ChBE 4200 **Additive and Polymer-Based Manufacturing** **FALL 2022**

1 Catalog Description

Scaling up prototypes through industrial processes. Operating principles of advanced forms of 3D printing (stereolithography and powder bed fusion). How the properties of polymeric, ceramic, and metallic materials inform the 3D printing process and certification of printed parts. Computer aided modeling of manufactured parts with a focus on minimizing anisotropic properties and dimensional instability. Fundamentals of polymer melt flow. Simulation of flow, pressure, and temperature of polymer melt in mold cavities to optimize part fabrication. Students will have the opportunity to design a prototype injection mold and iterate on their design using flow simulation software and 3D printing. The final mold will be machined and tested on an injection molding machine. Prerequisite: DF 2100.

2 Class Meeting Times

3 Instructor

Professor David Florian

4 Textbook

The textbook for this course is Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani. Additive Manufacturing Technologies. 3rd Edition. Elsevier 2021. https://www.amazon.com/Additive-Manufacturing-Technologies-Ian-Gibson/dp/3030561267

5 Grading Policy

The contribution of each assignment to the final grade is listed below:

- Homework Assignments: 15%
- Exam 1: 20%
- Exam 2: 20%
- Generative Design Project: 20%
- Injection Molding Project: 25%

6 Course Learning Outcomes

This course is designed to teach engineering students about advanced manufacturing and how materials are processed. On completion of this course, students will have the ability to:

- Understand the fundamental concepts of commercial advanced manufacturing technologies, including stereolithography, powder bed fusion, and injection molding.
- Design parts for advanced manufacturing using CAD.
- Characterize material properties for designing advanced manufacturing processes.
- Select materials for advanced manufacturing technologies based on product specifications and process constraints.
- Scale up production of prototypes using injection molding.

7 Course Syllabus

NO.	DATE	TOPIC	Chapter(s)	ASSIGNMENT DUE
1	8/25	Intro		
2	8/30	Laser Cutting		HW 1
3	9/1	Stereolithography and Photopolymer Chemistry	4	
4	9/6	2-Photon and CLIP	4	
5	9/8	**SLA Lab**		HW 2
6	9/13	Material Jetting	7	
7	9/15	Powder Bed Fusion (Polymers)	5	
8	9/20	Powder manufacture / characterization	5, 14.4.1	
9	9/22	Powder Bed Fusion (Metals)		HW 3
11	9/27	Direct Write Technologies	11	
12	9/29	Direct Digital Manufacturing	18	
13	10/4	**Exam 1**		Exam 1
14	10/6	Generative Design (Asynchronous Content)		
15	10/11	Generative Design and SLS Project		
	10/13	*Fall Break*		
16	10/18	Generative Design and SLS Project		
17	10/20	Generative Design and SLS Project		
18	10/25	Rapid Tooling	20	GD Project
19	10/27	Overview of injection molding		
20	11/1	Mold Design		
21	11/3	Models of non-Newtonian fluids (w/ Dr. Guelcher)		
22	11/8	Modeling fluid flow in a mold (w/ Dr. Guelcher)		
23	11/10	Modeling fluid flow in a mold (w/ Dr. Guelcher)		
24	11/15	Parameter optimization for injection molding		
25	11/17	**Exam 2**		Exam 2
	11/22	*Thanksgiving Break*		
	11/24	*Thanksgiving Break*		
26	11/29	Injection Molding Project		
27	12/1	Injection Molding Project		
28	12/6	Injection Molding Project		
29	12/8	Injection Molding Project		IM Project