Introduction to 3D Printing

Summer 2025, Session I

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Course Requirements: Instead of buying a textbook, this course will require all participants buy a 3D printer, unless of course you already have access to one. One of the best entry level 3D printers is the Creality Ender, which usually sells for ~$160. This course will require that you have access to a 3D printer.

Course Overview

With the rise of 3D printing and additive manufacturing has come a paradigm shift of how objects can be designed and made. Inspiration for structural designs are currently coming from nature, mathematical models, and the human imagination, and still engineers have only scratched the surface of the vast potential that this technology offers. In this course, you will be introduced to the fundamental concepts of 3D printing and learn the skill set needed to design and build parts with this technology. During this time, you'll have the opportunity to explore topics that align with your personal interests in 3D printing, whether that be using this technology to advance the forefront of current research, solve real world problems, or make works of art.

Course Goals

This course is designed so that by the end you will:

- Be confident discussing the concepts, science, and applications of 3D printing and additive manufacturing with peers and a broader audience
- Be able to design, troubleshoot, and print 3D objects
- Have explored the forefront of the current research in geometrical design and material integration
- Been introduced to different types of 3D design strategies and encouraged to seek inspiration from a variety of sources

Meeting These Goals

In order to ensure and promote learning throughout this course, several graded assignments will be given in the form of a group project, homework, and two exams.

Design Project	40%
Homework	30%
Exam I	15 %
Exam II	15 %

Design Project – 20%
All students will work on an individual project throughout the semester that will culminate in a paper due near the end of the course. Topics for this assignment should be based on a personal interest you have with 3D printing. Tasks for your individual project will be integrated into some of your homework sets.

Homework – 20%
Approximately 5-6 homework assignments will be given throughout the semester to allow you to practice using the concepts and tools learned in class. You will be given approximately 1 week to finish each homework, and are encouraged to work with other students on these assignments

Exams (I & II) – 20%
Both exams (10% each) in the course will be open note, but will be required to be completed within a set amount of time. You will be able to prepare for these assessments through the use of study guides, group discussion on concepts, and completing and reviewing homework.

Participation – 5%
Group and class discussion will be an integral part of learning and studying new topics within this course. As such, your participation is vital for both your own understanding as well as the understanding of your peers and the class as a whole. To completely satisfy this portion of your grade, you should think critically about topics being discussed, ask questions, offer your point of view, and facilitate discussion within small groups.

Accommodations
Randolph is committed to providing learning experiences that are accessible for all students and will make reasonable accommodations for individuals with documented disabilities. If you have a learning difference or a disability — mental health, medical, or physical impairment — contact Larvail Jones, Coordinator of Access Services at ljones@randolphcollege.edu or 947-8132 for more information.

Mobility Impairments and Physical Accessibility
If you have a disability that makes accessing my office difficult for you, please let me know and I will arrange to meet you at an alternative location.

Religious Accommodations
If you wish to request academic accommodation for a religious observance you should submit your request to me by email as far in advance as possible. If you have questions or concerns about your request, contact the Chief Diversity Officer (cgibson@randolphcollege.edu. Note: Accommodations do not relieve you of the responsibility for completing coursework you miss due to religious observance

Title IX and Sexual Misconduct
As instructors, one of our responsibilities is to help create a safe learning environment on our campus. We have a mandatory reporting responsibility related to our role as faculty members. It is our goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. We will seek to keep information you share private to the greatest extent possible. However, we are required to share information regarding sexual misconduct or information about a crime that may have occurred on Randolph's campus with the College's Title IX

Coordinator, Jaclyn Beard (jbeard@randolphcollege.edu, 434-947-8031). We do this to make sure that you are able to get all the information and support you may need. The Health Center and Counseling Center staff are not mandated reporters (counselingcenter@randolphcollege.edu, 434-947-8130). As such, they are not required to share information about sexual misconduct and will keep your information private and confidential.

Randolph College Honor Code
Integrity is a mandatory quality for scientist and engineers and should always be cherished over grades. To ensure honest conduct that still facilitates group collaboration stick to these guidelines:
- Write answers in your own words
- Record who you are working with on your assignments
- In all situations, be transparent about how work was accomplished

Please let me know if you have any questions regarding the honor code. By enrolling in this course, you have agreed to abide by and uphold the honor code of Randolph College (www.randolphcollege.edu/studenthandbook), as well as the following policies specific to this course.

Artificial Intelligence
You may use AI programs e.g. ChatGPT to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor). AI may be used on assignments in this course if that use is properly documented and credited. For example, text generated using ChatGPT-3 should include a citation such as: [1] ChatGPT-3. (YYYY, Month DD of query). "Text of your query." Generated using OpenAI. https://chat.openai.com/. Any plagiarism or other form of cheating will be dealt with under relevant Randolph College honor code policies.

Course schedule

A tentative course schedule is provided below. This is how the topics and assignments should line up.

Topic	Assignments
Introduction: 3D printing in society	Homework 1: Learning SolidWorks
How to print: Technical aspects of 3D printing	Design Project: Selection of topic
Different types of 3D printing: Methods and Materials	Homework 2: Parameters for processing
Printing polymers: A closer look	
Tools of the trade: Sprayers, lasers and tasers	Homework 3: C-chains
Additive Manufacturing: Ways to melt metal	Exam I
Solidification: The science of freezing	Homework 4: Printing metal
Microstructure: How to control material properties	
Design: Lattices, light weighting, and listening to nature	
Design: Hierarchical structures and metamaterials	Homework 5: Mimicking nature
Design: Integrating geometry and material properties	
Applications: Looking at current research	Exam II
Applications: Looking ahead	Design projects due