Casper College Course Syllabus

**Course Number and Title:** MCHT 2790-01 COMPUTER NUMERICAL CONTROL (CNC) TURNING CENTER

**Semester/Year:** Spring 2016

**Lecture Hours:** 2  **Laboratory Hours:** 4  **Credit Hours:** 4

**Class Time:** 6:00 p.m.-8:50 p.m.  **Days:** Monday and Wednesday  **Room:** WT142

**Instructor’s Name:** Paul Brutsman

**Instructor’s Contact Information:**  |  **Office** GW 116I  
|  **Phone** 268-2529 w/voice mail  
|  **Email** pbrutsman@caspercollege.edu

**Office Hours:** Monday 4:00 p.m.-6:00 p.m.  
Tuesday 8:00 a.m.-9:00 a.m.  
Wednesday 4:00 p.m.–6:00 p.m.

**Course Description:** An introductory course in 2 axis CNC turning center programming. The course is structured so no prior experience with CNC lathe 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 group A G-Code CNC turning center programming and operation. A HAAS SL10 and HAAS TL1 Toolroom lathe will be used in class. 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 Objective:** Application of basic G-code in the programming of a 2 axis turning center.
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 student.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
<th>Grade Range</th>
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</thead>
<tbody>
<tr>
<td>Homework</td>
<td>60%</td>
<td>A= 90-100%</td>
</tr>
<tr>
<td>Quiz</td>
<td>10%</td>
<td>B= 89-80%</td>
</tr>
<tr>
<td>Final Project/Test</td>
<td>30%</td>
<td>C= 70-79%</td>
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<tr>
<td></td>
<td></td>
<td>D= 60-69%</td>
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<td>F= &lt;59%</td>
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</tbody>
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Required Text, Readings and Materials: Mike Lynch. Turning Center Programming and Operation. CNC Concepts, Inc. with workbook

References: Machinery’s Handbook, Industrial Press

Class Policies: Last Date to Change to Audit Status or to Withdrawal 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 shall 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.
- 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 3.5” disk.

Student Rights and Responsibilities: Please refer to 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/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.

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.
Course Outline

Week 1
Course Review
Review Syllabus
Review Shop Safety Rules
Identify and exercise appropriate use of safety equipment
Introduce Text
Machine Axis
Datums
Tour Shop
Homework
Key Concept 1, Lesson 1- Machine configurations
Key Concept 1, Lesson 5-Program zero and the rectangular coordinate system
Lesson 1 - Problems 1, 2, 3, 5, 9 and 10
Lesson 5 - Problems 1-3, 6-14

Week 2
Review Homework
Introduction to M and G Codes. S and T Functions
Pass out Fanuc Programming Book
Feeds and Speeds/HP Requirements
Amount of Material Removed
Incremental vs Absolute
Modal vs Non-Modal
Homework
Key Concept 1, Lesson 4 - Visualizing the execution of a CNC program
Key Concept 1, Lesson 8 - Introduction to programming words
Lesson 4 - Problems 1-10
Lesson 8 - Problems 1-13
Study for quiz on M & G Codes in notes: Haas and Fanuc Group A
Week 3
Review Homework
Quiz # 1 on M and G Codes
Detailed discussion of M and G codes
Diameter vs radius programming
Format for writing program on PC
Two programs in class
1) Casting contour
2) Single shoulder
Demo of Microsoft Notepad text editor
Machine controls
Overhead of machine control panel
Demonstrate machine startup procedure
MDI Mode
Common sense check of tool offsets 04 and 05 X and Z
Tool change position with G28
Feed control knob
Homework - Write program for Part O0003 and store on disk
Key Concept 3, Lesson 10 – Programming the Three Most Basic Motion Types
Key Concept 1, Lesson 2 - Understanding Turning Center Feeds and Speeds
Key Concept 5, Lesson 15 – Introduction to Program Structure

Week 4
Quiz # 2 on M and G Codes
Review Homework O0003
Overhead of machine startup procedure
Overhead of machine control panel
MDI Mode
Start spindle
Common sense check of tool offsets
Program O0003
Load Program O0003 into CNC from PC
Graph Program O0003
Run program in single block -Stock pushed back in collet - cut air only
Homework - Program for Part O0004

