

BSc in

Computer Science

Student Guide

CS General

Artificial Intelligence

Networks & Cybersecurity

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PREFACE

Welcome to the Computer Science Program at College of Computer and Information Sciences, King Saud University — where your journey into the world of technology begins.

Computing is at the heart of every breakthrough shaping our world today — from artificial intelligence and cybersecurity to data-driven innovation and intelligent systems. At our department, we believe that great computer scientists are not simply trained; they are inspired, challenged, and empowered.

Our **Bachelor of Science in Computer Science** is built for the ambitious student — one who is ready to think critically, build creatively, and lead confidently. Our program delivers a rigorous yet engaging curriculum across three specialized tracks:

- **CS General** — a versatile foundation for full-stack development, big data, and beyond
- **Artificial Intelligence** — for those who want to build the intelligent systems of tomorrow
- **Networks & Cybersecurity** — for those committed to securing the digital world

Beyond the classroom, you will grow through hands-on projects, field training, graduation research, and a community that values teamwork, entrepreneurship, and ethical responsibility. Our faculty are not just educators — they are active researchers and industry-connected mentors invested in your personal and professional success.

This booklet serves as your official academic reference, providing a comprehensive overview of the program's courses, tracks, and graduation requirements.

1. Program Overview

Mission

Preparing highly qualified professionals in Computer Science for an efficient contribution to the edification of the knowledge society and to the achievement of the national development goals through fostering an academic environment ideal for knowledge development, research, and innovation in the field of Computer Science.

Program Goals

The program objectives focus on preparing graduates who are capable to:

1. Work as computing professionals, conducting research and/or leading, designing, developing, or maintaining computer-related projects in various fields.
2. Demonstrate professionalism and a sense of societal ethical responsibility in all their endeavors.
3. Continue enhancing their skills, embrace new computing technologies through self-learning activities, and post-graduate training or education.

2. Program Tracks

The BSc in Computer Science offers three specialized tracks. Each track builds on a common foundation to prepare students for targeted career pathways:

Track	Credit Hours Breakdown	Career Pathways
CS General Track	32 Common Year + 8 KSU Req. + 64 CS Req. + 24 General CS	Full-Stack Developer, Big-Data Specialist, Data Analyst
Artificial Intelligence Track	32 Common Year + 8 KSU Req. + 64 CS Req. + 24 AI	AI Specialist, Intelligent Systems Developer
Networks & Cybersecurity Track	32 Common Year + 8 KSU Req. + 64 CS Req. + 24 Networks & Cybersecurity	Network Security Analyst, Cybersecurity Specialist

3. Program Structure

The program totals 128 credit hours distributed across institution, college, program, and track requirements as follows:

Program Component	Category	Courses	Credit Hours	Percentage
Institution Requirements	Common Year	10	32	25%
	Required	2	4	3%
	Elective	2	4	3%
College Requirements	Required	4	14	11%
Program Requirements	Required	15	45	35%
	Elective	1	4	3%
Tracks Requirements	Required	4	12	10%
	Elective	4	12	9%
Field Training / Internship	Required	1	1	1%
TOTAL		43	128	100%

4. Core Curriculum – Semester Plan

All Computer Science students follow a common foundational curriculum before specializing in their chosen track. The semester-by-semester plan is outlined below.

First Common Year (Levels 1–2)				
Code	Course Title	Type	Pre-Requisite	Credits
MATH 101	Differential Calculus	Mandatory	—	3
ENGS 100	English I	Mandatory	—	6
CHEM 101	General Chemistry I	Mandatory	—	4
ARAB 100	Writing Skills	Mandatory	—	2
ENT 101	Entrepreneurship	Mandatory	—	1
STAT 101	Probability & Statistics	Mandatory	—	3
ENGS 110	English II	Mandatory	ENGS 100	6
CT 101	Computer Skills	Mandatory	—	3
CI 101	University Skills	Mandatory	—	3
EPH 101	Health Education and Fitness	Mandatory	—	1

Level 3				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 111	Computer Programming I	Mandatory	CT 101	4
MATH 106	Integral Calculus	Mandatory	MATH 101	3
MATH 151	Discrete Mathematics	Mandatory	MATH 101	3
IC 107	Professional Ethics	Mandatory	—	3
Science	One Science Course from List A	Elective	—	4

