SAULT COLLEGE OF APPLIED ARTS & TECHNOLOGY

SAULT STE. MARIE, ONTARIO

COURSE OUTLINE

COURSE TITLE:	COMPUTER SYSTEMS I
CODE NO.:	CET 200 - 5
PROGRAM:	COMPUTER ENGINEERING TECHNICIAN / TECHNOLOGIST
SEMESTER:	THREE
AUTHOR:	PETER SAVICH
DATE:	JUNE 20, 1990
PREVIOUS OUTLINE DATED:	JUNE 1989
BY:	GERRY DAVIES

APPROVED: _____ DEAN _____ 95/08/15 DATE

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

TOTAL CREDIT HOURS: 80

LENGTH OF COURSE: 5 HOURS PER WEEK FOR 16 WEEKS
ONE 1 HOUR THEORY CLASSES PER WEEK
TWO 2 HOUR LAB CLASS PER WEEK

PREREQUISITE(S): NONE

I. PHILOSOPHY / GOALS

THE OBJECTIVE OF THIS COURSE IS TO EXPAND THE COMPUTER ARCHITECTURE AND MACHINE LANGUAGE PROGRAMMING CONCEPTS DEVELOPED IN CET 127 TO A MEDIUM-SIZED MULTI-USER SYSTEM. THE PDP-11 FAMILY OF COMPUTERS USING THE RSX-11/M OPERATING SYSTEM ARE USED. THE STUDENT WILL DEVELOP SKILLS IN EDITING, ASSEMBLING, LINKING AND RUNNING PROGRAMS USING THE MACRO-11 ASSEMBLY LANGUAGE.

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

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 SUCH AS "EM220" OR "ST240" THAT WILL ALLOW THE IBM PC TO SIMULATE A PDP-11 TERMINAL.

2. SUCCESSFULLY, "LOG-ON" AND "LOG-OFF" THE RSX-11M OPERATING SYSTEM AND PDP-11/73 COMPUTER INSTALLED AT SAULT COLLEGE.

3. USE THE DCL COMMANDS OF THE RSX-11/M OPERATING SYSTEM TO OBTAIN DIRECTORY INFORMATION, COPY, DELETE, RENAME, PURGE, TYPE AND PRINT FILES. USE THE DCL COMMANDS TO ASSEMBLE, LINK AND RUN FILES.

4. USE "EDT" TO EDIT. USE THE LINE EDIT MODE AND THE KEYPAD EDIT MODE.

5. USE THE MACRO-11 ASSEMBLER TO ASSEMBLE SOURCE CODE GENERATED BY THE EDITOR. USE THE LISTING FILE AND INTERPRET ANY ERROR MESSAGES. USE THE LINK COMMAND WITH AND WITHOUT THE QUALIFIER "DEBUG" TO PRODUCE EXECUTABLE CODE.

6. USE THE "ODT DEBUG" TO EXAMINE SIMPLE ASSEMBLY PROGRAMS.

7. PERFORM SIMPLE INPUT/OUTPUT USING THE SUBROUTINES PROVIDED, AND THE FILE CONTROL SERVICES (FCS) UTILITIES.

8. USE THE FLOATING POINT INSTRUCTION SET TO PERFORM SIMPLE ARITHMETIC CALCULATIONS USING REAL NUMBERS VERSUS INTEGER NUMBERS.

9. DESCRIBE THE METHODS USED TO MANAGE MEMORY IN THE PDP-11 FAMILY OF COMPUTERS.

10. SEPARATELY ASSEMBLE AND COMPILE BOTH LOW AND HIGH LEVEL LANGUAGE SEGMENTS OF A PROGRAM.

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

III. TOPICS TO BE COVERED

1. PRELIMINARIES:
   REVIEW BOOTING UP THE IBM PC'S, MS DOS OPERATING SYSTEM, LEARNING THE EMULATION SOFTWARE "EM220" OR "ST240", LOGGING ON/OFF THE RSX-11/M OPERATING SYSTEM, CHANGING PASSWORD ON ACCOUNTS.

