Fahad Bin Sultan University
College of Computing
Computer Science Department

جامعة فهد بن سلطان
FAHAD BIN SULTAN UNIVERSITY
كلية الحاسب الآلي
College of Computing

Master of Computer Science Program Study Plan

Program Information
Computer Science Department is a leading department in College of Computing. It was established in 1424 H. The department has graduated hundreds of students from its BS programs.

Program Tracks

1. Artificial Intelligence and Machine Learning
2. Computer Systems and Databases
3. Computer Networks and Security
4. Software Engineering

Degree Requirement

1) Project Track (42 credit hours)

- Successful completion of a minimum of 39 credit hours of graduate courses.
- Completion and successful defense of a research project of 3 credit hours.

2) Thesis Track (42 credit hours)

- Successful completion of a minimum of 30 credit hours of graduate courses.
- Completion and successful defense of a research project of 12 credit hours.

A. Compulsory Specialization Requirements

Course Code	Course Title	Required or Elective	Credit Hours
MSC 501	Advanced Design and Analysis of Algorithms	R	3
MSC 502	Software Engineering	R	3
MSC 503	Database Systems	R	3
MSC 504	Computer Networks and Security	R	3
MCS 514	Research Methodology	R	3
MSC 599/ Project Track	Project	R	3
MSC 600 A, B,C,D/ Thesis Track	Thesis	R	12

B. Program Specialization Elective Requirements (15 Credit Hours) selected from the below specialization courses

1. Artificial Intelligence and Machine Learning

Course Code	Course Title	Credit Hours
MSC 520	Artificial Intelligence	3
MSC 522	Web Database and Information Retrieval	3
MSC 526	Data Warehouse and Mining Systems	3
MSC 534	Expert Systems and Knowledge Engineering Applications	3
MSC 536	Selected Topics in Artificial Intelligence	3
MSC 524	Graphical User Interface	3
CEN 570	Simulation and Modelling	3
MSC 523	Advanced computer Graphics	3

2. Computer Systems and Databases

Course Code	Course Title	Credit Hours
MSC 522	Web Database and Information Retrieval	3
MSC 523	Advanced computer Graphics	3
MSC 526	Data Warehouse and Mining Systems	3
MSC 530	Cyber Threat Analysis and Modeling	3
MSC 533	Advanced Topics in Databases	3
MSC 538	Secure software Engineering	3
CEN 570	Simulation and Modelling	3
CEN 580	Programmable System-on-Chip	3

3. Computer Networks and Security

Course Code	Course Title	Credit Hours
MSC 521	Computer Security	3
MSC 527	Object Oriented Programming and Designing	3
MSC 530	Cyber Threat Analysis and Modeling	3
MSC 531	Cybersecurity Principles	3
MSC 532	Cryptography	3
CEN 531	Information Policy	3
MSC 538	Secure Software Engineering	3
MSC 529	Operating Systems	3
MSC 542	Cybersecurity Policies, Ethics, and Law	3
MSC 541	Advanced Topics in Cybersecurity	3

4. **Software Engineering**

Course Code	Course Title	Credit Hours
MSC 524	Graphical User Interface	3
MSC 525	Software Project Management	3
MSC 535	Software Quality Management	3
MSC 537	Selected Topics in Software Engineering	3
MSC 538	Secure Software Engineering	3
MSC 540	Database System Implementation	3
CEN 570	Simulation and Modelling	3

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Curriculum Study Plan (Project Track)

Semester	Course Code	Course Title	Required or Elective	Credit Hours	Pre-requisite Courses
Semester 1	MSC 501	Advanced Design and Analysis of Algorithms	R	3	
	MSC 502	Software Engineering	R	3	
	MSC 503	Database Systems	R	3	
	MSC 504	Computer Networks and Security	R	3	
	Total			**12**	
Semester 2		Elective course	E	3	
		Elective course	E	3	
		Elective course	E	3	
	MCS 514	Research Methodology	R	3	
	Total			**12**	
Semester	**Course Code**	**Course Title**	**Required or Elective**	**Credit Hours**	
Semester 3		Elective course	E	3	
		Elective course	E	3	
		Elective course	E	3	
		Elective course	E	3	
		Elective course	E	3	
	Total			**15**	
Semester 4	MCS 599	Project	R	3	MCS 514
	Total			**3**	