Level 4				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 113	Computer Programming II	Mandatory	CSC 111	4
CSC 220	Computer Organization	Mandatory	MATH 151	3
MATH 244	Linear Algebra	Mandatory	MATH 106	3
CSC 281	Discrete Mathematics for Computer Science	Mandatory	STAT 101, MATH 151	3
IC 108	Current Issues	Mandatory	—	2

Level 5				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 212	Data Structures	Mandatory	CSC 113	3
CSC 304	Ethical Issues in Computing and Research Methods	Mandatory	CSC 113	3
CSC 339	Theory of Computation	Mandatory	CSC 281	3
CSC 380	Fundamentals of Database Systems	Mandatory	CSC 212 (co-req)	3
CSC 21x	Track Programming Course	Mandatory	CSC 111	3
IC 10x	KSU Requirement Course	Mandatory	—	2

Level 6				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 227	Operating Systems	Mandatory	CSC 212	3
CSC 311	Design and Analysis of Algorithms	Mandatory	CSC 212, CSC 281	3
CSC 329	Computer Networks	Mandatory	CSC 227 (co-req)	3
CSC 361	Artificial Intelligence	Mandatory	CSC 212	3
CSC 429	Computer Security	Mandatory	CSC 329 (co-req)	3
IC 10x	KSU Requirement Course	Mandatory	—	2

Level 7 (Track specialization begins)				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 340	Programming Languages and Compilation	Mandatory	CSC 339	3
CSC 343	Systems Analysis and Design	Mandatory	CSC 212	3
CSC xxx	Track Mandatory Course	Mandatory	—	3
CSC 4xx	Graduation Project (1) – Track-specific	Mandatory	90 credit hours	2
CSC 479	Field Experience	Mandatory	90 credit hours	1
CSC xxx	Track Elective Course	Elective	—	3
CSC xxx	Track Elective Course	Elective	—	3

Level 8				
Code	Course Title	Type	Pre-Requisite	Credits
CSC 453	Parallel Processing	Mandatory	CSC 227	3
CSC 4xx	Graduation Project (2) – Track-specific	Mandatory	Graduation Project 1	4
CSC xxx	Track Elective Course	Elective	—	3
CSC xxx	Track Elective Course	Elective	—	3

5. CS Program – Course List

The following descriptions cover all mandatory core courses that form the academic foundation of the Computer Science program, common to all students regardless of their chosen specialization track.

CSC 111 Computer Programming I 4 CREDIT HOURS

Pre-Requisite: CT 101 – Computer Skills

An introduction to computers, programs, and the foundations of programming using Java. Topics include programmer's algorithm design, Java program structure, constants, variables, and built-in data types. The course covers arithmetic, assignment, increment and decrement operators, as well as object-oriented principles such as class and object definition, UML class representation, encapsulation, information hiding, and the message-passing paradigm. Students will also study relational and logical operators, Boolean expressions, conditional and loop statements, methods, constructors, setters, getters, parameter passing, and single-dimensional arrays.

CSC 113 Computer Programming II 4 CREDIT HOURS

Pre-Requisite: CSC 111 – Computer Programming I

A continuation of the fundamental concepts of Object-Oriented Programming introduced in CSC 111. This course covers advanced OOP topics including class relationships, inheritance, polymorphism, abstract classes, interfaces, error and exception handling, generics, and core data structures such as linked lists, stacks, and queues. Students will also receive an introduction to graphical user interface (GUI) design and development.

CSC 212 Data Structures 3 CREDIT HOURS

Pre-Requisite: CSC 113

A study of the fundamental concepts of data structures and their application in software development. Topics include performance measurement and complexity analysis of algorithms, and the implementation and use of abstract data types including lists, stacks, queues, priority queues, trees, heaps, hash tables, and graphs. The course also covers recursion and its applications. Students will complete programming assignments to reinforce theoretical concepts.

CSC 220 Computer Organization 3 CREDIT HOURS

Pre-Requisite: MATH 151

An introduction to the fundamental principles of computer architecture, digital logic design, and assembly language programming. The course develops an understanding of how hardware and software interact at the machine level. Topics include basic digital logic design (including DeMorgan's Law and Karnaugh maps), instruction codes, computer registers, timing and control, Register Transfer Language (RTL), Hardware Description Language (HDL), micro-operations, the Arithmetic Logic Unit (ALU), addressing modes, and Central Processing Unit (CPU) design and organization.

