| 1.	School	—	King Abdullah II School for Information Technology
2.	Department		Computer Science
3.	Program title (Arabic)		البكالوريوس في الأمن السيبراني
4.	Program title (English)		B.Sc. in Cybersecurity

5. Components of Curriculum:

The curriculum for the bachelor's degree in cybersecurity consists of (132) credit hours distributed as follows

Number	Type of requirement	credit hours
First	University Requirements	27
Second	School Requirements	24
Third	Department Requirements	81
Total		**132**

6. Numbering System:

A- Department number

| Number	Department
1	Computer Science (CS)
2	Computer Information Systems (CIS)
3	Business Information Systems (BIS)
4	Information Technology (IT)
5	Artificial Intelligence (AI)
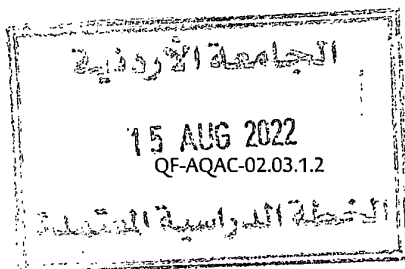
B- Course number

| Domain number	Domain title	Domain number	Domain title
0	General	5	Applications
1	Programming Languages	6	Distributed Systems and Data Communications
2	Information Systems and Management	7	Systems Development
3	Hardware Components and Basic Constructs	8	Specialized Topics
4	Computational Sciences and Algorithms	9	Special Topics and Project

C- Course number consists of 7 digits

School		Department		Level	Serial number	
1	9	1	1	X	X	X
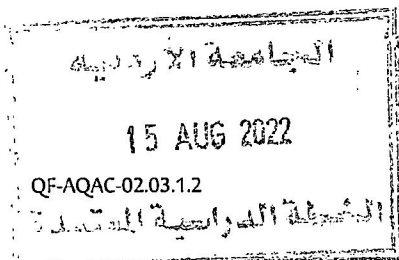
First: University Requirements (27) credit hours distributed as follows:

Preparation Program Requirements				
All students admitted to the university must apply for a degree examination in Arabic and English and the computer is prepared or approved by the university to determine their level. Based on the results of the examinations, either the student will study one or more of the requirements of the preparatory program. (0 - 15 Credit Hours)				
No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Community Service	0300150	0	-	-
2	Computer Skills Placement Test	1902098	0	-	-
3	Basics of Computing	1932099	3	1902098	Pass/Fail
4	Arabic Placement Test	3201098	0	-	-
5	Basics of Arabic	3201099	3	3201098	Pass/Fail
6	Arabic Languages Skills	3201100	3	3201099	Pass/Fail
7	English Placement Test	3202098	0	-	-
8	Basics of English	3202099	3	3202098	Pass/Fail
9	English Language Skills	3202100	3	3202099	Pass/Fail

Compulsory Requirements (18 Credit Hours)				
No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Military Sciences	2220100	3		
2	National Culture	3400100	3		
3	Ethics and Humans Values	3410100	3		
4	Entrepreneurship Innovation and Scientific Research	3410101	3	3410100/1932099	
5	Life And Practical Skills	3410102	3	3410100/1932099	
6	Introduction to Philosophy and Critical Thinking	3400103	3	3410100/1932099	

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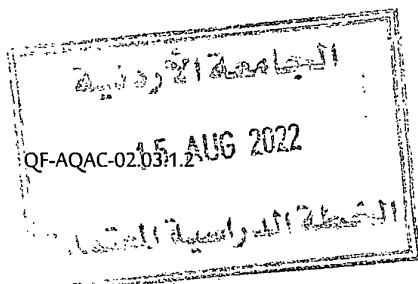
C- Electives
(9 Credit Hours)

Elective courses: (9) credit hours to be chosen from the first, second and third groups mentioned below. The student has to choose one course from each of the groups.

(First Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Islam and Contemporary Issues	0400101	3	-	-
2	Arab-Islamic Civilization	2300101	3	-	-
3	Jordan: History and Civilization	2300102	3	-	-
4	Great Books	3400107	3	-	-
5	Jerusalem	3400108	3	-	-

Electives
(Second Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Environmental Culture and Development	0310102	3	-	-
2	Islamic Culture	0400102	3	-	-
3	Health Culture	0720100	3	-	-
4	Legal Culture	1000102	3	-	-
5	Physical Fitness Culture	1100100	3	-	-

Electives
(Third Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Electronic Commerce	1600100	3		
2	Social Media	1900101	3		
3	Appreciation of Arts	2000100	3		
4	Foreign Language	2200103	3		
5	Special Subject	3400106	3		

Second: School courses: distributed as follows:
  A. **Obligatory school courses: (24) credit hours**
  B. **Elective school courses: (0) credit hours**

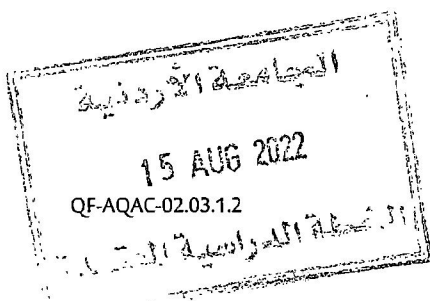 A. **Obligatory school courses: (24) credit hours:**

Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		
1901101	Discrete Mathematics	3	-	3	-
1931102	Computer Skills for Scientific Faculties	3	-	3	Pass Qualifications Exam or 1932099
1904101	Fundamentals of Information Technology	3	-	3	-
1904120	Web Applications Development	3	-	3	1931102
1902110	Object Oriented Programming	3	-	3	1931102
1901242	Data Structures	3	-	3	1902110
1902224	Database Management Systems	3	-	3	1902110
1915101	Linear Algebra for Computational Sciences	3	-	3	0301101
1902390	Seminar-Road to Software Industry	2	-	0	Pass 45 hours

