PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

MICROPROCESSORS I W/LAB
EET 2310

Class Hours: 3.0 **Credit Hours: 4.0**

Laboratory Hours: 3.0 **Date Revised: Fall 2001**

NOTE: This course is not intended for transfer credit.

Catalog Course Description:

Basic microprocessor architecture is covered with particular emphasis on the Motorola 68000. Topics include machine language programming, interrupts, and interfacing techniques with many commonly used integrated circuits; interface chips, e.g. the PIA (Parallel Interface Adapter), ACIA (Asynchronous Communication Interface Adapter), programmable timers, and modems.

Entry Level Standards:

The student must have an understanding of number systems, basic logic gates, combinational logic circuits, flip-flops, and sequential circuits

Prerequisite:

EET 1310

Textbook(s) and Other Reference Materials Basic to the Course:

Microprocessors Books I and II, Heathkit, Heath Company ISBN: 0-87119-105-9
Student Workbook ISBN: 0-8119-106-7
Project Parts: Approximate cost: $25.00
References:
Basic Microprocessors and the 68000, Bishop, Hayden
Fundamentals of Microprocessors, Daley, HRW
Digital Technology with Microprocessors, Cave, Terril, Reston

I. Week/Unit/Topic Basis:

Week	Topic
1	Basic Architecture and Terminology
2	Basic Instructions and Inherent, Immediate, and Direct Addressing Modes
3	More Instructions and Extended Addressing Mode
4	Flow Charts and Branching
5	Condition Codes and Conditional Branching
6	Timing and Program Execution

7	Indexed Addressing and More Programs
8	The Stack
9	Input/Output Operations and Interrupts
10	More Interrupts and Complete Program Execution and Timing of Signals on Data and Address Buses
11	Interfacing RAM and ROM
12	Interfacing Switches
13	Interfacing LEDs
14	The ACIA (Asynchronous Communication Interface Adaptor)
15	The PIA (Parallel Interface)
16	Review and Final Exam

II. Course Objectives*:

A. Understand the basic architecture of microprocessors. I, II, III, VII

B. Understand the complete instruction set of microprocessors. II, III

C. Understand the function of all control bus lines. II, IV, V, VI

D. Understand the various addressing modes. II, IV, V, VI

E. Understand the function and operation of interrupts. II, IV, V, VI

F. Understand the function and operation of the stack. II, IV, V, VI

G. Understand the timing of a program as it is executed and be able to justify all information which appears on the data, address, and control buses (as observed with a logic analyzer). II, IV, V, VI

H. Program an EPROM and interface it to the CPU. II, III, IV, V, VI

I. Interface switches and LEDs to the CPU. V, VI, VII

J. Understand the advantages of the PIA, interface it with the CPU, and write programs which utilize the PIA. I, VII

*Roman numerals after course objectives reference goals of the EET program.

III. Instructional Processes*:

Students will:

1. Participate in classroom discussions which challenge their abilities to think creatively and visualize complex spatial and mathematical relationships to solve problems. *Problem Solving and Decision Making Outcome*

2. Work in teams to conduct laboratory experiments and also to solve special problem

assignments. These activities are designed to foster interpersonal skills in teamwork and develop and enhance leadership skills, students' abilities to express ideas, and students' abilities to reach consensus solutions for the team through negotiation. *Active Learning Strategy, Problem Solving and Decision Making Outcome, Personal Development Outcome*

3. Use electronic test equipment to test electrical circuits constructed from schematics in the laboratory and acquire data. Use computers with applications software to simulate, analyze, and predict the behavior of electrical circuits. Compare expected responses to experimental responses of electrical circuits. Use the Internet for special assignments such as locating data sheets on electronic components. Use computers with word processing software to prepare reports. *Technological Literacy Outcome, Information Literacy Outcome, Numerical Literacy Outcome*

4. Prepare reports on laboratory experiments which include methodology, mathematical analyses of electrical circuit models, a comprehensive comparison of calculated results with experimental results, and conclusions. *Communication Outcome, Numerical Literacy Outcome*

5. Discuss the importance of personal qualities such as personal responsibility, time management principles, self?esteem, sociability, self?management, integrity and honesty in school and in the workplace, and dynamics of change in the workplace. *Personal Development Outcome, Cultural Diversity and social Adaptation Outcome, Transitional Strategy*

*Strategies and outcomes listed after instructional processes reference Pellissippi State's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

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

1. Define the terms: microprocessor, microcomputer, input, output, I/O, I/O device, I/O port, instruction, program, stored program concept, word, byte, MPU, ALU, operand, memory, read, write, RAM, fetch, execute, MPU cycle, mnemonic, opcode, and bus. A

2. Explain the purpose of the following circuits in a typical microprocessor: accumulator, program counter, instruction decoder, controller sequencer, data register, and address register. A