CSC 227 Operating Systems 3 CREDIT HOURS

Pre-Requisite: CSC 212

An introductory course covering the core concepts common to modern operating systems. Topics include computer system and OS structures, processes and threads — including inter-process communication, synchronization, and deadlock handling — CPU scheduling algorithms, memory management strategies, and

virtual memory. While the course is not specific to any single operating system, the concepts covered are applicable to all major existing systems.

CSC 281 Discrete Mathematics for Computer Science 3 CREDIT HOURS

Pre-Requisite: STAT 101, MATH 151

A rigorous treatment of the discrete mathematical foundations underlying computer science. Topics include logic and methods of proof, sets, functions, recursive definitions, sequences and summations, growth of functions, integers and division, rings and fields, and applications of number theory. The course also covers combinatorics (counting techniques, permutations, combinations, binomial coefficients, recurrence relations, and generating functions), as well as discrete structures such as relations, graphs, trees, and finite state machines.

CSC 304 Ethical Issues in Computing & Research Methods 3 CREDIT HOURS

Pre-Requisite: CSC 113

Provide students with the knowledge and analytical tools necessary to recognize and address ethical challenges in the information and communications technology (ICT) profession. It examines the broad societal impact of computing across social, economic, and political dimensions, and covers the moral and legal obligations of computing professionals. Key topics include security and privacy, freedom of information, intellectual property rights, professionalism, and research methods — encompassing data collection and analysis, critical evaluation, report writing, reference management, and presentation skills.

CSC 311 Design and Analysis of Algorithms 3 CREDIT HOURS

Pre-Requisite: CSC 212, CSC 281

A comprehensive study of algorithm design strategies and the mathematical tools used to analyze their efficiency. Topics include mathematical essentials, sorting algorithms, space and time complexity analysis, and core algorithm design paradigms including greedy algorithms, divide and conquer, and dynamic programming. The course also introduces graph theory and concludes with an introduction to NP-completeness and computational intractability.

CSC 329 Computer Networks 3 CREDIT HOURS

Pre-Requisite: CSC 227 – Operating Systems

A comprehensive coverage of computer networking theory and practice, addressing all fundamental aspects of modern networks. Topics include network reference models (OSI and TCP/IP), LAN, MAN, and WAN technologies, routing protocols, and switching. Students develop practical skills in the design of small to medium-sized networks and gain hands-on experience addressing real-world networking challenges related to routing and switching.

CSC 339 Theory of Computation 3 CREDIT HOURS

Pre-Requisite: CSC 281

A formal study of the mathematical foundations of computation. Topics include mathematical preliminaries, regular languages, regular expressions, deterministic and non-deterministic finite automata, closure properties, and the pumping lemma. The course progresses to context-free grammars and languages, pushdown automata, Turing machines, the Church-Turing Thesis, computability, decidability, the Halting problem, and computational complexity including classes P and NP.

CSC 340 Programming Languages and Compilation 3 CREDIT HOURS

Pre-Requisite: CSC 339

An exploration of programming language design principles and the theory and practice of language translation. Topics include the features and design considerations of programming languages, followed by a systematic study of compilation phases: lexical analysis, syntactic analysis (parsing), semantic analysis, and code generation.

CSC 343 Systems Analysis and Design 3 CREDIT HOURS

Pre-Requisite: CSC 212 – Data Structures

focuses on software engineering concepts and methodologies for developing software systems that satisfy functional requirements within a well-defined problem domain. It covers the full software development lifecycle including requirements analysis, system specification, design, and testing. The course introduces Object-Oriented Analysis and Design (OOAD) using the Unified Modeling Language (UML). Students work in teams to undertake a real development project, including feasibility studies, requirements definition, and full OOAD documentation.

CSC 361 Artificial Intelligence 3 CREDIT HOURS

Pre-Requisite: CSC 212 – Data Structures

An introduction to the core principles and techniques of artificial intelligence. Topics include problem solving using search strategies (depth-first, breadth-first, A*, and others), constraint satisfaction problems, adversarial game playing, knowledge representation, and inference procedures. The course also surveys an advanced AI topic such as machine learning or natural language processing. Students complete a small project applying AI techniques.

