



Master of Science in Computer Science

*Department of Computer Science
Jordan University of Science and Technology
Faculty of Computer and Information Technology*

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Preface

The demand on IT higher education has witnessed an astonishing increase in the Hashemite Kingdom of Jordan and worldwide, which is derived by many factors related to the continuous and ever-increasing competition from educational institutes and IT industries to attract IT professionals from all over the globe. This tight global completion has left our national IT educational systems in a difficult situation in terms of fulfilling staffing needs, particularly qualified instructors and faculty members. This is true not only for Jordan University of Science and Technology but also for many schools around the Hashemite Kingdom of Jordan.

One obvious solution to the problem of supplying the badly needed instructional staff is through a higher educational system that delivers the required expertise. In fact, the Dean's Council in Jordan University of Science and Technology has decided on May 2003 to establish a graduate program that leads to a master degree in Computer Science. In compliance with this resolution, the Department of Computer Science is offering a master program. The master program is designed to

- deliver a solid curriculum in computer science, which conforms to guidelines laid by the down College of Graduate Studies at Jordan University of Science And Technology.
- guarantee liberal choices to its candidates so that they can pick and choose from the various elective topics and emphasis areas that best fit their future career endeavors.
- supply our local industries and educational systems with qualified IT educationalists.
- emphasize the significance of conducting applied research that has direct impact on the concerns of the local community.
- prepare qualified candidates for further higher education opportunities.
- establish collaborative links and joint research programs in other departments in and outside the University.

MINIMUM ADMISSION REQUIREMENTS

Applicants to the masters program in Computer Science should comply with the rules and regulations of the masters program at the University issued by the Dean's council in 1997, resolution number 606/97.

THESIS OPTION

This option requires successfully defending a 9-credit master thesis that complies with the University guidelines plus the completion of 25 credit hours of graduate course work. These 34 credit hours are distributed as follows:

- 10 credit hours of core course work.
- 15 credit hours of electives selected from list B with advisor approval.
- 9 credit hours of thesis work.

The prerequisite information for all CS graduate courses will be resolved case-by-case (for each applicant) as approved by the CS Department Board.

A) Core Courses for the Thesis Option (10 Credit hours).

Course Code	Course Name	Credits
CS 728	Advanced Database Systems	3
CS 775	Advanced Operating Systems	3
CS 784	Advanced Algorithms	3
CS 789	Seminar in Advanced Computer Science Topics	1

B) Elective Courses for the Thesis Option (15 Credit hours).

Course Code	Course Name	Credits
CS 710	Advanced Software Engineering	3
CS 713	Software Project Management and Quality Assurance	3
CS 721	Information Retrieval Systems	3
CS 722	Natural Language Processing	3
CS 727	Object Oriented Databases	3
CS 729	Advanced Methods in Data Mining	3
CS 731	Theory of Programming Languages	3
CS 742	Advanced Computer Networks	3
CS 751	Advanced Computer Architecture	3
CS 754	Parallel and Distributed Computing	3
CS 762	Advanced Artificial Intelligence	3
CS 766	Expert Systems and Heuristic Programming	3
CS 771	Theory of Languages, Automata, and Complexity	3
CS 772	Formal Compiling Methods	3
CS 780	Advanced Computer Graphics	3
CS 795	Selected Topics in Computer Science	3
	Up to 6 credit hours graduate courses selected from other Departments with advisor approval	0-6

C) Thesis (9 Credit hours)

Course Code	Course Name	Credits
CS 799a	Master's Thesis	9
CS 799b	Master's Thesis	6
CS 799c	Master's Thesis	3
CS 799d	Master's Thesis	0

WORK PLAN (THESIS OPTION)

The recommended work plan for thesis option is summarized in the subsequent tables. Although the thesis will be registered in the last semester, it is highly recommended that a student choosing this option should start thinking about and discussing his/her thesis topic with faculty members ahead of time. Developing a successful thesis usually requires more than one semester.

