

# Master of Science in Computer Science

## Administrative Unit

The program is administered by the Office of Graduate Studies and Research through the Faculty of Computer Science, Department of Mathematics and Computer Science, College of Arts and Sciences.

## Objectives

The overall mission of the Master's of Science in Computer Science program is to prepare computer systems professionals to undertake leadership roles in business, industrial, and technology-based organizations. In addressing that mission, the following specific goals have been identified for the program:

- To instill in our graduates high principles of security, quality, and professional ethics.
- To prepare those who choose to do so to continue graduate work leading to the doctorate in computing.
- To prepare graduates who can apply and adapt business systems in distributed environments.

The program will have an overall emphasis on distributed computer systems, addressing both the architecture and the applications of the systems.

## Admission Requirements

*General* - Students who wish to enter the program must meet the general University requirements for admission to a graduate program.

*Departmental* - To be considered as having adequate preparation for the computer science master's program, students must present evidence of having completed courses equivalent to the following UT Permian Basin undergraduate computer science and mathematics courses. Students not adequately prepared may be admitted conditionally with the requirement that any course in this list not already completed be completed with a grade of B or better. Students admitted conditionally to computer science must complete assigned requirements before beginning the actual degree program.

- COSC 1430, 2430 - CS 1 and 2, with programming experience in Java
- COSC 3310 - Digital Computer Organization
- COSC 3312 - Discrete Mathematics
- COSC 3315 - Information Systems
- COSC 3420 - Data Structures
- MATH 2413, 2414 - Calculus and Analytic Geometry 1, 2

Descriptions of these courses can be found in the Computer Science and Mathematics sections of the undergraduate catalog at:

[http://www.utpb.edu/utpb\\_student/undgrad\\_catalog/ug\\_cat2\\_comp\\_science.htm](http://www.utpb.edu/utpb_student/undgrad_catalog/ug_cat2_comp_science.htm)

[http://www.utpb.edu/utpb\\_student/undgrad\\_catalog/ug\\_cat2\\_math.htm](http://www.utpb.edu/utpb_student/undgrad_catalog/ug_cat2_math.htm)

*Additional Background* - Several of the graduate courses have undergraduate prerequisites beyond these program prerequisites. Students are not required to complete these courses prior to admission to the graduate program and many will have completed them in their undergraduate program. In each case, the prerequisite course must be completed before undertaking the course for which it is a prerequisite. Up to two such courses, if not already taken as part of the undergraduate program, may be counted in the graduate degree program.

Here is the list of such courses:

- COSC 4330 – COSC 6310 (Computer Architecture)
- COSC 4370 – COSC 6370 (Networking), 6375 (Distributed Systems)
- COSC 4415 – COSC 6315 (Distributed Database Systems)
- COSC 4460 – COSC 6360 (Software Engineering)

More information regarding admissions can be found at:

[http://www.utpb.edu/utpb\\_student/grad\\_catalog/main\\_admissions.htm](http://www.utpb.edu/utpb_student/grad_catalog/main_admissions.htm)

## **Degree requirements**

### **Core Course Requirements**

- COSC 6310 – Computer Systems Architecture
- COSC 6315 – Distributed Database Systems
- COSC 6360 – Software Engineering in Distributed Environments
- COSC 6370 – Networking
- COSC 6375 – Distributed Systems

### **Computer Science Electives**

- COSC 6320 – Data Modeling and Mining
- COSC 6325 – Advanced Operating Systems and Real-time Computing
- COSC 6378 – Computer and Network Security
- COSC 6380 – Programming Languages and Concurrency Issues
- COSC 6385 – Analysis of Algorithms
- COSC 6390 – Theory of Computation

### **Program overview**

Every student completes a 36 credit hour program as follows:

- the five core courses 6310, 6315, 6360, 6370, 6375 (15 hours)
- at least two more graduate computer science courses (6 hours)
- three more elective courses, which may include courses from outside computer science approved by the student's committee, or may be additional computer science courses (9 hours)
- either a project or a thesis, either is the equivalent of two courses (6 hours)
- make an oral presentation of the results of the thesis or project effort

### **Course Listing**

#### **COSC 6310 Computer Systems Architecture (3)**

A study of the internal design and organization of computer architectures. Topics include computer systems design and architecture, such as pipe-lining and instruction-level parallelism, memory hierarchy system, interconnection networks, and multiprocessors. Focusing on a stored program computer system using logic gates, flip-flops, and components from a given library of digital components. (prerequisite COSC 4330 or equivalent or permission of the instructor)