CSC 380 Introduction to Database Concepts 3 CREDIT HOURS

Pre-Requisite: None

Co-Requisite: CSC 212 – Data Structures

A comprehensive introduction to database systems and the relational model. Topics include the purpose and architecture of database systems, data models, the Entity-Relationship (E-R) model and E-R diagram design,

relational database structure and algebra, SQL (DDL and DML), transaction management, storage management, database normalization (1NF, BCNF, 3NF), and the overall database design process.

CSC 479 Practical Training 1 CREDIT HOURS

Pre-Requisite: Completion of 90 credit hours
 Practical training is an integral component of the educational experience in the College of Computer and Information Sciences (CCIS). Students are required to complete a supervised placement at an approved government or private sector IT organization. The objective of the training is to bridge academic knowledge with real-world professional practice. Student performance is evaluated jointly by the on-site training supervisor and the CCIS training committee.

CS General Track

Full-Stack Development, Big Data & Data Analytics

6. CS General Track – Course List

The CS General Track provides a broad and versatile Computer Science education. Students graduate as full-stack developers, big-data specialists, or data analysts.

Code	Course Title	Type	Pre-Requisite	Credits
CSC 215/216	Programming Course (C or Python)	Mandatory	CSC 111	3
CSC 480	Big-Data and NoSQL Databases	Mandatory	CSC 380	3
CSC 496	Graduation Project I	Mandatory	CSC 343 (co-req), 90 credit hours	2
CSC 497	Graduation Project II	Mandatory	CSC 496	4
CSC 312	Data Visualization	Elective	CSC 212	3
CSC 320	Systems Programming	Elective	CSC 227	3
CSC 350	Full-Stack Web Development 1	Elective	CSC 329	3
CSC 384	Applied Numerical Computation	Elective	CSC 311	3
CSC 386	Algorithms & Techniques for Database Management Systems	Elective	CSC 380	3
CSC 412	Modeling and Simulation	Elective	CSC 311	3
CSC 413	Advanced Algorithms and Programming Techniques	Elective	CSC 311	3
CSC 437	Network Security	Elective	CSC 429	3
CSC 432	Cyber Physical-Systems	Elective	CSC 429	3
CSC 440	Human Computer Interaction	Elective	CSC 343	3
CSC 443	Software/IT Project Management	Elective	CSC 343	3

Code	Course Title	Type	Pre-Requisite	Credits
CSC 450	Full-Stack Web Development 2	Elective	CSC 350	3
CSC 455	Cloud Computing	Elective	CSC 329	3
CSC 456	Distributed Systems	Elective	CSC 329	3
CSC 462	Machine Learning	Elective	CSC 361	3
CSC 463	Deep Learning	Elective	CSC 462	3
CSC 482	Introduction to Data Science	Elective	CSC 480	3
CSC 484	Information Retrieval	Elective	CSC 380	3
CSC 489	Selected Topics in CS	Elective	CSC 480	3
SWE 483	Mobile Application Development	Elective	CSC 113	3

Course Descriptions – CS General Track

CSC 480 Big-Data and NoSQL Databases 3 CREDIT HOURS

Pre-Requisite: CSC 380

Provides a comprehensive introduction to NoSQL databases, exploring their fundamental principles, types including document-oriented, key-value, columnar, and graph databases, and use cases. Students will gain hands-on experience with popular NoSQL database systems, learning to design, implement, and manage non-relational databases. The course also covers the advantages and challenges of NoSQL databases compared to traditional relational databases.

CSC 312 Data Visualization 3 CREDIT HOURS

Pre-Requisite: CSC 212

Introduces principles, techniques, and tools for creating effective data visualizations. Students learn to transform raw data into meaningful visual representations using a variety of visualization techniques.

CSC 350 Full-Stack Web Development 1 3 CREDIT HOURS

Pre-Requisite: CSC 329

Introduces students to the principles and practices of modern back-end web development. Students will explore server-side programming languages, databases, and frameworks commonly used to build scalable and efficient web applications. The course emphasizes industry-standard tools and frameworks, equipping students with the skills required for building robust and secure back-end systems that interact seamlessly with front-end technologies.

CSC 384 Applied Numerical Computation 3 CREDIT HOURS

Pre-Requisite: CSC 311

Explores foundational techniques and algorithms in numerical computation for solving real-world problems. Covers practical applications from engineering, harnessing numerical methods for efficient and accurate solutions.

