

	preparation, critical analysis of published papers, survey of the literature, term paper, and oral presentations.
--	---

ب- المقررات الاختيارية:

NHM131	Marketing & Sales	شئس ١٣١ تسويق ومبيعات
Prerequisites:	-	
Course Content:	The course defines marketing; marketing process; market analysis: customer base; competition; best practices and lessons learned; business research and forecasting tools and techniques; trend analysis: economics; social; political; environmental; technology; technology assessment practices and techniques; presentation skills; sales and advertising practices; customer satisfaction strategies; marketing and branding techniques; product portfolio analysis; global trade and international operations; pricing strategies. managing marketing through: customer relationships; social responsibility; marketing ethics. It emphasizes e-commerce application and implementation through business models and technology essentials.	

NHM122	Organizational Behavior	شئس ١٢٢ السلوك التنظيمي
Prerequisites:	-	
Course Content:	Perception, learning, motivation and value; individual differences and work performance; understanding yourself; motivating yourself and others, working within groups, achieving success through goal setting, achieving high personal productivity and quality; achieving rewarding and satisfying career; communicating with people; leading and influencing others; building relationships with supervisors, co-workers and customers.	

NHM113	Communication & Presentation Skills	شئس ١١٣ مهارات العرض والاتصال
Prerequisites:	-	
Course Content:	Topics include: theories of communication – how to translate theories into complete strategies to communicate with diverse audience – written communications:	





	memoranda, letters, executive summaries, business and research reports – oral communications: listening, presentation skills, interviewing, conducting meetings, interpersonal communication – negotiation – intercultural communication – importance of communication in team building.
--	--

NHM241	Professional Ethics	شئس ٢٤١ أخلاقيات المهنة
Prerequisites:	-	
Course Content:	This course will first cover some types of ethical theory and codes of ethics for computer professionals. It will then discuss such topics as the responsibility and liability of software creators and software vendors, computers and privacy, computers and the distribution of power in our society, and ownership of software. Topics covered include: the need for computer ethics training and historical milestones, defining the field of computer ethics, developing the ethical analysis skills and professional values, computer ethics codes, and sample topics in computer ethics.	

NHM214	English 2	شئس ٢١٤ لغة إنجليزية ٢
Prerequisites:	NHM111 [English 1]	شئس ١١١ [لغة إنجليزية ١]
Course Content:	A course to provide a solid foundation on perfecting skills in English reading, writing, listening comprehension and speaking. The course emphasizes the practice of pronunciation, speed-reading, and effective writing and listening. The course contents include the grammar parts of revision of tenses, use of idioms, prepositions, modals, conditional sentence, use of linking words, use of suffixes and prefixes, synonyms and antonyms, words with multi names, reading parts include the skills in skimming, scanning, selecting information, writing parts include planning, outlining, organizing ideas, topic sentences, paragraph writing, essay writing, job applications, writing reports, writing research report.	

NHM232	Business Administration	شئس ٢٣٢ ادارة الأعمال
Prerequisites:	-	
Course Content:	Topics covered include: management concepts, level and types of management, planning and organization of work flow, delegation, leadership styles, decision making, stress and time management, and employee relations, decision-making in such areas as	





	investment in operations, productions planning, scheduling and control, reliability and maintenance.
--	--

NHM233	Fundamentals of Economics	مبادئ الاقتصاد	شئس ٢٣٣
Prerequisites:	-		
Course Content:	<p>The course presents definition of economics; economics and engineering; principles of economics. Topics include: Introduction to various economic systems – capitalist, command and mixed economy; Fundamental economic problems and the mechanism through which these problems are solved; Theory of demand and supply and their elasticities; Theory of consumer behavior; Cardinal and ordinal approaches of utility analysis; Price determination; Nature of an economic theory; Applicability of economic theories to the problems of developing countries; Indifference curve techniques; Theory of production, production function, types of productivity; Rational region of production of an engineering firm; Concepts of market and market structure; Cost analysis and cost function; Small scale production and large scale production; Optimization; Theory of distribution; Use of derivative in economics: maximization and minimization of economic functions, relationship among total, marginal and average concepts.</p>		

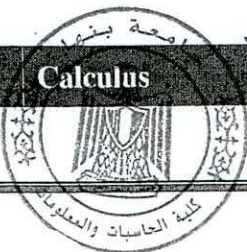
NHM251	Selected Topics in Humanities	موضوعات مختارة في الامسيات	شئس ٢٥١
Prerequisites:	Varies with the topics		
Course Content:	<p>Topics are selected from different areas in Humanities that are not covered in the description of the courses listed in the curriculum. This course will cover recent trends and issues in the field of Humanities and will be chosen at the discretion of the Program Administration Council and the Faculty Council.</p>		

ثانيا: متطلبات الكلية (٦٣) ساعة معتمدة

تنقسم إلى قسمين:

أ- علوم أساسية (الرياضيات والإحصاء والفيزياء والإلكترونيات):

NBS101	Calculus	حساب التفاضل والتكامل	شئس ١٠١
--------	----------	-----------------------	---------





<b>Prerequisites:</b>	-
<b>Course Content:</b>	This course covers pre-calculus review: sets and functions; limits and continuity – derivatives: techniques of differentiation; derivatives of the basic and fundamental functions; implicit differentiation; linear approximation and differentials; extreme of functions; optimization problems; velocity and acceleration – integrals: indefinite integrals; change of variables; definite integrals; the fundamental theorem of calculus – techniques of integration: integration by parts; trigonometric integrals and substitutions; integrals of rational functions – numerical integration – applications of definite integrals.

