

# **AL GHURAIR UNIVERSITY**



## **Bachelor of Science in Computer Science and Engineering (BSCSE)**

### **COURSE DESCRIPTIONS**

#### **ACADEMIC YEAR**

**2021-22**

**March 2022**

## General Education Courses

### English Composition (ENL 101)

(3-3-0)

#### Pre-requisite: None

The course deals with paragraph and essay writing in different rhetorical modes and shows how writers can achieve focus and coherence; support their claims with evidence as well as proofread and edit their work. This course will also focus on relevant language points in order to strengthen grammatical fluency and use of mechanics.

### Communication Skills (ENL 102)

(3-3-0)

#### Pre-requisite: None

The purpose of this course is to present an overview of the foundations of human communication, with particular emphasis on the skills necessary to establish and maintain effective professional and personal relationships. The course covers the elements, principles and goals of human communication. It deals with enhancing the skills of interpersonal and intercultural communication while focusing on four main types of communicative competence: linguistic, discourse, sociolinguistic, and strategic.

### Technical Writing (ENL 103)

(3-3-0)

#### Pre-requisite: None

Technical Writing prepares and familiarizes students with the principles of clear, concise writing in a technical environment for specific discourse communities. Technical Writing conventions such as headings, illustrations, style and tone in the writing of a variety of reports will be considered.

### Communication Skills in Arabic (GEN 101)

(3-3-0)

#### Pre-requisite: None

تحتوي هذه المادة على مجموعة من المهارات والقدرات والنشاطات النحوية والإملائية والبلاغية والمعجمية. يهدف هذا المساق إلى تنمية المهارات اللغوية لدى طلاب الجامعة و تدريبهم على إستخدام اللغة العربية استخداماً صحيحاً ، قراءة وكتابة وتحديثاً

### Fundamentals of Innovation and Entrepreneurship (GEN 102)

(3-3-0)

#### Pre-requisite: None

The purpose of this interactive course is to cover the concepts of innovation, entrepreneurship, sustainability and creativity. It includes the techniques for improving flexibility and originality of the thinking process and analyzing the topics in depth with logic. It also includes understanding the elements of reasoning and the kind of thinking involved in solving problems critically, making inferences, teaming techniques for creativity and effective decisions. It helps the students to enhance the basic tools and skills needed to achieve deep and significant learning in all disciplines while stimulating innovation.

### UAE Society (SAH 101)

(3-3-0)

#### Pre-requisite: None

The course includes several topics that aim at providing students with aspects of knowledge and methodological tools which enable them to understand the basic constituents of the U.A.E society and its variables that are derived from the Arabic Islamic Culture. The course also allows students to analyze and know about the structure of the society with its historical, geographical, demographic, economic, and political dimensions. It also raises the students' awareness of the dynamics of the contemporary changes occurring in the society due to modernization process and globalization steering, and knowledge of the role of the societal institutions in dealing and adjusting with these dynamics at present and in future.

### Islamic Studies (SAH 102)

(3-3-0)

#### Pre-requisite: None

This course is designed to develop a better understanding of Islamic belief and its application in life. In addition, the course deals with current issues and challenges. The course also provides basic knowledge

about the social and economic systems of Islam, with a view to providing a better understanding of Islam.

### **Fundamentals of Statistics (SAT 102) (3-3-0)**

#### **Pre-requisite: None**

This course discusses knowledge of theoretical and practical fundamentals of statistics. This includes statistic methodology and practical skills of collection, processing and analysis of statistical data characterizing modern economic and social development of society. The object of investigation in statistics is mass economic, financial and social events and processes.

## **Core Courses**

### **General Chemistry (CHM 111) (3-2-2)**

#### **Pre-requisite: None**

The course is designed to be taken by all students to fulfil the requirement. It covers the basic subjects of atomic theory and bonding, periodic table, electronic configuration, and some simple chemical calculations concerning concentrations, in addition to molarity, pH and other related subjects. The course shall answer to the required knowledge about conductivity and conductors along with the necessary theoretical background. The course will also cover the simple facts about clean energy and the on-going demand for the nuclear energy and its applications. Some simple practical examples of everyday chemistry will also be covered. The lab work in this course is designed to provide the students with very simple laboratory techniques.