3. Use a simplified block diagram of a microprocessor, trace the data flow that takes place between the various circuits during the execution of a simple program. A

4. Describe the difference between inherent, immediate, and direct addressing. D

5. Write simple, straight-line programs that can be executed by the ET-3400 Microprocessor Trainer. B

6. Develop flow charts that illustrate step-by-step procedures for solving simple problems.

7. Explain the purpose of conditional and unconditional branching. B

8. Trace the data flow during the execution of a branch instruction when using the block diagram of a microprocessor. C

9. Compute the proper relative address for branching forward or backward from one point to

another in a program. B

10. Explain the purpose of the carry, negative, zero, and overflow flags. Give an example of a situation that can cause each to be set and another example that will cause each to clear. List eight instructions that test one of these flags. B

11. Write programs that can: multiply by repeated addition; divide by repeated subtraction; convert binary to BCD; convert BCD to binary; add multiple-precision numbers; subtract multiple-precision numbers add BCD numbers. D

12. Write simple programs that use indexed and extended addressing. D

13. Find the opcode, number of MPU cycles, number of bytes, and effects on the condition code flags of every instruction discussed in this unit, using the 68000 instruction set card as a guide. D

14. Write simple programs that can store data in--and retrieve data from--the stack. F

15. Write programs that use the stack and indexing to move a list from one place in memory to another. F

16. Explain the operations performed by each of the following instructions: PULA, PULB, PSHA, PSHB, DES, INS, LDS, STS, TXS, and TSX. F

17. Define stack, subroutine, nested subroutine, interrupt, interrupt vector, and interrupt masking. F

18. Write programs that use subroutines and nested subroutines. F

19. Explain the operations performed by each of the following instructions: JMP, JSR, BSR, and RTS. B

20. Describe how the 68000 MPU performs input and output operations. C

21. Draw flowcharts depicting the sequence of events that occur during reset, non-maskable interrupt, interrupt request, software interrupt, return from interrupt, and wait for interrupt. E

22. Explain the operation performed by each of the following instructions: WAI, SWI, RIT, SEI, and CLI. E

23. Set up the HP logic analyzer, label all inputs, and take data in the timing or state mode of operation. G

24. Connect the logic analyzer to the 68000 trainer and verify all the data which appears on the address bus, data bus, and control bus. G

25. Program and EPROM and interface it to the trainer. H

26. Interface Switches and LEDs to the trainer and write a program to read the switches and output to the LEDs. I

27. Interface the PIA to the 68000 so that the PIA port A and B registers are located at consecutive memory addresses. J

28. Write programs to initialize the PIA using the 68000 index register. J

29. Use the PIA control lines to communicate with external devices. J

30. Write programs to initialize the PIA for several I/O control applications (polling, complete handshaking, partial handshaking). J

31. Perform complete input and output handshakes using the PIA control lines. J

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures: 80% of grade

The evaluation in the classroom will be determined by a combination of chapter tests, homework, a final exam, and laboratory activities. The percentage that each of these factors count and the frequency of tests and homework is left to the discretion of the instructor, but the following if offered as a guide:
Chapter Tests: 55%
Homework: 5%
Final Exam: 20%

B. Laboratory Expectations: 20% of grade

The laboratory portion of the grade will be determined by a combination of performance within the lab and the quality of demonstrated comprehension of the lab report. A lab test and lab project may also be included. There will be at least twelve labs during the semester to go along with the classroom material.
The laboratory serves as a medium for verifying classroom theory. The laboratory report serves as a means to practice both organizing a laboratory notebook and presenting technical observations in written form. Clean, concise, well-organized report writing in an engineering environment is of paramount importance to the EET student. Correct usage of English in the report is necessary and will be evaluated. The report grade may be reduced up to two grade levels as a result of incorrect usage of English.
A. Straight Line Program
B. Arithmetic and Logic Instructions
C. Logic Analyzer Basis
D. Program Branches and Logic Analyzer Usage
E. Additional Instructions
F. Extended and Indexed Addressing
G. The Stack Operations
H. Subroutines
I. Lab Test (Logic Analyzer)
J. RAM Interfacing
K. EPROM Programming and Interfacing
L. Interfacing Switches
M. Interfacing LEDs
N. The PIA
O. The ACIA

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

93 - 100 A
85 - 92 B
70 - 84 C
60 - 69 D
Below 60 F

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course (Pellissippi State Catalog). Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more stringent.
Attendance is required to all lab sessions unless excused by the instructor. Students missing more than four unexcused sessions will receive an "F" and no credit will be received. Students tardy past half an hour will be considered absent.

B. Other Policies:

The student is encouraged to read the regulations for student conduct in the PSTCC Catalog and Handbook.