<b>NBS131</b>	<b>Electronics</b>	شعبس ١٣١	الالكترونيات
<b>Prerequisites:</b>	-		
<b>Course Content:</b>	This course teaches classical switching theory including Boolean algebra, logic minimization, algorithmic state machine abstractions, and synchronous system design. This theory is then applied to digital electronic design. Techniques of logic implementation, from Small Scale Integration (SSI) through Application-Specific Integrated Circuits (ASICs), are encountered. Topics covered may include: electrical circuit laws and theorems: Ohm's Kirchhoff's, mesh, nodal, Thevenin's maximum power transfer theorems for both DC and AC circuits, R, L, C elements. Electronic components and circuits diodes – bipolar junction transistors – field-effect transistors and use of transistors in amplifiers. OP-Amp, digital circuits – PHical design of simple gates – flip-flops and memory circuits.		

<b>NBS111</b>	<b>Probability &amp; Statistics</b>	شعبس ١١١	احتمالات وإحصاء
<b>Prerequisites:</b>	NBS101 [Calculus]	شعبس ١٠١	[حساب التفاضل والتكامل]
<b>Course Content:</b>	Topics covered include: frequency distribution; mean, median, mode and other measures of central tendency. Standard deviation and other measures of dispersion. Moments, skewness and kurtosis, correlation and regression analysis. Elementary probability theory and discontinuous probability distribution, e.g., binomial, Poisson and negative binomial. Continuous probability distributions, e.g. normal and exponential. Characteristics of distributions. Elementary sampling theory. Estimation of parameter, Hypothesis testing, Index number. Time series analysis and Markov chain.		





NBS102	Discrete Mathematics	الرياضيات المتقطعة	شعس ١٠٢
Prerequisites:	-		
Course Content:	This course provides students a solid background on discrete mathematics and structures pertinent to computer science. Topics include logic; set theory; mathematical reasoning; counting techniques; discrete probability; trees, graphs, and related algorithms; modeling computation. Subjects may include proof by induction, introduction to graph theory, recurrences, sets, functions, and an introduction to program correctness.		

NBS121	Physics	فيزياء	شعس ١٢١
Prerequisites:	-		
Course Content:	This course covers vector analysis; coulombs law and electric field intensity, electric flux density, gauss law and divergence; energy and potential; conductors, dielectrics, and capacitance; experimental mapping methods; Poisson and Laplace equations. steady magnetic field, magnetic forces, materials, and inductance; time varying fields, and Maxwell's equations; the uniform plane wave; the laws of circuit theory.		

NBS212	Statistical Analysis	تحليل إحصائي	شعس ٢١٢
Prerequisites:	شعس ١١١ [احتمالات وإحصاء]		
Course Content:	NBS111 [Probability & Statistics] This course prepares students to carry out descriptive and inferential statistical analyses. It covers statistical skills for advanced work in the functional areas of data science and analytics, including descriptive statistics, probability and its distributions, sampling, and estimation.		

NBS203	Linear Algebra	جبر خطي	شعس ٢٠٣
Prerequisites:	-		
Course Content:	This course covers matrix theory and linear algebra. Topics covered include systems of linear equations, matrix algebra, vector spaces, linear independence, dimension,		





	linear transformations, eigenvectors and eigenvalues, inner products and orthogonality and projections, and their applications.
--	---

NBS204	Differential Equations	شعس ٢٠٤ معادلات تفاضلية
Prerequisites:	NBS101 [Calculus]	شعس ١٠١ [حساب التفاضل والتكامل]
Course Content:	<p>Ordinary Differential Equations: Degree and order of ordinary differential equations. Formation of differential equations, Solutions of first order differential equations by various methods. Solutions of general linear equations of second and higher orders with constant coefficients.</p> <p>Solution of homogeneous linear equations. Solution of differential equation of the higher order when the dependent or independent variable is absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method.</p> <p>Partial differential equations: Wave equations, Particular solutions with boundary and initial conditions.</p>	

ب- علوم حاسب أساسية:

NCS101	Computer Science Fundamentals	شعس ١٠١ أساسيات علوم الحاسب
Prerequisites:	-	
Course Content:	<p>The course presents a broad overview of Computer Science to provide students with an appreciation for and an understanding of the many different aspects of Computer Science. A comprehensive and rigorous exploration of computing is undertaken to lay a solid foundation to support further study. Topics include: Computers and Digital Basics, Numbering systems, Computer Hardware, Computer Software, Operating Systems and File Management, Local Area Networks, Digital Media, The Computer Industry: History, Careers, and Ethics, Information Systems Analysis and Design, Databases, Computer Programming, The Internet, and The Web and E-mail.</p>	

NCS141	Structured Programming	شعس ١٤١ برمجة هيكلية
Prerequisites:		





<b>Course Content:</b>	The course presents the fundamental concepts of structured programming and algorithmic problem solving: primitive data types, control structures, functions and parameter passing, top-down design, arrays, files, and the mechanics of compiling, running, testing, and debugging programs.
------------------------	--

<b>NCS142</b>	<b>Object Oriented Programming</b>	برمجة شبيهة	شع ١٤٢
<b>Prerequisites:</b>	NCS141 [Structured Programming]	شع ١٤١ [برمجة هيكلية]	
<b>Course Content:</b>	The course presents the principles of object-oriented program design and advanced algorithmic problem solving illustrated through an object-oriented language. Topics include encapsulation and information hiding; classes, subclasses, and inheritance; polymorphism; class hierarchies, and the creation, implementation, and reuse of APIs (application programming interfaces).		

<b>NCS121</b>	<b>Logic Design</b>	التصميم المنطقي	شع ١٢١
<b>Prerequisites:</b>	NBS131 [Electronics]	شع ١٣١ [إلكترونيات]	
<b>Course Content:</b>	Topics include: Digital logic, Boolean algebra, De-Morgan's law, logic gates and their truth tables, canonical forms, Combinational logic circuits, minimization techniques, Arithmetic and data handling logic circuits, decoders and encoders, Multiplexers and demultiplexers, Combinational Circuit design, Flip-flops, race around problems, Counters and their applications, PLA design, Synchronous and asynchronous logic design: state diagram, Mealy and Moore machines, State minimizations and assignments, Pulse mode logic, Fundamental mode design.		

