San Bernardino Valley College
Curriculum Approved: January 24, 2005

I. CATALOG DESCRIPTION:

A. Department Information:

Division: Science and Math
Department: Computer Science
Course ID: CS170
Course Title: Assembly Language
Units: 4
Lecture Hours: 3
Laboratory Hours: 3
Prerequisite: CS 110

B. Catalog and Schedule Description:

An introduction to assembly language and machine organization. Topics include memory location, register references, data definitions, machine instructions, screen processing, disk storage, and macros.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One time

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon completion of the course the student should be able to:

A. Design an algorithm for a machine-oriented programming problem;
B. Convert numbers in binary, octal, or hexadecimal into decimal;
C. Differentiate .COM and .EXE programs;
D. Recognize programs written in machine language and assembly language;
E. Read and write programs in IBM PC assembly code;
F. Recognize screen and keyboard controls;
G. Compare and contrast various addressing schemes;
H. Link macros and procedures;
I. Manage disk I/O processing.

IV. COURSE CONTENT:

A. Fundamentals of PC hardware and software
   1. Computer logic design and architecture
      a) Binary numbers and hexadecimal representation
      b) Processors, internal memory, and registers
      c) Internal codes
   2. Features of the operating system
      a) The boot process
      b) I/O interface
      c) Segments and addressing
   3. The execution process
      a) Memory locations and machine language
      b) Debugging
B. Elements of assembly language
   1. The assembly code
      a) Assemblers and compilers
      b) Identifiers and reserved words
      c) Statements and directives
   2. Initialize and end a program
      a) Assembling a source program
      b) Linking an object program
      c) Execution and cross-referencing listing
   3. Symbolic instructions and addressing
      a) Instruction set and operands

b) Extended operations
c) Data addresses

4. Writing .COM programs
   a) Differences between .EXE and .COM programs
   b) The .COM stack
5. Requirements for logic and control
   a) Instructions and instruction labels
   b) Conditional jump instructions
   c) Calling procedures
   d) Execution on the stack
   e) Shifting and rotation bits

C. Screen and keyboard operations
1. Screen and keyboard controls
   a) Setting the cursor
   b) Screen display and clear
   c) Functions for I/O
   d) Control characters
2. Video and text screen processing
   a) ASCII characters for boxed and menus
   b) Direct video display
   c) Graphics and text mode
3. The keyboard buffer and extended function keys
   a) Keyboard shift status
   b) Using INT 2IH, INT 16H, and BIOS INT 09H

D. Manipulating data
1. String processing
   a) Operation codes for string
   b) Scan and replace strings
2. Binary data for arithmetic
   a) Signed and unsigned data
   b) Addition and subtraction
   c) Multiplication and division
   d) Double word values and processing
3. ASCII and BCD data for arithmetic
   a) Decimal format
   b) Unpacked and packed data
   c) Data code and decode
   d) Shifting and rounding
4. Tables
   a) Defining, sorting, and searching a table
   b) Direct addressing and linked lists

E. Disk I/O
1. Disk storage and organization
   a) Characteristics of disk
   b) Disk system area and data area
   c) Boot record, directory, and file allocation table
2. Writing and reading disk files
   a) Strings and files
   b) Using file handles
   c) Error return codes
   d) Using file control blocks
3. Disk support functions
   a) Handling disk drives
   b) BIOS status
   c) Printing and printer control
   d) Mouse and ports

e) Generating sound

F. Macros and linking subprograms
   1. Using macro
      a) The LOCAL directive
      b) Using parameters
      c) Macro from a library
   2. Using subprograms
      a) The SEGMENT directive
      b) The EXTRN and public attributes
      c) Defining data and passing parameters
      d) Linking to Pascal, or C, or C++
   3. Memory management
      a) High-memory area
      b) Program segment prefix
      c) Memory allocation strategy
      d) Program loader
      e) Program overlays
G. Advanced features and references
   1. BIOS data area and program interrupts
   2. More on operators and directives
   3. The PC instruction set with 2-byte, 3-byte, and 4-byte instructions

V. METHODS OF INSTRUCTION:

A. Lecture
B. Discussion
C. Multi-media
D. Projects

VI. TYPICAL ASSIGNMENT(S):

A. Read the chapter reviewing Boolean logic and create a table of logic symbols and their meaning.
B. Write a summary of Boolean logic symbols and hypothesize about how they will be important in this course.
C. Write program in IBM PC assembly language
D. Write assembly language programs in lab
   1. Sample programming problem:
      a) Multiply the contents of the word DATAX by DATAY and store the product in DATAZ
      b) Divide DATAX by DATAY and store the answer in DATAV
      c) Try steps 1 and 2 again using double words for DATAX and DATAY
E. Discuss special assembly and machine programming techniques in class

VII. EVALUATION(S):

A. Programming projects: One project per week
B. Examinations and quizzes
   1. Two exams: midterm and final
   2. Weekly quizzes on reading assignments: Sample test questions:
      a) What is the maximum value in a byte for signed data and unsigned data?
      b) What is the maximum value in a word for signed data and unsigned data?
      c) Distinguish between a carry and a overflow
      d) What is the location of the first byte of the keyboard shift status in the BIOS data area?
      e) Explain the difference for INT 16H services 00H, 01H, and 10H.
      f) What is the maximum size of a COM program?

3. For a source program to convert to COM format, what segments can you define?

VIII. TYPICAL TEXT(S):

1. Introduction to Assembly Language Programming, Dandamudi, Sivarama; Springer, 2004.
2. Professional Assembly Language Programming, Blum, Richard; John Wiley & Sons, Inc., 2005.
3. The Art of Assembly Language, Hyde, Randall; No Starch, 2003.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: None