

# CNC Manufacturing Course: Comprehensive Overview

Transforming beginners into CNC experts, ready to command top industry wages in just 8 weeks!

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# Course Overview

## Legacy 1

Introduction to basic machining techniques.

## Legacy 2

Advanced manual machining operations.

## CNC Operation

Fundamentals of CNC machine operation.

## CNC Programming

CNC programming essentials and best practices.

## Advanced CNC/Programming

Advanced CNC techniques and programming.

# Safety Protocols & Procedures



# Blueprint Reading & Interpretation



## Blueprint Symbols

Decode the language of technical drawings. Recognize standard symbols and notations instantly.



## Interpretation Exercises

Practice reading complex drawings. Convert 2D information into 3D understanding.



## GD&T Reference

Master geometric dimensioning and tolerancing. Essential for high-precision parts.

# Measurement & Metrology

## Basic Measurement Tools

Master calipers, micrometers, and gauges. These tools form the foundation of precision work.

## Measurement Techniques

Learn proper positioning and reading methods. Accuracy depends on consistent technique.

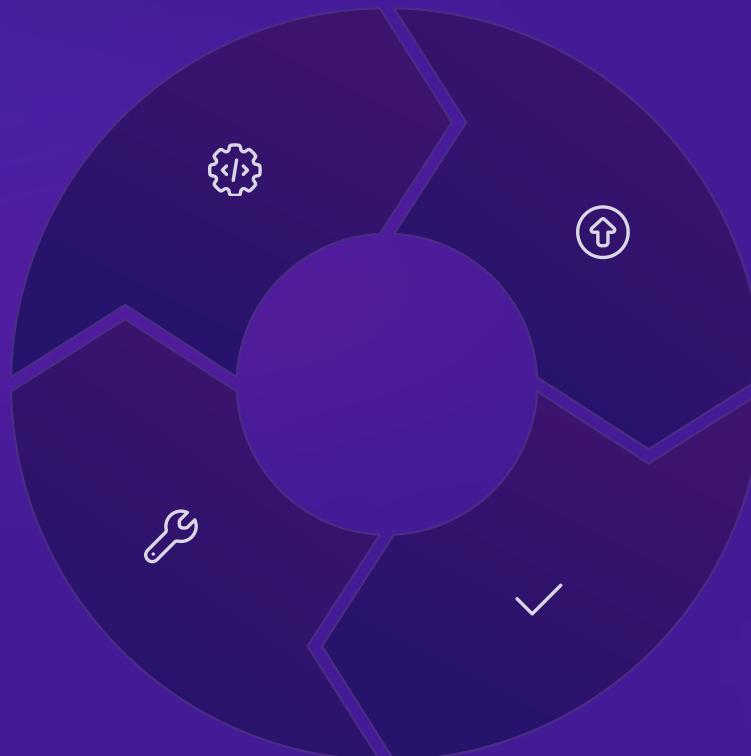
## Practice Worksheets

Complete measurement logs for various parts. Build confidence through repetition.

## Tool Calibration

Maintain measurement accuracy. Regular calibration ensures reliable results.

# Manual Lathe Operations



Setup  
Proper workpiece mounting and tool selection

Troubleshooting  
Solutions for common turning problems

Operation  
Turning, facing, boring, and threading techniques

Measurement  
Continuous verification of dimensions

# Manual Milling Operations



## Workholding

Secure parts with vises, clamps, and fixtures



## Tool Selection

Choose appropriate end mills and cutters



## Cutting Operations

Master facing, pocketing, and profiling



## Feed & Speed

Calculate optimal parameters for each material

# CNC Mill Operations

## Setup

Workpiece mounting and zero point establishment.

## Programming

G-code programming and toolpath generation.

## Tooling

Cutting tool and toolholder selection.

## Operation

Facing, pocketing, and drilling.