<b>NCS211</b>	<b>Data Structures</b>	هياكل البيانات	شع ٢١١
<b>Prerequisites:</b>	NCS141 [Structured Programming]	شع ١٤١ [برمجة هيكلية]	
<b>Course Content:</b>	A study of data structures and algorithms for their manipulation; analyzing basic data structure operations. The course introduces and develops methods for designing and implementing abstract data types and structures. Topics include: arrays, stacks, queues, lists, doubly-linked lists, trees, dynamic storage allocation, graphs.		





NCS202	Data Communications	تراسل البيانات	شعح ٢٠٢
Prerequisites:	NBS131 [Electronics]	شعح ١٣١ [إلكترونيات]	
Course Content:	<p>This course provides an introduction to the field of data communications and computer networks. Potential topics may include analog and digital signaling; data encoding and modulation; Shannon channel capacity; synchronous and asynchronously transmission; RS232 physical layer interface standards; FDM, TDM, and STDN multiplexing techniques; inverse multiplexing; analog and digital transmission; V series modem standards; PCM encoding and T1 transmission circuits; LRC, VRC, and CRC error detection techniques; Hamming and Viterbi forward error correction techniques; BSC and HDLC data link layer protocols; Huffman, MNP5, and V.42bis data compression algorithms; circuit, message, packet, and cell switching techniques; public key and symmetric encryption algorithms, authentication, digital signature, and message digest techniques, secure e-mail, PGP, and TSL/SSL security algorithms; Ethernet, Wi-Fi, Optical, and IP networks; reliability and availability; and queuing analysis network performance techniques.</p>		

NCS222	Computer Architecture	بناء الحاسب	شعح ٢٢٢
Prerequisites:	NCS121 [Logic Design]	شعح ١٢١ [التصميم المنطقي]	
Course Content:	<p>The architecture and organization of a simple computer system is studied. Topics covered include information representation and transfer, instruction and data access methods, the control unit: hardwired and microprogrammed, memory organization, I/O systems, channels, interrupts, DMA, Von Neumann SISD organization, RISC and CISC machines. Pipelined machines, interleaved memory system, caches, Hardware and architectural issues of parallel machines, Array processors, associative processors, multiprocessors, systolic processors, data flow computers and interconnection networks, High level language concept of computer architecture.</p>		

NCS223	Operating Systems	نظم التشغيل	شعح ٢٢٣
Prerequisites:	NCS101 [Computer Science Fundamentals]	شعح ١٠١ [أساسيات علوم الحاسب]	
Course Content:	<p>Topics include: Principles of operating systems, design objectives, sequential processes, concurrent processes, concurrency, functional mutual exclusion, processor cooperation and deadlocks, processor management, Control and scheduling of large information processing systems, Resource allocation, dispatching, processor access</p>		





	methods, job control languages, Memory management, memory addressing, paging and store multiplexing, Multiprocessing and time sharing, batch processing, Scheduling algorithms, file systems, protection and security, design and implementation methodology, performance evaluation and case studies.
--	--

NCS224	Signals and Systems	إشارات ونظم	شع ٢٢٤
Prerequisites:	NBS204 [Differential Equations]	شع ٢٠٤ [معادلات تفاضلية]	
Course Content:	The course covers the fundamentals of signal and system analysis, focusing on representations of discrete-time and continuous-time signals (singularity functions, complex exponentials and geometrics, Fourier representations, Laplace and Z transforms, sampling) and representations of linear, time-invariant systems (difference and differential equations, block diagrams, system functions, poles and zeros, convolution, impulse and step responses, frequency responses). Applications are drawn broadly from engineering and physics.		

NCS231	Introduction to Computer Networks	مقدمة في شبكات الحاسب	شع ٢٣١
Prerequisites:	NCS202 [Data Communications]	شع ٢٠٢ [تراسل البيانات]	
Course Content:	Topics include: Architecture and protocols of computer networks. Protocol layers; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local and wide area networks; network interconnection; client-server interaction; emerging networking trends and technologies; topics in security and privacy.		

NCS313	Design and Analysis of Algorithms	تصميم وتحليل الخوارزميات	شع ٣١٣
Prerequisites:	NCS211 [Data Structures]	شع ٢١١ [هياكل البيانات]	
Course Content:	Topics covered may include: Techniques for analysis of algorithms: asymptotic notation (Big-Oh, little-oh, and Theta) for estimating the complexity of a problem, using recurrence relations to analyze the complexity of recursive algorithms, searching, sorting, and depth- and breadth-first search in graphs, Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, back tracking, branch and bound, Basic search and traversal techniques, graph algorithms,		





	Algebraic simplification and transformations, lower bound theory, NP-hard and NP-complete problems.
--	---

NIS311	Databases	شع ٣١١	قواعد البيانات
Prerequisites:	NCS142 [Object Oriented Programming]	شع ١٤٢	[برمجة شبيهة]
Course Content:	Topics covered may include: Concepts and methods in database system, File organization and retrieval, Data manipulation, Query formulation and language, Database models, Data description languages, database integrity and security, Data dictionary/directory systems, database administration, Database design, Survey of some existing database management systems, some applications using commercial languages.		

NCS361	Artificial Intelligence	شع ٣٦١	النكاء الاصطناعي
Prerequisites:	-		
Course Content:	Topics covered may include: Survey and concepts in Artificial Intelligence, Problem solving agents, Uninformed and Informed search techniques, Game playing, Knowledge representation, Inference in Propositional and First Order logic, Theorem Proving, Decision tree learning, Neural Network, Bayesian learning, planning.		

