SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

Course Title: COMPUTER INTERFACING

Code No.: CET315-5 Semester: 6

Program: ELECTRICAL/ELECTRONIC ENGINEERING TECHNOLOGY

Author: TYCHO BLACK

Date: JAN., 1993 Previous Outline Dated: JAN. ,1992

APPROVED: L. C. Forsyth 93-04-29

Dean Date

COMPUTER INTERFACING — COURSE NAME
CET315-5 — CODE NO.

TOTAL CREDIT HOURS: 75

PREREQUISITES: CET228 , CET331

I. PHILOSOPHY/GOALS:

The objectives of this course are to study the general techniques used in computer interfacing, expanding upon the fundamentals learned in CET228, " Microcomputer Circuits and Applications" and to carry out practical exercises primarily with the IBM family of systems.

The importance of microprocessor-based hardware in all fields of Electrical and Electronic Technology cannot be over-emphasized. This course strives to expand the skills of the Technologist to include current microprocessor technology and many of the important "interfaces" between peripherals and microprocessors that are likely to be encountered in the workplace.

Lab activities will include the following: an IBM-PC interface project, Interrupt and DMA programming, CRT Controllers and Video Display Adapters, stepper-motor and servo-motor control, Parallel Port programming, an IEEE-488 bus project, an EPROM programmer exercise. In addition, students will learn to use test equipment such as logic analyzers in troubleshooting and development.

II. STUDENT PERFORMANCE OBJECTIVES:

Upon successful completion of this course the student will:

1. Be able to describe the system timing and operation of major components and subsystems in XT and AT computer systems and use logic analyzers to analyze and troubleshoot such systems.

COMPUTER INTERFACING — COURSE NAME
CET315-5 — CODE NO.

2. Be able to describe the characteristics of various busses and their control signals including the ISA, EISA, MCA and NuBus.

3. Be able to describe and program interrupt-driven and DMA applications in PC systems.

4. Be able to describe the interface standards associated with hard drives including the ST506, SCSI, ESDI and IDE interfaces.

5. Be able to program the Parallel Port on a PC to control external devices.

6. Be able to describe and utilize the IEEE-488 bus and any associated instruments as Automated Test Equipment.

7. Be able to describe the video interface and Video Display Adapter standards in PC systems and be able to program such interfaces.

8. Be able to control stepper and servo motors through microcomputer ports.

9. Be able to discuss recent developments and future directions in microprocessor technology and applications.

III. TOPICS TO BE COVERED:

1. ISA-based XT/AT Bus operation and timing.

2. Use of Logic Analyzers and other test equipment.

3. XT/AT interfacing requirements and techniques.

4. PC System Bus comparison: ISA, EISA, MCA and NuBus.

5. Shielding and Grounding issues.

6. Hard Drive interface standards: SCSI, IDE, ESDI and ST506.

7. CRT Controllers and Video Display Adapters.

8. DMA and Interrupt programming.

9. Other Peripherals, their control and interfacing.

10. Recent and Future Directions in Computer Technology.

IV. LEARNING ACTIVITIES

REQUIRED RESOURCES

Note: These Learning Activities will not necessarily be covered in the order shown below. Also, some minor objectives may have to be omitted if time does not allow.

BLOCK 1 - ISA BUS OPERATION AND TESTING

While some of this block is a review of ISA Bus operation and the role of various devices in XT systems, the emphasis is on analysis of the timing and cause and effect relationships and the role of a logic analyzer in demonstrating this. Students will be able to:

1. Describe the operation of XT and AT system boards, the cause and effect relationships that implement such major subsystems as memory refresh, keyboard scan code entry, interrupt handling, DMA cycles, and memory access.

2. Utilize the LA-3200 or other logic analyzer to analyze system timing and operation and be able to describe timing and state diagrams of relevant events.

3. Describe the major characteristics, differences and advantages of various microcomputer-based system busses such as ISA, EISA, MCA and NUBus and the protocols used to control devices.

4. Describe the characteristics, hardware signalling and bus control techniques for various microprocessors past and present.

5. Understand the electrical requirements of PC interfaces and the shielding and grounding practices required.

6. Describe the IBM-XT I/O Channel and be able to design and analyze interfaces for it.

"Microcomputer Servicing"

LA-3200 Logic Analyzer Users Manual

Instructor's Notes

COMPUTER INTERFACING
COURSE NAME

CET315-5
CODE NO.

