College of Sciences

- Master's of Science in Computer Sciences
- Master's of Science in Biotechnology

Department of Computer Sciences

1. Introduction\Program Mission

The Program mission is to prepare students to be fully abreast of the latest developments in all areas of computing. Graduates of this program are expected to competently fill key positions in their fields of interest and to lead the ongoing process of modernization and development in the United Arab Emirates and abroad.

2. Program Objectives

In line with the university's dedication to the highest spirit of scientific pursuit and learning as well as to the principle of instilling in its students a commitment to critical thinking and continuous progress, the M.Sc. program is oriented to achieve the following objectives:

- To strengthen the students' in-depth understanding of the field of computer science by providing them with strong theoretical & practical foundation.
- To extend to the students an environment, both stimulating and challenging, where they can study different subjects in several advanced areas.
- To equip the students with the necessary skills to meet the needs of the governmental and the business sectors in terms of highly trained and qualified IT professionals.
- To prepare the students to be able to pursue higher degrees and research, and be ready to properly fill computer science teaching positions in higher educational institutions.
- To build strong ties with other national and international academic institutions as well as with industry.

3. Program Structure and Requirements

The Department of Computer Science offers requires the following courses:

Requirement	Credits
Core Courses	10
Elective Courses	15
Thesis	9
Total	34

Students have to take ten credit hours in four core courses, 15 credit hours in five elective courses and 9 credit hours for the thesis. The work involved in the thesis is research-oriented and allows students to demonstrate an ability to do research and to do innovative work with minimal supervision.

3.1 Core Courses

Course #	Course Title	Credits	Prerequisites	Semester
1411550	Advanced Operating Systems	3	1411352 or equiv.	1
1411560	Object Oriented Software Engineering	3	1411363 or equiv.	1
1411570	Advanced Design & Analysis of Algorithms	3	1411371 or equiv.	2
1411590	Research Methodologies	1		2
Total		10		

3.2 Elective Courses

Elective computer science courses are to be chosen from a list of courses offered by the Department. Students are strongly encouraged to choose among alternative groupings of electives in different areas of computer science to fulfil breadth and depth requirements provided that at least six credit hours are to be taken from the group "Applications". The Department offers four general groupings:

- Applications
- Computer Systems
- Information Systems
- Theoretical Foundations

Prior to selecting any courses, students are required to consult their academic

advisors for approval. The groups and their associated courses are:

Group	Course #	Course Title	Credits	Prerequisites
Applications	1411530	Advanced Artificial Intelligence	3	1411330 or equiv.
	1411531	Machine Learning	3	1411330 or equiv.
	1411535	Computer Vision & Image Processing	3	1411330 or equiv.
	1411540	Advanced Computer Graphics	3	1411440 or equiv.
Computer Systems	1411552	Communications & Networking	3	1411451 or equiv.
	1411650	Parallel Computing	3	1411352 or equiv.
	1411652	Advanced Computer Architecture	3	1411352 or equiv.
Information Systems	1411565	Data Management & the Internet	3	1411362 or equiv.
	1411660	Topics in Software Engineering	3	1411560
	1411662	Topics in Database Systems	3	1411362 or equiv.
Theoretical Foundations	1411572	Computational Geometry	3	1411371 or equiv.
	1411670	Theory of Computation and Complexity	3	1411371 or equiv.

3.3 Master's Thesis

An M.sc. thesis typically consists of a thorough, integrated literature survey in a specific area, with a critical analysis of approaches and results, and a discussion of areas requiring further work. In addition, it includes a report on the research undertaken by the student. The report must constitute sufficient evidence of students' mastery of the research area. A student can register the thesis after completing successfully 18 credits. The student must present a technical seminar based on the thesis research, prior to the scheduling of the final oral examination. An examination committee will re-view the thesis to determine whether or not it meets the standards set, and will conduct an oral examination to test the candidate's knowledge of the thesis subject and related fields. The examining committee will be formed in accordance with the University graduate regulations.

4. Study Plan:

Semester			Semester 2		
Crs. No.	Course Title	Cr. Hrs.	Crs. No.	Course Title	Cr. Hrs.
1411550	Advanced Operating Systems	3	1411560	Object Oriented Software Engineering	3
1411570	Advanced Design & Analysis of Algorithms	3	1411xxx	Elective	3
1411xxx	Elective	3	1411xxx	Elective	3
		9			9

Semester 3			Semester 4		
Crs. No.	Course Title	Cr. Hrs.	Crs. No.	Course Title	Cr. Hrs.
1411xxx	Elective	3	1411695	MSc Thesis	9
1411xxx	Elective	3			
1411590	Research Methodologies	1			
		7			9

5. Course Description

1411530	Advanced Artificial Intelligence	3

Prerequisite: 1411330 or equivalent or written consent of instructor. Knowledge representation; production rules; resolution; deductive and knowledge-based systems. Reasoning under uncertainty: Bayesian reasoning; certainty factors; Dempster-Shafer theory; fuzzy logic; expert systems and knowledge engineering.

1411531	Machine Learning	3

Prerequisite: 1411330 or equivalent or written consent of instructor. Learning problems; concept learning; decision tree learning; artificial neural networks; genetic algorithms; inductive and analytical learning; case-based reasoning; explanation-based learning; and knowledge-based artificial neural networks.

1411535	Computer Vision & Image Processing	3

Prerequisite: 1411330 or equivalent or written consent of instructor.

Image processing basics; image segmentation and region analysis; thresholding; connected component labelling; pattern recognition; morphology; image and video; motion detection and compensation; stereo vision and depth perception; knowledge-based vision; biometrics-based authentication and identification; and special-purpose computers for vision applications.

