

ENGT 016: COMPUTER NUMERICAL CONTROLS II

Originator

dkgonzalez

Justification / Rationale

Labor market indicators show that there are jobs available and an advisory committee recommended the course.

Effective Term

Fall 2019

Credit Status

Credit - Degree Applicable

Subject

ENGT - Engineering Technology

Course Number

016

Full Course Title

Computer Numerical Controls II

Short Title

CNC II

Discipline**Disciplines List**

Engineering Technology

Modality

Face-to-Face

Catalog Description

This advanced course in Computer Numerical Controls (CNCs) is a continuation of ENGT 015A and ENGT 015B with great depth and scope. An introduction to a CNC lathe with advanced part geometry will be covered along with an introduction to CNC Wire Electrical Discharge Machining (EDM). Emphasis is placed on cycle time efficiency and the incorporation of flexible manufacturing concepts.

Schedule Description

This advanced course in Computer Numerical Controls (CNCs) is a continuation of ENGT 015A and ENGT 015B with great depth and scope.

Prerequisite: ENGT 015B

Advisory: ESYS 004

Lecture Units

2

Lecture Semester Hours

36

Lab Units

1

Lab Semester Hours

54

In-class Hours

90

Out-of-class Hours

72

Total Course Units

3

Total Semester Hours

162

Prerequisite Course(s)

ENGT 015B

Advisory: ESYS 004

Required Text and Other Instructional Materials**Resource Type**

Book

Author

Valentino, James V., Goldenberg, Joseph

Title

Introduction to Computer Numerical Control

Edition

5th

Publisher

Pearson

Year

2012

College Level

Yes

ISBN #

978-0132176033

For Text greater than five years old, list rationale:

This is the most recent edition of the book available.

Class Size Maximum

30

Entrance Skills

Introductory level in computer numerical control.

Prerequisite Course Objectives

ENGT 015A-Identify what basic components comprise Computer Numerical Control systems.

ENGT 015A-Analyze the two types of control systems used to output tool movement.

ENGT 015A-Identify the two types of loop systems used with Computer Numerical Control controllers.

ENGT 015A-Evaluate the Cartesian coordinate system.

ENGT 015A-Evaluate Computer Numerical Control machine axis of motion.

ENGT 015A-Analyze the types and applications of drills used with Computer Numerical Control equipment.

ENGT 015A-Identify and describe the tooling used for such hole operations as boring, reaming, tapping, counterboring, and countersinking.

ENGT 015A-Create a program to produce a drilled part from a blank using holing operations.

Entrance Skills

Computer Numerical Control (CNC) basic skills

Prerequisite Course Objectives

ENGT 015B-Explain the commands used for clockwise, as well as counterclockwise, circular interpolation.

ENGT 015B-Explain what circular interpolation is.
ENGT 015B-Analyze how to read conventional tolerances
ENGT 015B-Identify the components of vertical and horizontal machining centers.
ENGT 015B-Identify the four important functions of tool holders.
ENGT 015B-Evaluate the terms: orthographic projection, first angle projection, third angle projection, and auxiliary projection.
ENGT 015B-Identify the various types of dimensioning systems and practices used in CNC prints.
ENGT 015B-Analyze how to read material notes in drawings.
ENGT 015B-Evaluate the meaning of important terminology connected with word address programming.
ENGT 015B-Describe the importance of G and M codes in a program.
ENGT 015B-Identify the meaning of a fixed or "canned" cycle.
ENGT 015B-Identify the different codes of information required to program a fixed cycle.
ENGT 015B-Write simple hole operation programs with the aid of canned cycles.
ENGT 015B-Write complete CNC programs for linear profiling
ENGT 015B-Apply cutter diameter compensation in programming milling operations.
ENGT 015B-Write complete programs by utilizing subprogramming.

Entrance Skills

Industrial mathematics skills

Prerequisite Course Objectives

ESYS 004-Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers.
ESYS 004-Compute the value of expressions containing natural number exponents.
ESYS 004-Apply the order of operations to simplify expressions involving several operations.
ESYS 004-Convert between improper fractions, mixed numbers, and decimals.
ESYS 004-Use rounding and estimation skills to solve problems.
ESYS 004-Convert units within the US and metric systems and between the US and metric system units using unit fractions.