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Curriculum Study Plan (Thesis Track)

Semester	Course Code	Course Title	Required or Elective	Credit Hours	Pre-requisite Courses
Semester 1	MSC 501	Advanced Design and Analysis of Algorithms	R	3	
	MSC 502	Software Engineering	R	3	
	MSC 503	Database Systems	R	3	
	MSC 504	Computer Networks and Security	R	3	
	Total			**12**	
Semester 2		Elective course	E	3	
		Elective course	E	3	
		Elective course	E	3	
	MSC 514	Research Methodology	R	3	
	Total			**12**	
Semester 3		Elective course	E	3	
		Elective course	E	3	
	MCS 600	Thesis (A, B)	R	6	MSC 514
	Total			**12**	
Semester 4	MCS 600	Thesis (C,D)	R	6	Thesis (A, B)
	Total			**6**	

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Courses Description

A) MSC Core Courses:

MSC 501 Advanced Design and Analysis of Algorithms (3 Credits)

This course offers a review of major data structures and basic design techniques mainly: Divide and conquer - Greedy method Backtracking - Dynamic programming. It also covers Parallel algorithms - Analysis of algorithms - Orders of magnitude - Lower bound theory - Time and space complexity - NP-hard and NP-complete problems - applications and examples - Correctness of algorithms - Structure of algorithms.

MSC 502 Software Engineering (3 Credits)

The course emphasis on the knowledge needed to be able to model, design, implement and evaluate larger software systems effectively. Software engineering is an inherently practical subject and applying the concepts being taught is a vital component of developing expertise in this area. The course aims to enable you to achieve the following: develop a deep understanding of the nature and impact of current challenges faced by the IT industry, Develop an awareness of the methodologies and technologies that are available within computer science to address these challenges, by evaluating and analyzing specific situations, and convey knowledge and develop practical skills in the use of some of these technologies, including both fundamental concepts and stateof-the-art support tools.

MSC 503 Database Systems (3 Credits)

To explain the concepts of Database systems, DBMS functions; database architecture and data independence, the different issues involved in the design and implementation of a database system, Data modeling, relational, hierarchical, manipulation and control languages to design and manage the database. Also, this course aims to explain the Database query languages: Overview of database languages; SQL; query optimization; 4th-generation environments; embedding non-procedural queries in a procedural language; introduction to Object Query Language and to design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS, Relational databases, the essential DBMS concepts and relational database design.

MSC 504 Computer Network and Security (3 Credits)

To provide comprehensive knowledge of the concepts of hardware and networking, expose the students to the various networking components and their organization, provide the in-depth knowledge of the principles of routing and the semantics and syntax of IP, an overview of the design and implementation aspects of networks, familiarize the student with current topics such as security, network management, sensor networks, and/or other topics, this course unit aims also to develop skills needed to go out and setup secured networks in small and medium sized organizations.

MSC 514 Research Methodology (3 Credits)

This course aims to pay attention to all dimensions of Research including, literature survey, design and implementation, finding and results, conclusion and research methodology. The course will enable the Researchers to develop the most appropriate methodology for their research studies. The mission of the course is to impart research skills to the postgrads and help them improve the quality of their research by the existing researchers. The course also focuses on foundations of research such as objectives, motivation, and concept of theory, deductive and inductive theories. Characteristics of scientific method, understanding the language of research, research process, problem identification and formulation, research question, research design such as concept and importance in research and features of a good research design.

599 Project (3 Credits) A dissertation project that is accomplished via the formal, academic, and scientific approach under the supervision of an academic advisor.

MSC 600 Thesis (12 Credits) A dissertation thesis that is accomplished via the formal, academic, and scientific approach under the supervision of an academic advisor.

