Course Number and Title: MCHT 2780-01 Computer Numerical Control I: Milling

Semester/Year: Fall 2006

Lecture Hours: 2  Laboratory Hours: 2  Credits: 4

Class Time: 6:00p.m.-9:00p.m.  MW  Room:  WT142

Instructor’s Name: Paul Brutsman
Instructor Contact Information:  Phone (W) 237-5528 x3052  (H) 235-8174

Course Description: An introductory course in 3-axis CNC mill programming. The course is structured so no prior experience with CNC mill programming or operation is required. The time will be divided between classroom and shop.

Statement of Prerequisites: None

Goal: To educate the student in CNC mill programming and operation.

Outcomes: To educate the student in CNC mill programming and operation of a HAAS VF1 machining center. The student will write programs from component prints, input those programs into CNC and machine the part. The student will also learn machine tooling and setup.

Attendance Policy: Attendance is very important. It will be very difficult to make up missed class time. More than three unexcused absences and student will be dropped from class.

Evaluation Criteria: The course grade will be calculated as follows:

Homework 50%  A= 90-100%
Quiz 10%  B= 89-80%
Tests 20%  C= 70-79%
Lab 20%  D= 60-69%
F= <59%

Required Text: Machining Center Programming and Operation, Mike Lynch
Required Supplies: Clip Board, Graph Paper, Safety Glasses and 3.5” disk.

References: Machinery’s Handbook, Industrial Press
Haas Workbook (provided by instructor)

CLASS POLICIES:  Last Date to Change to Audit Status:  November 3, 2006
Last Date to Withdraw With a W Grade: November 3, 2006

SAFETY: Personal and equipment safety standards will be strictly enforced. It is the individual’s responsibility to develop a safe work attitude.
STUDENT RIGHTS AND RESPONSIBILITIES: Please refer to the Casper College Student Conduct and Judicial Code for information concerning your rights and responsibilities as a Casper College Student.

*Chain of Command:* If you have any problems with this class, you should first contact the instructor in order to solve the problem. If you are not satisfied with the solution offered by the instructor, you should then take your problem through the appropriate chain of command starting with the department head, then the division chair, and lastly the vice president for academic affairs.

*Academic Dishonesty - Cheating and Plagiarism:* Casper College demands intellectual honesty. Proven plagiarism or any form of dishonesty associated with the academic process can result in the offender failing the course in which the offence was committed or expulsion from school. See the Casper College Student Code of Conduct.

*ADA Accommodations Policy:* It is the policy of Casper College to provide appropriate accommodations to any student with a documented disability. If you have a need for accommodation in this course, please make an appointment to see me at your earliest convenience.
Course Outline

Week 1
Course Review
Review Syllabus
Review Shop Safety Rules
Introduce Text
Introduce Haas Programming Book
Machine Axis
Cartesian Coordinate System
Incremental vs Absolute
Datums
Tour Shop
Homework
  Read Key Concept Number 1, lesson 1 thru lesson 6.
  Exercise 1 - 1,2,3,13,14,23.
  Exercise 2 - 6,7,8,9. Exercise 3 - 2,3,4,5,6,8,9,10
  Exercise 4 - 1,3,6,7,8,9,10,11,12,16

Week 2
Introduction to M, G, S and T functions
Modal vs NonModal Commands
Feeds and Speeds
Amount of Material Removed
HP Requirements
  EDIT
  MEM
  MDI/DNC
  HANDLE JOG
  ZERO RET
  LIST PROG
  GRAPHIC SIMULATION MODE

Shop Demonstration
Machine Startup Procedure
Machine Axis X,Y,Z
Machine Modes
  EDIT
  MDI/DNC
  HANDLE/JOG
  ZERO RET
  LIST PROG
  LIST PROG
  GRAPHIC SIMULATION MODE