2. ARCHITECTURE OF THE PDP-11 FAMILY

3. MEMORY MAPPING FOR THE PDP-11

4. REGISTERS, ADDRESSING MODES, AND INSTRUCTION SET OF THE PDP-11 FAMILY OF COMPUTERS

5. EDITING, ASSEMBLING, LINKING, RUNNING IN "ODT DEBUG" SIMPLE ASSEMBLY PROGRAMS

6. PROGRAM MODULARIZATION USING SUBROUTINES AND MACROS

7. INPUT/ OUTPUT TECHNIQUES

8. FLOATING POINT NUMBERS AND THE F.P. INSTRUCTION SET

9. LINKING OF HIGH AND LOW LEVEL LANGUAGES AVAILABLE TO THE PDP-11 (FORTRAN AND MACRO-11)

10. MEMORY MANAGEMENT METHODS IN THE PDP-11 FAMILY

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

IV. LEARNING ACTIVITIES

LEARNING ACTIVITIES	REQUIRED RESOURCES
1.0 PRELIMINARIES	
UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO:	TEXT: COURSE NOTES
1.1 BOOT UP THE IBM PC'S, FORMAT DISKS, USE THE KEYBOARD	C O M P L E T E ASSIGNMENT PART 1 OF TEXT
1.2 USE EITHER THE "EM220" OR "ST240" EMULATION SOFTWARE	
1.3 LOG ON AND OFF THE RSX-11/M OP/SYS CHANGE PASSWORD	
1.4 LEARN DCL COMMANDS: TO OBTAIN DIRECTORY INFORMATION, COPY, DELETE, RENAME, PURGE, TYPE AND PRINT FILES. USE THE DCL COMMANDS TO ASSEMBLE, LINK AND RUN FILES.	
2.0 ARCHITECTURE OF THE PDP-11 COMPUTER	
UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO:	COURSE NOTES & TEXTBOOK
2.1 DESCRIBE THE INTERNAL STRUCTURE OF THE PDP-11 COMPUTER	
2.2 DRAW A BLOCK DIAGRAM OF THE PDP-11 COMPUTER AND IDENTIFY THE COMPONENTS	
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	COURSE NOTES & TEXTBOOK

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

3.0 MEMORY MAP OF THE PDP-11 FAMILY OF COMPUTERS

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: TEXT & COURSE NOTES

3.1 RECOGNIZE ADDRESSABLE MEMORY AS HAVING BYTE SIZE AND WORD SIZE DATA

3.2 BRIEFLY DESCRIBE THE THREE AREAS OF MEMORY: VECTOR ADDRESS AREA, USER PROGRAM AREA AND PERIPHERAL ADDRESS AREA

4.0 REGISTERS, ADDRESSING MODES, AND INSTRUCTION SET OF THE PDP-11 FAMILY OF COMPUTERS

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: TEXT & COURSE NOTES

4.1 DEMONSTRATE UNDERSTANDING OF THE 16 BIT WIDE REGISTERS BY USING DEBUG TO OPEN THE 8 DIFFERENT REGISTERS R0 TO R7

4.2 USE THE 8 DIFFERENT ADDRESSING MODES IN SIMPLE PROGRAMS

4.3 USE THE FOUR PC ADDRESSING MODES IN SIMPLE PROGRAMS

4.4 KNOW THE TEN MOST COMMON MACRO-11 INSTRUCTIONS (OUT OF 87 INSTRUCTIONS AVAILABLE) AND USE THEM UNDER ALL PERMITTED ADDRESS MODES.

