RAS 210: Computer-Aided Design and Manufacturing (CAD/CAM)

Fall 2025

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Office: ISTB12 250J
Office Hours: M-W 2:00 PM – 3:00 PM (or by appointment)
Classroom: TBD

Class Meeting Day & Time: M-W 10:30 AM-11:45 AM
Location: Poly – ISTB12 215

Course Description:
RAS 210 – Computer-Aided Design and Manufacturing (3) credit hours
Provides a basic understanding of solid modeling, engineering drawings and principles of modern-day 3-axis, 4-axis machine tool control using computer-aided manufacturing (CAM) software tools. Emphasizes transferring part geometry from CAD to CAM for the development of CNC-ready programs. Also investigates industry file formats, machining strategies, G & M code generation, optimization and verification techniques within the CAD/CAM software tool. Emphasizes the concurrent nature of ideation, engineering drawing-based communication, basic engineering analysis and manufacturing as students review case studies and develop their own models via geometric modeling and descriptive geometry to assist in problem visualization and prototyping with 3D printing and Computer Numerical Control (CNC) manufacturing machines.

Enrollment requirements: Prerequisite(s): Manufacturing Engineering BS major or EGR 102 or RAS 102; Credit is allowed for only EGR 240 or RAS 210 OR Visiting University Student

Course Objectives:
During this course, students will accomplish the following:

- Develop 3D solid models and assemblies using Autodesk Fusion, incorporating sketching, constraints, and parametric design.
- Create detailed 2D engineering drawings that communicate design intent through templates, views, annotations, and symbols.
- Create and interpret GD&T symbols and feature control frames on engineering drawings to ensure proper fit, function, and manufacturability.
- Convert CAD models into CAM-ready formats and generate CNC toolpaths for 2D and 3D milling and turning operations.
- Assign materials, apply rendering techniques, and perform basic animations to visualize and communicate product functionality.
- Model component interactions using assembly constraints and joint features.
- Write, interpret, and optimize basic G-code instructions and verify toolpaths using simulation and verification tools.
- Work as a team member to generate CAD models and 2D drawings based on physical models through reverse engineering.

Accreditation Learning Outcome:

- *User Centered Design* (ABET 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.
- *Communications* (ABET 3): an ability to communicate effectively with a range of audiences.
- *Multidisciplinary Teamwork* (ABET 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.
- *Strategic/self-learning* (**ABET 7**): an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Student Learning Outcomes

Upon successful completion of this course, the student should be able to:

- Design complex 3D models and assemblies using the specified CAD tool
- Analyze and apply core CAD principles to develop accurate and functional 3D designs, effectively employing sketching, constraints modeling, and assembly techniques.
- Synthesize knowledge of CAM processes to efficiently translate CAD models into executable CNC programs.
- Collaborate effectively in teams on CAD projects, analyze design requirements, synthesize detailed 2D drawings, and create the necessary documentation that collectively communicates the design intent.
- Demonstrate the ability to independently identify, learn, and apply new CAD/CAM tools, technologies, and methodologies, integrating self-directed learning strategies to enhance design and manufacturing processes.

Textbooks:

- There is no required textbook for this course

Grading Policy:

Course assessment is derived from individual assignments and quizzes, class activity and participation in class discussions, team assignments, and project summary report & presentation. The point distribution for each assessment component follows.

Grading Schedule:

Description	%
Class Activities	**25%**
Quizzes	**10%**
Assignments	**35%**
Project	**30%**
Total	**100%**

Grading Scale

Percentage Points Earned	Final Grade Assignment
>97%	A+
93%	A

90%	A-
87%	B+
83%	B
80%	B-
77%	C+
70%	C
60%	D
<60%	E

Course Outline:

- Introduction to CAD/CAM
- Fusion 360 fundamentals
- Sketching
- Dimensions and constraints
- 2D drawing (templates, views, annotations, symbols)
- Geometric Dimensioning and Tolerancing (GD&T)
- Part modeling
- Extruded, revolved, sweep, and loft features
- Component design
- Rendering and material assignment
- Animation
- Assembly modeling
- Working with joints
- Introduction to Numerical Control (NC)
- CAM overview
- G-cod programing
- 2D CAM (CNC Milling and Turning)
- 3D CAM (CNC Milling and Turning)

Readings, Assignments, Examinations, Special Materials, Required Activities

No required textbook - resources will be posted to the course's Canvas LMS site during the semester.

