CASPER COLLEGE COURSE SYLLABUS
Course Number and Title: MCHT 2780 01 CNC Machining Center

Semester/Year: Fall 2015

Lecture Hours: 2	**Lab Hours**:4	**Credit Hours**: 4
Class Time: 6:00 – 9:00 p.m.	**Days: Monday and Wednesday**	**Room: WT 142**

Instructor's Name: Paul Brutsman

Instructor's Contact Information:	**Office Phone:** (307) 268-2529 w/voice mail	**Email:** pbrutsman@caspercollege.edu

Office Hours: Monday and Wednesday 12:00 p.m. - 1:00 p.m. and 5:30 p.m. – 6:00 p.m.
Tuesday 12:00 p.m. 12:30 p.m. and 3:15 p.m. -3:30 p.m.
Thursday 12:00 p.m. – 12:30 p.m. and 3:15 p.m. -4:00 p.m.

Course Description: An introductory course in 3-axis CNC machining center programming and 2-axis CNC plasma cutter programming. The course is structured so no prior experience with CNC machining center or CNC plasma programming or operation is required. The time will be divided between classroom and shop.

Statement of Prerequisites: None

Institutional Outcomes:

☐Demonstrate effective oral and written communication
☐Use the scientific method
☒Solve problems using critical thinking and creativity
☐Demonstrate knowledge of diverse cultures and historical perspectives
☐Appreciate aesthetic and creative activities
☐Use appropriate technology and information to conduct research
☐Describe the value of personal, civic, and social responsibilities
☐Use quantitative analytical skills to evaluate and process numerical data

Program Goals: The goal of the Machine Tool department is for students to obtain an education and practical skill development that promotes lifelong learning and insures student success in a career in machining.

Course Goals: To educate the student in CNC mill programming and operation of a HAAS VF1 machining center and G5 Fabricator CNC plasma table. 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

Course Objectives: Use of CNC machining center in the manufacturing process.

Methodology: Practical application of theoretical concepts is emphasized in the classroom and lab. Concepts discussed in lecture will be demonstrated and then applied by the students.

Evaluation Criteria:

Homework	60%	A= 90-100%
Quizzes	10%	B= 89-80%
Tests	30%	C= 70-79%
		D= 60-69%
		F= <59%

Casper College may collect samples of student work demonstrating achievement of the above outcomes. Any personally identifying information will be removed from student work.

Required Text, Readings, and Materials: Machining Center Programming and Operation *(*text and workbook*)*, Mike Lynch, CNC Concepts Inc.

References: Machinery's Handbook, Industrial Press.

Class Policies: Last Date to Change to Audit Status or to Withdraw with a W Grade:
- Refer to Casper College Catalog.
- Late assignments will not receive full credit. A letter grade will be deducted for each day the assignment is late. After four class periods the assignment will not be accepted.
- Cell phone use in the classroom is reserved for emergency purposes only. Please set all phones to vibrate and excuse yourself from the classroom if use is necessary.
- No i-pod or other electronic devices will be used during lecture or in the shop.
- Personal and equipment safety standards will be strictly enforced. It is the individual's responsibility to develop a safe work attitude. Jackets (hoodie) with strings are not allowed in the shop!
- Attendance is very important. It will be very difficult to make up missed class time. Students missing 5 classes will be given the choice of taking an "F" for the class, withdrawing from class or changing to an audit **and** continue to participate.
- Required Supplies: Clip Board, Graph Paper, *Safety Glasses* and 4GB or smaller thumb drive.

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 to attempt to solve the problem. If you are not satisfied with the solution offered by the instructor, you should then take the matter through the appropriate chain of command starting with the Department Head/Program Director, the Dean, and lastly the Vice President for Academic Affairs.

Academic Dishonesty: (Cheating & 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 offense was committed or expulsion from school. See the Casper College Student Code of Conduct for more information on this topic.

Official Means of Communication: Casper College faculty and staff will employ the student's assigned Casper College email account as a primary method of communication. Students are responsible to check their account regularly. This is also, where you will find course evaluation links during course evaluation periods.

ADA Accommodations Policy: If you need academic accommodations because of a disability, please inform me as soon as possible. See me privately after class, or during my office hours. To request academic accommodations, students must first consult with the college's Disability Services Counselor located in the Gateway Building, Room 344, (307) 268-2557, bheuer@caspercollege.edu . The Disability Services Counselor is responsible for reviewing documentation provided by students requesting accommodations, determining eligibility for accommodations, and helping students request and use appropriate accommodations.

<div align="center">**Course Outline**</div>

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, 4, 6, 7, 8, 9, 10, 13
                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 (place program zero at lower left corner of workpiece)

Week 2
        Introduction to M, G, S and T functions
        Modal vs Non-Modal Commands
        Feeds and Speeds Amount of Material Removed HP Requirements (optional)
        Machine Modes Page 27-30 Haas Operator's Manual
                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, 5. Exercise 6 - 1, 3, 13, 15
                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)
      Preparatory 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 pages 95-107

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 G02 and G03 pages 108-116
    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
        Exercise 10 - 1, 2, 3, 4, 6, 9, 10, 11, 12
        Program for part %4

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 softjaws
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 pages 201-218
>Key Concept Number Five Lesson 14, lesson 15 pages 187-192
>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 230
>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/Floating 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 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
        Final Project

Week 14

    Work on Final Project
    Final Project Program
        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
        Work on final project

Week 15

    Work on Final Project
    Program
        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
        Work on final project

Week 16

Finish Final Project
Other topics covered if time allows:
Thread milling with G02 and G03 Canned cycles
 subprogramming with incremental mode