

SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE: MICROPROCESSOR PROGRAMMING

CODE NO.: CET 205 - 5

PROGRAM: ELECTRICAL & ELECTRONIC
TECHNICIAN / TECHNOLOGIST

SEMESTER: THREE

AUTHOR: PETER SAVICH

DATE: JULY 18, 1989

PREVIOUS OUTLINE
DATED: MAY 18, 1988

APPROVED:

P. Savich
CHAIRPERSON

89/08/31
DATE

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TOTAL CREDIT HOURS: 75

LENGTH OF COURSE: 5 HOURS PER WEEK FOR 15 WEEKS

PREREQUISITE(S): NONE

I. PHILOSOPHY / GOALS

THE OBJECTIVE OF THIS COURSE IS TO ENHANCE THE STUDENT'S KNOWLEDGE OF MICROPROCESSOR THEORY, PRACTICE AND APPLICATIONS. THE COURSE USES THE 8088 ASSEMBLY LANGUAGE TO PROVIDE THIS KNOWLEDGE OF MICROPROCESSORS. THE CET228 COURSE OFFERING IN FOURTH SEMESTER WILL FOLLOW UP ON HARDWARE INTERFACING AND INTERRUPTS. THE STUDENT OF THE CET205 COURSE WILL BE GIVEN TIME TO ACQUIRE THE EDITING, ASSEMBLING, LINKING, DEBUGGING SKILLS FOR RUNNING ASSEMBLY PROGRAMS. THIS REQUIRES THE STUDENT TO FIRST UNDERSTAND THE VARIOUS ADDRESSING MODES AND INSTRUCTION SETS AVAILABLE.

II. STUDENT PERFORMANCE OBJECTIVES

UPON SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENT WILL BE ABLE TO:

1. TURN ON THE IBM PC MICROCOMPUTER, AND RUN APPLICATION PROGRAMS
2. USE "NORTON'S EDITOR" TO EDIT, "MASM" TO ASSEMBLE, AND "DEBUG" TO RUN SIMPLE ASSEMBLY PROGRAMS.
3. USE "DEBUG" TO SAVE, RETRIEVE, ASSEMBLE, UNASSEMBLE, TRACE, AND EXAMINE SIMPLE ASSEMBLY PROGRAMS.
4. USE THE "P8086" FROM THE UNIVERSITY OF PITTSBURGH, DEVELOPMENT SYSTEMS TO ASSEMBLE AND DEBUG SIMPLE ASSEMBLY PROGRAMS.

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III. TOPICS TO BE COVERED

1. REVIEW BOOTING UP THE MS DOS OPERATING SYSTEM, LEARNING THE MS DOS COMMANDS.
2. ARCHITECTURE OF THE 8086/8088
3. LEARNING THE SUPPORT CHIPS OF THE 8088
4. MEMORY MAPPING FOR THE 8088
5. REGISTERS, ADDRESSING MODES, AND INSTRUCTION SET OF THE 8088
6. HOW TO USE DEBUG TO LOAD AND WRITE SIMPLE ASSEMBLY PROGRAMS
7. HOW TO USE "NORTON EDITOR" TO CREATE SIMPLE ASSEMBLY PROGRAMS
8. ASSEMBLING USING "MASM", LINKING, AND RUNNING ASSEMBLY PROGRAMS
9. DOING KEYBOARD I/O USING DOS INT 21

IV. LEARNING ACTIVITIES

LEARNING ACTIVITIES

REQUIRED RESOURCES

1.0 REVIEWING BOOTING UP/LEARNING MS DOS

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

- 1.1 SET THE REALTIME CLOCK AND CALENDAR,
FORMAT DISKS, USE THE KEYBOARD

COMPLETE
ASSIGNMENT
PART 1 OF TEXT

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2.0 ARCHITECTURE OF THE 8086/8088

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

2.1 DESCRIBE THE INTERNAL STRUCTURE OF
THE 8086 MICROPROCESSOR

ASSIGNMENT

2.2 DRAW A BLOCK DIAGRAM OF A BASIC
MICROCOMPUTER AND IDENTIFY THE
COMPONENTS

ASSIGNMENT

2.3 DEFINE THE FOLLOWING TERMS: MICROPROCESSOR,
MICROCOMPUTER, CLOCK, MEMORY DEVICE, I/O
DEVICE, RAM, ROM, INSTRUCTION, MACHINE CODE,
BYTE, WORD, DOUBLE WORD, REGISTER, ADDRESS

UNIT 1 OF TEXT

3.0 LEARNING THE SUPPORT CHIPS OF THE 8088

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

3.1 BRIEFLY DESCRIBE THE FIVE PROGRAMMABLE CHIPS:
PCI, PIT, PPI, PIC, PKDB

HANDOUTS

3.2 BRIEFLY DESCRIBE THE FIVE CONTROLLER CHIPS:
CRT, KEYBOARD, DMA, FLOPPY/HARD DISK, BUS

HANDOUTS

3.3 BRIEFLY DESCRIBE FIVE OTHER CHIPS:
NUMERIC CO-PROCESSOR, ROM, RAM, CLOCK GENERATOR,
VIDEO CHARACTER DISPLAY GENERATOR