Course Content

1. Review of ENGT 015A/B
2. Introduction to the CNC lathe
 - a. Background
 - b. Axes of motion
 - c. Features of the Machine Control Unit (MCU) Lathes
 - d. Basic Lathe operations
 - e. Tooling
 - f. Cutting speeds, feeds and depth of cut
3. Fundamental concepts of CNC Lathe Programming
 - a. Establishing locations via Cartesian coordinates (CNC Lathes)
 - b. Types of tool positioning modes
 - c. Reference point, machine origin, and program origin
 - d. Methodizing of operations
 - e. Setup procedures
 - f. G Codes
 - g. M Codes
 - h. Setting the machining origin
 - i. F Code
 - j. S Code
 - i. Spindle speed
 - ii. With constant surface speed control
 - iii. With clamp speed and constant surface speed controls
 - k. Automatic tool changing
 - l. Tool edge programming
 - m. Tool nose radius compensation programming
 - n. Linear interpolation commands
 - o. Circular interpolation commands
 - p. Grooving Commands
4. Techniques and fixed cycles for CNC lathe programming

- a. Turning and boring cycle (G90)
- b. Facing Cycle (G94)
- c. Multiple repetitive cycles (G70-75)
- d. Stock removal in turning and boring cycle (G71)
- e. Finish turning and boring cycle (G70)
- f. Peck drilling and face grooving cycle (G74)
- g. Peck cutoff and grooving cycle (G75)
- h. Thread cutting on CNC lathes and turning centers
 - i. Single-pass threading cycle (G32)
 - j. Multiple-pass threading cycle (G92)
 - k. Multiple-repetitive threading cycle (G76)
5. Introduction to CNC Wire EDM
 - a. Different types of EDM
 - b. Operation requirements
 - c. Fundamentals of operation
 - d. Programming
 - e. New horizons
6. Modern Computer-Aided Part Programming
 - a. Using an off-line computer to write and store part programs
 - b. An introduction to computer-aided programming languages
 - c. Basic elements of the APT programming language
 - d. CAD/CAM terminology
 - e. Elements comprising CAD
 - f. Elements comprising CAM
 - g. Creating a Complete Part program using Mastercam CNC software

Lab Content

1. Review of ENGT 015A/B
2. Introduction to the CNC lathe
 - a. Background
 - b. Axes of motion
 - c. Features of the Machine Control Unit (MCU) Lathes
 - d. Basic Lathe operations
 - e. Tooling
 - f. Cutting speeds, feeds and depth of cut
3. Fundamental concepts of CNC Lathe Programming
 - a. Establishing locations via Cartesian coordinates (CNC Lathes)
 - b. Types of tool positioning modes
 - c. Reference point, machine origin, and program origin
 - d. Methodizing of operations
 - e. Setup procedures
 - f. G Codes
 - g. M Codes
 - h. Setting the machining origin
 - i. F Code
 - j. S Code
 - i. Spindle speed
 - ii. With constant surface speed control
 - iii. With clamp speed and constant surface speed controls
 - k. Automatic tool changing
 - l. Tool edge programming
 - m. Tool nose radius compensation programming
 - n. Linear interpolation commands
 - o. Circular interpolation commands
 - p. Grooving Commands
4. Techniques and fixed cycles for CNC lathe programming

- a. Turning and boring cycle (G90)
- b. Facing Cycle (G94)
- c. Multiple repetitive cycles (G70-75)
- d. Stock removal in turning and boring cycle (G71)
- e. Finish turning and boring cycle (G70)
- f. Peck drilling and face grooving cycle (G74)
- g. Peck cutoff and grooving cycle (G75)
- h. Thread cutting on CNC lathes and turning centers
 - i. Single-pass threading cycle (G32)
 - j. Multiple-pass threading cycle (G92)
 - k. Multiple-repetitive threading cycle (G76)
5. Introduction to CNC Wire EDM
 - a. Different types of EDM
 - b. Operation requirements
 - c. Fundamentals of operation
 - d. Programming
 - e. New horizons
6. Modern Computer-Aided Part Programming
 - a. Using an off-line computer to write and store part programs
 - b. An introduction to computer-aided programming languages
 - c. Basic elements of the APT programming language
 - d. CAD/CAM terminology
 - e. Elements comprising CAD
 - f. Elements comprising CAM
 - g. Creating a Complete Part program using Mastercam CNC software