ثالثا: متطلبات التخصص (٦٦) ساعة معتمدة

تنقسم إلى ثلاثة أقسام:

أ- علوم تطبيقية (٥٧) ساعة معتمدة:

• (٤٢) ساعة معتمدة إجبارية مقسمة كالتالي:

NCS343	Networks and Web Programming	شع ٣٤٣	برمجة الشبكات والويب
Prerequisites:	NCS231 [Introduction to Computer Networks]	شع ٢٣١	[مقدمة في شبكات الحاسب]
Course Content:	This course will cover the practical aspects of computer network programming, with emphasis on the Internet. The goal of this course is to introduce the students to the basics of computer networks and Internet programming. It will introduce the students		



	to the TCP/IP protocol stack and some of its important protocols. Students will also be introduced to multi-tier application development and RPC technologies including: RMI, CORBA, EJB, and Web Services. It will also look at industry trends and discuss some innovative ideas that have recently been developed. Topics may include Sockets Programming: TCP Programming (TELNET, HTTP) - UDP Sockets: TFTP, DNS - Web Programming: HTTP, CGI, Cookies, JavaScript, HTML, XML - Network Security: Secure Sockets (SSL), TLS, SSH, HTTPS, PGP, Kerberos - Client/Server Programming, 3-tier architecture - Remote Method Invocation (RMI) - Common Object Request Broker Architecture (CORBA) - Simple Object Access Protocol (SOAP), UDDI, and Web Services - Enterprise Java Beans (EJB) - Java Server Pages (JSP) and Java Server Faces (JSF) - JavaMail and E-mail programming: SMTP, POP, IMAP.
--	--

<b>NCS332</b>	<b>Routing and Switching Essentials</b>	أساسيات التوجيه والتحويل	شع ٣٣٢
<b>Prerequisites:</b>	شع ٢٣١ [مقدمة في شبكات الحاسب] NCS231 [Introduction to Computer Networks]		
<b>Course Content:</b>	This course is intended to provide students with a solid understanding of the state of the art in computer network systems and protocols. Topics are covered in some depth, including both abstract and concrete aspects. Topics covered may include: Review of the OSI reference model. Logical link control. HDLC. Multiplexing. WANs. ATM. Frame relay. Ethernet LANs and VLANs. Wireless LANs.		

<b>NCS303</b>	<b>Mobile Computing</b>	الحوسبة المتنقلة	شع ٣٠٣
<b>Prerequisites:</b>	شع ٢٣١ [مقدمة في شبكات الحاسب] NCS231 [Introduction to Computer Networks]		
<b>Course Content:</b>	This course will introduce students to mobile computing and mobile application development. Mobile computing will be discussed from three perspectives: mobile technology, application development, and user interaction. The course will first overview various mobile computing applications, technologies and wireless communication. Next, students will learn about common paradigms in mobile computing such as low power computing, computing in an environment with limited resources, fault tolerance, and persistence. Students will be introduced to and use mobile application frameworks and development environments to reinforce concepts covered in lectures. User interface and user experience will be discussed and application development guidelines from various vendors will be discussed and analyzed. Lastly, the course will look at some current research in mobile computing. Students will be expected to learn at least one mobile application development framework and use it to implement their assignments and course project.		





NCS391	Software Engineering	هندسة البرمجيات	شع ٣٩١
Prerequisites:	NCS313 [Design and Analysis of Algorithms] [تصميم وتحليل الخوارزميات]		
Course Content:	<p>This course is designed to provide the student with principles and techniques for the design and construction of reliable, maintainable, and useful software systems. Software life cycle, requirements specifications, and verification and validation issues. Implementation strategies (e.g., top-down, bottom-up, teams), support for reuse, and performance improvement. Topics covered may also include: concepts of software engineering: requirements definition, modularity, structured design, data specifications, functional specifications, verification, documentation, software maintenance, Software support tools, Software project organization, quality assurance, management and communication skills.</p>		

NCS371	Cryptography	علم التشفير	شع ٣٧١
Prerequisites:	NCS313 [Design and Analysis of Algorithms] [تصميم وتحليل الخوارزميات]		
Course Content:	<p>This course focuses on the foundation of cryptography. It provides a basic introduction to central aspects of symmetric and asymmetric cryptography. It aims to establish knowledge and understanding of how cryptographic techniques are used to establish security in modern information- and communication systems. Topics include Classical systems, information theory, mathematical background material, symmetrical crypto systems, block ciphers, stream ciphers, DES, Advanced Encryption Algorithm (AES), hash functions and message authentication (MAC), asymmetric cryptosystems, RSA and El Gamal, digital signatures, elliptic curves, provable security.</p>		

NIS321	Project Management	ادارة مشروع	شع ٣٢١
Prerequisites:	-		
Course Content:	<p>This course guides students through fundamental project management concepts and behavioral skills needed to success-fully launch, lead, and realize benefits from projects in profit and nonprofit organizations. Successful project managers skillfully manage their resources, schedules, risks, and scope to produce a desired outcome. In this course, students explore project management with a practical, hands-on approach</p>		





	through case studies and class exercises. A key and often overlooked challenge for project managers is the ability to manage without influence—to gain the support of stakeholders and access to resources not directly under their control. Special attention is given to critical success factors required to overcome resistance to change. We will review causes of project failure and how to mitigate risks through proper planning in the early phases of a new initiative. The course may be taken for credit at the Harvard Extension School, but does not offer credits towards outside certification.
--	--

NCS333	Wireless and Mobile Networks	الشبكات اللاسلكية وشبكات المحمول	شع ٣٣٣
Prerequisites:	NCS231 [Introduction to Computer Networks]		
Course Content:	<p>This course introduces the source of changes in the wireless and mobile industry from the view point of new service models, such as the mobile ecosystem (e.g., Apple and Android ecosystems)". It describes the fundamental components that tend to be unchanged for long periods such as mobile IP, Wi-Fi, and cellular. Topics include the potential issues in wireless media access, such as the hidden terminal problem and the exposed terminal problem - the basics of a Wi-Fi network, such as protocol stack and frame structure, and its development, such as IEEE802.11 a/b/g/n series standards - the basic concepts in cellular network, such network architecture, framework and LTE etc. - the main characteristics of mobile IP and explain how it differs from standard IP with regard to mobility management and location management; illustrate how traffic is routed using mobile IP – the features of typical wireless MAC protocols.</p>		