HANDOUTS

3.4 BRIEFLY DESCRIBE THE I/O CHANNEL

HANDOUTS

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4.0 MEMORY MAPPING FOR THE 8086/8088

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

- | | | |
|-----|--|--------------------|
| 4.1 | DESCRIBE THE DIFFERENCE BETWEEN LOGICAL ADDRESSING AND PHYSICAL ADDRESSING | TEXT & HANDOUTS |
| 4.2 | DESCRIBE THE DIFFERENCE BETWEEN MEMORY MAPPED VERSUS ISOLATED I/O ADDRESSING | TEXT & HANDOUTS |
| 4.3 | DESCRIBE WHAT THE INTERRUPT VECTOR TABLE IS USED FOR | HANDOUTS |
| 4.4 | UNDERSTAND WHY THE SYSTEM MEMORY MAP AND THE I/O SPACE MAP IS USED IN A MICROCOMPUTER DESIGN | HANDOUTS |

5.0 REGISTERS, ADDRESSING MODES, AND INSTRUCTION SET OF 8088

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

- | | | |
|-----|---|---------|
| 5.1 | DEMONSTRATE UNDERSTANDING OF THE 16 BIT WIDE REGISTERS BY USING DEBUG TO OPEN THE 14 DIFFERENT REGISTERS | |
| 5.2 | SET THE CONDITIONS OF THE FLAG REGISTER | |
| 5.3 | USE THE SEVEN DATA ADDRESSING MODES IN DEBUG | |
| 5.4 | KNOW THE JMP INSTRUCTION AND ALL ITS DERIVATIVES | |
| 5.5 | KNOW THE STACK ADDRESSING INSTRUCTIONS: PUSH AND POP | |
| 5.6 | RELATE SOME OF THE INSTRUCTIONS STUDIED TO THE ADDRESSING MODES, REG/MEM, TO THE NUMBER OF CYCLES NEEDED, AND NUMBER OF TRANSFERS | HANDOUT |

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6.0 HOW TO USE DEBUG TO LOAD AND WRITE SIMPLE ASSEMBLY PROGRAMS

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

6.1 USE ANY OF THE FOLLOWING DEBUG COMMANDS:
A,C,D,E,F,G,H,I,L,M,N,O,Q,R,S,T,U,W

HANDOUT

6.2 USE DEBUG WRITE A SERIES OF SIMPLE
ASSEMBLY PROGRAMS THAT USE DIFFERENT
ADDRESSING MODES TO SOLVE A "CALCULATOR"
TYPE PROBLEM

ASSIGNMENT

7.0 HOW TO USE "NORTON EDITOR" TO CREATE SIMPLE ASSEMBLY
PROGRAMS

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

7.1 WRITE SIMPLE PROGRAMS USING THE EDITOR

7.2 KNOW THE ASSEMBLY DIRECTIVES NEEDED AND THE
PROGRAM INITIALIZATION

7.3 USE THE SKELETON PROGRAM TO SPEED UP THE
WRITING OF SOURCE CODE

7.4 SAVE, RENAME, RETRIEVE SOURCE CODE

ASSIGNMENT

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8.0 ASSEMBLING USING "MASM", LINKING, AND RUNNING ASSEMBLY PROGRAMS

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

8.1 ASSEMBLE USING "MASM", CORRECTLY
KNOW THE ERROR MESSAGES IF INCORRECT, AND
THEN RE-ASSEMBLE

8.2 LINK THE OBJECT CODE TO PRODUCE EXECUTABLE
CODE. KNOW THE ERROR MESSAGES

8.3 RUN THE EXECUTABLE CODE WITHIN DEBUG

ASSIGNMENT

9.0 DOING KEYBOARD I/O USING DOS INT 21

UPON SUCCESSFUL COMPLETION OF THIS UNIT,
THE STUDENT WILL BE ABLE TO:

TEXT: ADVANCED
MICROPROCESSORS

9.1 PERFORM SIMPLE OUTPUT TO THE SCREEN
USING DOS INT 21

9.2 PERFORM SIMPLE INPUT TO THE COMPUTER
VIA THE KEYBOARD USING DOS INT 21

HANDOUTS
ASSIGNMENT

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V. METHOD(S) OF EVALUATION

1.

THE STUDENT WILL BE ASSESSED THROUGH A SERIES OF THREE (3) WRITTEN TESTS. THESE TESTS WILL EACH BE WEIGHTED TO 20% OF THE FINAL MARK.

THE TENTATIVE DATES ARE: OCT 5 /89
NOV 3 /89
DEC 19/89

THESE TEST DATES WILL BE RE-ANNOUNCED APPROXIMATELY ONE WEEK IN ADVANCE.

2.

THE STUDENT WILL BE ASSESSED THROUGH A SERIES OF UNANNOUNCED QUIZZES. THE TOTAL WEIGHT OF THESE QUIZZES ARE NOT TO EXCEED 10% OF THE FINAL MARK.