LOCK 2 - PARALLEL INTERFACING AND THE IEEE-488 BUS

This block introduces the student to a practical knowledge of Parallel Port utilization on PC's and the IEEE-488 bus and their associated instruments for use in automated testing. Students will be able to:

1. Describe the nature of the Parallel Ports on a PC and be able to program them in C or Assembler to control external peripherals. "Instructor's Notes"

2. Describe the IEEE-488 bus signals and the protocol used to transfer information on this bus.

3. Be able to write programs in Basic or C to control the operation of frequency counters, digital multimeters, and frequency synthesizers using the IEEE-488 bus in an ATE system.

4. Be able to describe the operation and programming requirements of interface chips that control the IEEE-488 bus such as the Intel 8291. (Time permitting).

LOCK 3- INTERRUPT AND DMA PROGRAMMING

Practical aspects of DMA and Interrupt-driven applications are studied in this block. In addition, various useful interface devices and techniques are studied. The student will:

1. Be able to program the Intel 8259 Interrupt Controller and write interrupt-driven programs for the PC. "Microcomputer Servicing"

2. Be able to describe DMA, Direct Memory Access, the programming requirements of the 8237 DMA Controller and be able to write DMA programs which perform I/O on devices.

3. Understand the process of EPROM programming and be able to utilize EPROMs to store program code in such devices to control systems. "Instructor's Notes"

4. Control Servo and Stepper Motors through I/O Ports and understand the requirements and interfacing techniques for devices requiring higher power "M A T Lab Manuals"

input.

BLOCK 4 - HARD DRIVE AND VIDEO INTERFACES

This block involves the study of 2 important subsystems in PC systems: the video interface and the hard drive interface. Representative devices and standards are studied for each. Specifically the student will be able to:

1. Describe the characteristics and operation of various hard drive interfaces including ST506, IDE, ESDI AND SCSI. "Instructor's Notes"

2. Describe the methods and video standards for displaying data on colour and monochrome raster-scan CRT's.

3. Describe the operation of the MC6845 CRT Controller chip (and its compatible successors) and their application in video display adapters. In addition, be able to program the video interface in Assembler or C. "Microcomputer Servicing"

BLOCK 5- RECENT DEVELOPMENTS AND FUTURE TRENDS

1. This block will involve the study of recent innovations and trends in the utilization of microprocessors in Electronics and Electrical applications. Students will be assigned individualized topics to research and present.

COMPUTER INTERFACING — COURSE NAME
CET315-5 — CODE NO.

V. METHOD OF EVALUATION:

3 THEORY TESTS (20% each)	60%
LAB PROJECTS	32%
ORAL PRESENTATION AND REPORT	8%

(The percentages shown above may have to be modified if changing circumstances require it. Students will be notified of any modifications.)

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.
3. The student has not had a failing grade in all of the theory tests taken.
4. The student has made reasonable efforts to participate in class and complete assignments.

LABS AND ASSIGNMENTS:

1. Lab activities represent a very important component of this course in which practical 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.

2. Lab assignments must be completed satisfactorily to succeed. In addition, the Theory component (Tests) and the Lab component must each have a minimum of 50% to pass this course.

3. It is acceptable that students consult with each other in relation to their assigned problems and lab projects. However, it is unacceptable to copy programs or reports written by someone else and submit them as your own work. Where plagiarism or copying is found, a mark of zero will be assigned. If it is impossible to determine whose original work it is, a mark of zero will be assigned to all assignments involved.

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.

VI. REQUIRED STUDENT RESOURCES:

TEXT BOOK:

"MICROCOMPUTER SERVICING: Practical Systems and Troubleshooting"

by Asser, Stigliano and Bahrenburg (Merrill Publishing)

"Instructors Notes" (as provided)

VII. ADDITIONAL RESOURCE MATERIALS AVAILABLE:

1. "INTERFACING TO THE IBM PERSONAL COMPUTER"

   by LEWIS EGGEBRECHT (2nd ED)
   (SAMS PUBLICATIONS)

2. Various Lab Equipment Reference Manuals

COMPUTER INTERFACING
COURSE NAME

CET315-5
CODE NO.

VIII. SPECIAL NOTES:

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.

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.