Richland College is determined to prepare the student with the knowledge and skills you need to succeed in today's dynamic work environment. Towards this end, foundation skills and workplace competencies (SCANS skills) have been designed into the curriculum for Engineering Technology and Semiconductor Manufacturing.

**CATALOG DESCRIPTION**

A study of Computer-Aided Manufacturing (CAM). Utilize software which is used to develop applications for manufacturing. Emphasis on tool geometry, tool selection, and the tool library. Introduction to the common types of lathes. Emphasis on basic parts, nomenclature, lathe operations, safety, machine mathematics, blueprint reading, and theory. Fundamentals of CNC Machine Controls with an emphasis on turning centers.

**COURSE LEARNING OUTCOMES**

Use Computer-Aided Manufacturing (CAM) software to create multi-axis part programs; transfer programs to the machine control unit; and machine parts.

The student will review the history and application of CAD-CAM systems; design and draw the 3D part model; demonstrate competency of CAD-CAM software and related input and output devices; and interface CAD-CAM to machines and produce the part.

**In addition:** Wax prototypes are used to check tool movement and part accuracy.
COURSE DESCRIPTION:

Course Number: MCHN 2338-83701

Course Title: Advanced Computer-Aided Manufacturing (CAM)

Credit Hours: 3    Lecture Hours: 2    Lab Hours: 4

Suggested Prerequisites: None

A study of Computer-Aided Manufacturing (CAM) software which is used to develop applications for manufacturing. Emphasis on tool geometry selection, and the tool library.

TEXTBOOK:

MASTERCAM U CURRICULUM, by MasterCAM. CNC Software. LATEST ISBN# MCONLINECURR

SUPPLIES:

FLASH DRIVE/WRITABLE CD
Pencil
Calculator

COURSE REQUIREMENTS:

Students are encouraged to take notes in class and will turn assigned material in for grading. To receive full credit for your work, assignments must be turned in on or before the due date of assignment, unless otherwise specified by the instructor. Late work will be accepted but only partial credit will be given. Students must participate and complete lab assignments during the scheduled lab time, unless alternative arrangements are made.

METHOD OF PRESENTATION:

The class will be presented using formats that will include lectures, lab experience, demonstrations, discussions, and/or group participation. Student participation and interaction is expected
METHOD OF EVALUATION:

Evaluation will be based upon completion of all assigned work. The course average will be computed as follows:

- Classroom Grades and Quizzes .................. 25%
- Laboratory Grade ................................. 40%
- Mid-Term & Final Exam .......................... 10%
- Final Project ..................................... 20%
- Instructor Evaluation ............................ 5%

(Attendance, punctuality, class participation, assignments turned in on due date)

(Attendance, punctuality, 3.125 pts / day for unexcused absent. Late 3 X (less than 5 minutes) = 1 unexcused absent 3.125 pts, 5 minutes or more = 1 unexcused absent 3.125 pts, group & class participation)

Unless otherwise specified by the instructor, the grading system will be:

- 90 - 100 ..... A
- 80 - 89 ..... B
- 70 - 79 ..... C
- 60 - 69 ..... D
- 59 ..... F

ATTENDANCE POLICY:

You are expected to attend all classes and are fully responsible for your attendance. If at any time you wish to drop this course, or to withdraw from the college, initiate that action yourself. Do not assume that if you stop attending class you will be automatically dropped. It is the student’s responsibility to drop or withdraw. You must withdraw from this course before the drop date specified to receive a grade of “W”.

CLASS CERTIFICATION DATE: ................. Monday, February 2, 2015

WITHDRAWAL POLICY:

If you are unable to complete this course, it is your responsibility to withdraw formally.

The withdrawal request must be received in the Registrar’s Office by Thursday, April 16, 2015 (COURSE DROP DATE). Failure to do so will result in your receiving a performance grade, usually an “F”.

If you drop a class or withdraw from the college before the official drop/withdrawal you will receive a “W” (Withdraw).
CLASSROOM POLICIES:

Determined by Instructor

CLASSROOM FOOD AND DRINK POLICY:

Food and drink are not allowed in the classroom. (ref. OM CHB-801)

ACADEMIC PROGRESS:

Students are encouraged to discuss academic goals and degree completion with their instructors. Specific advising is available throughout the semester. Check 7Steps2Success for more details.

INSTITUTION POLICIES:

For Institution Policies, please refer to the Richland College website www.richlandcollege.edu (current students) or to www.richlandcollege.edu/syllabusinfo/syllabusInformation.pdf

QEP: LEARNING TO LEARN: DEVELOPING LEARNING POWER

“Richland’s Quality Enhancement Plan (QEP) provides techniques, practices, and tools to help students develop the habits, traits or behaviors needed to be effective lifelong learners empowering success in college and in life.”
For information log onto http://www.richlandcollege.edu/qep2013/

SYLLABUS CHANGE DISCLAIMER:

The instructor reserves the right to amend syllabus as necessary.