CSC 386 Algorithms & Techniques for Database Management Systems 3 CREDIT HOURS

Pre-Requisite: CSC 380

Enables students to analyze a given database task, and suggest an alternative implementation if standard database solutions are not efficient. In particular, the student should be able to: Analyze and choose among main indexing technologies; Understand and perform query optimization; Solve concurrency execution query; Explain how to do error recovery analyze.

CSC 412 Modeling and Simulation 3 CREDIT HOURS

Pre-Requisite: CSC 311

Introduction to Simulation. Concepts in Discrete-event Simulation (DES). Components of DES. Monte Carlo simulation, the life cycle of a simulation study, input and output data analysis, world views and time control, random number generation, credibility assessment of simulation results, simulation languages, Parallel and Distributed Simulation, applications of simulation using contemporary simulation modeling and support software.

This course combines theoretical knowledge and programming skills. It provides the students with basic design and programming skills with some advanced topics of S&M as well that will be used and further developed throughout the curriculum.

CSC 413 Advanced Algorithms and Programming Techniques 3 CREDIT HOURS

Pre-Requisite: CSC 311

An advanced-level course designed to delve into sophisticated algorithms and programming methodologies essential for solving complex computational problems efficiently. This course typically targets students with a solid understanding of data structures, algorithms, and programming fundamentals. It equips students with the knowledge and skills needed to design, analyze, and implement sophisticated algorithms to tackle challenging computational problems effectively. It prepares them for careers in software development, data science, artificial intelligence, and other fields where algorithmic problem-solving is essential.

CSC 440 Human Computer Interaction 3 CREDIT HOURS

Pre-Requisite: CSC 343

Introduction to HCI. The Human User: Capabilities and Limitations. The Computer: Capabilities and Limitations. The Interaction: Models of Interaction and Interaction Styles. Usability Principles: Principles of HCI that support usability. Interface design: dialog notation and design - Visual Design. Design support: Systems that support the design process. Usability Evaluation.

CSC 443 Software/IT Project Management 3 CREDIT HOURS

Pre-Requisite: CSC 343

Project Management will be presented using the structure and vocabulary used by PMI (Project Management Institute) and the Project Management reference book (PMBOK Guide).

The PMBOK Guide is process-based, meaning it describes work as being accomplished by processes. This approach is consistent with other management standards such as ISO 9000 and the Software Engineering Institute's CMMI.

Project life cycle; Project constraints; Project organization; Risk management; Project cost; Integrated schedule and critical path analysis; Baseline cost; Team building; Project planning; Reporting on project status; Closing and sign-off.

CSC 450 Full-Stack Web Development 2 3 CREDIT HOURS

Pre-Requisite: CSC 350

Offers an in-depth exploration of modern front-end web development, focusing on the latest technologies and best practices. Students will learn to build responsive and interactive user interfaces using popular frameworks and tools. Emphasis is placed on the development of dynamic and visually appealing web applications in alignment with industry standards.

CSC 455 Cloud Computing 3 CREDIT HOURS

Pre-Requisite: CSC 329

Provides students with an understanding of cloud computing, encompassing both theoretical knowledge and practical skills. The course introduces the basics of cloud computing, including its various deployment models such as public, private, and hybrid clouds. It also aims to familiarize students with the major cloud service providers in the industry, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). Also, the course explains the core cloud services, which include computing, storage, networking, databases, and AI/ML services. It delves into the discussion of different optimization strategies and highlights the economic benefits of cloud computing. Furthermore, the course guides students in selecting the appropriate cloud models and services that are best suited for different purposes.

CSC 456 Distributed Systems 3 CREDIT HOURS

Pre-Requisite: CSC 329

Understanding the main characteristics of distributed systems and the various design choices required for building a distributed system such as: the architectural models varying from client/server to peer-to-peer, grid-computing; the communication models varying from client-pull (RPC/RMI, Message Queuing, ...) to server-push models (publish-subscribe, ...); the synchronization techniques based on system clock, on logical clock(timestamp) and on token ring; the communication standards such as RPC, RMI, Corba and SOAP.

CSC 482 Introduction to Data Science 3 CREDIT HOURS

Pre-Requisite: CSC 480

Provides an introduction to data science methods and applications. In this course, students will learn basic concepts and tools for data mining, including data sources, data cleaning tools and techniques, mainstream algorithms for data mining, statistical modelling, and popular tools for mining structured data and unstructured data. Students will also learn the different applications of data mining in various areas. The students will conduct a data analytics project and use the tools introduced in the course to tackle the problem. This course is appropriate for students with essential knowledge and skills in database management systems. Prior programming skills are helpful but not required.

