Raritan Valley Community College
Course Outline

EMET 253 – CNC Machining Center

I. Basic Course Information

    A. Course Number and Title: EMET253 – CNC Machining Center

    B. New or Modified Course: New

    C. Date of Proposal: Fall 2018

    D. Effective Term: Spring 2019

    E. Sponsoring Departments: Science and Engineering Department

    F. Semester Credit Hours: 3

    G. Weekly Contact Hours: 6   Lecture: 3
                                      Laboratory: 3
                                        Out of Class Student Work per Week: 7.5

    H. Prerequisite: EMET152 – Conventional Machining Operations II

    I. Laboratory Fees: Yes

    J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval: Marianne Baricevic (Chair), Marianne.baricevic@raritanval.edu; Sarah Imbriglio (Dean), sarah.imbriglio@raritanval.edu

II. Catalog Description

Prerequisite: EMET152 – Conventional Machining Operations II

The Computer Numerical Controlled (CNC) Machining center course is the third of four courses designed to prepare students to develop the requisite skills to become a Certified Level 1 Machinist in accordance with the National Institute for Metalworking Skills training and performance criteria (NIMS – Machining Level 1) and serves as a Technical Elective for the RVCC Mechanical Engineering Technology program. The course training includes the fundamentals of calibration, geometric dimensioning and tolerancing, understanding of materials, mechanical systems, and metal cutting, CNC turning and milling operations and programming. Classes are conducted in a fully functional machine shop environment located on the RVCC Campus equipped with manual and CNC mills and lathes, virtual machining centers, precision measurement equipment, and all basic machine shop tools. Through this course students earn can two

NIMS Metalworking Skills Certifications.

Certificate 9:   CNC Milling: Programming Setup & Operations: CNC Programming I

Certificate 11:   CNC Milling Operator

III. Statement of Course Need

The CNC Programming course is taken in conjunction with the other Advanced Manufacturing Courses and serves as a Technical Elective for the RVCC Mechanical Engineering Technology (MET) program. It provides the basic skills necessary to prepare students for entry into the following courses:

- EMET 254 - CNC Machining Operations

IV. Place of Course in College Curriculum

A. This course is a Free Elective
B. This course is a Mechanical Engineering Technology Elective
C. This course meets an elective program requirement for A.S. Mechanical Engineering Technology.
D. Course transferability; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go to their individual sites.

V. Outline of Course Content

A. CNC Milling: Operations
    a. Basics of the HAAS CNC Mill
        i. Describe the general machine components of the CNC mill and their basic functions
        ii. Understand different cutting operations
    b. Control Panel Functions for the CNC Mill
    c. Offsets on the CNC Mill

B. CNC Milling: Programming Setup & Operations
    a. Coordinates for the CNC Mill
        i. Cartesian and Polar Coordinates
        ii. Incremental vs. absolute coordinate concepts
        iii. Linear and circular interpolation
        iv. Machine zero and program zero
    b. Basics of G Code Programming
        i. Understanding different codes and what they are used for
        ii. Describe how G code programming is used to create a part program

     c. Creating a CNC Milling Program
     d. Calculations for Programming the Mill
     e. Canned Cycles for the Mill

VI. General Education and Course Learning Outcomes:

A. <u>General Education Learning Outcomes:</u>

At the completion of the course, students will be able to:
1. Perform calculations required for the design and machining of a mechanical part (GE-NJ 2)
2. Apply knowledge of machining and materials to machine and solve problems when machining mechanical parts (GE-NJ 2, GE-NJ 3) *

    *embedded critical thinking

B. <u>Course Learning Outcomes (CLO)</u>

At the completion of the course, students will be able to:
1. Select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly defined engineering technology activities.*
2. Select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies.*
3. Create Computer Aided Design (CAD) models with Parametric CAD software.
4. Create CAM models with Computer Aided Manufacturing (CAM) software.
5. Demonstrate competency by completing defined physical models.
6. Demonstrate the principles of Lean Manufacturing and Statistical Process Control (SPC).
7. Demonstrate basic components of the machining center as well as the devices used on this machine
8. Demonstrate the HAAS control and the features/functions
9. Demonstrate how and why parts can be successfully made on the CNC mill or machining center
10. Create G codes to direct CNC machines to create a part.
11. Define the sequence of operations necessary to machine a part and assign toolpaths
12. Calculate the various toolpaths on a CNC mill or machining center for a variety of common operations.
     a. Face Milling
     b. Pocket Milling
     c. Milling full and partial arcs
13. Must pass all NIMS certifications to receive college credit.

* This Course Learning Outcome supports the achievement of <u>TAC of ABET Criterion 9 requirements</u>.

VII. Modes of Teaching and Learning

    A. Lectures and online interactive textbooks
    B. demonstrations
    C. laboratory work
    D. instructional videos/DVDs

VIII. Papers, Examinations, and other Assessment Instruments

    A. laboratory performance
    B. examinations

IX. Grade Determinants

    A. lab performance
    B. examinations
    C. class participation

X. Text and Materials

Suggested Text: Tool-U

XI. Resources

    A. reference books
    B. safety equipment
    C. instructional videos/DVDs