  B. **Elective school courses: (0) credit hours:**

| Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		

Third: Specialty courses: (81) credit hours distributed as follows:

  B. **Obligatory specialty courses: (69) credit hours**
 C. **Elective specialty courses: (12) credit hours**

Study Plan- Bachelors

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A. Obligatory specialty courses: (69) credit hours:

Course No.	Course Name	Contact Hours		Credit Hours	Pre Required
		Theoretical	Practical		
0301101	Calculus-1	3	-	3	-
0301131	Principles of Statistics	3	-	3	-
1911101	Principles of Security	3	-	3	-
1911211	Programming for Cybersecurity	3	-	3	1911101 + 1902110
1911221	Security Risk Management and Ethics	3	-	3	1911101
1911231	Computer Architecture and Assembly Language	3	-	3	1901101 + 1904101
1911241	Cryptography	3	-	3	1901101 + 1911101 + 1915101
1901341	Theory Of Algorithms	3	-	3	1901242
1905320	Artificial Intelligence	3	-	3	1901242
1901363	Computer Networks	3	-	3	1901242
1902372	Software Engineering	3	-	3	1902224
1911351	Security of Web Applications	3	-	3	1904120 + 1902224
1911361	Network Security	3	-	3	1901363
1911371	Secure Software Engineering	3	-	3	1902372
1911381	Penetration Testing and Ethical Hacking	4	-	4	1901363 + 1911211
1911431	Cyber Physical Systems Security (CPSS)	3	-	3	1911361
1901473	Operating Systems	3	-	3	1901242
1911461	Authentication and Security Models	3	-	3	1901363 + 1911241
1911481	Reverse Engineering and Malware Analysis	4	-	4	1911231 + 1911371
1911483	Digital Forensics for Cybersecurity	4	-	4	1901363 + 1901473
1911489	Security Intelligence	3	-	3	0301131 + 1905320
1911496	Project-1	-	-	0	Pass 90 hours
1911497	Project-2	-	-	3	1911496
1911498	Training	6 Weeks		0	Pass 90 hours
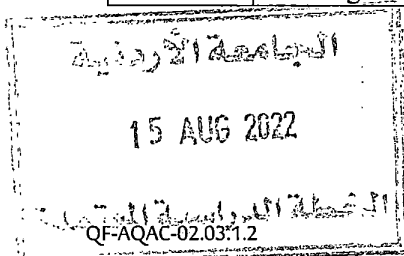
B. Elective specialty courses: (12) credit hours:

Course No.	Course Name	Contact Hours		Credit Hours	Pre Required
		Theoretical	Practical		
1905222	Data Mining	3	-	3	1902224 + 1915101
1901442	Network Programming	3	-	3	1901363
1902324	Database Technologies and Applications	3	-	3	1902224
1911321	Security Management and Auditing	3	-	3	1911221
1911323	Security Policies and Law	3	-	3	1911221
1911363	Wireless and Mobile Security	3	-	3	1911361
1911382	Security Certificates	3	-	3	Pass 60 hours
1911383	Steganography and Digital Watermarking	3	-	3	1901242 + 1915101
1911387	Security Operations	3	-	3	Pass 60 hours
1901446	Computer Systems Performance	3	-	3	0301131 + 1911231
1931460	Fundamentals of IoT	3	-	3	1901473 + 1901363
1931461	Cloud Computing Concepts	3	-	3	1901473 + 1901363
1904487	e-Payment Systems	3	-	3	1902372
1911451	Blockchain Technology	3	-	3	1901242 + 1911241
1911452	System Administration and Network Services	3	-	3	1901363 + 1901473
1911486	Emerging Topics in Cybersecurity	3	-	3	Pass 60 hours

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Study Plan- Bachelors
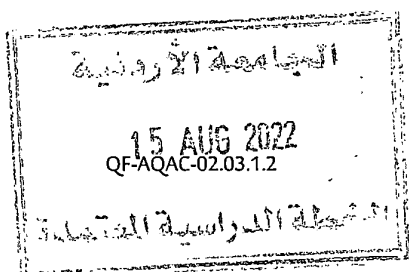
Fourth: Courses offered by other faculties and departments (Physics, Math, Computer Information System, Information Technology, Artificial Intelligence)

Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		
0301101	Calculus-1	3	-	3	-
0301131	Principles of Statistics	3	-	3	-
1904101	Fundamentals of Information Technology	3	-	3	-
1904120	Web Applications Development	3	-	3	1931102
1902110	Object Oriented Programming	3	-	3	1931102
1902224	Database Management Systems	3	-	3	1902110
1915101	Linear Algebra for Computational Sciences	3	-	3	0301101
1905222	Data Mining	3	-	3	1902224 + 1915101
1905320	Artificial Intelligence	3	-	3	1901242
1902372	Software Engineering	3	-	3	1902224
1902390	Seminar-Road to Software Industry	2	-	0	Pass 45 hours
1902324	Database Technologies and Applications	3	-	3	1902224
1904487	e-Payment Systems	3	-	3	1902372
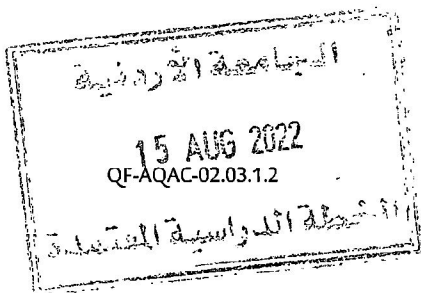
Fifth: Advisory Study Plan

(First) Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0301101	Calculus-1	3	1904120	Web Applications Development	3
1901101	Discrete Mathematics	3	1902110	Object Oriented Programming	3
1931102	Computer Skills for Scientific Faculties	3	1915101	Linear Algebra for Computational Sciences	3
1904101	Fundamentals of Information Technology	3	1911101	Principles of Security	3
	Univ. Req	3		Univ. Req	3
				Univ. Req	3
Total		**15**	**Total**		**18**