PROGRAMMING

TOOLING



# CNC Lathe Operations

## Setup

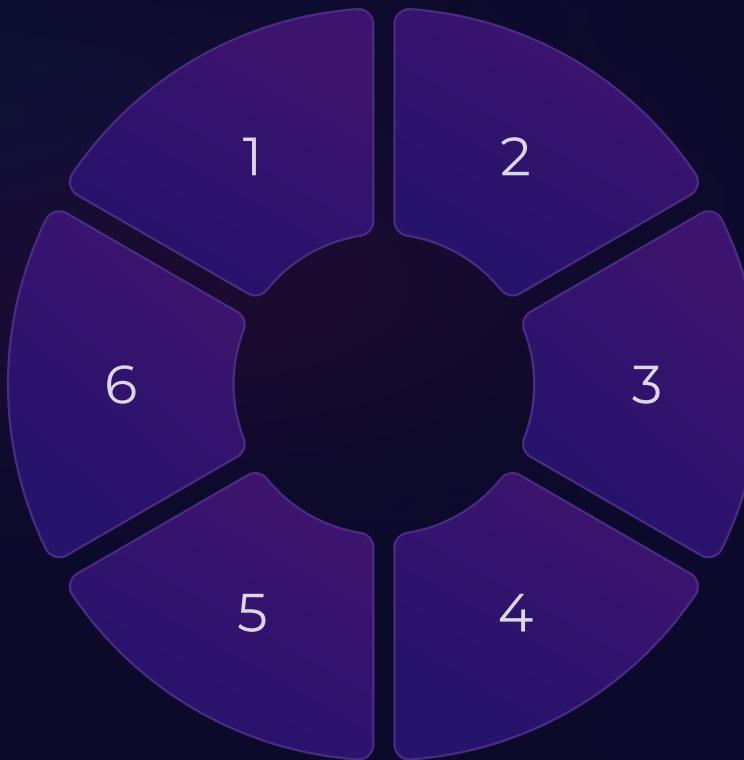
Proper workpiece mounting, material selection, and zero point establishment.

## Troubleshooting

Identifying and resolving common issues during CNC lathe operations.

## Measurement & Inspection

Using precision instruments to verify part dimensions and tolerances.



## Programming

G-code programming, toolpath generation, and simulation.

## Tooling

Selection of appropriate cutting tools, inserts, and toolholders for various materials and operations.

## Operation

Turning, facing, threading, grooving, and boring operations on CNC lathes.

# Mastering Manual Grinding

## Secure the Workpiece

Ensure the material is firmly clamped or held in a vise to prevent movement during grinding.

Achieving a precise finish in manual grinding requires a combination of careful preparation, attentive execution, and consistent technique.

## Inspect the Grinding Wheel

Check for cracks, chips, or uneven wear. Dress the wheel if necessary to ensure a smooth, balanced surface.

## Apply Consistent Pressure

Use smooth, even strokes with moderate pressure. Avoid dwelling in one spot to prevent overheating and uneven material removal.

# CNC Programming & Operations

G-Code	Function	Example
G00	Rapid Positioning	G00 X0 Y0
G01	Linear Interpolation	G01 X5 F100
G02	CW Circular Motion	G02 X10 Y10 R5
M03	Spindle On Clockwise	M03 S1000
M08	Coolant On	M08

# Metallurgy

**Metallurgy** is the science and technology of working with metals – including how they're extracted, processed, shaped, and treated to improve strength, durability, and performance.



## Molten Metal in Motion:

A foundry worker pours glowing molten metal into molds, showcasing the intense heat and precision involved in the metallurgical casting process.

# Advanced CNC Techniques

## 1 Multi-axis Machining

Create complex geometries with 4 and 5-axis techniques. Reduce setups and improve accuracy.

## 2 CAM Programming

Generate efficient toolpaths with specialized software. Optimize cutting strategies for surface finish.

## 3 Advanced Fixturing

Design custom workholding solutions. Minimize vibration and maximize rigidity for precision cuts.

## 4 Quality Assurance

Implement inspection protocols. Verify tolerances with CMM and other measurement technologies.



# Troubleshooting & Problem Solving

## ▼ Poor Surface Finish

Check for tool wear, excessive speed, or inadequate coolant. Replace dull tools and adjust cutting parameters.

## ▼ Dimensional Inaccuracy

Verify tool offsets, check for fixture movement, and inspect for thermal expansion. Re-measure and adjust as needed.

## ▼ Abnormal Tool Wear

Evaluate cutting speed, feed rate, and material hardness. Adjust parameters and ensure proper coolant application.

## ▼ Machine Alarms

Document error codes and follow manufacturer troubleshooting guide. Check for limit switches and overloads.