Course Objectives

Objectives	
Objective 1	Identify the basic elements comprising the CNC lathe.
Objective 2	Describe the most important cutting operations performed on the CNC lathe.
Objective 3	Identify and state the different types of tooling used for CNC lathe operations.
Objective 4	Name the important components of CNC lathe tooling.
Objective 5	State the basic setup operations performed on the CNC lathe prior to running a job.
Objective 6	Analyze the important preparatory (G) codes and miscellaneous (M) codes used in programming lathe operations.
Objective 7	State the codes for specifying values of the spindle speed, tool feed, and changing tools.
Objective 8	Explain and program the rough boring cycle G90 and rough facing cycle G94.
Objective 9	Analyze and program the finish turning and boring cycle G70.
Objective 10	Describe and program the peck drilling and face grooving cycle G74.
Objective 11	Evaluate and program the peck cutoff and grooving cycle G75.
Objective 12	Describe and program the following threading cycles: single pass G32, multiple-pass G92, and multiple repetitive G76.
Objective 13	Identify basic operations of a CNC wire EDM.
Objective 14	Evaluate the advantages of using a computer-aided programming language.
Objective 15	State the key elements comprising a CAD/CAM systems.

Student Learning Outcomes

Upon satisfactory completion of this course, students will be able to:	
Outcome 1	Explain Computer Numerical Control wire Electrical Discharge Machining.
Outcome 2	Safely operate a Computer Numerical Control lathe.
Outcome 3	Complete a part program using Mastercam Computer Numerical Control software.

Methods of Instruction

Method	Please provide a description or examples of how each instructional method will be used in this course.
Discussion	Students will discuss the material during lecture and lab.
Laboratory	Laboratory will be used to gain a hands-on understanding of the material presented in lecture.
Lecture	Lecture will provide a theoretical introduction and explanation of the material being covered.
Participation	Students will be asked questions during lecture and lab.

Methods of Evaluation

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Computational/problem-solving evaluations	Students will be assigned homework and quizzes over Canvas. Also, labwork will utilize both Computer Aided Design and CNC machines that require computational problem solving.	In and Out of Class
Group activity participation/observation	During lab students will work in teams to perform and solve the lab report	In and Out of Class
Laboratory projects	During Lab students will be expected to discuss with their classmates the purpose of the lab and their findings. Laboratory projects will be assigned to teach students how to operate a CNC machine.	In and Out of Class
Mid-term and final evaluations	Students will be tested through Canvas to determine their understanding of the material.	In Class Only
Student participation/contribution	Students will be evaluated by their participation in both lecture and lab	In Class Only
Tests/Quizzes/Examinations	Quizzes and Exams will include multiple choice questions.	In Class Only
Written homework	Homework will be assigned via Canvas and some questions will require a short written response.	Out of Class Only

Assignments
Other In-class Assignments

1. Take notes
2. Participate in discussion
3. Quizzes
4. Labs
5. Lab notebooks
6. Midterm/Final Exams

Other Out-of-class Assignments

1. Lab write up
2. Reading assignments
3. Writing assignments

Grade Methods

Letter Grade Only

Comparable Transfer Course Information
University System

CSU

Campus

CSU Long Beach

Course Number

ET 244

Course Title

Machine Tools

Catalog Year

2018

Rationale

Operations and use of the conventional and non-conventional machine tools.

MIS Course Data**CIP Code**

15.0000 - Engineering Technology, General.

TOP Code

092400 - Engineering Technology, General

SAM Code

C - Clearly Occupational

Basic Skills Status

Not Basic Skills

Prior College Level

Not applicable

Cooperative Work Experience

Not a Coop Course

Course Classification Status

Credit Course

Approved Special Class

Not special class

Noncredit Category

Not Applicable, Credit Course

Funding Agency Category

Not Applicable

Program Status

Not program-applicable

Transfer Status

Transferable to CSU only

Allow Audit

No

Repeatability

No

Materials Fee

No

Additional Fees?

No

Approvals

Curriculum Committee Approval Date

11/06/2018

Academic Senate Approval Date

11/29/2018

Board of Trustees Approval Date

12/14/2018

Chancellor's Office Approval Date

3/20/2019

Course Control Number

CCC000603614

Programs referencing this course

Engineering Technology AS Degree (<http://catalog.collegeofthedesert.eduundefined?key=209>)

Robotics Certificate of Achievement (<http://catalog.collegeofthedesert.eduundefined?key=211>)