

Kennesaw State University
MET 4342 – Numerical Control of Machines
(CNC Multi-Axis Machining and Programming)
(2-3-3)

MET 4342 A course in tooling and programming for Computer Numerical Control (CNC) machines. The course includes G-Code, multi-axis machining, and Computer Aided Manufacturing (CAM) programming languages and systems. Considerable emphasis on the integration of CNC planning and programming into manufacturing process optimization. Prominent topics include machine selection, workholding, and part process documentation.

Prerequisite: MET 2322
Instructor: Randy Emert
Assistant Professor, MET

Office Hours: T, Th 1:00-2:00
Q151
678-915-7406

remert@kennesaw.edu

Software: HSM Works download for free. Works inside SolidWorks.
<http://www.hsmworks.com/>

Text: (Recommended) Secrets of 5-Axis Machining, Karlo Apro. ISBN: 978-0-8311-3375-7

Online Text: ToolingU

Websites: <http://academy.titansofcnc.com/>
<https://www.mazakusa.com/machines/process/5-axis/>
<http://www.mscdirect.com/>
<https://www.mcmaster.com/>
https://www.youtube.com/results?search_query=hsmworks
https://www.youtube.com/results?search_query=haas+tip+of+the+day+multi+axis

Outcomes: Students completing MET 4342 will have the ability to:

1. Perform CAD/CAM programming for various CNC and multi-axis machining applications.
2. Specify tooling and workholding for common CNC machined parts.
3. Optimize machining and minimize manufacturing process operations.
4. Identify machine specifications required for part optimization.
5. Document required workholding, tooling, machine setup, CAD/CAM CNC program, and engineering drawings for manufacturing process optimization.

Grading:	ToolingU	20%
	Assignments	10%
	Labs	40%
	Tests/Quizzes	30%

Assignments: Topics will cover stock size selection, tooling selection, workholding identification, part process optimization, and machine specification. All assignments are to be formally documented and turned into D2L.

- Labs:** All laboratory projects are completed in the KSU laboratories. Laboratory exercises may be performed in small groups.
Labs will be documented with:
Material Size and Specification
Tooling Sheet
MSC Tooling Cost Shopping Cart
HSM Works Setup Sheet
Engineering Drawing
Solid Model w/HSM Works CAM tool paths
- Quizzes:** We will have quizzes on multi-axis machining, speeds & feeds, and workholding
- Tests:** There will be one test on Tooling and one test on Part Optimization
- Attendance:** Therefore, attendance is extremely important in order to retain the material and gain the skills necessary to complete the CNC projects.
- Late Work:** Late assignments and labs will not be accepted. Makeup tests are not given. However, if prior arrangements have been made or due to extenuating circumstances exceptions may be granted.

Honor Code

As a member of the Kennesaw State University community of scholars, I understand that my actions are not only a reflection on myself, but also a reflection on the University and the larger body of scholars of which it is a part. Acting unethically, no matter how minor the offense, will be detrimental to my academic progress and self-image. It will also adversely affect all students, faculty, staff, the reputation of this University, and the value of the degrees it awards. Whether on campus or online, I understand that it is not only my personal responsibility, but also a duty to the entire KSU community that I act in a manner consistent with the highest level of academic integrity. Therefore, I promise that as a member of the Kennesaw State University community, I will not participate in any form of academic misconduct. I also understand that it is my responsibility to hold others to these same standards by addressing actions that deviate from the University-wide commitment to working, living, and learning in an environment conducive to a quality education. Thus, I affirm and adopt this honor code of Kennesaw State University.

MET 4342 – Numerical Control of Machines

WK1	Introduction to MET 4342	Read Ch1-3 Secrets of 5-Axis Machining	
		Stock Size Selection 1	
WK2	Types of Multi-Axis Machines	Review Mazaks website	
WK3	CNC Machine Features	Process Optimization 1	
	Multi-Axis Machine Quiz	Machine Selection Discussion	
Tooling			
WK4	Cutting Processes and Machine Tools	Tooling Selection 1	
	Basic Cutting Theory		
WK5	Introduction to Metal Cutting Fluids		
	Speeds and Feeds for the Mill/Lathe		
WK6	Cutting Tool Materials	Part Process Optimization 2	
	Tool Geometry Mill/Lathe		
WK7	Optimizing Tool Life and Process		
	Tooling Quiz		
Workholding			
WK8	Introduction to Workholding	Stock Size Selection 2	
	Supporting and Locating Principles		
WK9	Locating Devices and Clamping	Workholding Identification	
	Chucks, Collets and Vises		
WK10	Fixture Body Construction		
	Workholding Quiz		
Toolpaths and Programming Strategies			
WK11	High Speed Machining (HSM)		
	Adaptive Clearing/Feed Milling	Part Process Optimization 3	
WK12	Indexing Toolpaths	Read Ch4	
	TCPM/TCPC	Haas Videos	
WK13	Simultaneous Toolpaths	Read Ch5,6	
	Swarf, Contour and Flow	Part Process Optimization 4	
WK14	Machine Simulation	Read Ch7	
	5-Axis Machine Selection	Read Ch8	
WK15	CAD/CAM System Selection	Read Ch9	
	Putting it All Together	Read Ch10	
May 2	Part Process Optimization Test		

This syllabus including scheduling and grading may be modified based on mutual agreement of instructor and student.