B.Sc. in Computer Science-Course Description

LNG 181   **English I for Engineering & Computing**

LNG 181 builds on the reading and writing skills. This course provides practice in analyzing and responding to various rhetorical modes of writing with an emphasis on authentic texts. The course focuses on exposition and argumentation specialized for Engineers. ***Pre-requisite None***

LNG 182   **English II for Engineering & Computing**

This course builds the written and oral communication skills that enable Engineering students to communicate according to the conventions of the profession. It includes writing (letters, memos, proposals, emails, and reports), principles and practices in delivering informal and formal public speaking, and presenting solutions and results of research in a clear and effective way. ***Pre-requisite LNG-181***

GED 198   **Islamic Culture**

The course presents an elementary survey of Islam as a religion and an approach to life. Topics include: the Quran, its names characteristics and miracles, the scientific miracles in the Quran, an introduction to the prophetic heritage (the Sunnah), the history of Islam and the Islamic civilization, Islam's vision of the human being, the universe and life, and the pillars of Islamic faith. Students are invited to reflect on the relationships between Islam and other civilizations. ***Pre-requisite None***

GED 196   **Communication Skills in Arabic 1**

يطمح هذا المساق إلى تحقيق مجموعة من المهارات التعليمية الأساسية لبناء شخصية الطالب الجامعي بناء ثقافياً يوافق حياته المهنية ، ويدفعه نحو آفاق ثقافية تساعده على بلوغ مرحلة متقدمة من مراحل استخدام اللغة العربية في المجال العلمي ، والبحث الأكاديمي.

ويشمل هذا المساق ثلاثة محاور أساسية تنطلق من حاجات الدارسين اللغوية :

1- قراءات في مجال الاتصال والتواصل الإنساني .

2- قراءات في الثقافة الأدبية : يتناول مجموعة من المقالات والدراسات المتقدمة التي تطرح إشكاليات وقضايا تتلاءم مع أهداف التنمية العلمية والفكرية والثقافية والاقتصادية التي تسعى الجامعة إلى تحقيقها على مستوى الفرد والمجتمع .

3- أنشطة البحث العلمي : وتتناول البحث الصفي ومجالاته المختلفة ، اختيار نقطة بحثية وإجراءات معالجتها بدءًا من صياغة عنوان البحث ، و طرق جمع مادته و كيفية تدوينها و توثيقها ، و صوغ أفكاره وإخراجه في صورته النهائية

Pre-requisite None

GED 199E   **UAE Society**

This course is an introduction to the UAE society in its political, geographical, cultural, demographical and social aspects. Students are encouraged to reflect on the evolution of society in view of the fast changes brought by modernization and globalization. Topics include: the Emirates geography and history, aspects of life before and after the Emirates political union, economic and social development, the cultural life before and after the union. ***Pre-requisite None***

ENT 141   **Fundamentals in Innovation and Entrepreneurship 1**

This course is developed for the UAE based on decades of practices and experiences of teaching innovation and entrepreneurship at Stanford University that has fueled innovation and high growth in Silicon Valley. The goal of the course is to equip the next generation of leaders in the UAE with an innovative and entrepreneurial mindset

and its related core skills. Most sessions include a mix of components: lecture, discussion, interactive activities in class, and open Q & A if an appropriate expert or guest speaker is available. The session descriptions below contain a summary of the session, a list of materials to read and videos to watch before the session, and a set of study questions to contemplate beforehand and to be used in class discussion. You will focus on the principles of design thinking. ***Pre-requisite None***

ENT 142   Fundamentals in Innovation and Entrepreneurship 2

This course is developed for the UAE based on decades of practices and experiences of teaching innovation and entrepreneurship at Stanford University that has fueled innovation and high growth in Silicon Valley. The goal of the course is to equip the next generation of leaders in the UAE with an innovative and entrepreneurial mindset and its related core skills. Most sessions include a mix of components: lecture, discussion, interactive activities in class, and open Q & A if an appropriate expert or guest speaker is available. The session descriptions below contain a summary of the session, a list of materials to read and videos to watch before the session, and a set of study questions to contemplate beforehand and to be used in class discussion. ***Pre-requisite ENT-141***