(Second) Year

(First) Semester			(Second) Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
1911241	Cryptography	3	1911211	Programming for Cybersecurity	3
1911221	Security Risk Management and Ethics	3	1911231	Computer Architecture and Assembly Language	3
1901242	Data Structures	3	0301131	Principles of Statistics	3
1902224	Database Management Systems	3		Univ. Req	3
	Univ. Req	3		Univ. Req	3
	Univ. Req	3			
Total		**18**	**Total**		**15**

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(Third) Year

(First) Semester			(Second) Semester		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
1902372	Software Engineering	3	1911371	Secure Software Engineering	3
1911351	Security of Web Applications	3	1905320	Artificial Intelligence	3
1901341	Theory Of Algorithms	3	1911361	Network Security	3
1901363	Computer Networks	3	1911381	Penetration Testing and Ethical Hacking	4
	Elective Course	3	1902390	Seminar-Road to Software Industry	0
	Univ. Req	3		Univ. Req	3
Total		18	Total		16

(Fourth) Year

(First) Semester			(Second) Semester		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
1911461	Authentication and Security Models	3	1911481	Reverse Engineering and Malware Analysis	4
1911431	Cyber Physical Systems Security (CPSS)	3	1911483	Digital Forensics for Cybersecurity	4
1901473	Operating Systems	3	1911497	Project-2	3
1911489	Security Intelligence	3	1911498	Training	0
1911496	Project-1	0		Elective Course	3
	Elective Course	3		Elective Course	3
Total		15	Total		17

Study Plan- Bachelors
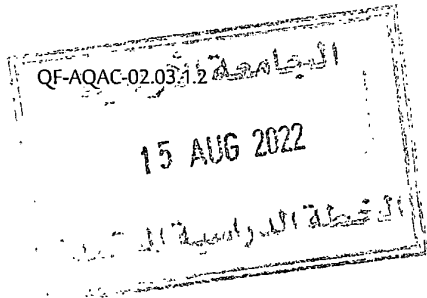
Course Description

A. Obligatory school courses

Course Number 1901101	Course Title Discrete Mathematics	Credit Hours 3
Prerequisite: (None)		
Course Description This course studies the mathematical elements of computer science and their applications. Topics include propositional logic; predicate logic; mathematical reasoning; techniques of proof; mathematical induction; set theory; number theory; matrices; sequences and summations; functions, relations and their properties, elementary graph theory, and tree (graph theory). In each subject, its characteristics, forms, ways of representing it, the operations used in it, and ways of linking these subjects together are studied. Homework will be assigned.		

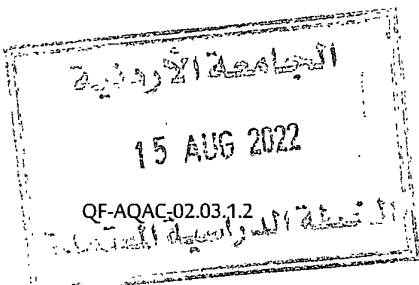| Course Number 1931102	Course Title Computer Skills for Scientific Faculties	Credit Hours 3
Prerequisite: (Pass Qualifications Exam or 1932099)		
Course Description This course studies the fundamental concepts of programming using C++. Topics includes: basic structures of programming tools, like: variable names, data types, input and output statements, and output formatting. Files. Selection statements structures. Repetition statements structures. Functions. Enumeration datatype and strings data type. Arrays; 1D and 2D. The lectures will be provided in the lab through active teaching methodologies individually or within groups.		

Course Number 1904101	Course Title Fundamentals of Information Technology	Credit Hours 3
Prerequisite: (None)		

Course Description

This course will introduce the fundamental knowledge of information technologies, and it works as an introductory course for computer-related courses. It is a combination between a theoretical and a practical course. In particular, the course provides students with a grounding knowledge on several areas of information technologies including cutting edge technologies, careers in IT, basic concepts of cloud computing and web technologies, and a general perceptive of project management. Students are also going to be introduced practically to hardware maintenance, software diagnostics and technical support. In addition, critical thinking methodologies and techniques will be discussed, including numbering systems, flowcharts and related case studies. Operating systems such as LINUX/UNIX with, memory allocation, and an introduction to networks and security, and block chain concepts. The final part is concerned with technical applications needed such as excel, advanced excel, technical writing, report generating and type writing. Technical sections will be taught on lab sessions and group works. Active learning methodologies will be applied through role playing, presentations and problem solving exercises.

Course Number 1904120	Course Title Web Application development	Credit Hours 3
Prerequisite: (1931102)		

Course Description

This course aims to improve students' ability in Front-End Web applications development using client-side programming such as HTML 5, Cascading Style Sheet (CSS3), JavaScript. In addition, the students will learn the fundamental concepts of front-end web development frameworks such as Bootstrap and React front-end frameworks. The course will cover the Bootstrap framework, which is the most popular CSS framework for creating responsive mobile-first websites. This course will teach you how to create pages of a website using the Bootstrap v5 framework. In addition, the course also covers the basic concepts of the React framework such as Communicating with Props, Class-Based Components, State in React Components, Lifecycle Methods, Handling User Input with Forms and Events, Making API Requests with React, and Single Page Application Development. This course uses active teaching methodologies, such as weekly lab applied sessions, group work and technical projects.
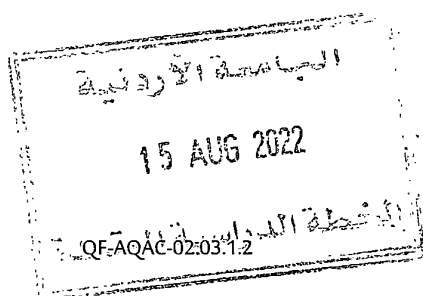
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Study Plan- Bachelors

Course Number 1902110	Course Title Object Oriented Programming	Credit Hours 3
Prerequisite: (1931102)		

Course Description

The course aims to cover the fundamental concepts of OOP, such as Encapsulation and Information-Hiding, Inheritance, Polymorphism, and Abstraction. The course uses Java Programming language starting from the basic Java syntax based on Eclipse IDE. It focuses on the understanding and practical mastery of OOP principles and Java components, such as classes, objects, input/output, scanner objects (to read either from the keyboard or a file), loops, decision-making, array and multidimensional array, data abstraction, methods, method overloading, objects garbage-collector, an introduction to exception-handling, etc. Finally, it presents an introduction to JavaFX and its hierarchy based on Java inheritance OOP concepts, for developing rich client applications. Lectures will be given in the lab for practical application. This course is assessed through exams, practical tests and assignments.

