PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

**ADVANCED CNC MACHINING**
**MET 2740**

**Class Hours: 0.0** **Credit Hours: 2.0**

**Laboratory Hours: 6.0** **Revised: Fall 06**

**Catalog Course Description:**

Advanced CNC Machining is a state-of-the-art machining course which expands the computer-assisted programming skills presented in CNC Milling and CNC Turning. The course will include 3-D surface and solid modeling, 4-axis programming, bar feeder applications, and modification of post-processors.

**Entry Level Standards:**

Students entering this course should have basic math and writing skills, a working knowledge of WordPerfect or MS Word, AutoCAD, geometric dimensioning and tolerancing, CMM programming, and programming principles introduced in CNC Milling and CNC Turning.

**Prerequisites:**

MET 2720

**Textbook(s) and Other Course Materials:**

Textbook: Instructor Developed Materials

References: *FeatureCAM User Guide*: Current Version, Engineering Geometry Systems.
*FeatureCAM Post Processing Guide*: Current Version, Engineering Geometry Systems.
*Haas VF-Series Operators Manual*: Current Edition, Haas Automation, Inc.
*Haas SL Series Operations Manual*: Current Edition, Haas Automation, Inc.

**I. Week/Unit/Topic Basis:**

| Week | Topic |
|---|---|
| 1-2 | 3-D Surface & Solid Modeling<br>4-Axis Programming |
| 3-4 | Bar Feeder Applications<br>Post-Processor Modification |
| 5-14 | Design, Programming, Machining, and Inspection Of Special Projects |
| 15 | Final Project |

## II. MET Program Objectives & Outcomes:

### Objectives:

I. Apply basic engineering theories and concepts.

II. Apply basic engineering theories and concepts.

III. Identify and solve work related problems with minimum assistance.

IV. Operate equipment and instruments with a high degree of skill.

V. Communicate effectively, including verbal, writing, and graphical skills.

VI. Apply the principles of good work ethics.

VII. Obtain gainful employment in the MET discipline or matriculate to a 4-year program in engineering technology.

### Outcomes:

A. apply the knowledge of mathematics, science, and engineering technology. (I, II, IV, VI)

B. use the techniques and modern engineering tools needed for engineering technology practices. (I – IV, VI)

C. identify, formulate, and solve engineering technology-based problems. (I, II, VI)

D. design and conduct experiments, as well as analyze and interpret collected data. (I– IV, VI)

E. create or fabricate a system, subsystem, component, or process to meet specified needs. (I – IV, VI)

F. read and extract information from manuals, journals, and other discipline related literature. (I –IV, VI)

G. communicate effectively, including verbal, writing, and graphical skills. (IV, V, VI)

H. function and contribute positively in team situations. (II, IV- VI)

I. comprehend social, professional, and ethical responsibilities, including development of a respect for diversity and other contemporary issues.(II, V, VI)

J. realize the impact of engineering technology solutions in a global and societal context. (V, VI)

K. realize the importance of a commitment to quality, timeliness, and continuous improvement. (V, VI)

L. recognize the importance of life-long learning.(I – VI)

## III. Course Objectives*:

A. create, program, and machine various 3-D surfaces and 4-axis features by computer- assisted methods. (A-C, E)

B. set-up, maintain, and functionally operate a bar feeder and 4-axis controller. (B)

C. modify and verify functional operation of a post-processor. (A-C)

D. design, machine, and inspect a variety of parts and analyze results. (A-C, E)

E. communicate technical information. (F, G)

*Letters after course objectives reference MET Program Outcomes (as required by ABET).

