SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: MICROPROCESSOR CIRCUITS AND APPLICATIONS

Code No.: CET228-5 Semester: 3

Program: COMPUTER ENGINEERING TECHNOLOGY

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APPROVED: L C Ouzett 93-04-30

Dean Date

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TOTAL CREDIT HOURS: 75

PREREQUISITES: ELN107, CET127

I. PHILOSOPHY/GOALS:

This course will expand a student's understanding of microprocessor circuits and systems and the peripheral devices used to support them, as well as strengthen his/her knowledge of digital devices in general. Microcomputer system hardware components will be studied and practical lab exercises, primarily based on the IBM PC and the MAT (Microcomputer Application Trainer) systems, will reinforce the theory. The essential principles of operation of microprocessor-based systems are approached from the point of view of maintaining and troubleshooting such systems, modifying and designing interfaces for them, and writing software routines to test and control them.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

1. Describe the basic organization of typical microprocessor systems as implemented with address, data and control busses.

2. Describe the operation of the 8088 and 8086 microprocessors in detail, including the various support chips required in typical microprocessor-based systems.

3. Describe the different types of memory devices found in computer systems, their advantages and disadvantages, principles of operation and interfacing.

4. Describe the general operation of the system board and the I/O subsystems in an IBM PC or similar computer subsystem such as the MAT system, and be able to explain the operation of and write code to control most of the major I/O devices found in such systems.

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5. Describe the basic operation of microcomputer peripherals such as keyboards, floppy and hard disk systems, serial ports and printers.

III. TOPICS TO BE COVERED:

1. Microcomputer System organization and bus structure.
2. Operation of 8088 and 8086 microprocessors.
3. Memory devices used in microcomputer systems.
4. The operation of the I/O subsystem in typical microcomputer systems and its interaction with the CPU.
5. The organization and detailed operation of the IBM PC/XT at the chip level.
6. Troubleshooting various hardware- and software-related faults in PC-based systems.
7. Peripherals: Keyboards, Floppy and Hard drives and Printers.
8. Assembly language control of typical support chips found in Intel-based computer systems.
9. Architecture of other Intel microprocessors: 80X86.

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IV. LEARNING ACTIVITIES	REQUIRED RESOURCES
1 - MICROPROCESSOR FUNDAMENTALS	TEXT:
1. Describe the general nature of address, data and control busses in microcomputer systems.	"MICROCOMPUTER THEORY & SERVICING" CHAPT. 8
2. Describe the evolution of microprocessor technology from its origins to the present day.	Instructor's Notes
3. Describe the operation and use of flip-flops, buffers and transceivers in computer systems.	CHAPT. 4,5
4. Discuss the need for 3-state logic and the use of 3-state devices in computer systems in general.	CHAPT. 5
5. Describe general procedures for troubleshooting digital circuits in computer systems.	CHAPT. 6
2 - 8088\8086 CPU OPERATION AND SYSTEM ORGANIZATION	CHAPT. 11
1. Describe the 8088 and 8086 CPU, internal organization, timing, pin functions and operating modes. Be able to use a logic analyzer to demonstrate this understanding.	
2. Discuss the operation of the 8284 Clock Generator.	
3. Describe the way bus multiplexing is accomplished in 8088-based systems with (and without) the 8288 Bus Controller	
3 - MEMORY DEVICES AND MEMORY INTERFACING	CHAPT. 7
1. Describe the use of memory maps, memory-mapped I/O and dedicated I/O.	

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2. Describe the use of address decoders such as the 74138 to selectively enable memory devices.

3. Identify the principal types of static(SRAM) and dynamic (DRAM) Read/Write Memory (RWM or RAM) and describe their features, operation, advantages and disadvantages and their implementation in memory systems.

4. Describe the characteristics of various ROM,(Read-Only Memory devices), PROMs, EPROMs, and EEPROMs and understand the process of EPROM programming.

5. Describe the characteristics of various Programmable Logic Devices (PLD's), PLAs, PAL's and ASICs.

4 - 8088 I/O INTERFACING FUNDAMENTALS CHAPT. 10

1. Understand the operation and function of various buffers, latches and register circuits including the 74244, 74245, 74151, 74374,and the 74373.

2. Describe I/O instructions used to access I/O ports, the nature of I/O addressing in 8088 systems and address decoding techniques for I/O ports. The I/O decoder in the MAT systems will be studied as a specific example.

3. Describe Direct Memory Access (DMA) and its implementation with the 8237A DMA Controller.

4. Describe the architecture of the Intel 8255 Programmable Peripheral Interface (PPI) and be able to program it in Assembler in a variety of modes.

5. Discuss the use of interrupts in the 8088 and understand the operation of the Intel 8259 Programmable Interrupt Controller.