SPECIAL INFORMATION:

If you are a student with a disability and/or special needs who requires accommodations, please contact the college Disability Services Office at 972-238-6180 (Voice/TTY), visit Thunderduck Hall, suite T120, or go http://www.richlandcollege.edu.dso.

Absences for observance of a religious holy day are excused. A student whose absence is excused to observe a religious holy day is allowed to contract with the instructor to take a make-up examination or complete an assignment within a reasonable time after the absence.
COURSE OBJECTIVES

1.00 Differentiate between NC, CNC, and DNC
   1.01 Identify the advantages and disadvantage of CAD/CAM code generation
   1.02 Determine Machine Axes Designation & Direction
   1.03 Identify Reference Zero Points
   1.04 Identify positioning systems

2.00 Review Machining Fundamentals
   2.01 Identify terminology used in cutting operations
   2.02 Differentiate between point-to-point and incremental path controls
   2.03 Differentiate between Face milling and pocket milling
   2.04 Differentiate between milling, drilling, boring and turning operations
   2.05 Identify machining parameters

3.00 Create geometry elements/Toolpaths
   3.01 Create CAD geometry to be used as a tool path
   3.02 Demonstrate use of the workplace environment
   3.03 Create 2D Geometry
   3.04 Modify Existing Geometry – Scale, Trim, Move, Mirror, etc.
   3.05 Convert Free-Form Geometric Elements into a Profile
   3.06 Assign tools to geometry
   3.07 Edit the Toolpath

4.00 Specify tools for specific operations
   4.01 Identify tooling systems for turning operations
   4.02 Identify tooling for milling operations

5.00 Create Job/Tool Information Reports
   4.01 Demonstrate the creation of a complete job plan
   4.02 Create tooling and machining data

6.00 Create a Process Plan
   6.01 Create a Raw Material Drawing
   6.02 Identify the cutting operations to be performed
   6.03 Identify the sequence of operations
   6.04 Determine Toolpath movement

7.00 Control sequence of machine operations
   7.01 Insert with a tool to assign geometry to Toolpath
   7.02 Verify roughing and finish Toolpaths
8.00 Generate roughing and finish Toolpaths
  8.01 Evaluate Tool movement
  8.02 Edit Tool movement
  8.03 Demonstrate use of cutter compensation as it pertains to milling programs
  8.04 Generate tool movement
  8.05 Create multiple passes in the Z-Direction

9.00 Use profile curves to generate meshes
  9.01 Create meshes of complex surfaces
  9.02 Edit Meshes
  9.03 Define parameters of meshes

10.00 Perform cavity roughing
  10.01 Create planar cuts
  10.02 Control z-Depth of Cavity
  10.03 Close open profiles
  10.04 Define material boundary and boundary clearance

11.00 Import CAD files for CAM profiles

12.00 Export a CAM file

13.00 Generate Code
  13.01 Produce coded information from CAM graphics.
  13.02 Create code for a multiple drilling operation
  13.03 Create code for a profile milling operation
  13.04 Create code for a pocket milling operation
  13.05 Create an advanced mill and drilling program code
  13.06 Create code for complex surfaces (Difficult code to write)

14.0 Create *.STL

15.0 Create Industry Standard Sheet Up Sheets
SCANS SKILLS:

The skill standards listed in this section are from the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) report. SCANS skills activities shown in **bold** indicate learning activities specific to this class.

MAXIMIZE RESOURCE ALLOCATIONS

*Allocate time* by organizing class time to accomplish class activities and assignments. Feedback on observed effective use of available time will be provided.

USE INFORMATION SKILLS

*Acquire, Evaluate, Organize, Maintain, Interpret, Communicate, and Process Computer information* through means such as lectures, literature, computer resources, lab reports, portfolios, and group discussions to accomplish class requirements and successfully achieve the learning outcomes.

*Organize Information* by sequencing the machining operations and tool paths during code creation.

*Evaluate Information* by collecting and evaluating system data and comparing it to calculated results.

EMPLOY INTERPERSONAL SKILLS

*Participate as a team member* by interacting within groups during lab or group projects. Feedback on observed team participation will be provided.

USE SYSTEMS CONCEPTS

*Apply systems concepts* by organizing the interface between the CAD/CAM software and the machine tool.

*Monitor performance* by watching the tool movement on the screen to ensure the part is being cut correctly.

*Correct performance* by editing the tool movement when the tool is cutting at the wrong depth or in the wrong sequence.

*Improve system performance* by maximizing tool movement and improving efficiency of the machining operation.

*Design Systems* by creating an assembly that performs a system operation and cutting the parts that make up the system. (Air engine parts – project)
USE TECHNOLOGY

Select Technology by identifying electronic, electromechanical, and/or computer resources to accomplish a defined task.

Apply Technology by utilizing electronic test equipment and computer applications to analyze electronic circuits.

Maintain Technology by monitoring, evaluating, adjusting, and repairing electronic equipment.

Troubleshoot technology by applying troubleshooting techniques as needed to interact, assess, and correct system malfunctions.