ENT 241   Entrepreneurship I

Introduction to entrepreneurship theory and practice. Business plan development and execution. Funding possibilities and investments. Definition of entrepreneurship; classical and modern management theories and identification of opportunities; strategic planning and execution. ***Pre-requisite ENT-142***

ENT 242   Entrepreneurship II

Business plan and pitch development and execution. Funding possibilities and investments. Definition of entrepreneurship; classical and modern management theories and identification of opportunities; strategic planning and execution. ***Pre-requisite ENT-241***

GED 110E   Modern Art Appreciation

Modern Art Appreciation' is a broad-based (1) theoretical and (2) practical course. It focuses on (1) visual theory, the major modern art movements, such as The Origins, The Islamic Art, The Renaissance Art, The Modern (19th century) Artistic Movements. (2) In addition, students will identify various styles within Modern Art Movements, and apply this knowledge in studio and class assignments. ***Pre-requisite None***

GED 111   Music Appreciation and Communication

Stimulate music appreciation and communication. Identify factors that promote and inhibit music, music history, music practice and communication via music. Look at popular music and its impact on every-day life. Understand the value of music as part of mass communication and media. Learn the building blocks of music history, music practice and music appreciation. ***Pre-requisite None***

GED 112   Using Positive Psychology at Work

This advanced psychology course invites students to explore the emerging field of Positive Psychology with a focus on the workplace. Students will learn about the science of happiness by exploring theory and concepts relative to a state of well-being, such as the architecture of sustainable happiness, adaptation, broaden and build theory and flow. The second part of this class will focus on the application of theory in the workplace as well as in one's personal life. Students will be invited to engage in several positive psychology interventions (PPIs), such as generating positive emotions

to improve creativity, relationships with coworkers, and work performance. How these techniques are currently being used within organizations to increase employee retention and job satisfaction will also be reviewed through the identification and evaluation of two corporate wellness programs. Students should be aware that there is a significant amount of reading involved. Failure to keep up with the readings will result in poor academic results. ***Pre-requisite LNG-172 or LNG-182***

GED 252E   Critical Thinking

This course aims to engage student's in critical thinking in a range of contexts. Student's will analyze and evaluate the language of argumentation by identifying premises and conclusions, deductive and inductive reasoning. Furthermore, students will evaluate arguments; validity, soundness and problems of interpretation as well as common fallacies of reasoning. Students will distinguish different types of thinking through evaluating independent and collaborative learning, and group dynamics. In addition, students will acquire strategies and methods to solve problems, equate probability and causality. Lastly, students will learn to analyze reading texts and respond by composing a critical analysis. ***Pre-requisite LNG-172 or LNG-182***

GED 205E   Psychology in Every Day Life

An introduction to concepts and principles of selected areas of psychology and their applications to daily living. The aim is to foster students' understanding of the self and its interactions with the environment. Topics include: research methodology in psychology, basic neuro-psychology, theories of learning, memory, motivation, development, and intelligence, as well as a focus on health, psychotherapy, and social psychology. ***Pre-requisite LNG-172 or LNG-182***

GED 272E   Fundamentals of Public Speaking

Being able to communicate well in public situations is something any university graduate is expected to be able to do with ease.

This course will introduce students to the fundamentals of public speaking. These include the steps of the speech-making process. The course will also focus on developing oral communication skills and presentation skills that students need to succeed in their major programs of study and to advance in their future careers. Students will be asked to give various speeches in a wide range of settings and for a variety of purposes to enhance their appreciation of and comfort with the art of public speaking. Fundamentals of Public Speaking' also focuses on developing skills for thinking critically, whether one is designing one's own presentation, listening to the presentations of others, or evaluating information and solutions in the process of accomplishing a group task. ***Pre-requisite LNG-172 or LNG-182***

GED 324E   Ethical Reasoning for Today's World

This course examines the theories, skills and applications of moral philosophy, including a description and a discussion of the three influential approaches to morality, namely: character ethics, consequence- based ethics, and principle-based ethics. Students will also engage in a good citizenship project where they will put into action their character strengths as per the Aristotelian theory and consider what their role is in the larger social context as a good, ethical citizen. ***Pre-requisite LNG 172 or LNG 182***