Course Number 1901242	Course Title Data Structures	Credit Hours 3
Prerequisite: (1902110)		

Course Description

This Course introduces the students to the concepts of data structures. Topics includes: Pointers, and pointer operations. Array implementation of lists, stacks, and queues. Dynamic implementation of lists (singly, doubly, circular), stack operations and queue operations (and their implementation as linked lists). STL, like: vectors, pairs, maps, sets, lists, stacks, queue. Recursion. Tree dynamic, like binary search trees, segment, red-black, AVL trees. Hash Table and Collision resolution. Weekly lab assignments will be given to the students and to be discussed through active teaching methodologies, in addition to problem solving tasks.
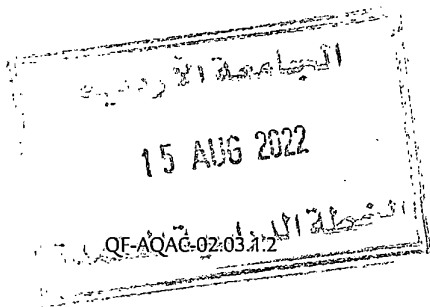
Course Number 1902224	Course Title Database Management Systems	Credit Hours 3
Prerequisite: (1902110)		

Course Description

The course aims to provide students with an overview of database management system architecture and environment, an understanding of the basic database design and implementation techniques, and a practical experience of designing and building relational databases. Furthermore, it enables applying conceptual design methodologies for databases and learning about the architecture and environments of the database management system. Students will practice using database tools to create and manage database schemas systems and formulate DDL, DML commands and run SQL queries. Advanced SQL topics such as creating database functions, database Stored Procedures and database Triggers will be covered. Also, students will learn how to manage database privileges and design suitable security and integrity constraints for database schemas. Furthermore, the course will provide the students with practice project to connect a relational DB using a programming language, in addition to practice using basic Oracle Forms and Oracle Reports. This course will use a combination of traditional lectures, active teaching methodologies, and hands-on lab lectures.

Course Number 1915101	Course Title Linear Algebra for Computational Sciences	Credit Hours 3
Prerequisite: (0301101)		

Course Description

The course uses linear algebra as one of the most important tools in applied mathematics, data science, and artificial intelligence to help students learn how to handle vectors and matrices, solve matrix-vector equations, perform Eigen value and Eigen vector and diagonalization analyses and use principal component analysis to do dimension reduction on real-world datasets. It covers topics such as: solving systems of linear equations; matrices and matrix operations; homogeneous and non-homogeneous systems; Gaussian elimination; elementary matrices and a method for finding $A-1$; determinants; Euclidean vector spaces; linear transformations from Rn to Rm and their properties; general vector spaces; subspaces; basis; dimension; row space; column space; null space of a matrix; rank and nullity; and inner product spaces. All analysis will be performed in python or any similar popular programming language. Lectures will be given in the lab for practical application. This course is assessed through exams, practical tests and assignments.

Course Number: 1902390	Course Title: Seminar-Road to Software Industry	Credit Hours: 0
Prerequisite: (Pass 45 Hours)		

Course Description

IT students increasingly demand and require coverage of emerging technologies to prepare themselves for subsequent employment and research. Industry and professional bodies are also concerned that IT education does not always prepare students adequately for the world of work. This professional practice seminar course aims to contribute to solving these two issues by providing real-world experiences, inspiring students to choose their career path, and exposing them to the trends, methods, and techniques that are of current interest in software industry through a weekly seminar series. Professionals from software companies are invited to present different aspects of their companies and to share their first-hand experience with students. This course can enhance IT education and motivate students by covering leading-edge technologies and practices. After each seminar, students will submit a personal evaluation and short reports relevant to the seminar's presentation. Attendance and participation in 8 seminars, including the evaluation of each seminar and the short reports are the minimum requirements to pass the course.

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B. Obligatory specialty courses

Course Number 0301101	Course Title Calculus I	Credit Hours 3
Prerequisite: (None)		

Course Description

Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit, computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rule; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus ; the area under a curve; the area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions; derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions.

Course Number 0301131	Course Title Principles of Statistics	Credit Hours 3
Prerequisite: (None)		

Course Description

Describing statistical data by tables, graphs and numerical measures, Chebychev's inequality and the empirical rule, counting methods, combinations, permutations, elements of probability and random variables, the binomial, the Poisson, and the normal distributions, sampling distributions, elements of testing hypotheses, statistical inference about one and two populations parameters
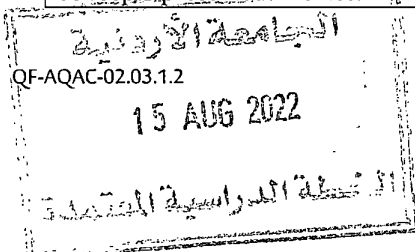
Course Number 1911101	Course Title Principles of Security	Credit Hours 3
Prerequisite: (none)		

Course Description

This course introduces students to a basis for cyber security. Topics included are: security properties (integrity, confidentiality, and availability), authentication and access rights management, vulnerabilities and attacks, principles of network security such as firewall, IDS, and VPN, and principles of security models and design. Practical experience and skills are gained through the use of several security tools.