Homework
  Key Concept #1, Lesson 7
  Exercise 5 - 1,2,4. Exercise 6 - 1,3,13,15
  Chpt 6 pages 140, 144-151, 164. Problem 23 and 24 (instructor provided)
  Study M & G Codes, Haas Work Book page 14 -15
Week 3
Review Homework
Quiz # 1 on M and G Codes
Detailed Discussion of M, G, S and T Functions
Initial Rapid Plane vs Rapid Plane
Format for Writing CNC Program on PC
  Microsoft Notepad
  First line of program %
  Program Commenting (NAME)
  Prepatory line
  End of Program M30
  Last Line of Program %
  Using Notepad search feature for Z and O values!
Program in Class
  Point to Point Program
Modal vs Non-Modal
Demo of Microsoft NotePad
Machine Controls
  Overhead of Machine Startup Procedure
  Overhead of Machine Modes
  Overhead of X, Y, and Z “zero” for T1
Machine Controls
  Demonstration of Machine Startup Procedure
  Demonstration of X, Y, and Z “zero” for T1
  Demonstration of Feed Rate Override
  Demonstration of Spindle Speed Override
  Machine Demonstration of Graphics Mode
Homework
  Write Program for Part %1 and store on Disk
  Key Concept #2, lesson 8. Key Concept #3, lesson 9, 3.1 thru 3.3

Week 4
Quiz # 2 on M and G Codes
Review Homework %1
Handout Print for %2
Circular interpolation G02 and G03
MDI Mode
  Start Spindle
  Pickup tool offset G54 X, Y and Z for Tool 1
Program %1
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework
  Key Concept #3, lesson 9, 3.4
  Program for Part %2
Week 5
Review Homework %2
Handout Print for part %3
Cutter Centerline Programming
Program %2
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework - Program for part %3

Week 6
Review Homework %3
Handout Print for %4
Work Surface Path Programming
Cutter Compensation G40, G41 and G42
Using Cutter Compensation for Rough and Finish Machining
Tool length Offsets G43
Program %3
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework
  Key Concept #4, lesson 10, 11 and 12
  Program for part %4
  Exercise 10 - 1, 2, 3, 4, 5, 6, 9, 10, 11, 12

Week 7
Review Homework %4
Handout Print %5
Drilling Cycles G83, G81 and G73
Canned Cycle Cancel G80
G98 vs G99 Return Planes
Program Format for Multiple Tools
Multiple Tool Length Offsets
Basic Trigonometry
Program Commenting for Multiple Tools
Program Stop M00 and Optional Stop M01
Program %4
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework - Program for part %5
Week 8
Review Homework %5
Handout Print for %6
Program %5
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework - Program for part %6
Key Concept Number Six, Lesson 16, 6.1-6.2.6
Key Concept Number Five, Lesson 15, 5.2-5.2.1 and 5.2.3
Haas Work Book pages 74-80

Week 9
Review Homework %6 Softjaws
Handout Print for %7 (2 softjaws simultaneously using G54 -G59 and subroutines)
Fixture Offsets G54-G59
Demonstration of Picking Up Multiple Fixture Zeros
Subroutines\Subprograms M97 and M98
Program %6 softjaws
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence
Homework - Program for part %7
Key Concept Number Four, Lesson 13
Key Concept Number Six, Lesson 17 to page 6-20
Haas Work Book Manual 104-108

Week 10
Review Homework %7
Review for Test #1
Program %7
  Load Program into CNC from Floppy
  Run Program in Graphics Mode
  Run Program in single block. Use Z offset to run program 2” above workpiece
  Run program in full sequence cutting air only
Homework - Study for Test #1

Week 11
Test #1
Week 12
Review Test #1
Handout final project print
Rigid Tapping G84
Rigid Tapping vs Float Tapping
Tension and Compression/Float Tap Holder
Rigid tapping calculations
G12/G13 Circular Pocketing and G150 Rectangular Pocketing
Homework - Haas Manual page 203 -205, 247-250
   Final Project

Week 13
Work on Final Project
Final Project Program
   Load Program into CNC from PC
   Run Program in test mode
   Run Program in single block. Use Z offset to run program 2” above workpiece
   Run program in full sequence
Homework - Final Project

Week 14
Work on Final Project
Programming a radius cutter bit
Final Project Program
   Load Program into CNC from PC
   Run Program in test mode
   Run Program in single block. Use Z offset to run program 2” above workpiece
   Run program in full sequence
Homework - Work on final project

Week 15
Work on Final Project
Program
   Load Program into CNC from PC
   Run Program in test mode
   Run Program in single block. Use Z offset to run program 2” above workpiece
   Run program in full sequence
Homework - Work on final project

Week 16
Review for Final
Program Session
   Load Program into CNC from PC
   Run Program in test mode
   Run Program in single block. Use Z offset to run program 2” above workpiece
   Run program in full sequence
Homework - Study for Final Exam
Other topics covered if time allows,
Thread milling with G02 and G03
Canned cycles, subprogramming with incremental mode