First semester / First year

Course Code	Course Name	Credits
CS 775	Advanced Operating Systems	3
CS 784	Advanced Algorithms	3
CS 789	Seminar in Advanced Computer Science Topics	1
Total		7

Second semester / First year

Course Code	Course Name	Credits
CS 728	Advanced Database Systems	3
	Elective course	3
	Elective course	3
Total		9

First semester / Second year

Course Code	Course Name	Credits
	Elective course	3
	Elective course	3
	Elective course	3
Total		9

Second semester / Second year

Course Code	Course Name	Credits
CS 799a	Master's Thesis	9
Total		9

NON-THESIS OPTION

This option requires the completion of 34 credit hours of graduate course work and passing a comprehensive examination.

The 34 credit hours of required graduate course work are distributed as follows:

- 19 credit hours of core course work.
- 15 credit hours of elective selected from list B with advisor approval.

A) Core Courses for the Non-Thesis Option (19 Credit hours)

Course Code	Course Name	Credits
CS 710	Advanced Software Engineering	3
CS 728	Advanced Database Systems	3
CS 742	Advanced Computer Networks	3
CS 775	Advanced Operating Systems	3
CS 784	Advanced Algorithms	3
CS 789	Seminar in Advanced Computer Science Topics	1
CS 790	Project	3

B) Elective Courses for the Non-Thesis Option (15 Credit hours).

Course Code	Course Name	Credits
CS 713	Software Project management and Quality Assurance	3
CS 721	Information Retrieval Systems	3
CS 722	Natural Language Processing	3
CS 727	Object Oriented Databases	3
CS 729	Advanced Methods in Data Mining	3
CS 731	Theory of Programming Languages	3
CS 751	Advanced Computer Architecture	3
CS 754	Parallel and Distributed Computing	3
CS 762	Advanced Artificial Intelligence	3
CS 766	Expert Systems and Heuristic Programming	3
CS 771	Theory of Languages, Automata, and Complexity	3
CS 772	Formal Compiling Methods	3
CS 780	Advanced Computer Graphics	3
CS 795	Selected Topics in Computer Science	3
	Up to 6 credit hours graduate courses selected from other Departments with advisor approval	0-6

WORK PLAN (NON-THESIS OPTION)

First semester / First year

Course Code	Course Name	Credits
CS 775	Advanced Operating Systems	3
CS 784	Advanced Algorithms	3
CS 789	Seminar in Advanced Computer Science Topics	1
Total		7

Second semester / First year

Course Code	Course Name	Credits
CS 710	Advanced Software Engineering	3
CS 728	Advanced Database Systems	3
CS 742	Advanced Computer Networks	3
Total		9

First semester / Second year

Course Code	Course Name	Credits
	Elective course	3
	Elective course	3
	Elective course	3
Total		9

Second semester / Second year

Course Code	Course Name	Credits
	Elective course	3
	Elective course	3
CS 790	Project	3
Total		9

APPENDIX A: COURSE DESCRIPTION

CS 710 Advanced Software Engineering

3 Credit Hours

Study of advanced principles and practices in software engineering—including evolutionary software development, software prototyping, object-oriented analysis and design, software system architectures, software project management, software testing, software metrics and measurement, software quality assurance, software reuse, software maintenance, reverse engineering, and computer-aided software engineering.

CS 713 Software Project Management and Quality Assurance

3 Credit Hours

Managing people, management by metrics, feasibility and early planning, models for managerial planning, software quality assurance, software resource estimation, and reliability.

CS 721 Information Retrieval Systems

3 Credit Hours

Design concepts and approaches, vocabulary control and indexing languages, text retrieval issues (such as parallel retrieval, retrieval algorithms, stemming algorithms, parallel query-document comparison functions, output ranking, association weighting, etc.), searching models (building block, citation pearl growing, successive fractions, most specific facet first, lowest posting first, etc.), retrieval effectiveness (relevance, precision and recall, probability ranking, retrieval limits etc.), information retrieval experiments methodologies, case studies (such as Cranfields, Medlars, Thomas, CONIT, etc.), and retrieval languages.

CS 722 Natural Language Processing

3 Credit Hours

An introduction to the problems of computing with human languages. Parsing. Semantic representations. Text generation. Lexicography. Discourse. Sublanguage studies. Applications to CAI, database interfaces and information retrieval.