1411540	Advanced Computer Graphics	3

Prerequisite: 1411440 or equivalent or written consent of instructor. Principles and properties of lighting models such as Phong shading, ray tracing and radiosity; a selection of visualization and modelling techniques;
2D and 3D animation techniques; and color and human perception.

1411550	Advanced Operating Systems	3

Prerequisite: 1411352 or equivalent or written consent of instructor Centralized and distributed operating systems; distributed system structures; synchronization in distributed systems; processes and processors in distributed systems; distributed shared memory; protection and security. Distributed file systems

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1411552	Communications & Networking	3

Prerequisite: 1411451 or equivalent or written consent of instructor. Resource sharing; computer traffic characterizations; layered network structure; network design and optimization; network protocols; routing, flow control and extended error control techniques; introduction to formal techniques for protocol specification, and verification and testing.

1411560	Object Oriented Software Engineering	3

Prerequisite: 1411363 or equivalent or written consent of instructor. Conventional methodologies such as Structured, JSD, SADT, etc.; OO paradigm; OO design methodologies (OMT, Booch's,Yourdon's methodologies): a comparative study; conversion from imperative to OO designs. Evaluation of OO designs and software metrics. Use of OO methodologies in various application domains such as multimedia, hypermedia, etc. Automation of the methodologies; OO design evaluation. Case Study.

1411565	Data Management & the Internet	3

Prerequisite: 1411362 or equivalent or written consent of instructor. Fundamental concepts in database management systems; Web as a medium for sharing and interoperating databases across the Internet; mathematical models and measurements of the Web; URL sampling and search engines; data integration and interchange; XML solutions; querying XML data; storing XML data; data mining, and selected topics.

1411570	Advanced Design & Analysis of Algorithms	3

Prerequisite: 1411371 or equivalents or written consent of instructor.
The course concentrates on developing and analyzing algorithms for problems, which arise in various applications such as shortest path problems, depth first search and applications, general matching, planarity testing, graph colorability, etc. Depending on the year and instructor, a treatment of topics such as, randomized algorithms, average case analysis of algorithms, the class of #P and algorithms for enumeration problems may be covered.

1411572	Computational Geometry	3

Prerequisite: 1411371 or equivalents or written consent of instructor.
The design and analysis of algorithms for geometric problems including convexity, intersection, triangulation, search, proximity and optimization. Lower bound arguments, NP-completeness results, probabilistic algorithms, approximation algorithms, dynamization techniques, and other issues applicable to geometric problems. Applications of geometric algorithms are emphasized.

1411590	Research Methodologies	1

Prerequisite: Graduate-level standing
This course explores the research process in general and the resources for research in computer science. Traditional research approaches and use of emerging technology will be discussed. Attendance at Department seminars and classes is required.

1411630	Topics in Artificial Intelligence	3

Prerequisite: 1411330 or equivalents or written consent of instructor.
Various topics can be covered subject to the interest of the students and the availability of faculty. Such topics include: natural language processing; machine translation; speech processing; foundations and applications of logic programming; intelligent computer-aided design; etc.

1411635	Computational Robotics	3

Prerequisite: 1411330 or equivalents or written consent of instructor. Algorithmic fundamentals of robotics: representing rigid bodies, polyhedral models, representing rotations, configuration space; elementary notions from algorithms and geometry: computational complexity, O notation, graph search techniques, convex hull, intersection detection, algorithms for distance calculations; gross motion planning: global motion planning, local collision avoidance, planning with non-holonomic constraints, and path planning in dynamic environments.

1411640	Topics in Graphics & HCI	3

Prerequisite: 1411440 or equivalents or written consent of instructor.
Topics of current research interest in advanced graphics and human interfaces, chosen from such areas as intelligent user interfaces, user modelling, user interface design, visualization, computer animation, advanced multimedia, and computer-based training using visual display, touch, gesture, and marking; speech, language, and audition; subject to the interests and availability of faculty.

1411650	Parallel Computing	3

Prerequisite: 1411352 or equivalents or written consent of instructor. Principles and practice of parallel computing; design, implementation, and evaluation of parallel programs for shared-memory architectures, local- memory architectures, and vector processors.

1411652	Advanced Computer Architecture	3

Prerequisite: 1411351 or equivalents or written consent of instructor. Interaction between computer systems hardware and software. Pipeline techniques - instruction pipelines -arithmetic pipelines. Instruction level parallelism. Parallel and distributed system architecture. Cache mechanism. I/O structures. Examples taken from existing computer systems.

1411660	Topics in Software Engineering	3

Prerequisite: 1411560 or written consent of instructor.
Study of formal methods in software engineering: formal specification; algebraic specification; model-based specification; inductive specification; automated program transformation; automated test generation; towards automated program maintenance.

1411662	Topics in Database Systems	3

Prerequisite: 1411362 or equivalents or written consent of instructor.
OO data modelling; OO DBs; version management; schema evolution; query processing and optimization; transaction management; authorization and security in OO databases; client/server environment and distributed databases; and deductive databases.

1411670	Theory of Computation and Complexity	3

Prerequisite: 1411371 or equivalents or written consent of instructor.
Study of the nature and complexity of computations; formal theory of computability and decidability; complexity on Turing machines; RAMs and circuits; non-deterministic computation and NP-completeness; new developments on topics including randomized algorithms; parallel computation; counting problems; and approximation.

1411695	Thesis	9

Prerequisite: Completion of 18 credits.
An independent research project carried out under the supervision of a faculty member. The work must be non-trivial, but is not necessary sufficiently original for publication in the open literature. A successful defence of the thesis leads to Pass grade.