HOWARD UNIVERSITY

Department of Electrical and Computer Engineering

ELEG 416 Microprocessor Fundamentals and Applications
5:10 - 6:30PM TR

Catalog Data: Examines microprocessor and support architectures, hardware/software system design, microprocessor project applications, and digital state space pathology.

Textbook: (1) The 68000 Microprocessor Hardware and Software Principles and Applications, 4th ed., James L. Antonakos, Merrill Publishing Co., 1999.
(2) **Embedded Computing using PIC16F877 - Assembly Language Approach**. Charles Kim, 2006

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Goals: To give students an introduction to microprocessor fundamentals and their applications in 3 distinct CPUs. First, software and hardware model of MC68000 microprocessor will be studied and a substantial introduction to I/O interfacing principles will be provided. A number of (MC68000) microprocessor-based applications will be discussed. Students will use the ASM68K assembler and its companion simulator (emulator), EMU68K, to develop and test programs (in assembly language) for these systems. Second, Microchip's 16F877 8-bit flash memory microcontroller will be investigated in architecture and instruction. The program testing will similarly be done using a protoboard.

Prerequisites: Digital Systems

Topics:

I. COMPUTER ARCHITECTURE

An Overview of Digital Computer Systems and Microcomputers
Princeton Architecture and Harvard Architecture
CISC and RISC
A Basic Organization of Microprocessor-based Systems
Address and Data Bus; Binary and Hex Numbers
Microprocessor Operation
Hardware / Software Requirements of a Microprocessor-based System

II. MOTOROLA 68000 MICROPROCESSOR

The Software Model: Address/Data Registers, Program Counter, Status Register

User/Supervisor Mode
A Functional Description
Data Size/Organization: Even/Odd Addresses (UDS and LDS)
Hardware Overview: Specifications, Pin Description, Timing Diagrams
Instruction Types
Developing Software for MC68000: 68K Assembler and Simulator
Program Practice 1
Program Practice 2
Program Practice 3
Program Practice 3
Program Project 1

IV. MICROCHIP PIC 16F877 MICROCONTROLLER

PIC Architecture
Memory Structure
Register Files
I/O
A/D Converter
Instruction Sets
Developing Software for 16F877: MPLAB Assembler and Simulator
Program Practice 5
Program Practice 6
Program Practice 7
Program Practice 8
Program Project 2

Class Projects: **1. 68000 Program Project**
2. 16F877 Program Project

Grading Policy:

Program Practices (8*5)	40%
Program Projects (2*20)	40%
Final Exam	20%

Final Course Grade:

100-90	A
89-80	B
79-70	C
69-60	D
59 and below	F

Safety/Ethics: Follow instructions carefully, avoid touching live bare wires and equipment. See "Safety Manual" in Room 3113, L.K. Downing Hall. Do your own work. If there is a group assignment, participate fully. See "Undergraduate Handbook."

E-mail and Web-Site:

Check your e-mail frequently: Assignments are important information will be announced over e-mail. Also a class note web-site is available at **http://www.hirstbrook.com/classnotes.html**

SPECIAL NOTE:

Howard University is committed to providing an educational environment that is accessible to all students. In accordance with this policy, students in need of accommodations due to a disability should contact the Office of the Dean for Special Student Services for verification and determination of reasonable accommodations as soon as possible after admission to the University, or at the beginning of each semester. The Dean of the Office of Special Student Services, Dr. Barbara Williams, can be reached at (202) 238-2420.

ABET Engineering Criteria 2000

(c) An ability to design a system component, or process to meet desired needs

Programming Projects. Students are required to develop software (assembly language programs) for the system component/process defined in each project. Solutions are typically open-ended. Students must demonstrate (through simulation/execution) that the developed software meets the desired specifications and needs.

Minimum competence: demonstrated working solution/software and its simulation; a grade of C on subsequent written reports.

(e) An ability to identify, formulate, and solve engineering problems

Programming Projects. Students must identify and develop solution (software) for the (engineering) problem (process) the assigned projects.

Minimum competence: demonstrated working software and its simulation; a grade of C on the subsequent written reports.

(g) An ability to communicate effectively

Programming projects. Communication/writing skill are required in the written reports detailing requested process/design, developed programs and their simulation, execution/simulation results and analysis, as well as the oral presentation of the project.

Minimum competence: grades of C on written reports, and average communication skill.

(h) A knowledge of contemporary issues

Reading Assignments. Readings from special sections of the textbook, as well as articles on contemporary issues (technical journals) such as advanced microprocessors and microcomputers, are assigned to complement the class lectures. Class assignments (problems, unfinished designs, etc) require the knowledge gained from the reading assignments.

Minimum competence: A grade of C on the class assignments and written reports.

(i) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

Programming Assignment: Students are required to use necessary assembler and emulator in the programming and testing program.

Minimum competence: A grade of C on the Program Assignments