#### **COSC 6315 Database Systems (3)**

A study of advanced topics in database systems. Topics include relational database theory, query optimization, recovery techniques, concurrency control, security and integrity, distributed database systems, object oriented database systems and real-time database systems. (Prerequisite: COSC 4415 or equivalent or permission of the instructor)

**COSC 6320 Data Modeling and Mining (3)**

A study of how data mining can be used to construct models of data. Topics include data-oriented structures, data modeling techniques, data warehouses, and data mining algorithms such as market basket analysis, nearest neighbor, and decision trees. (Prerequisite: COSC 6315)

**COSC 6325 Advanced Operating Systems and Real-time Computing (3)**

A study of advanced topics in computer operating systems. Topics include process management, virtual memory, inter-process communication, context-switching, concurrent processing, load balancing, real-time operating systems and distributed operating systems. (Prerequisite: COSC 6310)

**COSC 6360 Software Engineering in Distributed Environments (3)**

Students will work in groups to apply software engineering principles to large applications development and maintenance projects. Software engineering principles for project management, procurement requirements, analysis and design, construction, quality and security control, and implementation will be studied. (Prerequisite: COSC 4460 or equivalent or permission of the instructor)

**COSC 6370 Networking (3)**

A study of design and analysis of computer communication networks. Topics include queuing systems, data link protocols, topological design, router design, mobility, peer-to-peer networking, multimedia networking, and network performance evaluation.

(Prerequisite: COSC 4370 or equivalent or permission of the instructor)

**COSC 6375 Distributed Systems (3)**

The course will cover both the hardware and software issues involved in computer systems that are distributed over multiple processors and multiple machines. The Internet will be used as an example of a distributed system.

Principles of distributed systems such as synchronization, sharing of resources, and data communications will be a primary focus of this course. Students will do a hands-on project with a distributed system. (Prerequisites: COSC 4330 and COSC 4370 or permission of the instructor)

**COSC 6378 Computer and Network Security (3)**

Issues in setting up and maintaining a secure network will be studied in detail. Current issues and security trends will be covered as well as standards for security and a study of the most prominent security websites and organizations. Various security measures such as cryptography will be investigated. (Prerequisites: COSC 6310 and COSC 6370)

**COSC 6380 Programming Languages and Concurrency Issues (3)**

Principles of language design and programming paradigms will be covered. Various programming languages will be analyzed and compared with an emphasis on concurrency issues prevalent in a distributed environment and the effects of different languages on the issues. (Prerequisite: COSC 6390)

**COSC 6385 Analysis of Algorithms (3)**

A study of efficient algorithms for a variety of problems, with mathematical proof of correctness and analysis of space and time complexities. Topics include upper bound, lower bound, and average case analysis for sorting, amortized analysis of data structures, tree and graph algorithms, parallel algorithms, and NP-completeness.

(Prerequisite: COSC 3312 or equivalent or permission of instructor)

**COSC 6389 Selected Topics (3)**

Graduate courses that are offered only once, will be offered infrequently, or are being developed before a regular listing in the catalog.

**COSC 6390 Theory of Computation (3)**

The goal of the course is to discover what is (and is not) computable. Mathematical models of computation, including regular expressions, grammars, recursive functions, and the automata that model them, including Turing machines.

The course culminates with a discussion of Church's thesis, Gödel numbering, and the Halting Problem.

(Prerequisite: COSC 3312 or equivalent or permission of instructor)

**COSC 6391 Contract Study (3)**

For students who are pursuing independent study or research (as described in the contract study form).

**COSC 6398 Project (3)**

The design and development of a significant project, applying the principles and theories of computer and information systems to a real world problem. The project will ordinarily involve an extensive review of the literature, considerable work in the laboratory, and may include the formulation and testing of hypotheses.

**COSC 6399 Thesis (3)**

Research in the application of the principles and theories of computer and information systems to some problem of interest. The research is usually a laboratory or field experiment requiring a thorough review of the literature, the formulation of hypotheses, the collection and analysis of data, and the testing of the hypotheses. (Prerequisite: MATH 6301 or equivalent)

**MATH 6301 Statistics (3)**

Statistical concepts emphasizing simple and multiple regression, hypothesis testing and analysis of variance. (prerequisite one year of college level mathematics)