3.

THE STUDENT WILL BE ASSESSED THROUGH A SERIES OF LAB ASSIGNMENTS. COLLECTIVELY THESE ASSIGNMENTS WILL BE WEIGHTED TO 25% OF THE FINAL MARK.

4.

THE STUDENT WILL BE ASSESSED ON HIS/HER ABILITY TO ANSWER QUESTIONS ABOUT THE LAB ASSIGNMENT ONCE SUBMITTED. THE STUDENT'S RESPONSE TO THESE LAB DEMONSTRATION QUESTIONS WILL BECOME PART OF HER/HIS "PRACTICAL DEMONSTRATION" MARK. THIS MARK WILL BE WEIGHTED TO 5% OF THE FINAL MARK.

5.

THE STUDENT ATTENDING MORE THAN 80% OF THE TIME WILL RECEIVE A BONUS OF 2%.

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SUMMARY OF FINAL MARK

| | | | |
|----|-------------|------|------------|
| 1. | TESTS | 60% | |
| 2. | QUIZZES | 10% | |
| 3. | ASSIGNMENTS | 25% | |
| 4. | DEMOS | 5% | |
| | | ---- | |
| | | 100% | |
| 5. | ATTENDANCE | 2% | BONUS ONLY |

COURSE GRADING SCHEME

| | | |
|----|---------|--|
| A+ | 90+ | OUTSTANDING ACHIEVEMENT |
| A | 80 - 89 | ABOVE AVERAGE ACHIEVEMENT |
| B | 70 - 79 | AVERAGE ACHIEVEMENT |
| C | 55 - 69 | SATISFACTORY ACHIEVEMENT |
| U | | UNSATISFACTORY GIVEN AT MIDTERM ONLY |
| S | | SATISFACTORY GIVEN AT MIDTERM ONLY |
| 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 HAVE THE CHAIRPERSON'S APPROVAL AND HAS A MAXIMUM TIME LIMIT OF 120 DAYS. |

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3. 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 "REPEAT" GRADE ON ALL TESTS WILL REMOVE THE OPTION OF ANY UPGRADING AND AN "R" GRADE WILL RESULT. THE HIGHEST ON A RE-WRITTEN TEST OR ASSIGNMENT WILL BE 56%.

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
WRITING OF COMPREHENSIVE SUPPLEMENTAL EXAMINATION

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VI. REQUIRED STUDENT RESOURCES

THE TEXT REQUIRED TO BE PURCHASED BY STUDENTS ARE:

ADVANCED MICROPROCESSORS, BY HEATHKIT EDUCATIONAL SYSTEMS
THERE ARE 3 BOOKS: BOOK I, BOOK II, AND STUDENT WORKBOOK.

THE STUDENTS WILL ALSO BE EXPECTED TO PURCHASE APPROXIMATELY 10
FLOPPY DISKS 5 AND ONE QUARTER INCH, DOUBLE SIDED, DOUBLE
DENSITY.

VII. ADDITIONAL RESOURCE MATERIALS (AVAILABLE IN COLLEGE
LIBRARY)

THERE ARE MANY OTHER BOOKS ON ASSEMBLER LANGUAGE FOR THE
8086/8088 MICROPROCESSOR FAMILY.

VIDEO TAPES: THE ONTARIO TV SERIES: THE EDUCATION OF MIKE
MACMANNIS. THE 13 PART SERIES COMPUTERS AND
COMPUTER LITERACY.

PERIODICALS: THERE ARE PC MAG, BYTE MAG, COMPUTING CANADA

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VIII. SPECIAL NOTES

FOR THE ELECTRICAL & ELECTRONIC STUDENTS THE CET205 COURSE IS BEING OFFERED THIS YEAR (1989) AND FOR THE FUTURE, USING THE 8088 MICROPROCESSOR. FOR ANY REPEATING STUDENTS OR STUDENTS WITH PAST CREDIT IN CET205, THE COURSE WAS OFFERED BEFORE USING THE 6800, "HEATHKITS" AS THE MICROPROCESSOR. THE COLLEGE HAS UPGRADED TO THE MORE POWERFUL 8088 FAMILY OF MICROPROCESSORS. THIS WILL PROVIDE THE STUDENT WITH THE NECESSARY PRE-REQUISITES FOR THE CET228 AND CET306 COURSES OFFERED IN THE FOURTH AND FIFTH SEMESTERS OF THEIR PROGRAM. THE CET315 "INTERFACING" COURSE OF THE SIXTH SEMESTER COMPLETES ALL THE COMPUTER RELATED COURSE MATERIAL OF THE ELECTRICAL/ ELECTRONIC PROGRAM. THUS THE 8088 MICROPROCESSOR, AND 8088 ASSEMBLER LANGUAGE OF THE IBM PC MICROCOMPUTER IS WELL STUDIED.

THIS IS A NEW COURSE, SO THE COURSE OUTLINE MAY HAVE TO BE ADJUSTED DURING THE SEMESTER. STUDENTS WILL BE NOTIFIED OF ANY CHANGES NEEDED.