ENHANCE BASIC SKILLS

Demonstrate (technical) writing skills through written lab reports, technical presentations, etc.

Demonstrate listening skills by acquiring, interpreting, and evaluating data from lectures and group discussions required for class assignments.

Demonstrate reading competence through the understanding and interpretation of written materials, including texts, manuals, graphs, tables, schedules, and charts to explain or solve engineering technology problems.

Demonstrate arithmetic skills utilizing numerical values, such as percentages and dimensions, acquiring data from tables, charts, and graphs to convey or solve engineering technology related problems.

Demonstrate mathematical skills by selecting and applying appropriate mathematical formulas to explain and solve engineering technology related problems.
APPLY THINKING SKILLS

*Exhibit decision-making skill* when selecting tools, mathematical formulas, data records, and project selections.

*Use problem-solving skills* in the application of scientific and engineering principles to solve real world problems.

*Visualize mind’s eye concept* by organizing and processing symbols, graphs, objects, and other information, such as determining a circuit operation from a schematic, seeing a finished product from a blueprint, and seeing a product from a CAD line drawing and schematic.

*Exhibit reasoning skills* by using logic to draw conclusions from available data and applying scientific standards and principles to solve technical problems.

DISPLAY APPROPRIATE PERSONAL QUALITIES

*Exhibit responsibility* by demonstrating task completion to required standards, paying attention to detail, attendance, punctuality, and enthusiasm. Feedback on observed responsibility exhibited will be provided.

*Exhibit self-esteem* by showing confidence in one’s own skills and abilities and an awareness of one’s capabilities. Feedback on observed self-esteem exhibited will be provided.

*Demonstrate appropriate social skills* by the interaction in-group or team setting, which includes self-assertion, listening, and participation. Feedback on observed social skills exhibited will be provided.

*Display self-management skills* by demonstrating task completion to required standards, paying attention to detail, attendance, punctuality, and enthusiasm. Feedback on observed self-management skills exhibited will be provided.

*Display integrity/honesty* by demonstrating behavior consistent with professional and ethical standards commonly held in industry and society. Feedback on observed integrity/honesty exhibited will be provided.
COURSE OUTLINE:

The following is the course outline with topics and assignments. The instructor reserves the right to modify course outline at anytime. Students will be given advanced notice of any changes made by instructor.

<table>
<thead>
<tr>
<th>SEMESTER / YEAR:</th>
<th>Spring 2015</th>
<th>COURSE / SECTION:</th>
<th>MCHN 2338-83701</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSTRUCTOR:</td>
<td>Fleming</td>
<td>OFFICE NUMBER:</td>
<td>WH-184</td>
</tr>
<tr>
<td>(a) PHONE NUMBER:</td>
<td>972.238.6321</td>
<td>EMAIL:</td>
<td><a href="mailto:bfleming@dccc.edu">bfleming@dccc.edu</a></td>
</tr>
<tr>
<td>OFFICE HOURS:</td>
<td>TBA</td>
<td>TUTORING AVAILABLE ON REQUEST</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Introduction, G &amp; M Code, Orthographic projection, Blue Print Reading, Dimensioning, Measurement Tools MasterCAM Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Manual Programming, G &amp; M Code, Getting Started Section ON-LINE Curr, Complete Geometry Practice Part, Facing Operation</td>
</tr>
<tr>
<td>Week 3</td>
<td>Lathe Design ON-Line Curr</td>
</tr>
<tr>
<td>Week 4</td>
<td>Lathe Setup On-Line Curr. Part 1</td>
</tr>
<tr>
<td>Week 5</td>
<td>Lathe Toolpath ON-Line Curr.</td>
</tr>
<tr>
<td>Week</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Week 6</td>
<td>Lathe Toolpath ON-Line Curr.</td>
</tr>
<tr>
<td>Week 7</td>
<td>Lathe Toolpath ON-Line Curr. Cutting Speeds, Feeds &amp; Revolutions per Minute (RPM)</td>
</tr>
<tr>
<td>Week 8</td>
<td>Lathe Toolpath ON-Line Curr. Chip Formation, Load and Material Removal Rates</td>
</tr>
<tr>
<td>Week 9</td>
<td>Lathe Toolpath ON-Line Curr. Chip Formation, Load and Material Removal Rates</td>
</tr>
<tr>
<td>Week 10</td>
<td>Lathe Toolpath ON-Line Curr. Work Holding and Set-up</td>
</tr>
<tr>
<td>Week 11</td>
<td>Lathe Toolpath ON-Line</td>
</tr>
<tr>
<td>Week 12</td>
<td>Plunge Turn Toolpath ON-Line Curr. 2D High Speed Toolpath</td>
</tr>
<tr>
<td>Week 13</td>
<td>Final Project</td>
</tr>
<tr>
<td>Week 14</td>
<td>Review for Final Exam</td>
</tr>
<tr>
<td>Week 15</td>
<td>Review for Final Exam</td>
</tr>
<tr>
<td>Week 16</td>
<td>Final Exam Week</td>
</tr>
</tbody>
</table>