B) MSC Elective Courses:

MSC 520 Artificial Intelligence (3 Credits)

This course aims to apply advanced techniques implemented to AI problem solving - Knowledge representation – Evolutionary algorithms – supervised learning - Learning by analogy - Learning by discovery - Self-reference and Self-production - Reasoning: causal reasoning - common sense reasoning - Bayesian network – logical agents and approaches - reasoning with uncertainty Confirmation theory - Belief theory - Necessity and possibility theory - Theory of endorsements - Spatial and temporal reasoning.

MSC 521 Computer Security (3 Credits)

Threats and vulnerabilities - Identification and authentication - Access control - Intrusion detection - Encryption and privacy Security policies and their evaluation.

MSC 522 Web Databases and Information Retrieval (3 Credits)

Modeling - Query operations - Markup languages - XML technologies and its applications - Searching the Web - IR models and Languages - Indexing and Searching - Digital libraries - Project: Designing and developing parts of IR Systems.

MSC 523 Advanced Computer Graphics (3 Credits)

Mathematics for computer graphics in three dimensions - Hierarchical representation and basic shapes - Surfaces and curves in three dimensions - Three-dimensional modelling - Solid bodies modelling – Three-dimensional viewing - Visible surface Illumination and shades - Texture mapping - Computer Graphics Systems: Open GL - Animation techniques - Case study.

MSC 524 Graphical User Interface (3 Credits)

This course aims to introduce the foundations of human computer interaction, to examine and teach structured approaches to the design of human computer interaction and how it fits into overall system development, to show how concepts from different disciplines are applied to the design of interactive SW systems, implement the techniques and skills to develop usable interactive SW systems, to be aware of the different interaction styles that can be used in the design of interactive software systems, to enable students to make sound judgments about the design of the user interface and its usability based on usability attributes and evaluation.

MSC 525 Software Project Management (3 Credits)

Introduction to project management - Basic activities of software project management -
Charts used in project management - Evaluation and acceptance of project phases - Advanced techniques of project management as for maintenance - Project scheduling - Project insurance and arbitrage - Project management tools - Case study.

MSC 526 Data Warehouse and Mining Systems (3 Credits)

Introduction to Decision Support Systems (DSS) - Development of DSS - Data
Modelling Techniques and Development of Data Warehouse in an architecture Environment - Study of different Data Warehouse Architectures and Development Techniques - User-Interface for Data Warehouses - Data Mining - Application Domains for Data Warehouse and Mining - Project: Development of a Prototypical Data Warehouse/Mining System.

MSC 527Object Oriented Programming and Designing (3 Credits)

This course introduces the concepts of object-oriented programming (OOP) and design principles. Students will learn how to design and implement software systems using an object-oriented approach, leveraging principles such as encapsulation, inheritance, and polymorphism. The course will cover advanced topics in OOP, including design patterns, software architecture, and best practices for writing maintainable and extensible code.

MSC 528 Selected Topics in Computer Science (3 Credits)

New trends in Computer science - methodology of application - current research topics.

MSC 529 - Operating Systems (3 Credits)
This course provides an in-depth understanding of the concepts and principles of modern operating systems. Students will learn about the key components and functions of an operating system, including process management, memory management, file systems, input/output (I/O) management, and security. The course will also cover advanced topics such as virtualization, distributed systems, and real-time operating systems.

MSC 530 - Cyber Threat Analysis and Modeling (3 Credits)
This course provides an in-depth exploration of cyber threats, attack techniques, and adversary models. Students will gain a comprehensive understanding of various cyber threat models, types of threats, and the motivations and capabilities of cyber adversaries. The course covers a wide range of attack techniques, including backdoors, Trojans, viruses, ransomware, wireless attacks, social engineering, and covert channels. Additionally, students will learn about password cracking, data interception, spoofing, session hijacking, data disclosure, alteration, and sabotage threats, as well as repudiation threats and denial of service attacks.

MSC 531 Cybersecurity Principles (3 Credits)
various threats, vulnerabilities, and risks associated with computer systems and networks, as well as the methods and techniques used to mitigate these risks. The course covers a range of topics, including cryptography, access control, network security, application security, and incident response and management.