NCS334	Network Applications	تطبيقات الشبكات	شع ٣٣٤
Prerequisites:	NCS231 [Introduction to Computer Networks]		
Course Content:	<p>This course describes the key components of a web solution stack using LAMP as an illustrative example. It explains the different roles and responsibilities of clients and servers for a range of possible applications. It helps the students to select a range of tools that will ensure an efficient approach to implementing various client-server possibilities. It helps the students to design and build a simple interactive web-based application (for example, a simple web form that collects information from the client and stores it in a file on the server). The course discuss web software stack technologies such as LAMP solution stack (Linux, Apache HTTP server, MySQL, PHP/Perl/Python). Also, It describe characteristics of web servers such as handling permissions, file management, and capabilities of common server architectures. It describes support tools for web site creation and web management. It describes at a high level how a wide variety of clients and server software interoperates to provide e-mail services worldwide.</p>		





<b>NCS404</b>	<b>Network Performance and Evaluation</b>	اداء وتقييم الشبكات	شعح ٤٠٤
<b>Prerequisites:</b>	شعح ٢٣١ [مقدمة في شبكات الحاسب] NCS231 [Introduction to Computer Networks]		
<b>Course Content:</b>	<p>The purpose of this course is to present a comprehensive breadth-focused overview of empirical, analytical, and simulation techniques used for modeling and studying the performance of communication networks. In particular, following details will be covered: a. Empirical techniques: how to design valid experiments through which we systematically analyze communication networks through measurements? b. Analytical techniques: how to we make analytical models to analyze and model the performance of communication networks? In particular, we will gain an overview of queueing theory and its most important results. c. Simulation techniques: how do we make computational models to analyze and model the performance of communication networks?</p>		

<b>NCS425</b>	<b>Virtualization Infrastructure</b>	البنية التحتية للحوسبة الافتراضية	شعح ٤٢٥
<b>Prerequisites:</b>	شعح ٢٢٢ [نظم التشغيل] NCS223 [Operating Systems]		
<b>Course Content:</b>	<p>Virtualization is an increasingly ubiquitous feature of modern computer systems, and a rapidly evolving part of the system stack. Hardware vendors are adding new features to support more efficient virtualization, OS designs are adapting to perform better in VMs, and VMs are an essential component in cloud computing. Thus, understanding how VMs work is essential to a complete education in computer systems. Topics to be covered include: virtualization concepts, virtualization benefits and limitations, virtualization technologies, memory management, paravirtualization, hardware virtualization, OS-level virtualization (containers), security, and advanced research topics.</p>		

<b>NCS472</b>	<b>Network Security</b>	امن الشبكات	شعح ٤٧٢
<b>Prerequisites:</b>	شعح ٣٣٢ [اساسيات التوجيه والتحويل] NCS332 [Routing and Switching Essentials]		
<b>Course Content:</b>	<p>Computer Security Concepts: OSI security architecture, security attacks, security services, security mechanisms, network security model.</p> <p>Classical Encryption Techniques: symmetric cipher model, cryptanalysis, substitution techniques (Ceasar, Monoalphabetic, Playfair, Hill cipher), transposition techniques,</p>		





	<p>rotor machines, steganography. BlockCiphers and the Data Encryption Standard (DES): block cipher principles, Data Encryption Standard (DES), strength of DES, differential and linear cryptanalysis.</p> <p>Public-Key Cryptography and RSA: principles of public-key cryptosystems, RSA algorithm.</p> <p>Diffie-Hellman Key Exchange: Discrete logarithm, key exchange and generation algorithm, attacks on Diffie-Hellman protocol.</p> <p>Cryptographic Hash Functions: applications of cryptographic hash functions, requirements and security, hash functions based on Cipher Block Chaining (CBC), Secure Hash Algorithm (SHA).</p> <p>Digital Signatures: essential elements, limitations of symmetric key, Digital Signature Standard (DSS). Distribution of public keys and X.509.</p> <p>Network Security Protocols: Authentication, key exchange and key distribution protocols.</p> <p>Network Security Standards: IP security (IPsec), Secure Sockets Layer (SSL), Transport Layer Security (TLS), Hypertext Transfer Protocol Secure (HTTPS).</p> <p>Security analysis: Use of formal tools, e.g., Automated Validation of Internet Security Protocols and Applications (AVISPA).</p>
--	---

<b>NCS426</b>	<b>Server Administration</b>	<b>إدارة الخادم</b>	<b>شعح ٤٢٦</b>
<b>Prerequisites:</b>	شعح ٢٢٣ [نظم التشغيل]		
<b>Course Content:</b>	<p>This course concerns deployment and maintenance of modern computer systems in an operational environment. The course provides both conceptual knowledge and practical experience. Topics to be covered include architectures, heterogeneous systems, authentication and security, network services including firewalls, storage services, performance analysis and tuning, management and configuration of services and system resources, system initialization, drivers, cross-platform services, policies and procedures.</p>		

<b>NCS427</b>	<b>Distributed Systems</b>	<b>الأنظمة الموزعة</b>	<b>شعح ٤٢٧</b>
<b>Prerequisites:</b>	شعح ٢٢٣ [نظم التشغيل]		
<b>Course Content:</b>			





	The course introduces the main principles underlying distributed systems: processes, communication, naming, synchronization, consistency, fault tolerance, and security. Students will be familiar with some of the main paradigms in distributed systems: object-based systems, file systems, web-based and coordination-based systems. On the completion of this course, students will understand the fundamentals of distributed computing and be able to design and develop distributed systems and applications.
--	---