CS 727 Object-Oriented Databases

3 Credit Hours

Basic concepts for using object databases. Complex data. Comparing the Object and Relational models. Types of products that handle objects. DBMS standards for objects. The OMG Object Model. Object SQL (A language for the design and implementation of object databases. OQL “C++”: Extending C++ with an object query capability. C++ bindings to an object database. View support in object-oriented database systems. Authorization in object-oriented databases. Query Processing in object-oriented database systems. Physical object management. Versions. Object-oriented Database Systems: Promises, Reality, and Future. Where Object-Oriented DBMS Should Do Better: A Critique Based on Early Experiences.

CS 728 Advanced Database Systems

3 Credit Hours

Enhanced Entity–Relationship (EER) and object modeling. EER to relational model mappings, tuple relational calculus and domain relational calculus, overview of Query By Example (QBE), database systems architecture and system catalog, query processing and optimization, transaction processing concepts, concurrency control techniques, database recovery techniques, database security and authorization, enhanced data models and advanced applications (object–relational and extended–relational models).

CS 729 Advanced Methods in Data Mining

3 Credit Hours

Advanced techniques in data mining Topics may include: Association Rule Mining, Classification, Clustering, Text Mining, Knowledge Extraction, Web Information Retrieval, Mediators, Wrappers and Data Warehousing, Web Mining and Crawling, Decision Trees, Statistical Methods, Pattern Recognition and Machine Learning Techniques.

CS 731 Theory of Programming Languages

3 Credit Hours

An exploration of modern or unconventional concepts of programming languages, their semantics, and their implementations; abstract data types; functional, object–oriented, logic programming, and concurrency. Example languages include ML, Ada, Oberon, PROLOG, Modula 2, and CSP.

CS 742 Advanced Computer Networks

3 Credit Hours

Wire and Wireless Networks, Channel Propagation Model, Multiple Access, High–speed networks, ISDN, N–ISDN, B–ISDN, Multimedia Networks, Optical Networks, Bandwidth allocation, flow control, Design and performance issues, Frame Relay, Congestion Control, Applications, ATM, Traffic Management, Quality of Service, Voice/IP, IP/ATM, Mobile Communication Fundamentals, Generic Mobile Network, GSM Cellular, and Current research directions.

CS 751 Advanced Computer Architecture

3 Credit Hours

Array, parallel, and pipeline architectures; multiple processor systems, and concepts of data flow and high–order language architectures. Performance evaluation of computer systems.

CS 754 Parallel and Distributed Computing

3 Credit Hours

The course is centered on three concepts: Architectures, Algorithms and Programming. Parallel and Distributed architectures: parallel and distributed computers taxonomy, examples of parallel and distributed computers, fundamental communication operations, and performance metrics. Parallel algorithms: design and analysis of parallel algorithms with emphasis on sorting, matrix problems, and graph problems. Parallel programming: types of parallelism, parallel programming paradigms, message passing programming, data and parallel programming.

CS 762 Advanced Artificial Intelligence

3 Credit Hours

AI concepts and methods for problem solving, heuristic search, planning, hypothesis formation, modeling and knowledge representation, knowledge acquisition (learning), and AI's programming methodologies and tools. Applications of AI in areas of automatic programming, theorem proving, game playing, machine vision, natural language systems, and robots. Mobile agents and probabilistic reasoning.

CS 766 Expert Systems and Heuristic Programming

3 Credit Hours

Expert systems concepts and their architectures. Languages and tools for knowledge engineering. Heuristic versus algorithmic methods, treatment of heuristics as used in expert systems, and heuristic programming techniques. Class and individual projects to illustrate concepts.

CS 771 Theory of Languages, Automata, and Complexity

3 Credit Hours

Finite-state, context-free, context-sensitive, recursive languages. Turing machines. Partial recursive functions. Chomsky hierarchy. Grammars and automata. Rice's theorem. Church's Thesis. Undecidability. Reducibility and completeness. Time complexity and NP-completeness. Probabilistic computation. Interactive proof systems.

