

**TCSS 372 Master Syllabus
(Approved: June 2, 2017)
(Effective: Autumn 2017)**

Course Title

Computer Architecture

Catalog Description

Covers the microarchitecture level of machine design and advanced architecture features for performance enhancement. Topics include computer performance measures, microarchitecture instructions, CPU design (datapath, pipelines, control unit, instruction level parallelism), memory hierarchy, cache memory, virtual memory, parallel processing and multicore architectures. Prerequisite: a minimum grade of 2.0 in TCSS 371.

Preconditions

Prior to taking the class, students must be able to:

- explain the function of basic digital logic circuits
- translate between assembly instructions and machine code
- write short programs in assembly language including function calls
- explain the instruction execution cycle

Course Objectives

The objectives of this course are to teach students:

- Assembly programming
- CPU implementation, i.e. control signals in single and multi-cycle machines
- Pipeline architectures and hazard handling
- Memory hierarchy organization
- Cache and virtual memory organization
- Microprogramming
- Parallel architectures

Student Learning Outcomes

Upon successful completion of the course, students should be able to:

- write assembly programs
- explain the hardware implementation of micro architecture instructions
- trace the flow of data and control signals through a datapath
- explain the principles of cache and virtual memories
- explain the principles of parallel processing and multicore architectures

Relationship of this course to CSS student learning outcomes:

This course supports and assesses the achievement of the following elements of the program objectives:

- An ability to apply knowledge of computing and mathematics appropriate to the discipline
- An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

- An ability to use current techniques, skills, and tools necessary for computing practice.

Relationship to UWT student learning goals (to be added to syllabus handed out to students)

- *Inquiry and Critical Thinking*: Students will acquire skills and familiarity with modes of inquiry and examination from diverse disciplinary perspectives, enabling them to access, interpret, analyze, quantitatively reason, and synthesize information critically.
- *Communication/Self-Expression*: Students will gain experience with oral, written, symbolic and artistic forms of communication and the ability to communicate with diverse audiences. They will also have the opportunity to increase their understanding of communication through collaboration with others to solve problems or advance knowledge.

Topics Covered:

- **Computer Performance Evaluation**
 - Performance measures
 - CPI (Cycles per Instruction)
 - Amdahl's Law
 - Benchmarking
- **CPU Design**
 - Datapath implementation,
 - Instruction-level parallelism
 - Instruction pipelining and hazards
 - Control unit realization
- **Memory System**
 - Storage technologies
 - Memory hierarchy and localities
 - Cache memory
 - Virtual memory
 - RAID architectures
- **Parallel Processing**
 - Flynn's Taxonomy
 - Multi-threading
 - Multicore architectures
 - Shared memory
 - Cache coherence