

**PRIN 526 Materials: CNC Programming for 3 Axis  
Machining**

**Units: 4**

**Fall 2022: TH 12-3PM**

**Location:** IYH 111

**Instructor:** Adam Hughes

**Office:** TBD

**Office Hours:** Monday, 5:00 – 6:00 pm HSH 105

**Contact Info:** adamhugh@usc.edu

**IT Help:** <https://iovine-young.usc.edu/ait/index.html>

**Hours of Service:** 8:30am - 5:00pm

**Contact Info:** [iyhelp@usc.edu](mailto:iyhelp@usc.edu), 213-821-6917

**Course Description**

Covers the fundamentals of CNC\* programming and machining with a goal to introduce students to the principles of designing with specific manufacturing in mind.

\*computer numeric control

**Learning Objectives and Outcomes**

This course is all about how to program a machining to cut a specific material using speed and feed calculations for a CNC machine.

- Understand gcode language
- Understand CNC programming (2 , 2.5 and 3 axis)
- Understand various types of CNC Machines
- Understand Fixtures
- Understand X0 Y0 Z0 g54 part home
- Understand gcode simulation
- Understand posting gcode and error checking
- Understand Hass desktop and Mini Mill

**Prerequisite(s):** CAD experience is recommended

**Required Readings and Supplementary Materials**

**Required Textbook**

Textbook -TBD

Software- Solidworks Student Edition

**Optional Textbooks**

TBD

**Website**

All course material will be on Blackboard: blackboard.usc.edu

**Grading Breakdown**

Including the above detailed assignments, how will students be graded overall? Participation should be no more than 15%, unless justified for a higher amount. All must total 100%.

| Assignment    | Points | % of Grade |
|---------------|--------|------------|
| Assignemnts   | *      | 20%        |
| Projects (4)  | 300    | 30%        |
| Final Project | 400    | 40%        |
| Attendance    | 100    | 10%        |

### Grading Scale

Course final grades will be determined using the following scale

|    |              |
|----|--------------|
| A  | 95-100       |
| A- | 90-94        |
| B+ | 85-89        |
| B  | 80-84        |
| B- | 76-80        |
| C+ | 70-75        |
| C  | 65-69        |
| C- | 60-64        |
| D  | 51-59        |
| F  | 50 and below |

### Assignment Submission Policy

All assignments are to be submitted through Blackboard. The format of the course does not allow for late assignments. Late assignments will not be graded, unless you receive prior permission from the instructor.

### Grading Timeline

My plan is to have all assignments graded within one week of the due date.

### Academy Attendance Policy

The Academy maintains rigorous academic standards for its students and on-time attendance at all class meetings is expected. Each student will be allowed two excused absences over the course of the semester for which no explanation is required. Students are admonished to not waste excused absences on non-critical issues, and to use them carefully for illness or other issues that may arise unexpectedly. Except in the case of prolonged illness or other serious issue (see below), no additional absences will be excused. Each unexcused absence will result in the lowering of the final grade by  $\frac{1}{3}$  of a grade (e.g., an A will be lowered to A-, and A- will be lowered to a B+, etc.). In addition, being tardy to class will count as one-third of an absence. Three tardies will equal a full course absence.

Students remain responsible for any missed work from excused or unexcused absences. Immediately following an absence, students should contact the instructor to obtain missed assignments or lecture notes and to confirm new deadlines or due dates. Extensions or other accommodations are at the discretion of the instructor.

Automatically excused absences normally may not be used for quiz, exam or presentation days. Using an excused absence for a quiz, exam or presentation, such as in the case of sudden illness or other emergency, is at the discretion of the instructor.

In the case of prolonged illness, family emergencies, or other unforeseen serious issues, the student should contact the instructor to arrange for accommodation. Accommodation may also be made for essential professional or career-related events or opportunities. All accommodations remain at the discretion of the instructor, and appropriate documentation may be required.

## Academic Conduct

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles.

SCampus is USC's Student Guide to Policies and Conduct Code and can be found at <http://scampus.usc.edu/>. Section 11 contains the Behavior Violating University Standards and Appropriate Sanctions and can be found at <http://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards (SJACS) for further review, should there be any suspicion of academic dishonesty. The Review process can be found at <http://www.usc.edu/student-affairs/SJACS/>.

An academic integrity tutorial can be found at [http://www.usc.edu/libraries/about/reference/tutorials/academic\\_integrity/index.php](http://www.usc.edu/libraries/about/reference/tutorials/academic_integrity/index.php).

## Course Schedule: A Weekly Breakdown

|         | Topics/Daily Activities                        | Readings and Homework | Deliverable/ Due Dates             |
|---------|--|-----------------------|------------------------------------|
| Week 1  | Install Solidworks – Machine Lecture           | TBD                   | Bootcamp installed on mac computer |
| Week 2  | Metal Lecture – Lab cert                       | TBD                   | Solidworks installed 100%          |
| Week 3  | G – Code 101                                   | TBD                   | Simple Design                      |
| Week 4  | Solidworks Cam - Intro                         | TBD                   | gCode homework                     |
| Week 5  | Pen <u>Project</u> - 2 axis machining          | TBD                   | Ideation                           |
| Week 6  | Lab Day _ Tool Crib / Finding G54              | TBD                   | Top gCodes                         |
| Week 7  | Lab Day  | TBD                   | Tool Crib                          |
| Week 8  | Programming 201 – Posting Code                 | TBD                   | Ideation                           |
| Week 9  | Lab Day  | TBD                   |                                    |
| Week 10 | Name Plate <u>Project</u> – 2.5 Axis machining | TBD                   | Ideation                           |
| Week 11 | Programming 301 - CNC Program Simulation       | TBD                   |                                    |

|         |   |     |   |
|---------|---|-----|---|
| Week 12 | <b>3D contour <u>Project</u> (machine is x,y,z)</b>   | TBD | Deliver custom gCode with attached sim  |
| Week 13 | <b>Lab Day – 3 Axis machining</b>   | TBD | Ideation  |
| Week 14 | <b>Simultaneous x,y,z</b>   |     | Custom code delivery / full 3 axis toolpaths  |
| Week 15 | <b>Lab day (prep for final project)</b>   |     | Custom  |
| FINAL   | <b>Final EXAM – Use Hass mini mill to machine your final project delivery (limited to 4 operations)</b> |     | Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at <a href="http://classes.usc.edu/">classes.usc.edu/</a> . |

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP)*  
-213-740-9355 (WELL)

<https://studenthealth.usc.edu/sexual-assault/>

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Relationship and Sexual Violence Prevention and Services provides immediate therapy services for situations related to gender- and power-based harm (e.g., sexual assault, domestic violence, stalking). (wording from the site)

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*  
[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*USC Policy Reporting to Title IX (213) 740-5086*

<https://policy.usc.edu/reporting-to-title-ix-student-misconduct/>

The university encourages individuals to report prohibited conduct to the *Title IX Office*. Individuals can report to the university *Title IX Coordinator* in the *Office of Equity and Diversity*.

*Bias Assessment Response and Support - (213) 740-2421*

[studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*

[studentaffairs.usc.edu/sssa](http://studentaffairs.usc.edu/sssa)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.