COURSE OUTLINE

COS231 — **Fundamentals of Computer Architecture & Assembly Language**

Course Number — **Course Title**

4 — **3 Lecture Hours/Week and 2 Lab Hours/Week**

Credits — **Hours: lecture/laboratory/other (specify)**

Catalog description:

Explores the levels of organization in digital computers: logic circuit design, integrated circuits and assembly language coding

Prerequisites: COS102 or permission of department **Corequisites: none**

Required texts/other materials:

Principles of Computer Architecture, Murdocca and Heuring, Prentice Hall

LogicWorks 5 Manual and Software, Capilano Computing, Pearson Prentice Hall

Last revised: 3/05

Course coordinator: M. Hayes/D. Bostain

Information resources: Instructor's website: http://cos231.drbco.com/

Other learning resources: LogicWorks 5.0 circuit design software

Course goals: **The successful student will become familiar with the concepts and definitions related to:**

- **the structure and organization of "industry standard" personal computers (ISPC)**
- **the instruction-set architecture of the Intel 80x88 microprocessor**
- **computer-memory hierarchy comprising CPU registers, cache memory, random memory (RAM), and disks**
- **the representation of integer, character, string quantities in the ISPC**
- **input and output of data via keyboard, monitor, printer, magnetic disc**
- **the software stored in the read-only memory (ROM) of an ISPC**
- **the design of algorithms for accessing CPU registers, memory, disks, and external devices**
- **the use of an ISPC assembly language to translate machine-related algorithms into executable programs; monitors and loaders**
- **the implementation of machine structures (registers, RAM, ROM, display) in terms of digital circuits and logic gates**

Course-specific General Education goals and objectives.

Critical thinking, problem solving and information literacy: Students will use critical thinking and problem solving skills in analyzing information gathered through different media and from a variety of sources.

Students will identify a problem and analyze it in terms of its significant parts and the information needed to solve it.
Students will use computers to access, analyze or present information, solve problems, and communicate with others.
Students will formulate and evaluate possible solutions to problems, and select and defend the chosen solutions.
Students will recognize weaknesses in arguments, such as the use of false or disputable premises, suppression of contrary evidence, faulty reasoning, and emotional loading.

Units of study in detail:

Unit I Levels of Computer Architecture

At the completion of Unit 1 the student will be able to:

- **summarize the history of computer architecture**
- **identify the basic parts of a computer**
- **formulate a high level view of a computer system**

Topics

The Von Neumann Model
The System Bus Model
Levels of Machines
Upward Compatibility
The Levels
A Typical Computer System

Unit 2 Data Representation

At the completion of Unit 2 the student will be able to:

- **understand how information is represented**
- **describe the most important encodings**
- **Use binary, octal and hexadecimal numbers**

Topics

Fixed Point Numbers
Floating Point Numbers
Character Codes

Unit 3 Digital Logic

At the completion of Unit 3 the student will be able to:

- **understand the logical makeup of digital components**
- **write truth tables for AND, OR, NAND, NOR, NOT, XOR and XNOR gates**
- **name the kinds of digital integrated circuit technologies**
- **analyze latch and flip-flop circuits using timing diagrams**
- **analyze buffer and shift register circuits**
- **analyze counter circuits**
- **explain bus organization**
- **explain the differences between ROM, PROM, and EPROM**
- **explain the difference between ROM and RAM, and between static and dynamic memory**
- **describe the synthesis of combinational logic circuits**

Topics

Truth Tables
Boolean Algebra
Logic Equations

Unit 4 Electronic Implementation of Logic and Reduction of Digital Logic

At the completion of Unit 4 the student will be able to:

- **understand the electrical devices in logic gates**
- **describe the function of buffers**
- **use Boolean algebra and Karnaugh maps in the design of combinational logic circuits**
- **understand computational completeness**
- **interpret circuit diagrams**
- **interpret a data sheet**

Topics

Logic Gates
Properties of Boolean Algebra
The Sum-of-Products Form, and Logic Diagrams
The Product-of-Sums Form
Positive vs. Negative Logic
The Data Sheet
Karnaugh Maps

Unit 5 Arithmetic

At the completion of Unit 5 the student will be able to:

- **Explain fixed point addition, subtraction, multiplication and division**
- **Describe BCD and floating point arithmetic**

Unit 6 The Instruction Set Architecture and Languages

At the completion of Unit 6 the student will be able to:

- **describe the basic architectural components involved in program execution**
- **state the role of the system bus in interconnecting the components**
- **describe the low level machine**
- **discuss the compilation, and assembly processes**
- **describe linking, loading and macros**
- **use assembly language instruction sets to write assembly language programs**
- **explain microinstruction, macroinstruction, microprogramming**

Unit 7 Datapath, Control, Memory and I/O

At the completion of Unit 7 the student will be able to:

- **analyze step-by-step the datapath and control unit both microprogrammed and hardwired**
- **discuss ram, cache and virtual memory**
- **describe bus communications and bus access methods**

Unit 8 Communication

At the completion of Unit 8 the student will be able to:

- **describe various network architectures and protocols**
- **compare error detection and correction methods**

Unit 9 Trends in Computer Architecture

At the completion of Unit 9 the student will be able to:

- **state the motivation for RISC processors and VLIW machines**
- **describe parallel and distributed architecture systems**

Unit 10 Circuit Design

At the completion of Unit 10 the student will be able to:

- **use the LogicWorks software as a virtual workbench to design, test and document circuits**

Evaluation of student learning:

Labs/Participation	**20%**
Homework/Quizzes	**20%**
Projects	**20%**
Tests	**20%**
Final Exam	**20%**

Academic Integrity Statement:

Mercer County Community College is committed to Academic Integrity -- the honest, fair and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work and that faculty and academic support services staff members will take reasonable precautions to prevent the opportunity for academic dishonesty.

See http://www.mccc.edu/admissions_policies_integrity.shtml for a complete explanation of policies and procedures regarding academic integrity and academic integrity violations.