**IV. Instructional Processes*:**

Students will:

1. Actively listen to class lectures and participate in class activities that develop and reinforce an understanding of the theories, concepts, principles, and applications of 3-D surface, and 4-axis machining. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Active Learning Strategies*

2. Work individually and in teams to complete lab projects and assignments related to the theories, concepts, principles, and applications covered in the lecture or demonstration portion of the course. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Active Learning Strategies*

3. Collect, analyze, and tabulate data in an orderly format to prepare a college level technical report using software packages such as AutoCAD, WordPerfect/Word, Excel, Mitutoyo MCAT, and FeatureCAM. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Active Learning Strategies*

4. Observe class demonstrations on CNC equipment, practice, and then demonstrate to instructor basic manipulative skills required to set-up, operate, and program equipment. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Active Learning Strategies*

5. Observe class demonstrations on CAM software, practice, and then integrate manipulative and cognitive skills with assimilated knowledge to successfully complete lab projects. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Active Learning Strategies*

6. Participate in technical meetings, plant tours, and seminars sponsored by local technical societies to increase student knowledge of machining and manufacturing processes and enhance awareness of required job skills and opportunities in industry. *Communication Outcome, Mathematics Outcome, Technological Literacy Outcome, Transitional Strategies, Active Learning Strategies*

*Strategies and outcomes listed after instructional processes reference TBR's goals for strengthening general education knowledge and skills, connecting course work to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

**V. Expectations for Student Performance*:**

Upon successful completion of this course, the student should be able to:

1. Construct, input milling properties, and simulate cutting operation of 3-D surface and solid modeling features by computer-assisted methods. A

2. Construct, input milling properties, and simulate cutting operation of 4-axis features by computer-assisted methods. A

3. Transfer a program file utilizing the ADNC Link@ process. A

4. Evaluate machining process during cutting operation and adjust initial variable settings to achieve maximum results. A & D

5. Calibrate and set-up bar feeder/CNC turning center for various stock sizes. B

6. Calculate and input bar feeder variables in controller. B

7. Align 4-axis controller and tailstock. B

8. Develop a post-processor for specific outputs. C

9. Test post-processor for functional operation and controller compatibility. C

10. Create a multiple part mechanism which requires both CNC milling and turning to manufacture. D

11. Apply the principles of GD&T to a multiple part design. D

12. Measure part features using GD&T and CMM techniques. D

13. Relate inspection results to machining variables. D

14. Locate and extract needed information from operational/programming manuals. E

15. Document technical information in a neat, orderly format. E

16. Comprehend and follow oral instructions. E

*Letters after performance expectations reference the course objectives listed above.

**VI. Evaluation:**

A. Testing Procedures:

Total evaluation will be based on the following point distribution.

<u>Programming Projects</u>

Project 1: 3-D Surface & Solid Modeling (20 Pts)
Project 2: 4-Axis Programming (10 Pts)
Project 3: Post-Processor Modification (10 Pts)
Project 3: Design Project (50 Pts)

Guidelines and requirements for each project will be provided by the instructor.

B. Laboratory Expectations:

N/A

C. Field Work:

N/A

D. Other Evaluation Methods:

Participation (10 Pts)

Based on instructor observation during the course, each student will be evaluated on participation activities. Evaluation parameters to include active participation in class discussions, being prepared, efficient use of lab time, striving to achieve more than minimum requirements, and regular attendance.

E. Grading Scale:

Final grade for this course will be based on the following alphabetic/numerical scale.

A 93-100
B+ 88-92
B 83-87
C+ 79-82
C 74-78
D 65-73
F Below 65

**VII. Policies:**

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course (Pellissippi State Catalog).

B. Academic Dishonesty:

Refer to the Pellissippi State Catalog & Handbook.

C. Accommodations for disabilities:

If you need accommodations because of a disability, if you have emergency medical information to share, or if you need special arrangements in case the building must be evacuated, please inform the instructor immediately. Please see the instructor privately after class or in his/her office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by going to Goins 127 or 131 or by phone: 694-6751(Voice/TTY) or 539-7153.

D. Other Policies:

Safety and Equipment Abuse: Repeated safety violations will result in a reduction of final grade, at the instructor's discretion. Flagrant violations which result in equipment damage or personal injury will result in automatic failure of the course.

Your instructor is available during posted office hours or by appointment.