

# **CATIA V5 Master Program – Product Design & CNC Manufacturing**

## **Target Audience**

This program is designed for professionals, engineering students and tool & die trainees. It is suitable for production engineers, CNC programmers, and machine operators seeking to upgrade to CAM-based programming. The course also benefits design engineers who want to expand into manufacturing and CNC domains. It prepares learners for careers in CAD/CAM, product development, tooling, and CNC manufacturing. The training focuses on the complete design-to-G-code workflow with practical industry exposure.

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## **Course Objectives**

- To develop strong fundamentals in CATIA V5 for 3D part modeling, assembly design, and drafting
  - To enable learners to create parametric and manufacturing-ready CAD models
  - To provide hands-on training in CAM workflow, from machine setup to toolpath creation
  - To generate, simulate, and validate CNC toolpaths and G-code programs
  - To build industry-ready skills for complete design-to-manufacturing integration
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## **Course Outcomes**

Upon successful completion of this program, participants will be able to create fully parametric 3D parts, complex assemblies, and detailed engineering drawings using CATIA V5. They will gain the ability to set up machining environments, define tools and machining strategies, generate and optimize toolpaths, and simulate material removal. Participants will also be capable of generating and understanding G-code for CNC machines. Overall, they will be equipped to handle the complete design-to-manufacturing workflow in real industrial environments.

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**Course Outline:** The course comprises **64-hours** of theory and labs and is divided into **22** different chapters. Each chapter will be followed by hands-on lab exercises to reinforce learning and gauge understanding of the topics covered.

### **Chapter 1. Introduction to CATIA V5**

- Overview of CATIA V5 Platform
  - Understanding Workbenches
  - File Types (.CATPart, .CATProduct, .CATDrawing)
  - User Interface & Customization
  - Mouse Controls and Navigation
  - Working with Specifications Tree
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### **Chapter 2. Drawing Sketches in the Sketcher Workbench – I**

- Entering Sketcher Workbench
  - Profile Tools (Line, Circle, Arc, Rectangle)
  - Spline and Conic Tools
  - Sketch Editing Tools
  - Sketch Analysis
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### **Chapter 3. Drawing Sketches in the Sketcher Workbench – II**

- Advanced Sketch Tools
  - Project 3D Elements
  - Axis and Construction Geometry
  - Creating Complex Profiles
  - Best Practices for Sketching
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## **Chapter 4. Constraining Sketches and Creating Base Features**

- Geometric Constraints
  - Dimensional Constraints
  - Fully Constrained Sketch Concept
  - Creating Pad (Extrude)
  - Creating Pocket (Cut)
  - Shaft (Revolve)
  - Groove Feature
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## **Chapter 5. Reference Elements and Sketch-Based Features**

- Creating Planes
  - Creating Axis System
  - Points and Lines
  - Rib & Slot
  - Multi-Section Solid
  - Remove Multi-Section
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## **Chapter 6. Creating Dress-Up and Hole Features**

- Fillet
  - Chamfer
  - Draft
  - Shell
  - Hole Types (Simple, Counterbore, Countersink)
  - Thread Representation
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## **Chapter 7. Editing Features**

- Editing Sketch
- Editing Feature Parameters
- Reordering Features
- Replace Face
- Boolean Operations
- Design Intent

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## **Chapter 8. Transformation Features and Advanced Modeling Tools – I**

- Rectangular Pattern
- Circular Pattern
- Mirror
- Scaling
- Translation & Rotation
- Thickness Feature

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## **Chapter 9. Advanced Modeling Tools – II**

- Advanced Boolean Operations
- PowerCopy Introduction
- Parameters and Formulas
- Design Table Basics
- Knowledgeware Introduction

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## **Chapter 10. Working with the Wireframe and Surface Design Workbench**

- Wireframe Elements
- Sweep
- Loft
- Multi-Section Surface

- Join, Trim, Split
  - Surface to Solid Conversion
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### **Chapter 11. Editing and Modifying Surfaces**

- Healing Surfaces
  - Boundary & Fill
  - Extrapolate
  - Blend
  - Surface Analysis Tools
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### **Chapter 12. Assembly Modeling**

- Creating CATProduct
  - Inserting Components
  - Assembly Constraints
  - Degrees of Freedom
  - Clash Detection
  - Exploded View
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### **Chapter 13. Working with the Drafting Workbench – I**

- Creating Drawing from 3D Model
  - Standard Views
  - Section Views
  - Projection Methods
  - Dimensioning
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### **Chapter 14. Working with the Drafting Workbench – II**

- Annotation Tools

- Tolerances & Surface Symbols
  - Bill of Materials (BOM)
  - Title Block Editing
  - Printing & Plot Settings
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## **Chapter 15. Working with Sheet Metal Components**

- Sheet Metal Parameters
  - Wall Creation
  - Flange
  - Bend & Unbend
  - Corner Relief
  - Flat Pattern Generation
  - Generating Sheet Metal Drawings
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## **Chapter 16. Introduction to Manufacturing Workbench**

- Overview of CATIA Manufacturing
  - Types of Machining (Prismatic, Surface, 3-Axis)
  - Interface of NC Manufacturing Workbench
  - Understanding Manufacturing Tree
  - Manufacturing File Structure (.CATProcess)
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## **Chapter 17. Machine Setup & Part Preparation**

- Creating Manufacturing Program
- Defining Machine Type (3-axis CNC)
- Setting Machine Zero (MCS)
- Defining Workpiece (Stock Definition)
- Defining Part Body

- Safety Plane Definition
  - Tool Assembly Setup
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## **Chapter 18. Tool Creation & Machining Parameters**

- Creating Milling Tools
    - End Mill
    - Face Mill
    - Drill Tool
  - Tool Geometry Parameters
  - Feed & Speed Definition
  - Spindle Speed & Cutting Data
  - Tool Library Management
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## **Chapter 19. Prismatic Machining Operations**

- Facing Operation
  - Pocketing Operation
  - Profile Contouring
  - Drilling & Peck Drilling
  - Chamfering Operation
  - Re-machining Strategy
  - Toolpath Strategy Selection
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## **Chapter 20. Surface Machining**

- Roughing Strategy
- Z-Level Machining
- Parallel Finishing
- Radial & Spiral Machining

- 3-Axis Toolpath Concepts
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## **Chapter 21. Toolpath Verification & Simulation**

- Toolpath Replay
  - Material Removal Simulation
  - Collision Detection
  - Toolpath Optimization
  - Editing & Regenerating Toolpath
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## **Chapter 22. Post Processing & G-Code Generation**

- Introduction to Post Processor
- Generating NC Code
- Understanding G & M Codes
- Saving .NC / .TAP Files
- Program Structure Overview
- Basic G-code Reading & Verification