Absence & Make-Up Policies

Students are permitted **up to two unexcused absences** without penalty. Each additional unexcused absence will result in a deduction of **1 point** from the student's final grade. Only with adequate notification or under special circumstances will students be allowed to make-up missed assignments.

Excused absences for classes will be given without penalty to the grade in the case of (1) a university-sanctioned event [ACD 304-02]; (2) religious holidays [ACD 304-04]; a list of religious holidays can be found here https://eoss.asu.edu/cora/holidays]; (3) work performed in the line-of-duty according [SSM 201-18]. Students who request an excused absences must follow the policy/procedure guidelines. Excused absences do not relieve students of responsibility for any part of the course work required during the period of absence.

Assignments:

All assignments shall be completed in a professional manner. Handwritten assignments will not be accepted. Assignments are due at the beginning of class on dates indicated by the instructor. Late assignments without proper approval will not be accepted and the grade shall be 0% for the assignment.

Classroom Behavior

Students in this class are expected to acknowledge and embrace the FSE student professionalism expectation located at: https://engineering.asu.edu/professionalism/

Cell phones and other electronic devices must be TURNED OFF during class to avoid causing distractions. The use of recording devices is not permitted during class. Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.

Laboratory Policy:

- Every student is responsible to maintain a clean work environment. Points will be deducted from a student's final grade for failing to clean-up workstations, equipment or supplies used in scheduled or open laboratories.
- Open lab time available to students on a sign in – sign out basis with the laboratory supervisor. Access is granted by the laboratory supervisor to ensure no one works alone in the lab.
- Requirements:
    - Proper dress and footwear for lab
    - Approved safety glasses with side shields
    - Acceptance of the laboratory safety policy.

Academic Integrity

All engineering students are expected to adhere to the ASU Student Honor Code and the ASU academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. If you have taken this course before, you may not reuse or submit any part of your previous assignments without the express written permission from the instructor.

All student academic integrity violations are reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). Withdrawing from this course will not absolve you of responsibility for an academic integrity violation and any sanctions that are applied. The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU college/schools.

Copyright

Course content, including lectures, are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5- 308 F.14 for more information).

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all

applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

Policy against threatening behavior, per the Student Services Manual, SSM 104–02

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services. Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations.

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU disabilities resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged.

Harassment and Sexual Discrimination

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As an employee of the University I am considered a mandated reporter and therefore obligated to report any information regarding alleged acts of sexual discrimination that I am informed of or have a reasonable basis to believe occurred.

ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Generative AI [may modify as needed]

Generative AI is a technology that can often be useful in helping students learn the theories and concepts in this course. However, unless explicitly allowed by your instructor, the use of generative AI tools to complete any portion of a course assignment or exam will be considered academic dishonesty and a violation of the ASU Academic Integrity Policy. Students confirmed to be engaging in non-allowable use of generative AI will be sanctioned according to the academic integrity policy and FSE sanctioning guidelines.

Photo requirement

Arizona State University requires each enrolled student and university employee to have on file with ASU a current photo that meets ASU's requirements (your "Photo"). ASU uses your Photo to identify you, as necessary, to provide you educational and related services as an enrolled student at ASU. If you do not have an acceptable Photo on file with ASU, or if you do not consent to the use of your photo, access to ASU resources, including access to course material or grades (online or in person) may be negatively affected, withheld or denied.

NOTE: *This course syllabus is established as a guide for the course and is subject to change during the semester. Students will be notified of any changes.*