### **Calculus I (MAT 111) (3-3-0)**

#### **Pre-requisite: None**

Topics include limit, continuity, Differential calculus of functions of one variable Derivatives of trigonometric, exponential, and logarithmic functions; chain rule; implicit differentiation. Maximum and minimum values. Increasing, decreasing and concave functions; inverse trigonometric functions; hyperbolic functions; some engineering applications. Integral calculus of functions of one variable: definite and indefinite integrals, application of integration, (area, volume, length of curves).

### **Calculus II (MAT 112) (3-3-0)**

#### **Pre-requisite: MAT 111**

This course explores the following topics: Technique of integrations includes Integration by parts, integration using powers of trigonometric functions, integration using trigonometric substitution, integration by partial fractions, integration of improper integrals, basic numerical integration methods, Polar coordinates, Functions of several variables and partial derivatives, Local maxima, minima and Saddle points. Double and triple integrals, infinite series, tests for convergence, power series expansion of functions. Taylor, Laurent, and Fourier series.

### **Linear Algebra and Complex Variables (MAT 113) (3-3-0)**

#### **Pre-requisite: MAT 111**

System of linear equations, matrices, matrix operations, partitioned matrices, Echelon form of a matrix, Gauss elimination solution of a system of a linear equation, (iterative methods), determinant of a matrix, eigenvalues and eigenvectors, diagonalization and similar matrices. The complex number system, Cauchy-Riemann conditions, analytic functions and their properties, roots, exponential, Log, trigonometric and hyperbolic functions of a complex variable.

### **Differential Equations (MAT 214) (3-3-0)**

#### **Pre-requisite: MAT 112**

Topics include: First order Differential Equations, Homogeneous, Exact, and linear. Second and higher order DE, homogenous and non-homogeneous linear second-order DE. Basic numerical solutions (Euler

& Rung Kutta methods), Applications of ordinary DE in engineering. Laplace transform: Inverse transform, Laplace transform of derivatives. Solution of ordinary DE by Laplace transform, Laplace transform of unit step function, General solution of linear system of differential equations with constant coefficients.

### **Introduction to MATLAB (MAT 216)**

(1-0-2)

#### **Pre-requisite: MAT 113**

This course is designed to give students experience in working with MATLAB programming software. MATLAB is used to solve different scientific problems also the students will have experience in using Simulink, the simulation toolbox within MATLAB.

### **Probability Theory (MAT 317)**

(3-3-0)

#### **Pre-requisite: SAT 102**

Probability, definition and basic axioms, Conditional probability, Bays theorem, independent events, Sampling from population, Discrete Random variable (binomial, hypergeometric, Poisson), Continuous random variable (normal, standard, t-distribution, chi-square distribution, Central limit theory, Estimation by confidence intervals for  $\mu$ ,  $\sigma^2$  and a proportion from normal distribution, Testing hypothesis, Regression analysis, Confidence interval for the correlation coefficient, Testing hypothesis for the correlation coefficient.

### **Engineering Physics I (PHY 111)**

(3-2-2)

#### **Pre-requisite: None**

This course covers motion in one and two dimensions, Newton's laws, work and energy, linear momentum in one and two dimensions, simple harmonic motion.

### **Engineering Physics II (PHY 112)**

(3-2-2)

#### **Pre-requisite: PHY 111**

This course covers Coulomb's law, electric field, Gauss's law, electric potential, capacitors, resistors, Ohm's law, Kirchhoff's rules, RC circuit, magnetism, laws of reflection and refraction.

### **Electric Circuits and Devices (ELE 220)**

(3-2-2)

#### **Pre-requisite: PHY 112**

Topics include Electrical quantities and variables; circuit principles; signal processing circuits, DC and AC circuit analysis, diodes, transistors and operational amplifiers, and digital device.

### **Introduction to Programming (ENG 131)**

(3-2-2)

#### **Pre-requisite: None**

This course introduces the introductory concepts of procedural programming. Topics include data types, control structures, functions, arrays, pointers, reading and writing of files, and the mechanics of running, testing, and debugging programs.