CSC 484 Information Retrieval 3 CREDIT HOURS

Pre-Requisite: CSC 380

The course aims to provide a modern approach to information retrieval from a computer science perspective. It will be including the basics of information retrieval, and in particular the heart of search engines. It introduces inverted indexes, builds on this introduction by detailing the manner in which documents are preprocessed before indexing and by discussing how inverted indexes are augmented in various ways for functionality and speed, discusses search structures for dictionaries and how to process queries that have spelling errors and other imprecise matches to the vocabulary in the document collection being searched. Also, it will cover a number of algorithms for constructing the inverted index from a text collection with particular attention to highly scalable and distributed algorithms that can be applied to very large collections. In addition, scoring, term weighting and the vector space model is provided. It will discuss the evaluation in information retrieval.

CSC 489 Selected Topics in CS 3 CREDIT HOURS

Pre-Requisite: CSC 480

Introducing the students to a different area of Computer Science. This will be achieved by exposing them to new tools, techniques, and research in Computer Science. In this semester, the course will focus on Cloud computing topics.

Artificial Intelligence Track

AI Specialist & Intelligent Systems Development

7. Artificial Intelligence Track – Course List

The AI Track prepares students for careers as AI Specialists and Intelligent Systems Developers, with deep expertise in machine learning, deep learning, and computer vision.

Code	Course Title	Type	Pre-Requisite	Credits
CSC 216	Programming with Python	Mandatory	CSC 111	3
CSC 462	Machine Learning	Mandatory	CSC 361	3
CSC 494	Graduation Project I in AI	Mandatory	CSC 361, 90 credit hours	2
CSC 495	Graduation Project II in AI	Mandatory	CSC 494	4
CSC 463	Deep Learning	Elective	CSC 462	3
CSC 464	Natural Language Processing	Elective	CSC 361	3
CSC 465	Game Programming	Elective	CSC 361	3
CSC 466	Reinforcement Learning	Elective	CSC 462	3
CSC 469	Selected Topics in AI	Elective	CSC 361	3
CSC 472	Computer Vision	Elective	CSC 361	3
CSC 474	Robotics and Unmanned Systems	Elective	CSC 227	3
CSC 478	Digital Image Processing and Analysis	Elective	CSC 361	3
IS 463	Introduction to Data Mining	Elective	CSC 361	3

Course Descriptions – AI Track

CSC 462 Machine Learning 3 CREDIT HOURS

Pre-Requisite: CSC 361

Gives an overview of many concepts, techniques, and algorithms in machine learning, beginning with topics such as linear regression, classification and clustering, and ending up with more recent topics such as convolutional neural nets and transformers. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work.

CSC 463 Deep Learning 3 CREDIT HOURS

Pre-Requisite: CSC 462

Covers basic fundamentals of deep neural networks and how these machine learning models are empowering AI tasks, such as speech and image recognition, autonomous driving, and natural language processing. It starts off with shallow neural networks and the backpropagation algorithm, and continues with deep learning models including Recurrent Neural Networks (RNN), Convolutional Neural Networks (CNN), Long-Short Term Memory (LSTM), Bidirectional LSTM, and sequence-to-sequence models. The course also emphasizes the tools required for building deep learning models.

CSC 464 Natural Language Processing 3 CREDIT HOURS

Pre-Requisite: CSC 361

This course provides an in-depth exploration of Natural Language Processing (NLP) with a focus on Arabization techniques. NLP is a subfield of artificial intelligence that deals with the interaction between computers and human language. Arabization, in the context of this course, refers to the adaptation and processing of the Arabic language in NLP applications. Students will gain a comprehensive understanding of NLP principles and methodologies, with a specific emphasis on Arabic language processing. The course covers fundamental NLP concepts, techniques, and tools, as well as hands-on practical experience in building NLP applications for Arabic text.

CSC 465 Game Programming 3 CREDIT HOURS

Pre-Requisite: CSC 361

This course provides a comprehensive introduction to the principles and practices of game programming, with a focus on developing interactive and engaging game experiences. Students will learn fundamental game development concepts, including game design, game mechanics, programming logic, graphics rendering, and user interface design. The course will also explore the integration of artificial intelligence (AI) techniques to enhance game behavior and create intelligent game agents. Building upon prior knowledge of AI algorithms and data structures, students will gain practical experience in implementing AI-driven features such as pathfinding, decision-making, and opponent behavior. Throughout the course, students will work on individual and team-based projects, culminating in the development of a fully functional game prototype.

