DE ANZA COLLEGE
APPLIED TECHNOLOGY DIVISION
COURSE OUTLINE

Degree Applicable

MANUFACTURING & CNC TECHNOLOGY 75B Effective: Fall 2004

I. Catalog Information

MFGD 75B Computer-Aided Numerical Control (CNC) Programming and Operation; Lathes, Advanced Mills 4 1/2 Units

Prerequisite: Manufacturing & CNC 75A with a grade of "C" or better or equivalent.

Nine hours lecture/lab

Introduction to lathe tool path programming using word address format, including coordinate system, cutter compensation and canned cycles. Advanced mill programming; sub programs, work coordinate system and use of macros. Program entry, editing, and back plotting. Machine controller functions and operations. Single point threading and Unified thread form classes and measurement. Cutting tool insert selection.

II. Course Objectives

The student will:

A. Write and interpret programs for CNC lathes.
B. Describe the controls and functions of CNC lathe controllers.
C. Prepare and interpret programs for CNC mills.
D. Use solid modeling software to verify mill and lathe programs.
E. Explain single point threading and measurement procedures for Unified threads.
F. Describe carbide insert ANSI designations, wear characteristics and applications.

III. Essential Student Materials

Scientific calculator (Texas Instruments-TI30 recommended).

IV. Essential College Facilities

A laboratory equipped with CNC machine tools and accessories for demonstration.

V. Expanded Description: Content and Form

A. Writing and interpreting programs for CNC lathes
   1 . Manuscript preparation
   2. Preparatory & miscellaneous functions
   3. Tool address and tool length offset
   4. Work shift coordinate system
      a . Machine reference
      b. Setting zero
   5. Spindle speed control
      a Fixed RPM
      b. Constant surface feet
   6. Tool point coordinates
      a. X, Z, U and W movements
      b. Circular interpolation with R
      c. Circular interpolation with I & K
      d. Manual application of tool nose radius compensation to angles
      e. Machine application of tool nose radius compensation
   7. Canned cycles
      a. Thread cutting
      b. Drilling

c. Finishing
d. Stock removal turn and face
e. Pattern repeat
f. Tapping

8. Plot coordinate points using tool nose radius compensation
   a. For chamfers and angles
   b. Blending radius to radius

B. CNC Lathe Controller Operation
1. Reference machine
2. View stored program numbers
3. Input and operate in MDI mode
4. Modify code in Edit mode
5. Identify and clear alarms
6. Call up and run programs in memory mode
7. Use jog functions to accurately locate tool
8. Understand controller operational aids
   a. Single block
   b. Block skip
   c. Dry run
   d. optional stop
   e. Feed rate override
   f. Interpret position screens
      (1) Absolute
      (2) Machine
      (3) Distance to go
   g. Interpret Command screens
      (1) Next block
      (2) Current block
9. Setting work shift offsets
   a. Setting tool offsets
   b. Setting tool nose radius (geometry) compensation
   c. Setting tool wear offsets
10. Run tool tryout with single block and adjusted feed rates

C. Writing and interpreting programs for CNC mills
1. Program functions as review
   a. Miscellaneous functions
   b. Speed, feed and tool address
   c. Tool coordinates
      (1) Circular interpolation
         (a) With I and J
         (b) With R
      (2) Slotting
      (3) Pocket milling
      (4) Bosses and islands
      (5) Bolt hole circles
2. Cutter compensation, ramp on/off moves
3. Canned cycles with R plane
   a. Peck drill (varible peck)
   b. Tapping
   c. Boring
4. Sub- routines
   a. Applications
   b. Formatting
   c. Sub- routines within sub-routines
5. Work coordinate sytem
   a. Moving part zero with G92
   b. Multiple fixtures with G54-G59
6. Macros; programs and applications

D. Verify mill and lathe programs with PC based solid modeling software
1. Enter and edit programs
2. Enter stock sizes and tool descriptions
3. Verity tool paths

E. External and internal Unified thread system

1. Thread form and terms
2. Pitch diameter calculation for various thread classes
3. Thread measurement using 3-wire method
4. Single point threading
   a. Tool geometry and grinding
   b. Lathe set-up for internal and external threads

F. Carbide lathe tools; descriptions and applications
1. Carbide insert types, ANSI designations and applications
   a. Tool shapes, cutting edge angles and applications
   b. Tool nose radius (TNR)
   c. Relief angles
   d. Chip breakers
      (1) Negative
      (2) Positive
   e. Carbide grades
   f. Sizes, inside circle
   g. Tolerance classes
2. Insert holders for manual and CNC machines
   a. Insert mounting methods
   b. Lead angles
   c. Adjusting rake and relief with holder
      (1) Angle of inclination
      (2) Effective rake angle
3. Insert wear characteristics and correction
   a. Cratering
   b. Fracturing
   c. Flank and/or nose wear
   d. Chipping and/or fatigue cracks
4. Tool geometry for different workpiece materials
   a. Hard/soft
   b. High elasticity
5. Coatings
   a. Titanium nitride and other types
   b. Advantages
6. Form and grooving tools
   a. High speed steel & carbide applications
   b. Design and grinding

VI. Assignments

A. Write Computer Numerical Control Programs.
B. Take home worksheets involving calculations.
C. Readings from textbooks, references and trade journals.

VII. Methods of Evaluating Objectives

A. Examinations covering lecture material and lab demonstrations
B. Completion of take home worksheets
C. Completion of programming exercises
D. A comprehensive, objective final exam

VIII. Texts and Supporting References

A. Texts:
   1. MCNC Staff, Advanced CNC Programming Manual, De Anza College, Cupretino, CA.,2003. (or equivalent)
B. References:
   1. Pusztai, Joseph and Michael Sava, Computer Numerical Control. Reston, Virginia: Reston, 2000. (or equivalent)