NCS405	Cloud Computing	شع ٤٠٥ الحوسبة السحابية
<b>Prerequisites:</b>	NCS424 [Virtualization Infrastructure]	شع ٤٢٤ [البنية التحتية للحوسبة الافتراضية]
<b>Course Content:</b>	<p>Overview of Distributed Computing: Trends of computing, introduction to distributed computing, next big thing: Cloud computing.</p> <p>Introduction to Cloud Computing: Cloud computing properties and characteristics, service models, deployment models.</p> <p>Attributes of Cloud computing: Multi-tenancy – a single instance of software or other computing resource serving several clients, massive scalability – ability to support hundreds of thousands of clients at the same time, elasticity – ability to grow or contract on demand, on-demand self-provisioning of resources.</p> <p>Infrastructure-as-a-Service (IaaS): Introduction to IaaS, resource (i.e., server, storage and network) virtualization, case studies.</p> <p>Platform-as-a-Service (PaaS): Introduction to PaaS. Cloud platform, management of computation and storage, case studies.</p> <p>Software-as-a-Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, case studies.</p> <p>Cloud issues and challenges: Cloud provider lock-in or vendor lock-in, security of Cloud computing.</p>	



• (١٥) ساعة يختارها الطالب من بين المقررات الاختيارية التالية:

NCS335	Network Management	شع ٣٣٥ ادارة الشبكة
<b>Prerequisites:</b>	NCS332 [Routing and Switching Essentials]	شع ٣٣٢ [أساسيات التوجيه والتحويل]
<b>Course Content:</b>	Networks today are high-speed, heterogeneous, and large-scale and delivers different media including data, audio and video. How do you effectively manage today's	



	<p>complex computer networks? This class provides complete yet accessible answers to network managers and researchers in this field. The course covers the basics of network management, alternative architectures, evaluation techniques, network management system components, SNMP and CMIP management protocols and the ISO network management applications: fault management, performance management, configuration management, security management, and accounting management. The course emphasizes the practical experience of developing network and distributed systems management tools using the SNMP++ and AdventNet wrappers. This course also highlights the latest advances in networks and distributed management area and shows case studies of academic and industrial systems such as HiFi, SMARRT, OpenView, NetView and Tivoli.</p>
--	---

<b>NCS328</b>	<b>Network Operating Systems</b>	شعح ٣٢٨ أنظمة تشغيل الشبكة
<b>Prerequisites:</b>	NCS223 [Operating Systems]	شعح ٢٢٣ [نظم التشغيل]
<b>Course Content:</b>	<p>This course introduces Computer Science majors to the fundamentals of Network Operating Systems. These will be described in terms of their architecture, their scope (LAN/WAN/Internet) and usage. Topics will include server/client vs peer-to-peer, directories and naming systems, memory management, security, and user interfaces. Hands-on Laboratory experience will be included.</p>	

<b>NCS362</b>	<b>Embedded Systems</b>	شعح ٣٦٢ الأنظمة المدمجة
<b>Prerequisites:</b>	NCS222 [Computer Architecture]	شعح ٢٢٢ [بناء الحاسب]
<b>Course Content:</b>	<p>This course on Embedded systems will first the students to the fundamental requirements of embedded systems and the interaction between hardware and software in such systems. Next the course will discuss some basic steps of hardware design, introduce the students to ASIPs, ASICs and FPGAs. Next, the students will be exposed to the very important issue of designing for less power consumption and introduce them to the techniques that are adopted to this end. Since many of the embedded systems will have real time constraints, basic issues of real time operating systems will be discussed. This will be followed by formal specification models and languages, mapping the specification to hardware and software components along with decisions on design tradeoffs and hardware software partitioning. Next, synthesis if hardware and software along with a few of the optimization techniques will be presented. The course will end with a brief overview of design verification methods that are adopted for embedded system design.</p>	





<b>NCS436</b>	<b>Wireless Sensor Networks</b>	شبكات الاستشعار اللاسلكية	شع ٤٣٦
<b>Prerequisites:</b>	NCS333 [Wireless and Mobile Networks] [شع ٣٣٣] الشبكات اللاسلكية وشبكات المحمول		
<b>Course Content:</b>	<p>This course covers fundamentals of wireless network technology and distributed sensor networks. After completing this course, the student should understand the principles of WSN and be able to design and maintain WSNs. Topics covered include: Sensor technology and WSN applications review, Wireless technology for distributed sensor networks - Clustering techniques in WSN - Routing in WSN: AODV, DSR - WSN security: principles and protocols - WSN security: key management - Industrial WSN protocols: ZigBee - Networked embedded systems: from chip to system - WSN network design and implementation - Introduction of wireless technologies in IoT - IoT Structure and Framework - IoT and Applications</p>		

<b>NCS473</b>	<b>Cyber Security</b>	الامن السيبراني	شع ٤٧٣
<b>Prerequisites:</b>	NCS371 [Cryptography] [شع ٣٧١] علم التشفير		
<b>Course Content:</b>	<p>This course provides an overview of Cyberspace, defines the scope of Cybersecurity, and addresses information classification and system compartmentalization. Course includes an appreciation of information confidentiality, integrity, and availability, and covers Cybersecurity architecture, strategy, services, hardware, software, and cloud services. The course also examines national security issues, critical infrastructure, and the potential for cybercrime and cyber terrorism, as well as the need for corporations to align their security with business needs and consider the threat from malicious employees, contractors, and/or vendors.</p>		