BCS-101   **Elements of Computing**

This course provides an introduction to algorithms: their definition, design, coding, and execution on computers. Students will learn the syntax and semantics of programming language including variables, data types, expressions, and assignment; program flow of control; conditions; and loops. Students are provided with a thorough conceptual grounding in computational problem solving before introducing them to specific programming language syntax, giving them the background to become successful programmers in any language. Intended for students who have no programming experience. ***Pre-requisite None***

BCS-102   **Introduction to Computing Science I**

Introduction to design and analysis of algorithms. Control structures: recursion, backtracking, exits. Data structures: structures, sequences, linked lists and references, binary search trees. Elementary searching and sorting. Introduction to assertions and loop invariants. Introduction to order-of-magnitude complexity. Introduction to numerical computation. Documentation, testing and debugging. ***Pre-requisite BCS-101***

MTH-112 Calculus I

The course introduces the students to the fundamental concepts of calculus: limits, continuity, differentiation and integration; and trains them to apply these concepts to problems that arise in engineering, science and computing. ***Pre-requisite Pass Math Placement test or MTH-012***

MTH-113   **Calculus II**

The course introduces techniques of integration, polar coordinates, and functions of several variables including partial derivatives and multiple integrals. In addition, students will develop the skills to apply these concepts to solve problems arising in engineering and computing. ***Pre-requisite MTH-112***

MTH-114   **Linear Algebra**

This course will cover fundamental topics in modern linear algebra including systems of linear equations, matrices and determinants, vector spaces and inner product spaces, linear transformations, eigenvalues, eigenvectors, and matrix diagonalization. In addition, the students develop the skills to apply these concepts to solve problems in arising science and engineering. ***Pre-requisite MTH-112***

MTH-130   **Probability and Statistics**

The course serves as an introduction to probability models and statistical methods for students in engineering, science and computing. Topics include: descriptive statistics, probability, conditional probability, discrete and continuous random variables and their probability distributions, correlation and simple linear regression. ***Pre-requisite MTH-112***

MTH-120   **Discrete Mathematics**

The course introduces students to the foundational concepts in mathematics used computer science. Students are exposed to the principles of logic, set theory, combinatorics, proofs, algorithms, tree structures, LCM and GCD. Applications to computer science and computing are presented. ***Pre-requisite None***

MTH-203   **Discrete Mathematics for Computing Science**

The course covers main concepts of discrete mathematics, as it is used for applications in computing. The main topics include proof by induction and contradiction, prime numbers and their properties, RSA encryption, recursive algorithms, computational complexity, Big O, combinations and permutations, graphs and their applications, trees and their applications. ***Pre-requisite MTH-120, BCS-102***

BCS-201   Logic for Computing Science

Elements of mathematical logic with computing applications. Formal proof systems for propositional and predicate logic. Interpretations, and satisfiability. Introduction to soundness, completeness and decidability. ***Pre-requisite MTH-120***

BCS-202   Introduction to Computing Science II

Introduction to object-oriented design, architecture, and programming. Use of packages, class libraries, and interfaces. Encapsulation and representational abstraction. Inheritance. Polymorphic programming. Exception handling. Iterators. Introduction to a class design notation. Applications in various areas. ***Pre-requisite BCS-102***

BCS-203   Software Specifications

This course covers the different popular techniques used for specifying the behavior of software, with applications of these techniques to design, verification and construction of software. The topics in this course cover the Halting problem, Church-Turing thesis, context-free languages, and logic-based techniques such as loop invariants and class invariants. Students will acquire knowledge about computability issues in software specifications, automata, grammar-based techniques, with applications to scanners, parsers, user-interface dialogs and embedded systems. The course is designed to familiarize students with the foundations and principles of computer science and to strengthen the students ability to carry out formal and rigorous mathematical arguments as well as using state diagrams. ***Pre-requisite BCS-201, BCS-202***

BCS-204   System-Level Programming

Basic concepts of Unix-like systems. Shells and scripting. System-level programming in the C language. Software development tools and techniques. ***Pre-requisite BCS-102***