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Course Number 1911211	Course Title Programming For Cybersecurity	Credit Hours 3
Prerequisite: (1911101 + 1902110)		

Course Description

The course provides students with the knowledge of writing programs/scripts to automate security tasks. Students will be introduced to some scripting languages such as Python and shell script. Topics included: introduction to programming, I/O, data structures, functions, and visualization using the Python programming language. Lectures will be given in the lab for practical application. This course is assessed through exams, practical tests and assignments.

Course Number 1911221	Course Title Security Risk Management and Ethics	Credit Hours 3
Prerequisite: (1911101 or 1911323)		

Course Description

This course introduces students to the three key elements of risk management. Topics covered: risk analysis, risk assessment, and vulnerability assessment. Both quantitative and qualitative methodologies will be discussed as well as how security metrics can be modeled, monitored, and controlled. Several case studies will be used to demonstrate the risk management principles featured throughout the course. Risk assessments on the selected case study scenarios will be conducted by team work. Mitigation plans will be developed, and the results of their analysis will be presented, both in written reports and oral presentations. Ethical implications of security procedures will be studied as well.

Course Number 1911231	Course Title Computer Architecture and Assembly language	Credit Hours 3
Prerequisite: (1901101 + 1904101)		

Course Description

This course introduces students to basic concepts about computer architecture from security perspectives. Its emphasis is on the lower level abstraction of a computer system. Topics included: digital logic, instruction set, ALU design, memory and assembly language programming. The course offers programming practice with an assembly language to provide practical application of concepts presented in class.
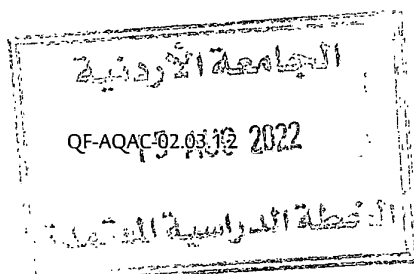
Course Number 1911241	Course Title Cryptography	Credit Hours 3
Prerequisite: (1901101 + 1911101 + 1915101)		

Course Description

This course introduces students to cryptography algorithms and mechanisms. Topics included are: symmetric key algorithms such as AES and 3DES, public key algorithms such as RSA and ECC, digital signature, hash functions, MAC and cryptographic protocols. The course provides security analysis to the algorithms as well.

Course Number 1901341	Course Title Theory of Algorithms	Credit Hours 3
Prerequisite: (1901242)		

Course Description

This is the first course in algorithms. The main goal is to introduce complexity analysis of algorithms with an emphasis on efficient design techniques for solving various computational problems. Topics include complexity analysis including big O, big omega, and big theta notations. Recurrence equations and recursive algorithms. Algorithm design techniques include sequential, divide-and-conquer, greedy, and dynamic programming. Sorting algorithms include insertion sort, merge sort, heap sort, and quicksort. Searching algorithms include breadth-first search and depth-first search. Graph-based algorithms including Kruskal's algorithm. Optimization problems include minimum spanning tree and multistage graph problems. Implementation of several algorithms. The assessment of this course is through exams, quizzes, and assignments.
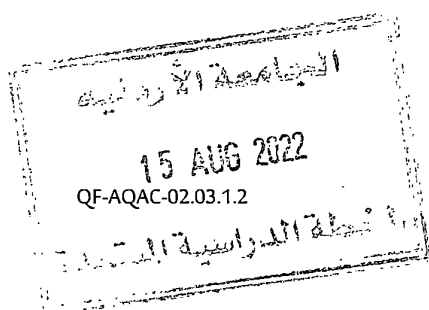
Study Plan- Bachelors

Course Number	Course Title	Credit Hours
1905320	Artificial Intelligence	3
Prerequisite: (1901242)		

Course Description

The aim of the course is to enable students to solve problems using explicit knowledge and reasoning techniques and to develop expert systems for simple problems. Students will be able (1) to express knowledge of a simple domain in propositional and/or first-order predicate calculus, (2) to design and develop expert solutions to simple problems where AI techniques can be employed, and (3) to write simple programs in Prolog that reason about the available knowledge to achieve their goals. Furthermore, students will learn some simple blind and heuristic search algorithms such as depth-first, breadth-first, best-first, hill climbing, and simulated annealing and techniques on how to control search using production systems. They will also have the ability to decide the appropriate search techniques (blind or heuristic) for some problems. The students will also be given some grounding in the principal techniques of data mining and be introduced to some applications of data mining. Students will be introduced to some learning techniques to help obtain a clear picture of the concepts of machine learning. This course will use a combination of lectures, class discussions, reading and writing assignments, case studies analysis, and hands-on work.

Course Number	Course Title	Credit Hours
1901363	Computer Networks	3
Prerequisite: (1901242)		

Course Description

This course explores key concepts and essential technologies of computer networks and broad range of topics in networking. It includes general overview, networks applications, network classifications and topologies, network layers, channel performance measures, transmission media, communication network protocols and architecture; Data link layer: framing, error detection and correction, CSMA/CD, LAN IEEE standards; Network layer: IP service model, IP addressing, subnetting, host configuration DHCP, ARP Protocol, ICMP protocol; Transport layer: UDP protocol, TCP protocol, TCP reliable transfer and sliding window, TCP flow and congestion control; Application layer: DNS protocol, NAT protocol, HTTP protocol, persistent and non-persistent HTTP connection. Weekly practice in the lab through active teaching methodologies.

