



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

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**Study Plan of Bachelor Degree in Network Engineering and Security**

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**(2025)**

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### About the Program:

The department of Network Engineering and Security (NES) offers a bachelor's program in network engineering and security based on modern curriculum that provides a solid foundation in network engineering and security's theoretical and practical aspects. The program aims to produce highly skilled network and security engineers capable of pursuing graduate studies and careers related to the design, development, maintenance, and security of network hardware and software. To enhance career readiness, the program offers opportunities for students to pursue international certifications, which can count as up to 6 credit hours toward their degree. The program also supports participation in leading competitions in the field of information and network security, such as capture the flag (CTF) and hacking competitions, where students apply their knowledge in real-world security challenges.

### 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 the 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.

### 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 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
HSS	Basic Sciences and Humanities
DS	Data Science
SE	Software Engineering
CY	Cyber Security
EE	Electrical Engineering
ME	Mechanical Engineering
PHY	Physics
MATH	Mathematics
CS	Computer Science
CHEM	Chemistry

### 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	32	0	32
Department requirement	94	9	103
Total	142	18	160

**1. University Requirements (25 credit hours):**

1-a). University Mandatory Courses (16 credit hours).

1-b). University Elective Courses (9 credit hours).

2. Faculty Requirements (32 credit hours):

Table 2: Mandatory Faculty Requirements

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
HSS101MATH	Calculus (I)	3	3	0	-	Face to Face
HSS101PHY	General Physics (1)	3	3	0	-	Face to Face
HSS102MATH	Calculus (II)	3	3	0	Passing HSS101MATH	Face to Face
HSS102PHY	General Physics (2)	3	3	0	Passing HSS101PHY	Face to Face
HSS112SE	Introduction to Object-Oriented Programming	3	3	0	HSS102SE + Passing HSS101CS	Face to Face
HSS201MATH	Intermediate Analysis	3	3	0	Passing HSS102MATH	Face to Face
HSS203DS	Communication and Professional Ethics	2	2	0	-	Blended
HSS211CS	Data Structures	3	3	0	Passing HSS112SE	Face to Face
HSS241MATH	Discrete Mathematics	3	3	0	-	Face to Face
HSS101CS	Introduction to Programming	3	3	0	CIS099 or Concurrent	Face to Face
HSS102SE	English Skills in Information Technology	3	3	0	-	Online

3. Department Requirements (103 credit hours):

3-a) Department Mandatory Courses (94 credit hours):

**Table 3: Department Mandatory Courses**

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
EE 204	Introduction to Linear Systems	3	3	0	HSS201MATH	Face to Face
EE 212	Electrical Circuits Analysis	3	3	0	HSS102PHY + HSS203MATH 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 (for non-EE students)	3	3	0	EE 212	Face to Face
ME 215	Engineering Mechanics	3	3	0	HSS101PHY	Face to Face
HSS103CHEM	General Chemistry	3	3	0	-	Face to Face
HSS107PHY	General Physics Laboratory (for non-physics students)	1	0	3	Passing HSS102PHY	Blended
HSS203MATH	Ordinary Differential Equations (1)	3	3	0	Passing HSS102MATH	Face to Face
CPE211	Scripting Languages Lab	1	0	3	HHSS112SE	Blended
CPE 231	Digital Logic Design	3	3	0	HSS112SE	Face to Face
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231	Blended
CPE 252	Computer Organization and Design	3	3	0	CPE 231	Face to Face
CPE 351	Microprocessor Systems	3	3	0	CPE 252	Blended
CPE 352	Computer Architecture	3	3	0	CPE 252	Blended
CPE 354	Microprocessor Systems Lab	1	0	3	CPE 232 + CPE 351	Face to Face
CPE 473	Operating Systems	3	3	0	CPE 352	Blended
NES 202	Introduction to UNIX	3	3	0	HSS211CS	Online
NES 301	Probability and Queuing Theory	3	3	0	HSS241MATH	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	Blended
NES 413	Computer Networks Laboratory	1	0	3	NES 312	Face to Face
NES 415	Networking Protocols	3	3	0	NES 312	Blended
NES 416	Network Programming	3	3	0	NES202+NES312+CPE473	Blended
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	Blended
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	Blended
NES 470	Network Management	3	3	0	NES 415	Blended
NES 490	Practical Training	3	0	25	Completion of 115 C.H.	Face to Face
NES 545	The Internet-of-Things	3	3	0	NES 441	Face to Face
NES 555	Ethical Hacking Laboratory	1	0	3	NES 456	Blended
NES 556	Digital Forensics	3	3	0	NES 453	Face to Face
NES 591	Graduation Project (1)	1	0	3	Completion of 115 C.H.	Online
NES 592	Graduation Project (2)	2	0	6	NES 591	Blended

3-b) Department Elective Courses (9 credit hours\*\*)

