MAC – 224, Advanced CNC Milling

Orientation and Introduction

Introduction

Concept Content:

In this section you will give an introduction of yourself to your class. This is an opportunity to state your relevant experiences and credentials to teach this subject along with your personal background. This can help connecting with students. You can make a video introduction and upload it to this page as well.

Also, this is where you will give a brief overview of the course and what it's contents will be. There is a section later on in this module where you will give more detail about the course.

Course Syllabus

Concept Goals:

Insert the student learning outcomes for the course here.

Concept Content:

This is where you will upload the syllabus. You can do this either by uploading the syllabus text here or you can upload a copy of the syllabus under the resources tab for this section. If you do upload it to the resources, please be sure to give instructions to your students to look for the syllabus there.

Course Resources

Concept Goals:

You can leave this section blank provided you uploaded the student learning outcomes to the previous section.

Concept Content:

This is where you would outline student support resources such as tutoring services, listing your office ours, contact info for support for your college's learning management system, etc. If there are documents you wish to upload, be sure to upload them to the resources tab and give instructions for the students to find the documents there.

Course Overview

Concept Goals:

Student Learning Outcomes:

1. Set up and run a CNC milling machine.
2. Create a qualified CNC program to create a machine part
3. Operate a CNC milling machine to create a complex machine part

Concept Content:

This course covers advanced methods in setup and operation of CNC machining centers. Emphasis is placed on programming and production of complex parts. Upon completion, students should be able to demonstrate skills in programming, operations, and setup of CNC machining centers.

Module	**Module Learning Objectives**
Unit 1 Week 1 - 3D Constructions Management	• Describe the process of 3D Constructions in Mastercam (SLO 2) • Know the different operating mode buttons on the CNC machine (SLO 1) • Create a program for a simple CNC part (SLO 1)
Unit 1 Week 2 - Solids and Surfaces	• Use the CNC machine to create a program for a simple part (SLO 2) • Describe the process of drafting solids in Mastercam (SLO 1) • Describe the process of drafting surfaces in Mastercam (SLO 1)
Unit 1 Week 3 - 5 Axis Coordinate Systems	• Create a program for a simple CNC Part (SLO 2) • Describe the axis in a five axis coordinate system (SLO 1, SLO 2) • Describe the cycles utilized in 5 axis programming (SLO 1, SLO 2)
Unit 2 - Week 4-15 - Projects	• Utilize a CNC machine to create complex machine parts (SLO 3)

Unit 3 - Final Exam	• Demonstrate understanding of course material

Instructor Note: This is a 15 week course. If you need a 16th week due to your semesters being 16 weeks, you may have to create a 16th week.

Notes/Helpful Tips

Next Steps...

Your Census assignments are REQUIRED in order to remain in the class and they MUST be completed prior to the Census Date **[insert census date here]**. **If you do not have a census date requirement, you can delete this section.**

Effective note taking is also important for not only this course, but for your career as well. Note taking is a great way to retain information. The process of taking notes can keep you alert and focused on the information being presented. It also keeps your mind engaged with what you are hearing, increasing the likelihood you will retain that information. Note taking can also allow you to better organize your thoughts on the information being discussed.

Here is a video that provides some tips for effective note taking.

Unit 1 - Introduction to the Course

Unit 1 Week 1 - 3D Constructions

Concept Goals:

By the end of this week, you should:

- Describe the process of 3D Constructions in Mastercam (SLO 2)
- Know the different operating mode buttons on the CNC machine (SLO 1)
- Create a program for a simple CNC part (SLO 1)

Concept Content:

Welcome to MAC 224. This semester we will focus on advanced cnc milling techniques and projects. For the first three weeks we will go over some advanced concepts that may not have been covered in previous courses and then we will spend ten weeks working on various advanced projects. This week we will start with going over 3D Constructions Management in Mastercam.

This week's material:

Lectures:

3D Constructions Management - 23 Slides

Work Board Layout - 16 Slides

Assignment:

Programing Exercise #1 - Download the worksheet and draft the program required to create the shape on the blueprint.

Unit 1 Week 2 - Solids and Surfaces

Concept Goals:

By the end of this week, you should:

- Use the CNC machine to create a program for a simple part (SLO 2)
- Describe the process of drafting solids in Mastercam (SLO 1)
- Describe the process of drafting surfaces in Mastercam (SLO 1)

Concept Content:

This week, we will go through drafting Solids and Surfaces in Mastercam. We will also go through two more programming exercises.