Study Plan- Bachelors

Course Number 1902372	Course Title Software Engineering	Credit Hours 3
Prerequisite: (1902224)		

Course Description
This course aims to present software engineering as a body of knowledge. The course is designed to present software engineering concepts and principles in parallel with the Software Development Life Cycle (SDLC). The course will begin with an introduction to software engineering, giving students a definition of this body of knowledge, as well as a discussion of the main methodologies of software engineering including agile methods i.e., XP. Students will then learn about the five major phases of the SDLC: requirements gathering and analysis, design, coding/implementation, validation, and evolution. This includes software modelling using Unified Modelling Language (UML), a standardized general-purpose modelling language used to create visual models of object-oriented software, for requirements gathering and analysis, and design. Students will also learn about project management and quality management for the purpose of delivering high-quality software that satisfies customer needs and is within budget and schedule. Delivery will be by in-class lectures, recorded lectures, practical sessions, case studies from different domains (i.e., healthcare domain), and assignments. Assignments will include a term project illustrative of professional practice in developing computer information systems. One or two guest speakers with many years of experience in software engineering will be invited to share their first-hand experience with students.

Course Number 1911351	Course Title Security of Web Applications	Credit Hours 3
Prerequisite: (1904120 + 1902224)		

Course Description

This course introduces students to a foundation in the theories and practice relating to web application security. Topics covered: web applications vulnerabilities and attacks, building secure web applications, concepts associated with deploying and securing a typical HTTP environment as well as defensive techniques that can be employed. Teaching of this course will be based on active learning methodology such that students will work in groups to discuss and analyze the vulnerability in web applications.

Course Number 1911361	Course Title Network Security	Credit Hours 3
Prerequisite: (1901363)		

Course Description

This course introduces students to many facets of network security and forensics and is a lab-based course. Topics covered: the areas of ARP related attacks, MAC table related attacks, VLAN related attacks, DNS related attacks, DHCP related attacks, and some concepts related to network forensics such as intrusion detection, evidence collection, network auditing, network security policy design and implementation as well as preparation for and defense against attacks. The issues and facilities available to both the intruder and data network administrator will be examined and evaluated with appropriate laboratory exercises to illustrate their effect.
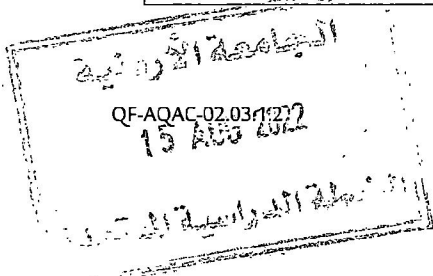
Course Number 1911371	Course Title Secure Software Engineering	Credit Hours 3
Prerequisite: (1902372)		

Course Description

This course introduces students to the development of a secure software. Topics include: providing security at every stage of software development life cycle including: requirement stage and how to involve security requirements, modeling stage and how to involve threat modeling, security programming guidelines and testing. Students will work together in groups to build secure applications.

Course Number 1911381	Course Title Penetration Testing and Ethical Hacking	Credit Hours 4
Prerequisite: (1901363 + 1911211)		

Course Description

This course introduces the principles and techniques associated with cybersecurity practice known as penetration testing or ethical hacking. This course covers the techniques used by hackers to break into an organization and necessary tools to have a hacker mind-set in order to protect network against future attacks. This course illustrates the differences between ethical and unethical penetration testing, describes and explains the phases of a penetration test including reconnaissance, scanning, enumeration, vulnerability assessment, exploitation, and covering tracks. Students will be able to apply different tools and methods to conduct penetration tests for the purpose of discovering how system vulnerabilities can be exploited and possible countermeasures. The lectures taught in the lab through active teaching methodologies.

Course Number 1911431	Course Title Cyber Physical Systems Security (CPSS)	Credit Hours 3
Prerequisite: (1911361)		

Course Description

This course introduces students to fundamental security primitives specific to cyber-physical systems and allows the students to apply them to a broad range of current and future security challenges. Much of the course is taught with the focus on one instance of cyber-physical systems - Industrial Control Systems (CPSs). Students will work with various tools and techniques used by hackers to compromise computer systems or otherwise interfere with normal operations. Students will also use tools that are unique to interacting with cyber-physical systems.

Course Number 1901473	Course Title Operating Systems	Credit Hours 3
Prerequisite: (1901242)		

Course Description

This course introduces students to management of computer resources. It includes: definition and role of the operating systems, history of operating systems and development, functionality and structuring methods of a typical operating system; concepts of process versus thread, scheduling, dispatching and context switching, concurrent execution: the "mutual exclusion" problem and some solutions; deadlocks: causes, conditions, and methods for resolution; memory management; virtual memory management; mass-storage structure. The course will involve regular assignments and instructions on Linux Operating System to map different theoretical parts with Linux. Students will get introduced to using a Linux machine, will learn key important Linux configurations, and will perform Linux performance evaluations for different system resources. The lectures taught in the lab through active teaching methodologies individually or within groups.
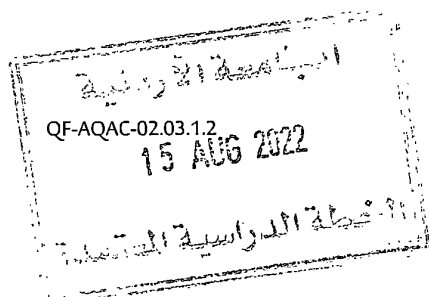
Course Number 1911461	Course Title Authentication and Security Models	Credit Hours 3
Prerequisite: (1901363 + 1911241)		

Course Description

This course introduces students to the growing impact of attackers on identification and authentication systems and additional strain put on the ability to ensure that only authorized users obtain access to controlled or critical resources. Topics covered: basic cryptology techniques and their application to contemporary authentication methods, introduction for Authentication, Crypto Hash Functions for Authentication, Message Authentication Codes, Digital Signature, Trust Models - key management and distribution, User Authentication, Access Control, Wireless Authentication, cloud and IoT authentication.