**Group (I) Students must select at least (6 C.H.)**

Course Number	Course Title	Credit Hours	Lecture	Lab	Prerequisite	Learning Type
NES 510	Network Simulation and Modeling	3	3	0	NES 416	Online
NES 540	Wireless Networking Protocols	3	3	0	NES 441	Face to Face
NES 541	Wireless Networks Security	3	3	0	NES 441 + NES 453	Face to Face
NES552	Reverse Engineering and Malware Analysis	3	3	0	CPE351+NES451+CPE473	Blended
NES 557	Software Security	3	3	0	NES 453	Blended
NES562	Applications of Multimedia Networking	3	3	0	NES 460	Face to Face
NES 580	Emerging Networking Technologies	3	3	0	NES 415	Face to Face
NES 581	Artificial Intelligence and Machine Learning	3	3	0	NES 441 + NES 453	Face to Face
NES 595	Special Topics in Network Engineering & Security	3	3	0	Department approval	Face to Face

**Group (II) Students may select at most (3 C.H.)**

CPE 560	Distributed Systems and Middleware	3	3	0	CPE 473	Blended
CPE 585	Cloud Computing	3	3	0	NES 312	Online
CS 412	Advanced Topics in Programming	3	3	0	HSS211CS	Face to Face
CS 415	Contemporary Programming Techniques	3	3	0	HSS211CS	Face to Face
CY453	Cloud Computing Security	3	3	0	NES 453	Blended
CY454	IoT Security	3	3	0	NES 441 + NES 453	Blended

\*\*A student may be exempted from studying up to (6) credit hours of elective department courses if they enroll in a training course from global academies, provided that the number of training hours for each course is no less than (70) hours. This is subject to the approval of the relevant department and the student obtaining an internationally accredited certificate after passing the international exam. Each successfully completed accredited course will be counted as (3) credit hours.

**Study Plan**  
**First Year**

**First Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
HSS101MATH	Calculus I	3	3	0	-
HSS101CS	Introduction to Programming	3	3	0	CIS 99 or Concurrent
HSS101PHY	General Physics (I)	3	3	0	-
LG 101	Communication Skills in English	3	3	0	LG 99
HSS102SE	English Skills in Information Technology	3	3	0	-
HSS 119	Entrepreneurship and Innovation	2	2	0	-
<b>Total</b>		<b>17</b>	<b>17</b>	<b>0</b>	

**Second Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
HSS102MATH	Calculus II	3	3	0	Passing HSS101MATH
ARB 102	Communication Skills in Arabic	3	3	0	-
LG 103	Life Skills	2	2	0	-
HSS102PHY	General Physics (2)	3	3	0	Passing HSS101PHY
HSS112SE	Introduction to Object-Oriented Programming	3	3	0	HSS102SE + Passing HSS101CS
HSS 110	Leader and Social Responsibility	3	2	1	-
<b>Total</b>		<b>17</b>	<b>16</b>	<b>1</b>	

**Second Year**

**First Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE211	Scripting Languages Lab	1	0	3	HSS112SE
CPE 231	Digital Logic Design	3	3	0	HSS112SE
EE 212	Electrical Circuits Analysis	3	3	0	HSS102PHY + HSS203MATH or Concurrent
HSS107PHY	General Physics Laboratory (for non-physics students)	1	0	3	Passing HSS102PHY
HSS201MATH	Intermediate Analysis	3	3	0	Passing HSS102MATH
HSS203MATH	Ordinary Differential Equations (1)	3	3	0	Passing HSS102MATH
HSS241MATH	Discrete Mathematics	3	3	0	-
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Second Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231
CPE 252	Computer Organization and Design	3	3	0	CPE 231
EE 204	Introduction to Linear Systems	3	3	0	HSS201MATH
EE 213	Electrical Circuits Lab	1	0	3	EE 212
DS 203	Communication Skills and Professional Ethics	2	2	0	-
HSS211CS	Data Structures	3	3	0	Passing HSS112SE
ME 215	Engineering Mechanics	3	3	0	HSS101PHY
<b>Total</b>		<b>16</b>	<b>14</b>	<b>6</b>	

**Third Year**

**First Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 351	Microprocessor Systems	3	3	0	CPE 252
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	HSS241MATH
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent
<b>Total</b>		<b>15</b>	<b>15</b>	<b>0</b>	

**Second Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 202	Introduction to UNIX	3	3	0	HSS211CS
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
HSS103CHEM	General Chemistry	3	3	0	-
<b>Total</b>		<b>16</b>	<b>15</b>	<b>3</b>	

**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 441	Wireless Networks	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
MS 100	Military Science	3	3	0	-
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Second Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 416	Network Programming	3	3	0	NES 202 + NES 312 + CPE 473
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
-	University Elective	3	3	0	-
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Summer Semester**

Course ID	Course Name	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 490	Practical Training	3	0	25	Completion of 115 C.H.
<b>Total</b>		<b>3</b>	<b>0</b>	<b>25</b>	



**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	3	Completion of 115 C.H.
-	Department Elective	3	3	0	-
-	Department Elective	3	3	0	-
-	University Elective	3	3	0	-
<b>Total</b>		<b>14</b>	<b>12</b>	<b>6</b>	

**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	6	NES 591
-	Department Elective	3	3	0	-
-	University Elective	3	3	0	-
<b>Total</b>		<b>11</b>	<b>9</b>	<b>6</b>	

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

## Course Description

### **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, 0H, 25L)**

*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, 3H, 0L)**

*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 low 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 system 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, 0H, 3L)

*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, 0H, 6L)

*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, 3H, 0L)

*Prerequisite: Department Approval*

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