<b>NCS463</b>	<b>Internet of Things</b>	انترنت الاشياء	شع ٤٦٣
<b>Prerequisites:</b>	NCS362 [Embedded Systems] [شع ٣٦٢] الأنظمة المدمجة		
<b>Course Content:</b>	<p>Demystify the IoT concept. Offer insight into the IoT components and explain the different principles and the several aspects of designing the IoT architectures. The course will be focused towards the edge of the IoT that is the "Things" (i.e., the edge devices). Several IoT areas of application will be analyzed, such as smart grids, home automation, and industrial IoT to demonstrate the different requirements and constraints in designing practical IoT architectures for these segments. Furthermore, the course will analyse the importance of the security, trust, and privacy issues for IoT and present techniques that address these. The course will also demonstrate the interplay and the role of diverse engineering and computer science fields that compose the IoT ecosystem.</p>		





NIS411	Big Data Analytics	تحليلات البيانات الكبيرة	شع ٤١١
Prerequisites:	-		
Course Content:	<p>This course begins with a basic introduction to big data and discusses what the analysis of these data entails, as well as associated technical, conceptual and ethical challenges. Strength and limitations of big data research are discussed in depth using real-world examples. Students then engage in case study exercises in which small groups of students develop and present a big data concept for a specific real-world case. This includes practical exercises to familiarize students with the format of big data. It also provides a first hands-on experience in handling and analyzing large, complex data structures.</p>		

NCS437	Optical Networks	الشبكات الضوئية	شع ٤٣٧
Prerequisites:	NCS231 [Introduction to Computer Networks] [شع ٢٣١ مقدمة في شبكات الحاسب]		
Course Content:	<p>This course provides an introduction to optical communication links and networks. Principles and procedures of optical networking with focus on high-speed optical signal transmission between network nodes, lightpath routing and distribution, multilayer network design, and advanced photonic techniques and devices for optical signal transmission and switching. Topics covered may include: basics of optical technologies – SDH-SONET technology – wavelength division multiplexing (WDM) technology – optical fiber transmission – optical transmitters/ receivers/ filters – optical amplifiers – WDM local area networks – optical WDM access networks – optical metro network – routed optical network – optical switching – optical multicasting.</p>		

NCS438	Selected Topics in Computer Networks	موضوعات مختارة في شبكات الحاسب	شع ٤٣٨
Prerequisites:	Varies with the topics		
Course Content:	<p>Topics are selected from different areas in computer networks that are not covered in the description of the courses listed in the curriculum. This course will cover recent trends and issues in the field of computer networks and will be chosen at the discretion of the Program Administration Council and the Faculty Council.</p>		





NCS406	Network Analysis and Troubleshooting	تحليل الشبكة واستكشاف الأخطاء وإصلاحها	شع ٤٠٦
Prerequisites:	NCS332 [Routing and Switching Essentials] [أساسيات التوجيه والتحويل]		
Course Content:	<p>This course discusses the theory and application of several different structured troubleshooting methodologies used for modern enterprise networks in a business environment. It examines the critical role of network analysis and troubleshooting for the continuous operation of networks in business, explains the benefits of structured troubleshooting, and identifies the leading principles that are at the core of the key troubleshooting methodologies. Students learn the different stages in a network troubleshooting procedure, its repetitive nature and how to apply and assess the different troubleshooting methodologies to examine, in detail, different layers of the OSI model. The role of the network support personnel in diagnosing and resolving problems to prevent the loss of productivity and revenue is also examined. Using analytical skills, students analyze, evaluate, solve and troubleshoot related practical problems.</p>		

NCS474	Wireless Security	الأمن اللاسلكي	شع ٤٧٤
Prerequisites:	NCS333 [Wireless and Mobile Networks] [الشبكات اللاسلكية وشبكات المحمول]		
Course Content:	<p>This course covers security and privacy issues in wireless networks and systems, such as cellular networks, wireless LANs, wireless PANs, mobile ad hoc networks, vehicular networks, satellite networks, wireless mesh networks, sensor networks and RFID systems. Security problems of MAC and especially upper layers will be emphasized. Attacks and proposed solutions at several layers, authentication, key distribution and key management, secure routing, selfish and malicious behaviors, and secure group communication are analyzed for applicable wireless network types. A short overview of cryptography and wireless networking principles will be given at the beginning of the course.</p>		

NCS481	Network Forensics	اكتشاف الأدلة الجنائية الرقمية في الشبكات	شع ٤٨١
Prerequisites:	NCS472 [Network Security] [أمن الشبكات]		
Course Content:	<p>This course provides a comprehensive understanding of network forensic analysis principles. Within the context of forensics security, network infrastructures, topologies, and protocols are introduced. Students understand the relationship between network forensic analysis and network security technologies. Students will learn to</p>		





	identify network security incidents and potential sources of digital evidence and demonstrate the ability to perform basic network data acquisition and analysis using computer based applications and utilities. Students will also identify potential applications for the integration of network forensic technologies and demonstrate the ability to accurately document network forensic processes and analysis.
--	---

<b>NCS475</b>	<b>Ethical Hacking and Network Defense</b>	الاختراق الأخلاقي ودفاع الشبكة	شعح ٤٧٥
<b>Prerequisites:</b>	NCS472 [Network Security] [أمن الشبكات] شعح ٤٧٢		
<b>Course Content:</b>	<p>This course introduces students to the principles and techniques of the cybersecurity practice known as penetration testing (pen testing), or ethical hacking, and covers the full pen test life cycle. Students discover how system vulnerabilities can be exploited and learn how to avoid such problems. Students will review various tools and methods commonly used to compromise information and control systems. Ethical hacking, also known as penetration testing, is the act of breaking into a system with the permission and legal consent of the organization or individual who owns and operates the system, with the purpose of identifying vulnerabilities to strengthening the organization's security. Students will conduct hands-on penetration tests in a lab environment to practice the concepts presented and tools reviewed in the course. This course is an ethical hacking course and students will learn hacking techniques within a controlled environment for the goal of better securing the IT resources of their rightful owners.</p>		