This week's material:

Solids Presentation Pt 1 - 34 Slides

Solids Presentation Pt 2 - 18 Slides

Surfaces Presentation Pt 1 - 34 Slides

Surfaces Presentation Pt 2 -31 Slides

Assignments:

Programing Exercise 1

Programing Exercise 2

Unit 1 Week 3 - 5 Axis Coordinate Systems

Concept Goals:

By the end of this module, you should:

- Create a program for a simple CNC Part (SLO 2)
- Describe the axis in a five axis coordinate system (SLO 1, SLO 2)
- Describe the cycles utilized in 5 axis programming (SLO 1, SLO 2)

Concept Content:

This week we will go over 5 Axis Coordinate systems. 5 Axis is a common advancement of CNC machining from the standard 3 Axis system. We will also go through two more programming exercises.

This week's content:

Lectures:

5 Axis Coordinate System - 8 Slides

Handouts:

5 Axis Code List

5 Axis Cycles

Part Clamping for 5 Axis

Assignments:

Programing Exercise 1

Programing Exerecise 2

Unit 2 - Projects

Unit 2 Outline

Concept Goals:

By the end of this module, you will:

- Utilize a CNC machine to create complex machine parts (SLO 3)

Concept Content:

Instructor Note: For this unit you can assign the projects as needed among the students. The next module over will have a bank of projects for you to pick and choose from. Given how students will move at their own pace, there are some more advanced projects in there for those who have the time. You will be responsible for selecting which projects to work on for each student in the order that makes the most sense for them.

Welcome students to the second part of this class. With the first few weeks of review complete, it is time to work on projects. From here to the end of the semester, we will be tackling various projects in class. They are projects for both the mill and the lathe machines. As there are not enough of either machine for all students to work on a singular project, you will each be assigned projects to work on individually. Some may start with a lathe project, some may start on the mill. This will be at my discretion.

Proceed to the next page for the bank of projects for MAC 224.

Unit 2 Projects

Concept Goals:

Outline the learning goals for this module here.

Concept Content:

Here are the blueprints for machining projects for this course. **(Instructor note: this is a bank of potential projects, you can pick and choose which ones you like. There are more projects there than most students would be able to do in one semester).**

Your instructor will assign the projects from this bank of projects.

Advanced Pocket Milling Project

Bailie Tube Roller

Bearing Cutter

CNC Milling Level II Nims Project **- Instructor Note: This project can help students work towards a certification from NIMS, see the instructor resources section for more detail on how students can obtain the credential.**

Fly Cutter Milling

Tiny Stirling Engine Project

Training Project 7

Training Project 8

Unit 3 - Final Exam

15.1 Final Exam

Concept Goals:

By the end of this module, you should:

- Demonstrate understanding of course material

Concept Content:

This week we will take our final exam. This exam will cover the material from the start of the class and other concepts we utilized in this course. To see the exam, go to the assignments tab and look under test.

The exam has - questions: **(Instructor note: you can adjust the number of questions by either adding your own or turning off the live function for the questions you don't want showing up).**

Also, if you have not finished your latest project, you will have time this week to work on it for final grading.

15.2 Course Wrap-Up

Concept Content:

Thank you for your participation in MAC 224 this semester! Best of luck moving forward with your studies.

Faculty Resources (For Instructor Only, Do Not Publish Live)

Odigia Guide

Concept Content:

Click on the resources tab to find the guide sheet for instructors.

NIMS CNC Milling Certification II Information

Concept Content:

Per the fourth project option in Unit 2, students who complete the project are eligible to apply for the CNC Milling I certification provided by NIMS. NIMS is a nationally recognized credentialling body that provides industry-recognized credentials for advanced manufacturing.

Per NIMS' website, here is a description of the credential:

Machining

Classic Credential: CNC Mill II

Description:

Independently set up unproven programs and load, run and inspect parts while monitoring and adjusting process, machine and tool conditions in metric units of measure.

- Industry Standards:
  - Classic standards only available upon request
- Performance Requirements:
  - Completion of Project
- Documentation:
  - Submission of online affidavit certifying all project part characteristics meet drawing requirements
- Theory Requirements:
  - Theory Exam: 70 questions
- Study Material (Textbook/E-Learning):

- None at this time

Completing the project and turning it in for review by NIMS is just half of the process. The other half is the theory exam provided by NIMS. Contact NIMS for options on how to get the exam proctored for your students.