite: NES 312

Basic concepts of Wireless Networks: Wireless Personal Area Networks (WPAN), Wireless Local Area Networks (WLAN), and Wireless Wide Area Networks (WWAN). Physical layer standards, medium access control, building and securing WLAN, Wide Area Networks including cellular networks and cellular data networks.

NES 442: Wireless Networks Laboratory

(1C, 0H, 3L)

Prerequisite: NES 441, NES 413

A set of experiments on configuring, implementing, integrating, and testing a variety of wireless technologies. Methods and tools for network management of wireless networks such as WLAN Network Management Systems, Routers, and Switches.

NES 453: Network Security

(3C, 3H, 0L)

Prerequisite: NES 312 & NES 352

This course provides the students with a fundamental background to the different topics related to network security. The topics covered in this course includes, but not limited to, network security models and architectures, network authentication protocols, public-key infrastructure, Key management fundamentals and protocols, network security protocols, application layer protocols and their security.

NES 454: Computer Network Defense

(3C, 3H, 0L)

Prerequisite: NES 453

This course provides in-depth understanding of network security threats and network security defense/countermeasures. It discusses main computer networks vulnerabilities and teaches the essential skills, methods, tools, policies and techniques needed to protect, defend, and secure an organization's information systems. Topics include: Internet infrastructure security, denial of service attacks, DNS security issues, Botnets, network security assessment using industry-leading standards, models and policies. Hands on exercises that cover core computer network defense technologies and countermeasures such as intrusion detection and prevention systems, network monitoring and mapping tools, packet filtering, and malware protection.

NES 455: Information Security Laboratory

(1C, 0H, 3L)

Prerequisite: NES 352

This course is designed to develop hands-on skills in the fundamentals of computer and information security. The course includes a set of lab experiments that cover the topics of cryptography, system security and operations, software security, and web security.

NES 456: Network Security Laboratory

(1C, 0H, 3L)

Prerequisite: NES 453 & NES 455

Experiments about conducting attacks against network protocols that include UDP, TCP, ICMP, IP and ARP, traffic sniffing attacks, DNS hacking, SYN flooding, port scanning, access control, intrusion detection systems, and Firewalls.

NES 460: Multimedia Networking

(3C, 3H, 0L)

Prerequisite: NES 415

Multimedia data types: images, video, and audio, multimedia compression technologies such as JPEG, MPEG, and H.264, multimedia protocols including RTP/RTCP and RTSP, Voice-over-IP and its protocols including SIP and H.323, multimedia streaming over best-effort and reservation-based networks, quality-of-service models.

NES 470: Network Management

(3C, 3H, 0L)

Prerequisite: NES 415

This course introduces the network management protocols that specify the monitoring, configuring, and controlling of network devices. Topics include introduction to network management and the functions of network management, data modeling languages for the definition of data sent over network management protocols (e.g., SMI and YANG), the organization and operation of network management protocols (e.g., SNMP, RESTCONF, and NETCONF), and encoding of the actual data inside the messages of the network management protocols.

NES 490: Practical Training

(3C)

Prerequisites: Completion of 115 credit hours

Twelve weeks of practical training in an institution that deals with networking and security.

NES 510: Network Simulation and Modeling

(3C, 2H, 1L)

Prerequisite: NES 416

Introduction to simulation concepts, discrete event simulation, random number generation, input modeling; statistical analysis of simulation, computer networks simulation, Discrete time Markov chains (DTMC), Continuous time Markov chains (CTMC), Queuing models (M/M/1, M/M/c/k, M/G/1). Well-known network simulation packages such as ns2 and/or Qualnet.

NES 540: Wireless Networking Protocols

(3C, 3H, 0L)

Prerequisite: NES 441

Challenges and latest solutions in wireless and mobile networks, and ad-hoc and wireless sensor networks, focusing on routing, auto-configuration, clustering, topology management, quality of service (QoS), reliable transport, energy conservation, mobility management, MAC, and service discovery. Existing and proposed standards, and current research projects in this field.

