Automation in Production Engineering

EIN 4905 / EIN 6905 / EML4930

Class Periods: 2 days a week, 1hr + 2hrs

Monday 9:35am – 10:25am, +Lab Time **TBD** (scheduled by group)

Credits: 3

Locations:

Lecture: MAE-C Room 010

Lab: MAE-C Room 010A / 002

Academic Term: Spring 2024

Instructor:

Dr. Sean Niemi
Email Address: srn@mae.ufl.edu
Office Phone: (352) 294-3381
Office Hours: TBD

Dr. Katie Basinger-Ellis
Email Address: katie.basinger@ufl.edu
Office Phone: (352) 294-7730
Office Hours: TBD

Teaching Assistants/Peer Mentors/Supervised Teaching Students:

Please contact through the Canvas website

- Andrea Camacho-Betancourt - andreacamachobet@ufl.edu
- Daniel Rodriguez de Souza
- Brett Feldman
- Kaiana Kibler
- Lauren Shaw
- Noelle Esposito

Course Description

Students will learn how to design for and program parts using CNC machining. Students will be able to design a part to meet specifications using Fusion 360, program the code for machining (Computer Aided Manufacturing), and operate a CNC machine to make the part. This course includes 1 hour of lecture, and 2 hours of lab time each week. Lab times are individual to the lab team and will have an instructor present.

Course Pre-Requisites / Co-Requisites

Due to the low course enrollment size, Drs. Basinger-Ellis and Niemi will be selecting a cohort of students from applicants.

MAE Students: EML2023, a grade of A- or better in EML2322L, 4EG classification

ISE Students: CAD with Solidworks or Fusion360 (no exceptions), *co-req* EIN4451 or EIN4360

Course Objectives

- Understand and apply fundamentals of component design for subtractive and additive manufacturing with a focus on multi-axis CNC manufacturing
- Be able to select workholding and determine manufacturing datums for designed parts.
- Apply tooling/tool/toolpath selection and determine cutting parameters to program CNC machines
- Learn the fundamentals of operation for 3, 4, and 5-axis CNC machines
- Understand the basics of estimating production times and arranging schedules
- Summarize additive manufacturing methods and its comparability with traditional manufacturing

Materials and Supply Fees

All materials, supplies, and tooling are provided through funding from the IACMI – The Composites Institute and a generous donation from Autodesk Inc.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- **Autodesk Fusion360** will be the primary CAD/CAM software used. Fusion360 is free for students with a ".edu" email address. It is compatible on Mac or PC and has a web-browser version.
- **Microsoft Teams** will be used as the primary communication tool for this course. Use of GroupMe or text messaging is highly discouraged.

Recommended Materials

- **Cutting Tool Applications** by George Schneider Jr., CMfgE (available for free via download)

Course Schedule

Lab #	Week		Lecture Topic	Lab Activity	Assignments (Due on Fri of the week)
1	1/8	1/12	**Course Intro** **Safety** Introduce Air Engine	**NO LABS - ACE TRAINING DUE THURSDAY 1/11 - IF NOT COMPLETE STUDENTS WILL BE DROPPED FROM COURSE**	ACE Online Course** Join Dr. Niemi's Fusion Team
2	1/15	1/19	**HOLIDAY - MLK DAY** ***VIDEO LECTURE: INTRO TO MACHINING***	Simulate Base Component **Machine Base Component**	CAM Base Component (Video) Base Simulation
3	1/22	1/26	**G-Code Basics**	Simulate Piston Block **Piston Block**	CAM Piston Block (Video) Piston Block Simulation (Group) Fix the G-Code
4	1/29	2/2	**Tools and Tool Holding**	Simulate Valve Block Simulate Piston Cross Hole **Machine Valve Block** **Machine Piston Cross Hole**	CAM Piston Cross Hole CAM Valve Block (Video) Piston and Valve Simulation
5	2/5	2/9	**Work Holding, Datums, and Work Coordinate Systems**	Simulate Wheel **Machine Wheel & Logo**	CAM Wheel (Video) Wheel Simulation
6	2/12	2/16	**Speeds and Feeds**	**Live Assessment**	Full Air Engine Assembly Excel Speed/Feed Calculator
7	2/19	2/23	**Tool Paths & Surface Finish**	Maze Design / CAM/ Engrave Piston Block	
8	2/26	3/1	**Machining Dynamics**	**Chatter Demonstration** **Work on Maze CAM/Design**	Maze Design / CAM
9	3/4	3/8	**5-Axis CAM**	**Maze Design / CAM**	
10	3/11	3/15	**SPRING BREAK!!!! – Be safe; have fun!**		
11	3/18	3/22	**Metrology & Tolerances**	Maze	Part: Maze Project Idea
12	3/25	3/29	**Machining Costs**	Project	
13	4/1	4/5	**Lean MFG**	Project	CAM of Project Part
14	4/8	4/12	**Job Scheduling**	Project	job shop activity
15	4/15	4/19	Project Work	Project	
16	4/22	4/26	Project Work	Project	Part(s): Project
Exam week	4/29	5/3	Project Week	Project	Project Due: 4/30 (Tues)

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance for lecture and lab sections is required. Students are expected to have all necessary CAD/CAM work completed prior to their arranged lab period. There will not be time in labs for anything more than a brief review for safety and operational parameters.

Do not use your cell phones as anything other than a camera or calculator when in lab. Cell phones are a major distraction and inhibit safe operation of the equipment.

If you are ill, or have a university approved excused absence, please bring it to the attention of the course instructors in a timely manner so we can schedule a suitable make-up period.
Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade	Notes
Air Engine + CAM	100	25%	Five components; 20 pts each
Feeds and Speeds	25	6.25%	Please don't machine more vise jaws
G-Code Quiz	25	6.25%	
Live Assessment	50	12.5%	Freedom!
Maze	100	25%	
Project 1	100	25%	Individual or group
Project 2 (Bonus)		Bonus	Individual

Grading Policy

	A: 93-100	A-: 90-92.99
B+: 88-89.99	B: 83-87.99	B-: 80-82.99
C+: 78-79.99	C: 73-77.99	C-: 70-72.99
D+: 68-69.99	D: 63-67.99	D-: 60-62.99
	E: 0-59.99	

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of

behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.