



# STARK STATE COLLEGE

## GENERAL SYLLABUS

### Course Information

**Course Name:** CNC Turning Center Programming in Conventional Format  
**Course Number:** ARL132

### Required Materials

**Textbook(s):** None  
**Required Readings:** None  
**Additional Materials:** Scientific Calculator, Laptops, Note Pads, Writing Utensils, Web Links, Handouts and related items as provided in class.

### Course Outline/Calendar

The date of coverage and order of coverage may be modified based on the faculty member and events beyond the control of faculty members that interfere with class times and teaching.

Week	Chapter/Topic/Lab
1 – Introduction to CNC and Mazatrol	<ul style="list-style-type: none"> <li>○ CNC basics: Learn the history and function of CNC turning centers.</li> <li>○ Machine operation: Understand the main components of a Mazak turning center, including the control panel, keypad, and axis movements.</li> <li>○ Mazatrol vs. G-code: Compare Mazatrol's conversational approach to traditional G-code programming.</li> <li>○ Safety protocols: Review standard operating and safety procedures for CNC machines.</li> </ul>
2 – Navigating the Control and Program Creation	<ul style="list-style-type: none"> <li>○ Control interface: Explore the Mazatrol control interface, including basic navigation and menu options.</li> <li>○ Program setup: Learn to create and name a new program using the "Work Number" key.</li> <li>○ Program header: Understand the essential program header information, such as material type, stock size, and speed limits.</li> <li>○ Workpiece coordinates: Define the stock shape and work zero position (WPC).</li> </ul>
3 – Basic Tuning Units	<ul style="list-style-type: none"> <li>○ Common unit: Learn about the common unit, which stores general program information.</li> <li>○ Facing units: Program basic facing operations to prepare the part's end face.</li> <li>○ Bar-material units: Use bar-material units to define and rough-turn the outer diameter (OD) and inner diameter (ID).</li> <li>○ Tooling data: Set up basic tool data in the program, including inserts, radii, and offsets.</li> </ul>
4 – Practical Programming and Simulation	<ul style="list-style-type: none"> <li>○ Simple part programming: Program and simulate a basic part with straight turns and faces.</li> <li>○ Graphic simulation: Use the Mazatrol graphics to verify the toolpath and stock removal.</li> <li>○ Practical machine operation: Run a simulated program on the machine control to practice the workflow.</li> </ul>

Week	Chapter/Topic/Lab
	<ul style="list-style-type: none"> <li>○ In-class exercises: Complete small projects involving simple OD and ID turning.</li> </ul>
5 – Advanced Turning Units	<ul style="list-style-type: none"> <li>○ Copy-machining: Learn to program complex profiles by copying existing shapes.</li> <li>○ Corner-machining: Create complex shapes using radius and chamfer functions.</li> <li>○ Taper machining: Program tapers on both OD and ID profiles.</li> <li>○ Grooving: Create and define grooves using the dedicated grooving units.</li> </ul>
6 - Threading	<ul style="list-style-type: none"> <li>○ Threading basics: Understand the principles of thread cutting and the types of threads.</li> <li>○ Threading units: Use Mazatrol's built-in threading units to program external and internal threads.</li> <li>○ Parameters: Learn to input thread-specific parameters, such as pitch, depth, and lead-in/lead-out.</li> <li>○ Hands-on threading: Practice programming and simulating various thread types.</li> </ul>
7 – Drilling, Boring, and Tapping	<ul style="list-style-type: none"> <li>○ Drilling units: Program and perform standard drilling operations.</li> <li>○ Boring units: Learn to use boring bars to machine internal diameters.</li> <li>○ Tapping: Understand the tapping unit and the necessary tool and program parameters.</li> <li>○ Multi-process parts: Program a part that requires drilling, boring, and tapping.</li> </ul>
8 – Tooling and Offsets	<ul style="list-style-type: none"> <li>○ Advanced tooling: Explore a wider range of tool types, including specialized inserts and holders.</li> <li>○ Tool data management: Understand how to manage and modify tool data effectively.</li> <li>○ Offsets and wear: Learn to use tool wear offsets to adjust part dimensions and maintain tolerance.</li> <li>○ Measuring tools: Practice using the tool probe (if available) for automatic tool measurement.</li> </ul>
9 – Sub-Spindle and Multi-Turret Operations	<ul style="list-style-type: none"> <li>○ Sub-spindle basics: Understand the concept and operation of sub-spindle machining.</li> <li>○ Transfer units: Learn to program part transfers between the main and sub-spindle.</li> <li>○ Multi-turret: Explore programming strategies for machines with multiple turrets for simultaneous cutting.</li> <li>○ Complex part transfers: Program a part requiring a full transfer and back-side machining.</li> </ul>
10 – Multi-Tasking and C-Axis Milling	<ul style="list-style-type: none"> <li>○ Multi-tasking overview: Understand the capabilities of Mazak multi-tasking machines.</li> <li>○ C-axis units: Program C-axis functions for milling, drilling, and tapping on the face or OD of a part.</li> <li>○ Polar coordinate interpolation: Learn to program circular features using polar coordinates.</li> <li>○ Practical milling: Program and simulate basic milling features like flats or hexes.</li> </ul>
11 – Tool Path and Cycle Optimization	<ul style="list-style-type: none"> <li>○ Cutting patterns: Explore advanced cutting patterns and their applications, such as pattern 2 for incremental cutting.</li> <li>○ High-speed machining: Understand parameters for high-speed cutting and how Mazatrol automates these functions.</li> <li>○ Manual programming: Learn to insert EIA/ISO (G-code) manually within a Mazatrol program for specific operations.</li> <li>○ Program optimization: Review and optimize existing programs to reduce cycle times and improve efficiency.</li> </ul>
12 – Advanced Features and Error Handling	<ul style="list-style-type: none"> <li>○ Optional blocks and comments: Use optional blocks and program comments to make programs more flexible and easier to read.</li> <li>○ Alarms and troubleshooting: Learn to identify common alarms and troubleshoot programming or machine errors.</li> <li>○ Safety features: Understand Mazatrol's built-in safety features and how to use them effectively.</li> <li>○ Review and project prep: Review key concepts and begin preparing for the final project.</li> </ul>
13 – Project Planning and Tool Selection	<ul style="list-style-type: none"> <li>○ Project kickoff: Receive project drawings for a complex part requiring multiple operations.</li> <li>○ Planning phase: Develop a comprehensive plan, including process selection and order of operations.</li> <li>○ Tooling strategy: Select and define all necessary tools for the project.</li> <li>○ Initial programming: Begin programming the first half of the project.</li> </ul>
14 – Project Programming and Simulation	<ul style="list-style-type: none"> <li>○ Programming phase: Complete the Mazatrol program for the entire project.</li> <li>○ Simulation and debugging: Thoroughly simulate the program to identify and correct any errors.</li> </ul>

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	<ul style="list-style-type: none"> <li>○ Hands-on practice: Test sections of the program on a machine to verify toolpaths and offsets.</li> <li>○ Instructor feedback: Receive feedback from the instructor to refine the program.</li> </ul>
15 – In Class Project Machining	<ul style="list-style-type: none"> <li>○ Setup and run: Set up the machine, load the material, and run the program to machine the final part.</li> <li>○ Machine operation: Gain practical experience operating the machine from start to finish.</li> <li>○ Inspection: Measure and inspect the finished part to ensure it meets all specifications.</li> <li>○ Revision: If necessary, revise the program to correct any deviations.</li> </ul>
16 – Course Review and Certification	<ul style="list-style-type: none"> <li>○ Final presentation: Present the finished part and programming process to the class.</li> </ul>