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Course Number 1911481	Course Title Reverse Engineering and Malware Analysis	Credit Hours 4
Prerequisite: (1911231 + 1911371)		

Course Description

This course introduces malware concepts, malware analysis, and reverse engineering techniques which will allow students to recognize, analyze and remediate infections. It involves analysis of the code, structure, and functionality of malicious software. Practical hands-on on malware analysis and reverse engineering based on various tools will be provided. The lectures taught in the lab through active teaching methodologies where students will work in group to analyze malwares.

Course Number 1911483	Course Title Digital Forensics for Cyber Security	Credit Hours 4
Prerequisite: (1911363 + 1901473)		

Course Description

This course introduces students to the fundamentals of computer and network forensics and investigations. Topics included are: historical and current digital forensic security issues; computer forensics law, file system analysis, applications forensics, network forensics. Practical exercises will be practiced enabling the students to use tools in order to implement various forensic analysis techniques by collecting evidence, identifying unknown files and analyzing them.
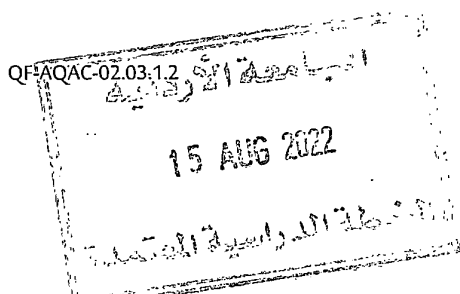
Course Number 1911489	Course Title Security Intelligence	Credit Hours 3
Prerequisite: (1905320 + 0301131)		

Course Description

This course introduces students to protecting an organization from external and inside threats as well as the processes, policies and tools designed to gather and analyze that information. It studies in-depth investigation of attackers and their techniques. Topics included: Various concepts, algorithms and techniques related to hunting, features extraction, attacks' classification and tracking.

Course Number 1911496	Course Title Project-1	Credit Hours 0
Prerequisite: (Pass 90 hours)		
Course Description		

Project includes theoretical and practical aspects in cybersecurity; the first stage of the graduation project, includes project proposal, analysis and preparation, and project design stages. A report at the end of each stage should be delivered to the department and the supervisor.

Course Number 1911497	Course Title Project- 2	Credit Hours 3
Prerequisite: (1911496)		
Course Description		

It includes the second stage of the graduation project, which covers the implementation, testing and evaluation stages, and completing the project in its final version. A documentation of the whole project should be delivered to the department and the supervisor. Finally, the project should be submitted for final examination.

Course Number 1911498	Course Title Training	Credit Hours 0
Prerequisite: (Pass 90 hours)		
Course Description		

The student must be trained in an institution, for at least 6 weeks. The student must provide a report from the institution that shows the efficiency of this training, according to the regulations of the Dean's Council of the Faculty's Departments, or get a certificate in one of the cyber security fields from a recognized institute.

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C. Elective Specialty Courses Description

Course Number 1905222	Course Title Data Mining	Credit Hours 3
Prerequisite: (1902224 + 1915101)		

Course Description

This course provides the students with an introduction to data mining and knowledge discovery (KDD). The course will focus on issues relating to the feasibility, usefulness, effectiveness, and scalability of techniques for the discovery of patterns hidden in large data sets. The students will learn the basic concepts of data pre-processing, frequent pattern mining and association rules, sequential patterns, and sub-graph patterns; and explore their applications, Classification methods, such as decision trees, k-nearest neighbour, and Naïve Bayes, ensemble learning methods such as random forest ...etc., outlier detection methods, such as Simple Statistical Methods and local outlier factor (LOF), cluster analysis techniques, such as k-means, hierarchical methods, and density-based methods. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.

Course Number 1901442	Course Title Network Programming	Credit Hours 3
Prerequisite: (1901363)		

Course Description

This course discusses the practical aspects of network programming using a modern programming language. Topics the course covers span: internet addressing; data streams; user datagram protocol: datagram packet, datagram socket, sending and receiving UDP packets, building a UDP Client/Server application; transmission control protocol: TCP sockets, server sockets; building a TCP Client/Server application; multi-threaded applications, synchronization; implementing application protocols. Hands-on lab exercises will be offered in each class meeting. The lectures will be taught in the lab through active teaching methodologies individually or within groups.

Course Number: 1902324	Course Title: Database Technologies and Applications	Credit Hours: 3
Prerequisite: (1902224)		

Course Description
This course aims to introduce the students to emerging topics in database systems. The course is specially designed with an emphasis on advanced and emerging concepts in database systems such as Big data management, data management with cloud platforms, NoSQL databases, and Graph databases. The course will allow students to focus on topics that are state-of-the-art research and recent technologies in the field of database and information systems.
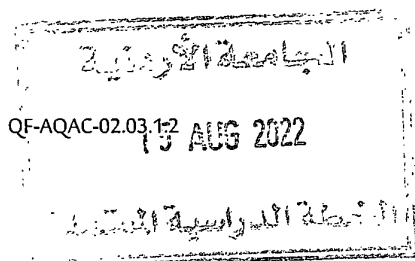
Study Plan- Bachelors

Course Number 1911321	Course Title Security Management and Auditing	Credit Hours 3
Prerequisite: (1911221)		

Course Description

This course introduces students to performing IT security audits at the enterprise level. Topics covered: How to determine which systems to audit first? How do you assess the risk to the organization related to information systems and business processes? What settings should be checked on the various systems under scrutiny? Is there a set of processes that can be put into place to allow an auditor to focus on the business processes rather than the security settings? How to turn this into a continuous monitoring process?

Course Number 1911323	Course Title Security Policies and Law	Credit Hours 3
Prerequisite: (1911221)		

Course Description

This course introduces students to security politics. Topics included: ethics, relevant laws, regulations, policies, standards, psychology, and hacker culture. Emphasis is on the human element and the motivations for cyber-crimes. Analysis covers techniques to prevent intrusions and attacks that threaten organizational data. The roles of individuals, groups, organizations and governments in computer and network security. How the interactions of these with the technical nature of digital systems in many cases forms the core of vulnerabilities.