CSC 466 Reinforcement Learning 3 CREDIT HOURS

Pre-Requisite: CSC 462

The course will provide an introduction to Reinforcement Learning. Topics include: Finite Markov Decision Processes, Tabular Methods for prediction and control (Dynamic Programming, Monte Carlo, TD(0), TD(1), TD(λ), SARSA, Q-Learning). Introduction to Value Function Approximation, Policy Gradient Methods, Actor-Critic methods, and deep RL. Students will do a small project in this course as well.

CSC 469 Selected Topics in AI 3 CREDIT HOURS

Pre-Requisite: CSC 361

In this course, topics are selected according to the new trends and research directions, in the different areas of Artificial Intelligence. Contemporary themes and subjects of recent issues and trends in AI will be covered. Students will learn state-of-the-art topics in artificial intelligence. Emphases will be placed on the latest development of related methodologies and/or practice. After completing this course, students will understand some current topics and methodologies in the area of artificial intelligence. The course is project driven and may also be seminar based.

CSC 472 Computer Vision 3 CREDIT HOURS

Pre-Requisite: CSC 361

This course introduces Computer Vision, which studies how computers can comprehend and interpret digital images and videos. It is an exciting and quickly developing field with numerous applications, including robotics, self-driving automobiles, and medical imaging. This course will cover Introduction to computer vision, Image formation and processing, Feature detection and matching, Camera models and multi-view

geometry, Object detection and recognition, Deep learning for computer vision. After completing this course, students will have a solid foundation in computer vision principles and be able to use that knowledge to address challenges in the real world.

CSC 474 Robotics and Unmanned Systems 3 CREDIT HOURS

Pre-Requisite: CSC 227

This course introduces students to the multidisciplinary field of robotics, combining elements of mechanical engineering, electrical engineering, computer science, and artificial intelligence. Students will explore the basic principles of robot design, sensors, actuators, control systems, and robot programming. The course aims to provide a hands-on understanding of how robots work, how they are built, and how they can be programmed to perform specific tasks autonomously or under human control.

CSC 478 Digital Image Processing and Analysis 3 CREDIT HOURS

Pre-Requisite: CSC 361

This course introduces basic concepts, methodologies and algorithms of digital image processing focusing on the following two major problems: (1) image enhancement and restoration, and (2) image segmentation and analysis. Some advanced image processing techniques like feature extraction, Convolutional Neural Nets, and object recognition will also be introduced in this course. Students will have a solid foundation to study advanced image analysis topics and gain understanding of algorithm design, mathematical tools, and practical implementations of various digital image applications..

Networks & Cybersecurity Track

Network Security Analyst & Cybersecurity Specialist

8. Networks & Cybersecurity Track – Course List

The Networks & Cybersecurity Track prepares students as Network Security Analysts and Cybersecurity Specialists with expertise in penetration testing, cryptography, and forensics.

Code	Course Title	Type	Pre-Requisite	Credits
CSC 215	Procedural Programming with C	Mandatory	CSC 111	3
CSC 437	Network Security	Mandatory	CSC 429	3
CSC 488	Graduation Project (1) in Networks & Cyber-Security	Mandatory	CSC 429, 90 credit hours	2
CSC 492	Graduation Project (2) in Networks & Cyber-Security	Mandatory	CSC 488	4
CSC 427	Penetration Testing and Vulnerability Assessment	Elective	CSC 429	3
CSC 432	Cyber Physical-Systems	Elective	CSC 429	3
CSC 433	Software Security	Elective	CSC 429	3
CSC 434	Applied Cryptography	Elective	CSC 429	3
CSC 435	Privacy Foundations	Elective	CSC 429	3
CSC 436	Cyber-Forensics	Elective	CSC 429	3
CSC 439	Selected Topics in Cyber-Security	Elective	CSC 429	3
CSC 462	Machine Learning	Elective	CSC 361	3
CEN 445	Network Protocols & Algorithms	Elective	CSC 329	3

Course Descriptions – Networks & Cybersecurity Track

CSC 437 Network Security 3 CREDIT HOURS

Pre-Requisite: CSC 429

Examines the techniques used in protecting and securing resources and communication in networks. Techniques for ensuring the confidentiality of messages are examined, including public and private key encryption, message and target authentication, digital signatures and key management issues. Network security applications are discussed including authentication, email and web security, IP security and network management security. Techniques for detecting and defending against intruders, malicious software and other forms of attack are also covered.