BCS-205   Programming Paradigms

This course introduces the different paradigms of programming languages such as functional, logic, and object-oriented programming languages and provides students with tools necessary for the critical evaluation of existing and future programming languages. Coverage includes topics varying from basic to advanced, in areas such as syntax and semantics, Scoping, Type checking, binding, data abstraction, exception and event handling. In addition, it covers Logic programming languages (such as PROLOG) and Operational interpretation of predicates and terms; concurrency support, functional programming (such as LISP and Haskell), and object-oriented programming. ***Pre-requisite BCS-202, BCS-201***

ENG-210   Computer Architecture

This course provides an introduction to computer system architecture and organization. Topics include: Data representation, CPU and Memory; Design, Implementation and Enhancement, Analysis and Comparison of CPU architectures; I/O Operation; and Computer Peripherals. ***Pre-requisite BCS-202 or ENG 101***

BCS-206   Information Structures

Design and implementation of advanced data structures and related algorithms, including correctness and complexity analysis. Efficient implementation of lists, sets, dictionaries, priority queues, trees, graphs, and networks using arrays, hash tables, heaps, and hierarchical linked structures. String and graph problems, such as string matching and shortest path. External storage and input-output complexity. ***Pre-requisite BCS-202, MTH-203***

BCS-302   Scientific Computing

This course is designed to help students obtain numerical solutions to problems in engineering and science. The course introduces MATLAB as an interactive computing system and as a programming language. Students will then progress to the core techniques of numerical methods and use them to solve otherwise unsolvable problems of modern technological significance. Topics covered by this course are; Basic Root-finding procedure; fixed-point iteration; bisection; newton's method; roots of polynomials; solving systems of equations; least-squares fitting of a curve to data and numerical solutions of ordinary differential equations. ***Pre-requisite BCS-102, MTH-114***

BCS-305   Software Architecture

This course covers information system concepts and the system development process. Coverage includes Structured systems analysis and design methodologies, functional decomposition, data flow diagram approach (DFD), and information modeling. The course emphasizes the development phase of analysis, the application of structured methods, and the use of tools. Students will learn how to evaluate the quality of a new system, and they will explore object-oriented analysis and design (OOA & OOD) models using industry standard UML techniques. Students will also learn how to use abstractions and patterns of interactions and relationships among modules, design recovery, and testing. ***Pre-requisite BCS-203, BCS-206***

BCS-306   Database Management Systems

Data models: relational, entity-relationship. Relational query languages: relational algebra and SQL. Relational database design. Application interfaces and embedded SQL. Storage and indexing. ***Pre-requisite BCS-202, BCS-201***

BCS-309   Algorithms I

This course introduces the principles of design, analysis, and implementation of efficient algorithms. Coverage includes growth of functions theory and the Divide and Conquer paradigm and explores some different types of algorithms such as Sorting, Hash tables and Heaps, Tree and graph algorithms. Then, it covers the Dynamic Programming and Greedy Paradigms. It follows by an overview of algorithm complexity and NP-Completeness. In addition, the course gives an exposure to Computational Geometry and String-Matching algorithms. ***Pre-requisite: BCS-201, BCS-206***

BCS-401   Ethics for Computing Professionals

This course covers the topics of ethics for computing and IT professionals, users and organizations. To fully assume responsibilities towards society the computing professional should consider social implications impacts of technologies. Topics include: rights and responsibilities of IT professional, professionalism and codes of ethics, understanding ethical problems, ethical problem-solving techniques, social implications and impacts of technology, identify unethical situations and practice moral reasoning to come to right course of action, ethics in computer and internet crime threats, security and privacy, ethics related to intellectual property. ***Pre-requisite None***

BCS-402   Computability and Complexity

This course is an introduction to models of computation, computability, and complexity. The course introduces important concepts from Computability and Complexity theory. Topics covered: theoretical limits of algorithmic computation, Finite automata and regular languages, Turing machines, Resource bounded complexity, Relationships between complexity classes, Savitch's theorem and Rice's theorem. ***Pre-requisite: BCS-203, BCS -309***

BCS-308 Communication Networks

Fundamental concepts in the design and implementation of computer communication networks, protocols, and applications. Overview of network architectures; applications; network programming interfaces (e.g., sockets); transport; congestion; routing and data link protocols; addressing; local area networks; wireless networks; mobility management. ***Pre-requisite: BCS-301***