CS 772 Formal Compiling Methods

3 Credit Hours

Lexical analysis; syntactic analysis; error detection; translation into intermediate code; storage allocation; optimization techniques. Models of syntactic analysis, including canonical precedence, LR(k) and LL(k) parsing methods and variants; efficiency of each. Synthesis techniques, including symbol tables, storage administration, parameter mechanisms, garbage collection; optimization considerations. Models of synthesis, including level, affix, attributed grammars. Students are expected to complete a large programming project as part of the course.

CS 775 Advanced Operating Systems

3 Credit Hours

Process Management: process concepts; asynchronous concurrent processes; deadlock and indefinite postponement; Storage Management: real storage; virtual storage organization; virtual storage management; Process Management: job and processor scheduling; Auxiliary Storage Management: disk performance optimization; Review of multiprogramming operating systems including process distributed memory multiprocessors and distributed systems. Topics include distributed file systems, concurrency, and distributed process coordination. Introduction to network communication issues and special purpose systems such as real time systems, transaction processing systems, and client-server technology. Network Operating Systems; Distributed Operating Systems.

CS 780 Advanced Computer Graphics

3 Credit Hours

Overview of display devices and applications. Vector graphics in two and three dimensions. Image generation, representation, and manipulation. Homogeneous coordinates. Modeling and hidden line elimination. Introduction to raster graphics. Perspective and parallel projections. Advanced topics in computer image generation. Scene representation: parametric surfaces, stochastic modeling, procedurally defined objects, volumetric models. Image rendering: scanline and ray-tracing algorithms, smooth shading and coloring, texture and bump mapping. Anti-aliasing. Additional course content variable, depending on state of the art and current research trends.

CS 784 Advanced Algorithms

3 Credit Hours

Strategies of algorithms synthesis and analysis. Design methodologies of classical algorithm categories such as: divide-and-conquer, greedy method, dynamic programming, search and traversal, backtracking, and branch-and-bound. Computational complexity and important theoretical results from lower-and upper-bound studies, NP-hard, and NP-complete problems.

CS 789 Seminar in Advanced Computer Science Topics

1 Credit Hours

By studying this course students will be taught how to write a proposal, find related material (in the library, on the web, etc), present their work in front of audience, defend their work, know art of writing scientific papers, etc.

CS 790 Project

3 Credit Hours

The student implements, tests and presents a project. Also a written report should be submitted to the Department and the project supervisor.

CS 795 Selected Topics in Computer Science

3 Credit Hours

Appropriate coverage in terms of breadth and depth of a selected area that reflects the state of the art in IT.

CS 799a Master's Thesis

9 Credit Hours

Program of research leading to an M. Sc. degree, arranged between a student and a faculty member.

CS 799b Master's Thesis

6 Credit Hours

Program of research leading to an M. Sc. degree, arranged between a student and a faculty member.

CS 799c Master's Thesis

3 Credit Hours

Program of research leading to an M. Sc. degree, arranged between a student and a faculty member.

CS 799d Master's Thesis

0 Credit Hours

Program of research leading to an M. Sc. degree, arranged between a student and a faculty member.

APPENDIX B: LIST OF GRADUATE COURSES

Course Code	Course Name	Credits
CS 710	Advanced Software Engineering	3
CS 713	Software Project Management and Quality Assurance	3
CS 721	Information Retrieval Systems	3
CS 722	Natural Language Processing	3
CS 727	Object-Oriented Databases	3
CS 728	Advanced Database Systems	3
CS 729	Advanced Methods in Data Mining	3
CS 731	Theory of Programming Languages	3
CS 742	Advanced Computer Networks	3
CS 751	Advanced Computer Architecture	3
CS 754	Parallel and Distributed Computing	3
CS 762	Advanced Artificial Intelligence	3
CS 766	Expert Systems and Heuristic Programming	3
CS 771	Theory of Languages, Automata, and Complexity	3
CS 772	Formal Compiling Methods	3
CS 775	Advanced Operating Systems	3
CS 780	Advanced Computer Graphics	3
CS 784	Advanced Algorithms	3
CS 789	Seminar in Advanced Computer Science Topics	1
CS 790	Project	3
CS 795	Selected Topics in Computer Science	3
CS 799a	Master's Thesis	9
CS 799b	Master's Thesis	6
CS 799c	Master's Thesis	3
CS 799d	Master's Thesis	0