<b>NCS451</b>	<b>Multimedia Communications</b>	اتصالات الوسائط المتعددة	شعح ٤٥١
<b>Prerequisites:</b>	NCS472 [Network Security] [أمن الشبكات] شعح ٤٧٢		
<b>Course Content:</b>	<p>This course introduces technologies for multimedia processing, coding, and communications. It will address how to efficiently represent multimedia data and how to deliver them over a variety of networks. In the coding aspect, state-of-the-art compression technologies will be presented. Emphasis will be given to state-of-the-art multimedia coding standards, including JPEG/JPEG-2000, H.26x, MPEG, and scalable video coding (SVC). Besides, considerations for constructing a video codec system will also be discussed. In the aspect of multimedia networking, special considerations for sending multimedia over the Internet and wireless networks, such as video adaptation, error resilience, error concealment, and quality of service will be discussed.</p>		

<b>NCS464</b>	<b>Semantic Web</b>	الويب الدلالي	شعح ٤٦
---------------	---------------------	---------------	--------





<b>Prerequisites:</b>	NCS211 [Networks and Web Programming]	شع ٣٤٣ [برمجة الشبكات والويب]
<b>Course Content:</b>	<p>The aim of this course is to teach the students the concepts, technologies and techniques underlying and making up the Semantic Web. Topics covered may include: Introduction to the semantic web and the use of ontology – existing web languages – in particular RDF (syntax and semantic) – OIL, DAML+OIL and OWL: syntax and semantics, relationship to RDF, relationship to description logics – reasoning with OIL, DAML+OIL and OWL: useful standard reasoning services in SW context, reasoning problems, algorithms and their implementation, tool demonstration – challenges and problems : supporting full OWL, scalability, further reasoning services to full support: design, usage ,evolution, integration, interoperation of ontology .</p>	

<b>FCS439</b>	<b>Selected Topics in Mobile Technology</b>	موضوعات مختارة في تكنولوجيا المحمول	شع ٣٩
<b>Prerequisites:</b>	Varies with the topics		
<b>Course Content:</b>	<p>Topics are selected from different areas in Mobile Technology that are not covered in the description of the courses listed in the curriculum. This course will cover recent trends and issues in the field of Mobile Technology and will be chosen at the discretion of the Program Administration Council and the Faculty Council.</p>		

<b>NPR401</b>	<b>Capstone Project I</b>	مشروع التخرج ١	شع ٤٠١
<b>Prerequisites:</b>	-		
<b>Course Content:</b>	<p>The purpose is for students to undertake an independent project that applies and synthesizes what they have learned in their major. This course is typically taken in the first of the student's final two semesters.</p> <p>During the first of the two terms, students will begin their work on the project and are expected to complete at least half the project by the end of the term. Students will develop and work on their projects under faculty supervision.</p>		

<b>NPR402</b>	<b>Capstone Project II</b>	مشروع التخرج ٢	شع ٤٠٢
<b>Prerequisites:</b>	NPR401 Capstone Project I		





<b>Course Content:</b>	<p>The purpose is for students to undertake an independent project that applies and synthesizes what they have learned in their major. This course is typically taken in the student final semester.</p> <p>Students will spend the second full term working on their collaborative group project from Capstone Project I. Students will then be required to present their completed projects during the on-campus immersion.</p> <p>One outcome will be a software package. A second outcome is a written full documentation of their project. A third outcome is a presentation of their work to the students and the faculty members.</p>
------------------------	--



(٤٢٥١)



## المراجع الخاصة ببرنامج "تكنولوجيا الشبكات والمحمول"

1. " National Academic Reference Standards (NARS) for Computing and Information, National Authority for Quality Assurance and Accreditation of Education (NAQAEE), Egypt, October 2010.
2. National Competence Framework Egypt (NCF), Information and Communications Technology (ICT) Qualifications Packs, URL: <http://ictskills.eg/> , Last visit: April 2018.
3. Computer Engineering Curricula 2016, Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering, A Report in the Computing Curricula Series Joint Task Group on Computer Engineering Curricula Association for Computing Machinery (ACM) and IEEE Computer Society, URL: <https://www.computer.org/cms/Computer.org/professional-education/curricula/ComputerEngineeringCurricula2016.pdf> , Last Visit: April 2018.
4. "Bachelor of Computer Science (Hons) - Network and Mobile Computing" Program, Nilai, Malaysia, URL: <https://scholarships.easyuni.com/courses/bachelor-of-computer-science-hons-network-and-mobile-computing-coventry-university-84/> , Last visit: April 2018.
5. " Bachelor of Computer Science (Hons) Mobile Computing and Networking" Program, Faculty of Business & Information Science, UCSI University, Kuala Lumpur, Malaysia, URL: <https://www.ucsiuniversity.edu.my/programmes/bachelor-computer-science-hons-mobile-computing-and-networking> , Last visit: April 2018.
6. "BSC (HONS) Computer Networks" Program, School of Computing, Science & Engineering, University of Salford, Manchester, United Kingdom, URL: <http://www.salford.ac.uk/ug-courses/computer-networks> , Last visit: August 2017.
7. "Bachelor's Degree in Mobile and Network Engineering" Program, College of Engineering, Ahlia University, Bahrain, URL: <http://www.ahlia.edu.bh/program/bachelors-degree-in-mobile-and-network-engineering-bsmne/> , Last visit: April 2018.
8. "Bachelor of Networking" Program, Melbourne Institute of Technology and FedUni, Federation University at MIT, Melbourne, Sydney, Australia, URL: <http://www.mit.edu.au/study-with-us/programs/bachelor-networking> , Last visit: April 2018.





9. "BSc (Hons.) in Mobile Computing" Program, Gulf College, Muscat, Oman, URL:  
<http://www.gulfcollege.edu.om/Programmes/BSc-Hons-in-Mobile-Computing> , Last visit:  
April 2018.



(٤٢٥٥)

٤٤