Class Hours: 1.0  Credit Hours: 2.0
Laboratory Hours: 3.0  Date Revised: Spring 02

NOTE: This course is not intended for transfer credit.

Catalog Course Description:

This course is an extended course in microprocessor technology using modern 16/32 bit microprocessors based primarily on the Motorola 68000 and 68020. Topics include A/D and D/A principles, programmable timers, architecture, 68000 instruction set, and processor capabilities.

Entry Level Standards:

The student must have an understanding of 8 bit microprocessor basics. This includes full instruction set understanding as well as comprehension of interrupts and interfacing of several devices to the CPU.

Prerequisite:

EET 2310

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

Textbook:
Microprocessor Interfacing, Heathkit, Heath Company
M 68000 Programmer's Reference Manual, Motorola

References:
16 Bit Microprocessors, Triebel, Prentice-Hall
The Motorola MC 68000, Harmon, Lawson, Prentice-Hall
16 Bit Microprocessor Architecture, Dollhoff, Reston

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1-2</td>
<td>Digital to Analog and Analog to Digital Converters</td>
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<tr>
<td>3-4</td>
<td>Programmable Timers</td>
</tr>
<tr>
<td>5-6</td>
<td>Modems and Other Interfacing Circuits</td>
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<tr>
<td>7-8</td>
<td>Internal Registers and Basic Architecture</td>
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II. Course Objectives*:

A. Understand the principles of Analog to Digital and Digital to Analog conversion. I, II, III
B. Understand Programmable Timers and interface them with the CPU. I, II, III
C. Understand how the address space is organized. II, IV, V, VI
D. Understand internal registers and basic architecture. II, IV, V, VI
E. Understand the addressing modes. II, IV, V, VI
F. Understand the instruction set. II, IV, V, VI
G. Understand the control bus. II, IV, V, VI

*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. Interface digital-to-analog converters to a microcomputer via the PIA. A
2. Interface analog-to-digital converters to a microcomputer and write software to start conversions and load data from eight different analog inputs. A
3. Describe the internal structure and I/O lines of the 6840 PTM. B
4. Interface the 6840 PTM to a 68000-based system and initialize the PTM to perform the task below. B
5. Generate time delays, continuous waveforms, and one-shot pulses using the 6840 PTM. B
6. Explain how the 68000 provides a 16 megabyte address space. C
7. List the four functional bus categories of the 68000 I/O lines. C
8. Explain how 68000 data is organized in memory. C
9. Describe the internal CPU register structure of the 68000. D
10. State the difference between the 68000 user and supervisor modes. D
11. Define each of the following 68000 addressing modes:
   * implied addressing
   * immediate addressing
   * absolute addressing
   * register direct addressing
   * register indirect addressing
   * program counter relative addressing E
12. List the five instruction categories of the 68000 instruction set. F
13. Describe the operation of the various 68000 MOVE instructions. F
14. State the arithmetic and logic capabilities of the 68000. F
15. The function of the 68000 program control instructions. F
16. Write a 68000 program to move a block of data within memory. F
17. Describe the function of each of the 68000 I/O lines. G
18. State the difference between asynchronous and synchronous bus control. G
19. List the 68000 asynchronous and synchronous bus control lines. G
20. Show how the 68000 provides both synchronous and asynchronous bus control. G

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

V. Evaluation:

A. Testing Procedures: 75% of grade

The evaluation in the classroom will be determined by a combination of chapter tests, homework, and a final exam. 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 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%
Final Exam: 20%°

B. Laboratory Expectations: 20% of grade

Laboratory topics may vary at the discretion of the instructor, but will be related in a timely manner to the course work. 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.

A. Digital to Analog Conversion
B. Analog to Digital Conversion
C. Programmable Timers
D. Log on the VAX editor and Program Assembly
E. Assemble, line and simulate a 68000 program
F. Further Assembly language programs
G. Downloading a program to the 68000 system
H. Assembly Language Programs
I. Lab Test

C. Field Work: 5% of grade

Homework

D. Other Evaluation Methods:

N/A

E. Grading Scale:

93 - 100  A
88 – 92  B+
83 - 87  B
78 - 82  C+
70 – 77  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 (PSTCC Catalog). Individual departments/programs/disciplines, with the approval of the vice president of Academic and Student Affairs, may have requirements that are more stringent.

Class Attendance for Lab:
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. Student Conduct:

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