4.5 KNOW THE TEN MOST FREQUENTLY USED BRANCH INSTRUCTIONS

4.6 KNOW THE FORMULAS FOR CALCULATING THE RELATIVE ADDRESS, FORWARD BRANCH OFFSET, BACKWARD BRANCH OFFSET, AND TARGET ADDRESS

4.7 GENERATE OCTAL CODE FROM THE MNEMONICS AND GENERATE MNEMONICS FROM OCTAL CODE

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

4.8 PERFORM THE ARITHMETIC INSTRUCTIONS: ADD, MULTIPLY, SUBTRACT, AND DIVIDE USING THE INTEGER NUMBERS BYTE SIZE AND WORD SIZE

5.0 EDITING, ASSEMBLING, LINKING, RUNNING IN "ODT DEBUG" SIMPLE ASSEMBLY PROGRAMS

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

TEXT & COURSE NOTES

5.1 WRITE SIMPLE PROGRAMS USING THE EDITOR IN "LINE MODE" AND "KEYPAD MODE"

5.2 KNOW THE ASSEMBLY DIRECTIVES NEEDED IN THE SOURCE CODE PROGRAMS

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

5.4 SAVE, RENAME, RETRIEVE SOURCE CODE

ASSIGNMENTS

5.5 ASSEMBLE USING "MACRO-11" CORRECTLY KNOW THE ERROR MESSAGES IF INCORRECT, AND THEN RE-ASSEMBLE

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

5.7 USE "ODT" DEBUG TO EXAMINE A SERIES OF SIMPLE ASSEMBLY PROGRAMS THAT USE DIFFERENT ADDRESSING MODES TO SOLVE A "CALCULATOR" TYPE PROBLEM

ASSIGNMENT

5.8 RUN ANY EXECUTABLE CODE WITHIN DEBUG

O N G O I N G ASSIGNMENTS

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

6.0 SUBROUTINES AND MACROS

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: TEXT & COURSE NOTES

6.1 DISCUSS THE USE OF THE STACK IN PDP-11 PROGRAMS

6.2 WRITE PROGRAMS UTILIZING BOTH INTERNAL AND EXTERNAL SUBROUTINES AND MACROS

6.3 DISCUSS THE METHODS USED FOR ARGUMENT TRANSMISSION WITH PASSING PARAMETERS TO AND FROM SUBROUTINES

6.4 DISCUSS THE ADVANTAGES OF USING MACRO AND OBJECT LIBRARIES

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

7.0 INPUT/ OUTPUT TECHNIQUES

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: TEXT & COURSE NOTES

7.1 DESCRIBE BRIEFLY THE THREE TECHNIQUES OF ACHIEVING I/O: USER DEFINED ROUTINES, FILE CONTROL SERVICES (FCS), OR FORTRAN I/O

7.2 PERFORM SIMPLE OUTPUT TO THE SCREEN USING THE USER DEFINED ROUTINE .PRINT IN "SUBLIB"

7.3 PERFORM SIMPLE INPUT TO THE COMPUTER VIA THE KEYBOARD USING THE "SUBLIB" ROUTINE .TTYIN TEXT & COURSE NOTES ASSIGNMENT