CEN 531 Information Policy (3 Credits)
This course examines the legal, ethical, and regulatory aspects of information management and security. Students will learn about the policies, laws, and standards that govern the collection, use, storage, and dissemination of information, with a focus on privacy, intellectual property, and cybersecurity. The course will cover topics such as data protection regulations, information governance, risk management, and compliance frameworks.

MSC 532 Cryptography (3 Credits)
This course provides an in-depth study of cryptography, covering both theoretical and practical aspects. Students will learn about the fundamental principles of cryptography, including symmetric and asymmetric cryptography, hash functions, and cryptographic protocols. The course will also cover cryptanalysis techniques, key management, and real-world applications of cryptography in areas such as secure communications, data protection, and authentication.

MSC 533-Selected Topics in Database Systems (3 Credits)
Contemporary topics - recent research directions.

MSC 534 Expert Systems and Knowledge Eng. Applications (3 Credits)
A brief introduction to expert systems – A brief presentation of knowledge representation paradigms (the emphasis will be put on rule-based systems) - inference rules - resolution - basic aspects of reasoning under uncertainty - ·Case studies: MYCIN - CLIPS - Application Modeling in CLIPS.

MSC 535 Software Quality Management(3 Credits)
Introduction to Quality Management Systems and Total Quality - ISO Quality System and its application to software industry Capability Maturity Model (CMM) and its five levels - Tick IT system - Quality Assurance - Application of Quality Systems Software Tools for Quality - Case Study.

MSC 536 Selected Topics in Artificial Intelligence (3 Credits)
Contemporary topics and research in Artificial Intelligence - methodology of application - current research topics.

MSC 537 Selected Topics in Software Engineering (3 Credits)
New trends in the area of software engineering - methodology of application - current research topics.

MSC 538 Secure Software Engineering (3 Credits)
This course focuses on the principles and practices of developing secure software systems. Students will learn about the various security threats and vulnerabilities that can affect software applications, as well as the techniques and methodologies used to mitigate these risks throughout the software development life cycle (SDLC). The course covers topics such as secure coding practices, software security testing, and secure design patterns.

MSC 539 Neural Network and Machine Learning Applications (3 Credits)

Approaches to machine learning: Explanation-based learning - Learning by observation and discovery - Analogical and Casebased Learning - Learning Models - Evaluation of Learning Algorithms - Experimental Methodology - Empirical Learning Reinforced Learning and Genetic algorithms - Neural Computations: examples and applications - History of Artificial Neural System development - Fundamental Concepts and Models of Artificial Neural systems. Applications: Neural Network Simulation and Implementations and other emerging applications of Neural Algorithms and Systems.

MSC 540 Database System Implementation (3 Credits)

In this course we will study four major topics relating to database system implementation. The emphasis is on the ``systems'' components of a database management system. To better understand these components, a database implementation project will be required where you will build some of the basic ``system'' components for a simple database management system. We start with a brief overview of the basic components of a database system and discuss a set of open issues in designing and implementing a database management system, including relational DBMS and NoSQL database system before we detail the four core system components: Storage, Query Processing, Transaction Management and Distributed Data Management

MSC 541 - Advanced Topics in Cybersecurity (3 Credits)

This course explores advanced topics and emerging trends in the field of cybersecurity. Students will delve into specialized areas of cybersecurity, such as cloud security, mobile security, industrial control systems security, and cyber-physical system security. The course will also cover advanced techniques and tools used in cybersecurity operations, including threat hunting, incident response, and digital forensics.

MSC 542 - Cybersecurity Policies, Ethics, and Law (3 Credits)

This course examines the legal, ethical, and policy frameworks that govern cybersecurity practices and operations. Students will learn about the various laws, regulations, and standards that apply to cybersecurity, as well as the ethical considerations and guidelines for conducting cybersecurity activities. The course will also cover topics such as cybercrime, digital forensics, and incident response from a legal and policy perspective.