### **Digital Logic Design (ENG 251)**

(3-2-2)

#### **Pre-requisite: None**

This course is designed to give students an introduction to digital concepts, including analog and digital signals, number systems and codes, analysis, and design of combinational and sequential circuits. It provides a foundation for subsequent study of microprocessor and computer architecture and design.

### **Engineering Economics (ENG 323)**

(2-2-0)

#### **Pre-requisite: None**

The course is designed to cover economic principles and concepts including Demand, Supply, Equilibrium, Costs, Revenue and equilibrium of a firm, Market Structures. Capital Budgeting and other concepts relating to Marginal Social Costs and Benefits, Government Intervention and Externalities.

**Signals and Systems (ENG 343) (3-3-0)****Pre-requisite: MAT 214 and MAT 216**

This course covers main types and properties of signals and systems, time-domain response, and convolution; frequency-domain response using Fourier series, Fourier transform and its properties; Discrete Fourier series and transform; Laplace transform and its use in signal analysis; Introduction to sampling and sampling theorem.

**Microprocessor Programming and Interfacing (ENG 354) (3-2-2)****Pre-requisite: ENG 251**

This course covers the foundation of design and development of microprocessor/microcontroller-based system found in robots, automobiles, and industrial control systems. Students will be taught the basics of microprocessor/microcontroller organization and architecture and assembly programming language. The course will be based on a selected microprocessor/microcontroller

**Social and Ethical Issues in Engineering (ENG 425) (2-2-0)****Pre-requisite: ENG 323**

This course discusses the principal philosophical frameworks – such as Kantianism – which underpin the codes of ethics and conduct that govern the on-the-job behavior of engineering professionals. Various case studies highlighting pertinent ethical issues and dilemmas are presented with a view to preparing students to react appropriately in order to solve a range of ethical/social problems in areas such as recognition of intellectual property rights, whistleblowing, and the threat of job loss due to AI-powered “smart” technology.

**Data Structures and Algorithm Analysis (CSC 210) (3-2-2)****Pre-requisite: CSE 233 and CSC 215**

The course covers data structures and algorithms analysis to solve engineering problems using an object-oriented programming language. The course focuses on basic and essential topics in data structures, including arrays, lists, stacks, queues, and trees. The course considers analysis and implementation of algorithms including sorting (shell sort, insertion sort, selection sort, bubble sort, heap sort, merge sort, and quicksort sort), and searching methods (binary search and hashing). Algorithms are presented in iterative and recursion forms.

**Discrete Structures (CSC 215) (3-3-0)****Pre-requisite: None**

This course covers fundamental concepts in discrete mathematics. The topics covered are sets, relations, functions, mathematical logic and proofing techniques, counting techniques, permutations, combinations and recurrence relations, recursion, algorithm complexity, graphs, and trees.

**Computer Organization (CSC 252) (3-2-2)****Pre-requisite: None**

This course presents an introduction to computer architecture and hardware, covering wide range of topics dealing computer internals. The topics included are computer arithmetic, processors, and memory and IO devices. The design of simple circuits found in modern computers is discussed.

**Computer Graphics (CSC 305) (3-2-2)****Pre-requisite: CSE 233**

The course provides an overview of the computer graphics. Topics covered include an introduction to the basic concepts of computer graphics, 2D and 3D modeling and transformations, viewing transformations, projections. Students will use a standard computer graphics API OpenGL to draw point, line, polyline, polygon, and pictures.

**Database Systems (CSC 322) (3-2-2)**

**Pre-requisite: ENG 131**

This course introduces the fundamental concepts necessary for designing, using, and implementing database systems and database applications. The topics include database systems concepts and architecture, conceptual data modeling and database design, relational data model and SQL, relational database design by ER to relational mapping, functional dependencies, and normalization for relational databases.

**Principles of Operating Systems (CSC 335)****(3-2-2)****Pre-requisite: CSC 252 and CSC 210**

This course demonstrates the history of the operating systems, concepts, and functions of different types of operating systems. The course introduces the principles of processes including inter-process communication, process scheduling, deadlocks, the principles of input / output that includes I/O hardware and software, memory and file systems management that includes swapping, paging, virtual memory, and page replacement algorithms.

