



# STARK STATE COLLEGE

## GENERAL SYLLABUS

### Course Information

**Course Name:** CNC Maching Center Programming in EIA Format  
**Course Number:** ARL131

### 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 Machining	<ul style="list-style-type: none"> <li>• Topic: CNC history, applications, and technology.</li> <li>• Topic: The EIA/ISO word address programming language.</li> <li>• Topic: Machine construction and components (e.g., axes, controls, and tooling).</li> <li>• Lab: Machine and classroom safety rules and procedures, including personal protective equipment (PPE).</li> </ul>
2 – Blueprint Reading and Shop Math	<ul style="list-style-type: none"> <li>• Topic: Interpreting mechanical blueprints for CNC projects.</li> <li>• Topic: Geometric dimensioning and tolerancing (GD&amp;T) symbols.</li> <li>• Topic: Cartesian coordinate systems (absolute and incremental positioning).</li> <li>• Lab: Practice calculating coordinate positions from part drawings.</li> </ul>
3 – Tooling and Workholding	<ul style="list-style-type: none"> <li>• Topic: Overview of cutting tools for CNC mills (e.g., end mills, drills, taps).</li> <li>• Topic: Tool holders and tool inspection.</li> <li>• Topic: Workholding devices (e.g., vises, clamps, and fixtures).</li> <li>• Lab: Tool identification and securing parts with different workholding setups.</li> </ul>
4 – Speeds, Feeds, and Machining Calculations	<ul style="list-style-type: none"> <li>• Topic: Cutting variables, including surface feet per minute (SFM) and feed rate.</li> <li>• Topic: Calculating speeds and feeds for different materials and tools.</li> <li>• Lab: Performing manual calculations and verifying results with manufacturer data.</li> </ul>
5 – The Programming Process	<ul style="list-style-type: none"> <li>• Topic: Planning a CNC program from a blueprint.</li> <li>• Topic: Program structure and block formatting in EIA.</li> <li>• Topic: Basic G-codes (e.g., G00, G01) and M-codes (e.g., M03, M05, M30).</li> <li>• Lab: Writing and simulating simple point-to-point programs.</li> </ul>

Week	Chapter/Topic/Lab
6 – Linear and Circular Interpolation	<ul style="list-style-type: none"> <li>• Topic: Programming linear moves with G01.</li> <li>• Topic: Circular motion with G02 (clockwise) and G03 (counter-clockwise).</li> <li>• Topic: Programming with radius versus center-point (I, J, K) methods.</li> <li>• Lab: Writing a full program for a part with linear and circular features.</li> </ul>
7 – Offsets and Compensation	<ul style="list-style-type: none"> <li>• Topic: Understanding work offsets (G54-G59).</li> <li>• Topic: Using tool length offsets (G43, G44).</li> <li>• Topic: Implementing cutter radius compensation (G41, G42).</li> <li>• Lab: Setting tool and work offsets on a training machine.</li> </ul>
8 – Machine Setup and Simulation	<ul style="list-style-type: none"> <li>• Topic: Machine startup procedures and control functions.</li> <li>• Topic: Manually jogging axes and running programs in single-block mode.</li> <li>• Topic: Verifying program paths using graphical simulation.</li> <li>• Lab: Performing a full machine setup from print to part, running a basic program, and inspecting the finished workpiece.</li> </ul>
9- Hole-Making Canned Cycles	<ul style="list-style-type: none"> <li>• Topic: Introduction to canned cycles (G81, G82, G83, G84).</li> <li>• Topic: Applications for drilling, peck drilling, tapping, and boring.</li> <li>• Lab: Programming and machining parts using various canned cycles.</li> </ul>
10 – Pocket Milling	<ul style="list-style-type: none"> <li>• Topic: Manual programming of pocket milling operations.</li> <li>• Topic: Using canned cycles for pocket milling where applicable.</li> <li>• Lab: Creating a program for a part with a simple rectangular pocket.</li> </ul>
11 - Subprograms	<ul style="list-style-type: none"> <li>• Topic: Understanding the use and structure of subprograms.</li> <li>• Topic: Calling subprograms (e.g., M98, M99) and looping.</li> <li>• Lab: Writing a program that utilizes a subprogram to machine repetitive features.</li> </ul>
12- Tool Management and Control Functions	<ul style="list-style-type: none"> <li>• Topic: Tool changes (M06).</li> <li>• Topic: Miscellaneous functions (M-codes) for coolant, stops, and other operations.</li> <li>• Lab: Expanding existing programs to include multiple tools and advanced M-codes.</li> </ul>
13 – Introduction to CAD/CAM	<ul style="list-style-type: none"> <li>• Topic: The role of computer-aided design (CAD) and computer-aided manufacturing (CAM) in programming.</li> <li>• Topic: Importing CAD models and generating toolpaths in CAM software.</li> <li>• Lab: Using introductory CAM software (e.g., Mastercam, Fusion 360) to generate a program.</li> </ul>
14 – Generating and Editing CAM Programs	<ul style="list-style-type: none"> <li>• Topic: Understanding the post-processor and its effect on G-code.</li> <li>• Topic: Modifying and optimizing a program generated by CAM software.</li> <li>• Lab: Generating a CAM program for a complex 2D part and manually editing the resulting G-code.</li> </ul>
15 – Course Review and Capstone Project	<ul style="list-style-type: none"> <li>• Topic: Review of core concepts, including coordinate systems, offsets, G-codes, and M-codes.</li> <li>• Lab: Working on a capstone project that requires a student to design, program, and machine a complex part from scratch.</li> </ul>
16 – Final Projects and Graduation	<ul style="list-style-type: none"> <li>• Topic: Review of core concepts, including coordinate systems, offsets, G-codes, and M-codes.</li> <li>• Lab: Working on a capstone project that requires a student to design, program, and machine a complex part from scratch.</li> </ul>