**CHAMP Course Map**

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| **Course Name:** MAC 205– Introduction to CNC Milling Operations |
| **Instructor Name:**  | **Date:**  |
| **Course Competencies:**I. Provide a transitional base that derives from conventional machining operations to operations consisting of numerical control technologyII. Provide fundamentals to CNC machining operations and applicationsIII. Identify NC controls and functions on a CNC machineIV. Demonstrate the basic concepts of CNC programmingV. List the factors that influence the selection of a NC machineVI. Identify the correct process plan and tooling selectionVII. Develop a manual program to run a NC machineVIII. Demonstrate competency to run a fixtured part using a NC program |

**Course Materials (Text, Edition and any other publisher items)**

**Textbooks and/or Resources:**

1. **Precision Machining Technology 2nd Edition**

Peter J. Hoffman, Eric S. Hopewell, Brian James

ISBN -10:1-2854-4454-X

1. **Precision Machining Technology Workbook and Projects Manual 2nd Edition**

David Lenzi, James Hillwig

ISBN – 10: 1-2854-4455-8

**NIMS Certification Alignment**

1. NIMS Measurement, Materials & Safety
2. NIMS CNC Milling: Programming Setup & Operations
3. NIMS CNC Milling: Operations

| **Module # and Title** | **CCNS Competencies** | **Content, Activities or Challenges****(Learner Interaction****& Engagement)** | **Assessments, Rubrics (Feedback)** |
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| **Module 1:**CNC Fundamentals | I.II.V. | * View pictures of different milling machines.
* View lecture 1 – CNC mill coordinates presentation
* View CNC milling coordinate system handout
* Discuss the different components of a Mill machine
	+ CNC Mill components presentation
* View Lecture 2 – G-Codes & M-Codes.pptx
* Read G90 and G91 Hole Pattern Handout
* Read Letter Address Descriptions for CNC Mill Handout
* Complete Absolute and Incremental Positioning exercise.
* Discussion questions
* Start HAAS simulator training
 | * Absolute and Incremental Positioning exercise.
* Discussion questions
* HAAS simulator training
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| **Module 2:**CNC Mill Program Structure | II.III.IV. | * Discussion questions
* View Lecture 1 – CNC Mill Coordinates.pptx
* Read Multiple Coords Example Handout
* Lecture 3 – Speeds and Feed.pptx
* Continue with HAAS simulator training
 | * Discussion questions
* HAAS simulator training
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| **Module 3:**Tools and Toolholders | IV.VI. | * Begin CNC Milling Tools descriptions and uses.
* Discuss various tool holders and their applications.
* Discuss G43 Tool length compensation.
* View Lecture 4 – Cutting Tool Holders.pptx
* Continue training on CNC milling machining and HAAS simulator.
 | * Discussion questions
* HAAS simulator training
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| **Module 4:**Linear Interpolation | IV. | * Discussion questions
* Complete Linear Interpolation exercise part 1.
* View Lecture 5 – Linear Interpolation.pptx
* View CNC Trigonometry.pptx
* Continue training on CNC milling machining and HAAS simulator
 | * Discussion questions
* HAAS simulator training
* Linear Interpolation exercise part 1.
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| **Module 5:**Compensation Concepts | VI. | * Discuss tool radius compensation and wear compensation and why learning these concepts are important to the job.
* Study the concept of compensation direction - G41 to left, G42 to right and G40 cancellation.
* Apply compensation to previous Linear Interpolation Exercise Part 1.
* View the cutter compensation training example.
* View CNC Milling Trigonometry.pptx
* Continue training on CNC milling machining and HAAS simulator
 | * Linear Interpolation exercise part 1 – Compensation
* Discussion questions
* Training on CNC milling machining and HAAS simulator
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| **Module 6:** Trigonometry | VI. | * Complete Linear Interpolation Exercise Part 2.
* Complete Linear Interpolation Trigonometry Training Handout.
* Complete Trigonometry Exercise 1.
* Complete Trigonometry Exercise 2.
* Complete Trigonometry Exercise 3.
* View CNC Trigonometry.pptx
* Complete Circular Interpolation Training Part 1.
* Complete circular Interpolation Exercise.
* View CNC Milling Circular Interpolation.pptx
* Continue training on CNC milling machining and HAAS simulator
 | * Linear Interpolation exercise with trigonometry part 2
* Trigonometry exercise 1
* Trigonometry exercise 2
* Trigonometry exercise 3
* Circular Interpolation exercise
* Circular Interpolation Training Part 1
* Training on CNC milling machining and HAAS simulator
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| **Module 7:**Circular Interpolation |  | * Discuss the concept of Circular Interpolation, why these skills are need on the job, and how it will be used on the job.
* View CNC Milling Circular Interpolation.pptx
* Discuss Plane Selection commands. G17, G18 and G19.
* Complete Quiz 1.
* View Tool Length Offset Visual Example Handout.pptx
* Continue training on CNC milling machining and HAAS simulator
 | * Discussion questions.
* Quiz 1.
* Training on CNC milling machining and HAAS simulator
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| **Module 8:**CNC Mill Bolt Circle Part | VII.VIII. | * View Lecture 7 - CNC Mill Operator Bolt Circle Part Program.pptx
* Develop a part program for CNC Mill Bolt Circle Part.
* View CNC Trigonometry.pptx
 | * Develop part program for CNC Mill Bolt Circle Part.
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| **Module 9:**Circular Interpolation and Bolt Circle Part | VII.VIII. | * Complete quiz 2
* Continue training on CNC milling machining and HAAS simulator
 | * Quiz 2
* Training on CNC milling machining and HAAS simulator
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| **Module 10:**Circular Pocket Milling | VII.VIII. | * Complete Circular Pocket Training Single Pass
* Complete Circular Pocket Training Multi-Passes
* View Lecture 8 - CNC Milling Circular Pocket Exercises.pptx
* Complete Circular Pocket Milling Student Exercise
* Complete General Pocket Milling Training Exercise
* View Lecture 9 - CNC Milling General Pocket Milling with Sub Programming.pptx
* Continue training on CNC milling machining and HAAS simulator
 | * Circular Pocket Training Single Pass
* Circular Pocket Training Multi-Passes
* Circular Pocket Milling Student Exercise
* General Pocket Milling Training Exercise
* Training on CNC milling machining and HAAS simulator
 |
| **Module 11:** Profiling, Bolt Circle Drilling and General Pocket Milling | VII.VIII. | * Complete Quiz 3
* Continue training on CNC milling machining and HAAS simulator
 | * Quiz 3
* Training on CNC milling machining and HAAS simulator
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| **Module 12:** Process Planning | VI.VII.VIII. | * Discuss the use of Process Planning, why it’s important and how it fits into Quality Improvement Plans.
* Discuss how to use the Fishbone Diagram as part of Process Planning.
* View Lecture 11 - Fishbone-Root Cause Analysis.pptx
* Create program for Process Planning and Drilling Cycles with Return Planes
* View Lecture 12 - CNC Canned Drill Cycles and Process Planning.pptx
 | * Discussion Questions
* Process Planning and Drilling Cycles with Return Planes exercise
 |
| **Module 13:** Lab Project |  | * Complete your final project-Vise Stop
 | * Vise Stop Project
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| **Module 14:**Process Planning Assessment and Final Exam | VI. | * Complete Final Test.
* Complete NIMS Criteria Sheet
 | * Final Test
* Criteria Sheet.
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