NES 541: Wireless Networks Security**(3C, 3H, 0L)***Prerequisite: NES 441, NES 452*

Confidentiality, Privacy, Integrity, Spoofing, Signal intercept, Key management and distribution, control of fraudulent usage of networks. Security of ad-hoc networks, wireless sensor networks, and cellular networks.

NES 545: The Internet-of-Things**(3C, 3H, 0L)***Prerequisite: NES 441*

This course covers the basics of the Internet of Things, its technologies and protocols, in addition to the hardware, tools and software used in it. The course includes fun activities and hands-on exercises on modeling sensors that are securely connected to cloud services through IP networks and data collection in IoT peripheral systems.

NES 552: Reverse Engineering and Malware Analysis**(3C, 3H, 0L)***Prerequisite: CPE351+NES451+CPE473*

This course introduces the essential concepts, tools, and techniques for understanding, analyzing, and investigating binary programs, in general, and malicious programs, in specific. It begins with easy methods that can be used to get information from relatively unsophisticated programs, and proceeds with increasingly complicated techniques that can be used to tackle even the most sophisticated malicious programs. Particular topics include static analysis techniques, dynamic analysis, assembly language and disassembly, recognizing C code constructs in assembly, debugging, and obfuscation techniques.

NES 555: Ethical Hacking Laboratory**(1C, 0H, 3L)***Prerequisite: NES 456*

This laboratory includes experiments related to footprinting and reconnaissance, scanning, networks enumeration, hacking malware, social engineering, denial of service, attacks on web applications, SQL injection, attacks on wireless networks, hacking web servers, evading IDS and firewalls.

NES 556: Digital Forensics**(3C, 3H, 0L)***Prerequisite: NES 453*

This course introduces the essential concepts, techniques, and tools used in obtaining evidence from digital media. The course covers the steps comprising the forensic process: acquisition, preservation, examination, analysis and reporting.

NES 557: Software Security**(3C, 3H, 0L)***Prerequisite: NES 453*

This course aims to build secure software. It considers essential software vulnerabilities and attacks that exploit them, and the course considers defenses that prevent these attacks, including advanced testing and program analysis techniques. Finally, the course covers ideas like threat modeling and security design principles; we present real-world examples of good and bad designs.

NES 562: Applications of Multimedia Networking**(3C, 3H, 0L)***Prerequisite: NES 460*

This course covers a broad range of topics in the frontier of multimedia computing and networking systems, focusing on transmission techniques and protocols, massive storage architectures and data security. Especially, this course covers rate and flow control, jitter management, error control and loss recovery, quality-of-service, video-on-demand, voice-over-IP, teleconferencing, multimedia over wireless networks, wide area caching systems and techniques, encryption and group key management.

NES 580: Emerging Networking Technologies**(3C, 3H, 0L)***Prerequisite: NES 415*

Foundations of modern networking, new demands from network systems, shortcomings of conventional networks, new trends and environments (e.g., data centers, cloud computing, big data, Internet of Things, and Smartphone devices), new network technologies, software defined networks (SDN), Network Function Virtualization (NFV), VLANs, VxLANs, MPLS, VPN, and network virtualization.

NES 581 - Artificial Intelligence and Machine Learning**(3C, 3H, 0L)***Prerequisite: NES 441, NES 453*

This course aims at introducing the major topics in artificial intelligence and machine learning. Basic problem solving techniques, knowledge representation and computer inference. Theory and basic techniques in machine learning: Review of several supervised and unsupervised learning approaches; methods for learning linear representations; on-line learning, Bayesian methods; decision-trees; clustering and dimensionality reduction, neural networks and deep learning. A set of assignments and/or projects in the application of artificial intelligence and machine learning in the context of computer networks and security

NES 591: Graduation Project 1**(1C)***Prerequisite: Completion of 115 credit hours*

The student should get familiar with the theoretical and practical aspects associated with the subject matter of the project.

NES 592: Graduation Project 2**(2C)**

Prerequisite: NES 591

The student implements, tests, and presents the project proposed in Graduation Project 1 course.

NES 595: Special Topics in Network Engineering and Security (3C)

Prerequisite: Department Approval

Selected state-of-the-art topics in network engineering and security.