CSC 427 Penetration Testing and Vulnerability Assessment 3 CREDIT HOURS**Pre-Requisite:** CSC 429

Encompasses key areas within penetration testing and vulnerability assessment. It delves into various subjects including methodologies for penetration testing, leveraging open-source intelligence, social engineering techniques, conducting network penetration tests, assessing web application vulnerabilities, exploring wireless network security, evaluating IoT device vulnerabilities, scrutinizing OT and SCADA systems, cloud infrastructure security assessments, binary analysis, exploit development, and the essential aspects of report writing and post-testing actions

CSC 432 Cyber Physical-Systems (IoT) 3 CREDIT HOURS**Pre-Requisite:** CSC 429

The IoT course provides a comprehensive illustration of emerging Internet of Things (IoT) systems, by focusing on both methodological and applicative/industrial aspects. The course program follows a data-centric approach, by presenting the data-path from the sensor acquisition till the “data valorization” through machine-learning and analytics techniques, and considering all the intermediate phases of data communication via emerging Machine-to-Machine (M2M) communication standards, streaming, storage on public/private clouds, and integration through Web semantic approaches. After a short introduction to pervasive computing and the emerging applications (e.g. Industry 4.0, demotics, intelligent transportation systems, smart energy, etc.) the course will provide an exhaustive illustration of the enabling components of IoT systems. These include: wireless standards for short and long M2M communication (e.g. BLE, 6LoWPAN, LoRa, NB-IoT, ...) among sensor edge-devices, languages and boards for the development of prototypal WSN, WPAN, WLAN sensor networks (e.g. Arduino, STM32 Nucleo, RaspberryPI, ...), and IoT network stacks and protocols (e.g. CoAP, MQTT, AMQP, ...) From the data transmission, we move to architectures and tools for data storage and processing, including sensor time-series database and fog/cloud approaches and services. Finally, the course will explore techniques for the valorization of sensor data and knowledge extraction from large IoT deployments and crowd-sensing environments, through the application of machine-learning and data analytics techniques. Current open issues, like scalability, data interoperability and energy-efficiency will be largely discussed.

CSC 433 Software Security 3 CREDIT HOURS**Pre-Requisite:** CSC 429

This course focuses on the principles and techniques for building secure software systems. Topics include secure software design, secure coding practices, vulnerability analysis, software security testing, and secure software deployments.

CSC 434 Applied Cryptography 3 CREDIT HOURS**Pre-Requisite:** CSC 429

This course covers the basic cryptographic techniques and their applications in computer systems and network protocols. Topics include classic encryption techniques, symmetric- key cryptography, block ciphers, stream ciphers, public-key cryptography, key management, cryptographic hash functions, cryptography applications in computer systems, and cryptography applications in network protocols.

CSC 435 Privacy Foundations 3 CREDIT HOURS

Pre-Requisite: CSC 429

This course provides a comprehensive overview of privacy principles, technologies, and legal frameworks. Topics include privacy models, threats, privacy-enhancing technologies such as encryption and anonymization and legal and ethical considerations, including PDPL and GDPR.

CSC 436 Cyber-Forensics 3 CREDIT HOURS

Pre-Requisite: CSC 429

This course covers fundamentals of digital forensics, cybercrime scene analysis and electronic discovery and the tools and techniques for collecting and preserving evidence of computer crimes. Digital forensics focuses on learning techniques used by hackers in order to improve the protection of systems and prevent breaches. Topics include file systems and storage analysis, data hiding techniques, network forensics; projects involving using, understanding, and designing digital forensic tools; anti-forensics; legal issues and standards.

CSC 439 Selected Topics in Cyber-Security 3 CREDIT HOURS

Pre-Requisite: CSC 429

In this course, topics are selected according to the new trends and research directions, in the different areas of Artificial Intelligence. Contemporary themes and subjects of recent issues and trends in AI will be covered. Students will learn state-of-the-art topics in artificial intelligence. Emphases will be placed on the latest development of related methodologies and/or practice. After completing this course, students will understand some current topics and methodologies in the area of artificial intelligence. The course is project driven and may also be seminar based.