7.4 CONVERT ASCII CHARACTER "UNPACKED" INTEGER NUMBERS INTO BINARY "PACKED" NUMBERS AND VISA VERSA

7.5 DESCRIBE THE REASONS FOR NEEDING FILE CONTROL SERVICES ON A MULTI-USER SYSTEM

7.6 DESCRIBE THE FCS MACROS AND THEIR FUNCTION

7.7 WRITE PROGRAMS THAT UTILIZE FCS MACROS TO PERFORM I/O TASKS ASSIGNMENT

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

8.0 FLOATING POINT NUMBERS AND F.P. INSTRUCTION SET

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: — TEXT & COURSE NOTES

8.1 DESCRIBE THE REAL NUMBER BASED SYSTEM FOR THE PDP-11 FAMILY CALLED FLOATING POINT (SINGLE AND DOUBLE PRECISION)

8.2 UNDERSTAND THE DIFFERENCE BETWEEN THE RANGE, ACCURACY, AND PRECISION OF A NUMBER

8.3 SUBDIVIDE A 32 BIT OCTAL F.P. NUMBER INTO ITS: MANTISSA, SIGN AND EXPONENT PARTS

8.4 CONVERT REAL NUMBER (DECIMALS) INTO F.P. NUMBERS AND VISA VERSA

8.5 WRITE PROGRAMS UTILIZING THE F.P. NUMBERS AND THE FLOATING POINT INSTRUCTION SET — ASSIGNMENT

9.0 LINKING OF HIGH AND LOW LEVEL LANGUAGES

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: — TEXT & COURSE NOTES

9.1 WRITE PROGRAMS USING F77 FORTRAN I/O INSTRUCTIONS SUCH AS READ AND WRITE

9.2 WRITE PROGRAMS USING MACRO-11 ASSEMBLY THAT CAN HANDLE HIGH LEVEL LANGUAGE ARGUMENT TRANSMISSION

9.3 LINK AND RUN PROGRAMS THAT WERE SEPARATELY COMPILED AND ASSEMBLED — ASSIGNMENT

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

10. MEMORY MANAGEMENT METHODS IN THE PDP-11 FAMILY

UPON SUCCESSFUL COMPLETION OF THIS UNIT, THE STUDENT WILL BE ABLE TO: TEXT & COURSE NOTES

10.1 DESCRIBE THE METHODS USED TO MANAGE MEMORY ON THE PDP-11

10.2 DISCUSS THE DIFFERENCE BETWEEN VIRTUAL ADDRESS AND PHYSICAL ADDRESS

10.3 DESCRIBE HOW THE REGISTERS: PAGE ADDRESS REGISTER PAR, PAGE DESCRIPTION REGISTER PDR FORM THE ACTIVE PAGE REGISTER APR

10.4 DEFINE THE THREE PROCESSOR OPERATING MODES: KERNEL, USER, AND SUPERVISOR

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

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 1 /90
NOV 5/90
DEC 10/90

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%.

COURSE NAME:

COMPUTER SYSTEMS I

CODE NO.:

CET 200 - 5

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 DEAN'S APPROVAL AND HAS A MAXIMUM TIME LIMIT OF 120 DAYS.

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

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

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

VI. REQUIRED STUDENT RESOURCES

THE TEXT REQUIRED TO BE PURCHASED BY STUDENTS ARE:

1.

PROGRAMMING IN ASSEMBLY LANGUAGE: MACRO-11
BY EDWARD F. SOWELL
PUBLISHER: ADDISON-WESLEY

2.

COURSE NOTES FOR CET 200
PREPARED BY PETER SAVICH
PUBLISHER: SAULT COLLEGE BOOKSTORE

3.

THE STUDENTS WILL ALSO BE EXPECTED TO PURCHASE APPROXIMATELY 1 FLOPPY DISKS 5 AND ONE QUARTER INCH, DOUBLE SIDED, DOUBLE DENSITY.

COURSE NAME: CODE NO.:

COMPUTER SYSTEMS I CET 200 - 5

VII. ADDITIONAL RESOURCE MATERIALS (AVAILABLE IN COLLEGE LIBRARY)

THERE ARE MANY OTHER BOOKS ON ASSEMBLER LANGUAGE FOR THE PDP-11 FAMILY.

1.
PDP-11 MICRO/PDP-11 HANDBOOK
BY DIGITAL EQUIPMENT CORP.

2.
MACHINE AND ASSEMBLY LANGUAGE PROGRAMMING OF THE PDP-11
BY ARTHUR GILL
PUBLISHER: PRENTICE HALL

3.
MACRO-11 ASSEMBLY LANGUAGE ARCHITECTURE & STRUCTURED PROGRAMMING
BY C.J. HWANG AND GIBSON
PUBLISHER: PRENTICE HALL

4.
MINICOMPUTER SYSTEMS ORGANIZATION, PROGRAMMING AND APPLICATIONS (PDP-11)
BY R. ECKHOUSE AND L.R. MORRIS

VIDEO TAPES: THE DIGITAL EQUIPMENT CORP. SERIES: THE VAX-11 FAMILY OF COMPUTERS.

PERIODICALS: DECUS MAGAZINE

USER GROUPS: SAULT STE MARIE VAX AND PDP-11 USER GROUP

COURSE NAME:

COMPUTER SYSTEMS I

CODE NO.:

CET 200 - 5

VIII. SPECIAL NOTES

INSTRUCTORS (PROFESSORS) RESERVE THE RIGHT TO MAKE CHANGES TO THE COURSE OUTLINES WHERE NECESSARY.