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6. Describe the 8253 Programmable Interval Timer (PIT), its operation and function.	
7. Understand the operation of the A/D and D/A circuitry in the Microcomputer Application Trainers and be able to interface them and control them with Assembler programs.	MAT Schematics and Instructor's Notes
5 - MICROCOMPUTER SYSTEMS	
1. Describe the configuration of major sub-systems in IBM-PC/XT/AT computers.	CHAPT. 11
2. Describe the nature of the power supply unit in a PC and its principles of operation.	CHAPT. 11
3. Be able to describe the theory of operation at the chip level of the IBM-PC System board including timing, I/O and Memory address mapping and decoding, Memory refresh, the DMA controller, and the Interrupt section.	Instructor's Notes
4. Describe the sequence of activities that occurs during the POST, Power on Self Test which is executed when a PC boots.	CHAPT. 14
5. Be able to diagnose various faults in PC-based systems.	CHAPT. 15
6. Be able to describe the architecture and capabilities of other Intel 80X86 micro-processors.	CHAPT. 16
6 - MEMORY PERIPHERALS	CHAPT. 12
1. Describe the principles of magnetic recording.	
2. Describe the nature of floppy disks, various formatting standards and digital encoding techniques used in magnetic media.	

3. Describe the organization and operation of Floppy Disk Controllers and Floppy disk drives.

4. Describe the characteristics of various hard drive interfaces and controllers.

7 - PERIPHERAL DEVICES CHAPT. 13

1. Discuss the principle of operation of various keyboards.

2. Describe the principles of operation and characteristics of various printers including dot matrix , daisy wheel, ink jet and laser printers.

3. Describe the nature of the Centronics printer interface and asynchronous serial interfaces using the RS-232C standard.

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V. METHOD OF EVALUATION:

3 THEORY TESTS (20% each)	60%
LAB PROJECTS/ASSIGNMENTS	35%
QUIZZES	5%

(The percentages shown above may vary slightly where circumstances warrant.)

GRADING SCHEME

A+	90	-	100%
A	80	-	89%
B	70	-	79%
C	55	-	69%
I	Incomplete		
R	Repeat		

UPGRADING OF INCOMPLETES

When a student's course work is incomplete or final grade is below 55%, there is the possibility of upgrading to a pass when a student meets the following criteria:

1. The students attendance has been satisfactory.
2. An overall average of at least 40% has been achieved in all work to date.
3. The student has not had a grade less than 40% in all of the theory tests taken.
4. The student has made reasonable efforts to participate in class and complete assignments.

LABS:

Lab activities represent a very important component of this course in which practical 'hands-on' skills will be developed. Because of this, attendance is mandatory and the satisfactory completion of all lab activities is required. It is the student's responsibility to discuss absences from regularly scheduled labs with the instructor so that alternate arrangements (where possible) can be made to complete the lab requirements. Lab reports are due one week after completion. A late penalty of 10 % will be applied to late reports.

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ATTENDANCE:

Absenteeism will affect a student's ability to succeed in this course. Absences due to medical or other unavoidable circumstances should be discussed with the instructor, so that remedial activities can be scheduled. Absenteeism for tests can only be allowed for medical reasons and should be authorized ahead of time. Unauthorized absences could result in a zero grade being assigned.

VI. REQUIRED STUDENT RESOURCES:

TEXT BOOKS:

1. "Micro Computer Theory and Servicing"

   by S. Asser, V.J. Stigliano, R.F. Bahrenburg

VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE:

Microprocessor Applications Trainer Manual

VIII. SPECIAL NOTES:

1. Students with special needs (eg. physical limitations, visual or hearing impairments, or learning disabilities) are encouraged to discuss any required accommodations confidentially with the instructor.

2. Your instructor reserves the right to modify the course as deemed necessary to meet the needs of students or take advantage of new or different learning opportunities.

3. The Blocks of objectives will not necessarily be covered in the order shown in this course outline.

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LAB REPORT FORMAT

The following guidelines should be used when writing lab reports for CET228 lab projects.

1. Title Page
   Each lab report should have a Title page which contains:
   - -Descriptive Lab Title
   - -Course
   - Your name and the names of lab partners.
   - -Date lab was begun and Date lab report submitted.

2. LAB OBJECTIVES
   A brief statement of the lab objectives.

3. PROCEDURES
   A brief description of the procedures followed. In some cases the original procedures handed out with the lab can be submitted with your lab report. This is only acceptable if it is in good shape and has not been marked up. The remaining sections of your report should refer to the various procedures by their corresponding procedure numbers.

4. BODY OF THE REPORT
   This section varies but should include the following where appropriate. All diagrams, graphs etc. should have a title which identifies them.
   - Schematics or wiring diagrams
   - Graphs and waveforms
   - Tables of recorded data
   - Calculations based on measured data
   - Detailed description of programs written with adequate documentation
   - Answers to any specific questions asked in the lab assignment. [Include the questions with the answers.]

5. CONCLUSIONS AND DISCUSSION
   Every report should contain a final section which summarizes the important results in the report and draws conclusions from them. In some cases, this would take the form of a restatement of the reports highlights, a brief statement of the steps taken in successfully completing a procedure, and a description of the degree of completion of the lab. Especially important is an honest statement describing whether any programs submitted, work as required, or their degree of completion.

**** Lab reports are due one week after the date of completion. Penalties will be applied to late reports.