**Object Oriented Programming (CSE 233)****(3-2-2)****Pre-requisite: ENG 131**

This course introduces the students to Object-oriented programming via the use of an Object-oriented programming language. The following topics are explored: data types (both primitive and reference), classes and their relation to objects, methods (including constructors), encapsulation, overloading, inheritance, polymorphism, exception handling, interfaces, application documentation using javadoc, and basic GUI implementation using the Java Swing classes.

**Automata and Formal Languages (CSE 334)****(3-3-0)****Pre-requisite: CSC 215**

This course introduces fundamental concepts of theory of automata and formal languages. The topics included are grammar, finite state automaton, regular expressions, formal languages, pushdown automaton, and Turing machine.

**Computer Networks (CSE 351)****(3-2-2)****Pre-requisite: CSC 210**

This course introduces the basic principles and concepts of data communications and computer networks. The layered architecture is introduced, as the services provided by each layer, the principles of the protocols that are responsible for providing those services, etc. are discussed. Emphasis is placed on general principles of protocol messaging, network multiple access control, error control, flow and congestion controls, routing, and etc. Important protocols used in networks such as TCP/IP Internet are explained.

**Fundamentals of Data Analytics (CSE 361)****(3-2-2)****Pre-requisite: SAT 102**

This course provides fundamentals of data analytics techniques such as Exploratory Data Analysis, Data and Sampling Distributions, Statistical Experiments and Significance Testing, Regression and Prediction, Classification, Statistical Machine Learning, and Unsupervised Learning and visualizations. These techniques will be implemented and applied using R in the lab.

**Internship (CSE 396)****(3-0-6)****Pre-requisite: Finished 80 credit hours and CGPA  $\geq$  2.0**

This course allows Computer Science and Engineering (CSE) program students to receive a supervised practical work experience where the students shall be able to apply classroom knowledge, skills as well as other design and analysis tools in an industrial and professional setting on a topic that is related to the main specializations of the CSE program. This course also allows the students to develop and practice team working, planning, and problem-solving skills.

**Software Engineering (CSE 441) (3-3-0)****Pre-requisite: CSE 233**

This course is concerned with the study and approaches for the development and documentation of large programming projects, including requirements capture & analysis, specification, design, rudimentary black box testing and maintenance. This course will prepare students for working in teams to develop software model.

**Computer Architecture (CSE 451) (3-2-2)****Pre-requisite: CSC 252**

This course provides a strong foundation in the design of modern computer system architecture. Topics include fundamentals of quantitative design and analysis, memory hierarchy design, instruction and data level parallelism, and instruction set principles.

**Artificial Intelligence (CSE 463) (3-2-2)****Pre-requisite: ENG 131 CSE 361**

This course introduces you to the basic concepts and techniques of Artificial Intelligence (AI). It covers intelligent agents, different Search techniques. Logic will be treated as Logic Agents and Propositional Logic, and First-Order Logic. The course also includes knowledge representation and reasoning. And finally, machine learning is introduced with emphasis on neural networks.

**Project Management (CSE 471) (3-2-2)****Pre-requisite: CSE 441**

The course introduces the basic concepts of project management. The topics covered are integration, scope, time, cost, communications, quality, risk, and stakeholder management.

**Senior Year Design Project (CSE 497) (3-3-0)****Pre-requisite:  $\geq 100$  Credits and ENL 103**

This course provides an opportunity to study a computer science and engineering problem from the perspective of system analysis and design experience. It also provides an opportunity to perfect skills of technical writing and oral presentation. Special attention will be paid to professional ethics, marketability, sustainability and the economic and environmental impacts of each design or product.

**Graduation Project (CSE 498) (3-0-6)****Pre-requisite: CSE 497**

In this course students will apply classroom knowledge and skills in computer science and engineering to solve real-world problems and to develop team and project planning skills. Special attention will be paid to professional ethics. Technical communication skills, both written and oral, are engaged during this course.

**Elective Courses****Data Warehousing and Mining (CEC 413) (3-2-2)****Pre-requisite: SAT 102 and CSC 322**

The data is accumulating at incredible rate due the advances in the technology. This course explains the knowledge discovery from the huge data. The topics included are knowledge discovery process, data preprocessing and its importance, OLAP versus OLTP, data warehousing, association rule mining and correlation, classification and prediction, and cluster analysis.

