SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: MICROPROCESSOR CIRCUITS AND APPLICATIONS

Course No.: CET228-5

Program: COMPUTER ENGINEERING TECHNOLOGY

Semester: THREE

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Author: TYCHO BLACK

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APPROVED: K P Chrzett — Dean

90/09/24 — Date

MICROPROCESSOR CIRCUITS AND APPLICATIONS

GENERAL OBJECTIVES

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 will reinforce the theory.

A comparative study of various 8, 16 and 32 bit microprocessors is undertaken before an in depth study of systems based on Intel 8088/8086 microprocessors is begun. Types of memory, bus concepts, I/O servicing, interrupts, direct memory access, system timing and the functions of various support chips will be included. The essential principles of operation of common peripherals found in microcomputer systems including keyboards, video displays, and floppy disk drives will be studied. The IBM-PC will be studied as a representative computer "system" to illustrate the interaction between components and subsystems and to enable a specific system to be used as the basis of troubleshooting exercises.

An important component of this course involves the study of maintenance and troubleshooting procedures on PC's. In the lab, projects in the following areas will develop practical experience to reinforce the theory:

PC Assembly/disassembly, Hard drive installation and low level formatting, PC board-level troubleshooting, Microcomputer Application Trainer(MAT) system interfacing and prototyping, 8255 PPI programming and an introduction to IBM-PC interfacing.

REQUIRED RESOURCES:

Textbook:

"MICROCOMPUTER SERVICING: Practical Systems and Troubleshooting"

by Asser, Stigliano and Bahrenburg (Merrill Publishing)

COURSE GUIDELINES AND GRADING SCHEME

COURSE: CET228

1. EVALUATION METHOD:

3 THEORY TESTS (20 % each)	60%
LAB PROJECTS/ASSIGNMENTS	30%
QUIZZES AND PRACTICAL TESTS	10%

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

2. TIME: 6 HOURS PER WEEK for 16 WEEKS

3. CREDITS: 5 Credits

4. TESTS:

Written tests will be conducted at approximately 5 week intervals. They will be announced about one week in advance. Quizzes may be conducted without advance warning and will generally not be re-writable if a student is absent.

5. 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.

NOTE: The requirements for lab reports is included at the end of this document and should be reviewed carefully before handing in lab reports.

6. ATTENDANCE:

Absenteeism will affect a student's ability to succeed in this course. Attendance will be taken in all regularly scheduled classes and will have a bearing on whether a student is granted the opportunity to make up for missed tests, incomplete lab projects or failing grades. Absences due to medical or other unavoidable circumstances should be discussed with the instructor, so that remedial activities can be scheduled.

7. GRADING SCHEME

A+	90	-	100%	Outstanding achievement
A	80	-	89%	Above average achievement
B	70	-	79%	Average Achievement
C	55	-	69%	Satisfactory Achievement

I Incomplete: Course work not complete at Mid-term. Only used at mid-term.

R Repeat

X A temporary grade that is limited to instances where special circumstances have prevented the student from completing objectives by the end of the semester. An X grade must be authorized by the Chairman. It reverts to an R if not upgraded in an agreed-upon time, less than 120 days.

8. 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 the student's performance warrants it. Attendance and assignment completion will have a bearing on whether upgrading will be allowed. A failing grade on all tests may remove the option of any upgrading in which case an R grade will result. The highest grade on re-written tests or assignments will be 56% unless otherwise announced.

The method of upgrading is at the discretion of the teacher and may consist of one or more of the following options: assigned make-up work, re-doing projects, re-doing of tests, or writing a comprehensive supplemental examination.

SPECIFIC OBJECTIVES

CET228 : MICROPROCESSOR CIRCUITS AND APPLICATIONS

The following topics identify the required learning objectives in this course.

The main reference for these topics is the textbook, "Microcomputer Servicing" but lecture notes and special material supplied by the instructor are required for some sections.

BLOCK 1: MICROPROCESSOR FUNDAMENTALS (Chap. 1)

1. Describe the general nature of address, data and control busses in microcomputer systems.
2. Discuss the evolution of microprocessor technology from its origins to the present day.
3. Describe the operation and use of flip-flops, buffers and transceivers in computer systems. (Review)
4. Discuss the need for 3-state logic and the use of 3-state devices in computer systems in general.
5. Describe general procedures for troubleshooting di ' circuits in computer systems.

BLOCK 2: 8088\8086 CPU OPERATION AND SYSTEM ORGANIZATION (Chap. 3,5)

1. Describe the 8088 and 8086 CPU, internal organization, timing, pin functions and operating modes.
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.

BLOCK 3: MEMORY DEVICES AND MEMORY INTERFACING (Chap 2,3,5)

1. Describe the use of memory maps, memory-mapped I/O and dedicated I/O.

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.

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

6. Discuss the use of parity and other error checking techniques in memory subsystems.

BLOCK 4: 8088 I/O INTERFACING FUNDAMENTALS (Chap. 5)

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.

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.

BLOCK 5: THE MICROCOMPUTER SYSTEM (Chap.6)

1. Describe the system configuration of an IBM-PC/XT.
2. Describe the nature of the power supply unit in a PC and its principles of operation.
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.
4. Describe the sequence of activities that occurs during the POST, Power on Self Test which is executed when a PC boots. [Ref: Chap. 10]

BLOCK 6: MICROCOMPUTER SYSTEM PERIPHERALS (Chap. 7,8)

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 the Floppy Disk Controllers and Floppy disk drives.
4. Describe maintenance and troubleshooting techniques for disk drives.
5. Discuss the principle of operation of various keyboards.
6. Describe the principles of operation and characteristics of various printers including dot matrix , daisy wheel, ink jet and laser printers.
7. Describe the nature of the Centronics printer interface and an asynchronous serial interface.

BLOCK 7: TROUBLESHOOTING PROCEDURES and TEST EQUIPMENT

This block includes practical information and procedures which will be partly taught and tested in the lab. Its content is based on Chapters 9 to 12 in the textbook and partly on special material handed out by the instructor.

1. PC/XT/AT Model characteristics including busses, memory organization, clock, power supply and system components.

2. Preventative Maintenance in PC's.

3. General Troubleshooting procedures.

    1. Board identification.
    2. DMA, IRQ, I/O Ports and DIP switches in common systems.
    3. Finding and replacing bad boards.
    4. Chip-level troubleshooting.
    5. System Board troubleshooting.
    6. Memory errors.

4. Power Supply Troubleshooting.

5. Hard Disk Drive Characteristics, installation and Troubleshooting. Backup and Low-level formatting of hard disks.

6. Floppy Disk Drive characteristics and troubleshooting.

7. Introduction to the PS/2's.

8. Discuss the application of test equipment, including logic analyzers when troubleshooting computer systems.

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
   - -Name and names of lab partners.
   - -Date lab 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.