Course Number 1911363	Course Title Wireless and Mobile Security	Credit Hours 3
Prerequisite: (1911361)		

Course Description

This course introduces students to wireless and mobile security. Topics covered: Mobile networks (4G & beyond) security, wireless networks whether infrastructure-based such as WLAN (IEEE802.11), WiMax (IEEE802.16) or infrastructure less networks such as Mobile Ad hoc Networks (MANET), security protocols of Wireless Sensor Network (WSN) and Internet of Things (IoTs). Practical experience and skills are gained through the use of several security tools/simulators.

Study Plan- Bachelors

Course Number 1911382	Course Title Security Certificates	Credit Hours 3
Prerequisite: (Pass 60 hours)		
Course Description This course introduces students to the principles and techniques associated with getting professional security certificates such as (CISSP, CISCO CCNA security, CompTIA, IBM Security, etc). The purpose of this course is to strengthen the relation with the industry and help students to be ready for the market and to compete as well.		

Course Number 1911383	Course Title Steganography and Digital Watermarking	Credit Hours 3
Prerequisite: (1901242 + 1915101)		
Course Description This course introduces students to principles, technical information, and insights on multimedia security. Topics covered include: data hiding, copyright protection of digital media, different steganographic and watermarking techniques, watermarking attacks and stegoanalysis. Main concepts related to image processing will be introduced. Practical handout will be provided		

Course Number 1911387	Course Title Security Operations	Credit Hours 3
Prerequisite: (Pass 60 hours)		
Course Description This course introduces students to the security operation domain that provides a wide range of security concepts and best practices. Topics included: resource protection, configuration management and vulnerability management.		

Course Number 1931461	Course Title Cloud Computing Concepts	Credit Hours 3
Prerequisite: (1901473, 1901363)		
Course Description This course explores the fundamentals as well as advances in Cloud Computing technologies. It covers topics such as virtualization, containerization, clustering, cloud resource management, and cloud storage. The course features popular cloud frameworks spanning batch and data stream processing, and discusses solutions to issues relevant to load management, fault-tolerance, distributed systems, and security in the Cloud. Hands-on weekly lab exercises using one or more cloud infrastructure technologies will be offered.		

Course Number 1931460	Course Title Fundamentals of IoT	Credit Hours 3
Prerequisite: (1901473, 1901363)		

Course Description

This course introduces the fundamentals of the Internet Of Things (IoT) and discusses how the Internet of Things IoT works. Topics covered span IoT networking, IoT smart objects, IoT Networking protocols, and smart object connections. In addition, the course explores IoT data networks, connection types, IoT security, and popular applications of IoT networks. Simulation-based hands-on exercises and project will be offered.

Course Number 1901446	Course Title Computer Systems Performance	Credit Hours 3
Prerequisite: (0301131, 1911231)		

Course Description

This course explores the concepts of performance evaluation, performance metrics, and benchmarking for Computer Systems. It discusses the characteristics of a good performance metric, and contrasts different techniques for data summarization. The course discusses the basics of error quantification in experiments, and sheds light on comparing alternatives. Measurement tools and techniques are also covered, in addition to the basics analytical modelling. Practical lab exercises and/or assignments on benchmarking and code profiling will be offered.

Course Number 1904487	Course Title e-Payment Systems	Credit Hours 3
Prerequisite: (1902372)		

Course Description

Financial technologies are drastically changing the financial services industries. This course provides an introduction to major techniques used in e-payment services such blockchain and cryptocurrencies, Bitcoin, Ethereum, smart contracts, decentralized applications, smart contracts, alternative and P2P lending and crowdfunding, and robo-advising. Students are expected to develop a broad understanding of the recent FinTech development and its impact in the financial industries. Students will also have hands-on and problem solving experiences that can be useful in e-payment applications. This course uses active teaching methodologies, such as weekly lab applied sessions, group work and technical projects. In addition, speakers from the industry will be invited to discuss case studies and show the latest trends on the industry.

Course Number 1911451	Course Title Blockchain Technology	Credit Hours 3
Prerequisite: (1911241, 1901242)		

Course Description

Course introduces students to Blockchain Technology (BC). Topics covered: definition of blockchain technology, types and properties of BCs, how does BC work, consensus algorithms, structure and properties of P2P, broadcasting process in P2P, goals of cryptography, public-key cryptography, hash functions, digital signature, verification process, BC transaction, structure of block, and smart contracts.

Course Number 1911452	Course Title System Administration and Network Services	Credit Hours 3
Prerequisite: (1901363 + 1901473)		

Course Description

This course introduces students to fundamental system administration concepts. Topics include: Understanding system administration, active directory, user management and security group implementation, network administration, and network file system. Practical hands-on will be provided.

Course Number 1911486	Course Title Emerging Topics In Cybersecurity	Credit Hours 3
Prerequisite: (Pass 60 hours)		

Course Description

This course introduces students to varied and emerging topics in cybersecurity. Topics are announced when the course is offered.

Study Plan- Bachelors

D. Service Courses Description

Course Number 1911322	Course Title Information Security and Privacy	Credit Hours 3
Prerequisite: (1901363 + 1902224)		
Course Description This course provides an introduction to information security and privacy. The course covers topics related to cryptography such as symmetric and asymmetric encryptions, hash functions, digital signatures, key management, and public key infrastructures. Also, the course covers topics related to network security as packet sniffing, spoofing, TLS, IPSec, Firewalls, wireless networks security. Furthermore, topics related to Authentication, Authorization, Web security and Steganography will be covered. Risk analysis and ethics, and their applications to the development of a secure healthcare systems as a case study will be presented. Practical hands-on will be provided.		