**Advanced Database Systems (CSC 410) (3-2-2)****Pre-requisite: CSC 322**

The course introduces the advanced database concepts. The topics included are SQL and PL/SQL, Client/Server and Internet database environments, data quality and database administration, database

backup and recovery, controlling concurrent access, data dictionaries and repositories, data availability, query processing and optimization. Finally, it gives an overview of distributed database systems and object-oriented data models.

### **Principles of Programming Languages (CSE 336) (3-3-0)**

#### **Pre-requisite: CSE 334 and CSE 233**

This course takes a comparative study of current programming languages. It examines the structure of programming languages and their use in problem solving. The course discusses several concepts common to many important programming languages and investigates different ways these concepts can be implemented. The course covers the following programming paradigms: imperative, object-oriented, functional and logic programming.

### **Software Testing (CSE 443) (3-2-2)**

#### **Pre-requisite: CSE 441**

This course provides a broad understanding of software testing and quality control/assurance concepts along with opportunities to apply such techniques via the actual testing of software systems in a laboratory environment. Topics covered are white box, black box testing techniques, path and code coverage testing, desk checking, test case design and implementation, integration testing, regression testing, usability testing, and test metric formulation

### **Web Application Development (CSE 445) (3-2-2)**

#### **Pre-requisite: CSE 233**

This course explores various internet technologies which are specifically employed in the design and implementation of web applications. The course covers the main languages such as HTML and XHTML for creating Web pages. CSS to control the layout of multiple web pages. JavaScript to code the web pages. And MySQL and PHP to create databases on the server and write scripts to be executed on the server. Practical activities are carried out on WAMP (Windows, Apache, MySQL, and PHP) which is often used for web development and internal testing.

### **Computer Security (CSE 461) (3-2-2)**

#### **Pre-requisite: CSC 335**

Computer security has become an essential topic with the widespread use of computers and Internet including ecommerce. The course deals with threats, attacks and vulnerabilities of computer systems and counter measures to these risks. The topics covered in this course include cryptography fundamentals, threats and attacks to computer systems, authentication, access control, intrusion detection and prevention, denial of service, and program security. Security planning, legal and ethical aspects related computer security are also discussed.

### **Internet of Things (CSE 475) (3-2-2)**

#### **Pre-requisite: CSE 351 and CSE 233**

This course introduces students to the concepts and techniques underlying the Internet of Things (IoT). The topics covered are IoT concepts and connected roads, buildings, and factories, IoT Network Architecture and Design, Engineering IoT Networks, Connecting Smart Objects, IoT Access Technologies, Application Protocols for IoT, Data and Analytics for IoT. The case studies from the industry will also be part of the course.

### **Special Topics in Computing (CSE 472) (3-2-2)**

#### **Pre-requisite: Depends on the course offered**

The course covers selected topics related to the use of new and innovative topics in the field of computing and technologies, management approaches, integration issues, and advances in security technologies. Students will learn about topics chosen based on relevant issues in the computing field. Upon successful course completion, students will demonstrate ability in applying the chosen topic.

*NOTE – the complete course syllabus will be prepared based on the topic(s) selected and will be discussed in the college meeting for its offering.*

**Digital Image Processing (CSE 473)****(3-2-2)****Pre-requisite: ENG 343 and MAT 216**

This course is an introduction to image processing principles and concepts. The topics include imaging sensors construction and their principles, image storage, Compression techniques, Image de-blurring and Noise reduction for image restoration purposes, Image filtering in spatial domain and frequency domain. Color processing for better image representation. Morphological Image processing with segmentation operations on binary and gray-scale image is also examined along with image feature extraction such as edges, corners, and textures.

*NOTE – the complete course syllabus will be prepared based on the topic(s) selected and will be discussed in the college meeting for its offering.*

**Fuzzy Logic and Neural Networks (CSE 474)****(3-2-2)****Pre-requisite: ENG 343 and MAT 216**

This course covers the fundamentals of artificial neural networks and fuzzy logic and their applications in control and system modeling.

*NOTE – the complete course syllabus will be prepared based on the topic(s) selected and will be discussed in the college meeting for its offering.*