Week 5
Review homework O0004
Handout print for part O0005
Lecture on cutting tapers
Review part off program O0001
Program O0004
Load Program O0004 into CNC
Graph Program O0004
Run Program in Single Block
Make part O0004
Pull up Program O0001 from program library
Edit O0001 at controller for Part O0004
Run program O0001 and part off O0004
Homework - Program O0005

Week 6
Review Homework O0005
Handout Print O0007
Circular Interpolation G02 and G03
subprograms M98 and M99
Program commenting and program stop M00
Review part off program O0001
Program O0005
  Load Program O0005 into CNC
  Graph Program O0005
  Run Program in Single Block
  Make part O0005
Pull up Program O0001 from program library
  Edit O0001 at controller for Part O0005
  Run program O0001 and part off O0005

Homework - Program O0007. Place the comment (I LOVE ARCS), program stop M00 and call up subprogram O0001 to part off workpiece.
Key Concept 3, Lesson 10 section G02 and G03 circular motion
Key Concept #6, Lesson 21 Subprogramming techniques

Week 7
Review Homework O0007
Review for Test #1
Program O0007
  Load Program O0007 into CNC
  Graph Program O0007
  Run Program in Single Block
Make part O0007
  Pull up Program O0001 from program library
  Edit subprogram O0001 at controller for Part O0007
  Run program O0001 and part off O0007
Homework - Study for Test #1

Week 8
Test #1 - Monday
Handout Print O0014 and O0015 without TNRC
Fixed cycles in programming G70, G71, G72, G75, G94
Tool change position G28 for part off using T0505
Example program in Class G70 and G71
Homework
  Program O0014 and O0015 using fixed cycles
  Key Concept 6, Lesson 17 - G90, G92 and G94
  Key Concept 6, Lesson 18 - G71 and G70 multiple repetitive cycles for turning and boring
  Key Concept 6, Lesson 19 - 6.4.9 G75 grooving cycle
Week 9
Review Test #1
Handout print O0018
Review Homework O0014 and O0015
Program O0014 and O0015
  Load Program O0014 and O0015 into CNC Graph Program O0014 and O0015 Run
  Program O0014 and O0015 in Single Block Make part O0014 and O0015
Homework - FANUC Programming manual pages 102-109
Fixed Cycle G70, G71, G75 (grooving and part off) and G94 for Part O0018

Week 10
Review Homework O0018
Tool nose radius compensation G40, G41, G42
Add TNRC to O0018
Program O0018
  Load Programs O0018 into CNC
  Graph Programs O0018
  Run Program O0018 in Single Block
  Make part O0018
Key Concept 6, Lesson 20 thru 6-33

Week 11
Handout print O0009
Class demonstration - Graph part O0007 with G71 and see results
Fixed Cycles in Programming G76 and G92 - Machine screw threads
Example program in Class G76 and G92
Homework - Program O0009 with fixed cycles G76, G94, G70, G71, G75.

Week 12
Review homework O0009
Handout print O0020
Tapered pipe threads with G76
Program O0009
  Load Programs O0009 into CNC
  Graph Programs O0009
  Run Program O0009 in Single Block
  Make part O0009
Homework - Program O0020 with fixed cycles G76, G94, G70, G71, G75.
Week 13
Review Homework O0020
Handout print O0010
Fixed Cycles in Programming G74, G80, G83, G85 and G32
Drilling Cycles G74, G83, G85
Tapping on a lathe with G32 threading cycle
Example program in class G74 cycle
Example program in class G32
Program O0020
Load Program O0020 into CNC from PC
Graph Program O0020 using graphing function
Run Program O0020 in single block
Make part O0020
Key Concept 19, 6-23 G74
Homework Program O0010
Fixed cycles G32, G70, G71, G74, G75, G94 EMCO
Fixed cycles G70, G71, G75, G83, G84, G94 HAAS

Week 14
Review Homework
Program O0010
Load Program O0010 into CNC from PC
Run Program O0010 in Single Block
Run Program O0010 Using Graphing Function
Make part O0010

Week 15
TBA

Week 16
TBA