BCS-304   Data Mining

Fundamentals of data processing and mining; Understanding the attributes of data, pattern mining, supervised and unsupervised learning, neural networks, support-vector machines, decision trees, metric-based clustering, data warehousing, classification, distribution-based clustering, rule-based techniques, clustering graphs, clustering high-dimensional data. ***Pre-requisite: MTH-114, MTH-130, MTH-203, BCS -202***

BCS-403   Advanced Database Systems

Topics include the presentation and storage of data, implementation concerns, and the integration of databases with other areas of computer science. The course examines the topic of big data by looking at the properties of database systems that store and manage different types of big data, namely structured data, unstructured data and streaming data. ***Pre-requisite: BCS-206, BCS-306***

BCS-301   Operating Systems

Evolution of computer systems: batch processing, multiprogramming, multi-processing, real-time, time-sharing, distributive systems; Process allocation; Process communication and synchronization; Deadlock management and handling; Memory management; Virtual memory systems; Resource allocation algorithms; File system implementation. ***Pre-requisite: ENG-210, BCS -206***

BCS-307   Digital Systems

This course introduces the principles of digital systems and covers both traditional and modern methods of applying digital design and development techniques. Topics includes: Logic gates, combinational circuits, logic simplification, sequential circuits, hardware description languages (HDL), HDL-based digital design, VHDL hardware description language, combinational and sequential logic design practices, state machine design and synthesis, register-level design, FPGA implementation. ***Pre-requisite: ENG-210***

BCS-303 Security Principles and Practices

This course introduces security theory and practice. Several Security threats, Risks, Vulnerabilities, and countermeasures are explored and explained. Topics include: several viral threats such as Trojan horses, viruses, and worms; Identification, Authentication and Authorization; password-based security, multilevel security and Access control; overview of Cryptography, an Operating system security; Network

attacks, Firewalls and intrusion detection systems; database and Cloud Computing security. ***Pre-requisite: BCS-206***

BCS-410 Computer Science Project

The project is an opportunity for the students to identify and analyze specific problems related to their major of study, design and implement appropriate solutions for them, and interpret and validate test results under the supervision of a faculty member. They are expected to engage in self-learning while, possibly, working as a member of a project team. ***Pre-requisite: Completed 90 Cr.H***

BSD-311   Human Computer Interaction

Developing usable software requires that human factors be considered throughout the design and development process. This course introduces a series of techniques for developing and evaluating usable software, and shows how these techniques can be integrated into a process for software development. ***Pre-requisite: BCS-206***

BCS-405   Artificial Intelligence

This course provides an introduction to the basic principles and tools of artificial intelligence. It covers problem solving methods and knowledge representation techniques, state-space search techniques, rules, expert systems, frames, semantic nets, and propositional and first-order predicate logic in order. ***Pre-requisite: BCS-206, BCS-205***

BCS-406   Computer Graphics

This course introduces students to the basic ideas of computer graphics including creating and displaying geometric models, understanding the mathematics of transformations, camera specifications, and the standard models used in representing light, color, reflectance. They will also learn the limitations of these models. The course also includes basic graphics applications and the user-interface concerns, design trade-offs and compromises necessary to make them efficient, possibly ending with some special topic like creating simple animations or writing a basic ray tracer. ***Pre-requisite: BCS-206, MTH-114***

BSD-404   Algorithms II

This course addresses advanced topics in algorithms. It builds upon the course BCS-309: Algorithms I to expand the student knowledge with deeper algorithmic skills. Topics include advanced topics in dynamic programming and greedy methods; sorting networks, advanced matrix operations; advanced linear programming: the simplex algorithm, duality; polynomials and efficient implementation the fast fourier transform; number-theoretic algorithms and cryptosystem applications; advanced string matching and computational geometry concepts; approximation algorithms. ***Pre-requisite: BCS -203, BCS -309***

BCS-400   Network Operating Systems

Characteristics of the Linux and Windows network operating systems; installation procedures; Security issues; Back up procedures and remote access; Directories and naming systems; Dynamic Host Configuration Protocol (DHCP); Active Directory; Manage accounts and client connectivity; HTTP and FTP server. ***Pre-requisite: BCS-301***