Texas Applied Arts

DIGITAL FABRICATION – SPRING 2019

TD 354T (unique #25819) – AET 339 (unique #20676) – TD 388L (unique #26004)

INSTRUCTOR: J.E. JOHNSON
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OFFICE HOURS: By appointment

CLASS: Monday and Wednesday 12:00 – 1:30 pm
LOCATION: Hatchery PAC 3.2045A and Automation Lab 2.208 (other locations as specified)
WEBSITE: http://sites.utexas.edu/appliedarts/

COURSE DESCRIPTION

Digital Fabrication will focus on specific skills and habits of mind associated with the craft of making physical objects by way of computer aided design (CAD) and computer numeric controlled (CNC) machines. Though digital fabrication is a very broad field we will cover only: fused filament fabrication (FFF) 3D printing, laser cutting, CNC routing, and vinyl cutting. We will use these tools in a rapid and iterative process to create, evaluate, and improve upon functional objects. Though previous experience in any handicraft or computer design application will be beneficial, the course is designed for each student to grow from their existing strengths and interests.

This course meets concurrently with Michael McKellar's Physical Computing course. Our course will collaborate with Physical computing to create an interactive environment for Maker Faire Austin which we are calling the UT Interactive Trophy Room.

All students are required to commit to a minimum of 4 hours on Friday, May 3 or Saturday, May 4 to assist with Trophy Room install, operation, and load out.

OBJECTIVES

Within the context of Digital Fabrication as described above, students will be evaluated on the following objectives.

1. Demonstrate methods to acquire and adapt existing designs available through file sharing websites.
2. Identify processes, materials, and joining techniques to create durable objects.
3. Choose appropriate surface treatments for cardboard, plastics, and wood.
4. Discriminate between digital design applications to develop workflows specific to needs of project.
5. Design mechanisms with an intentional, iterative process.
6. Develop effective collaborative relationships with peers and instructors to build and install a public exhibit.

TEXTBOOKS, SUPPLIES, AND MATERIALS

Textbook - REQUIRED
Making Things Move: DIY Mechanisms for Inventors, Hobbyists, and Artists. by Dustyn Roberts.

Supplies - Every student should own these items

- SD Card – 8 GB or more. Needed to transfer files to the 3D printers in The Hatchery. ($10 or less)
- USB Flash Drive – 8 GB or more. Needed to transfer files to equipment in The Foundry. ($10 or less)
- 3-button mouse with scroll wheel – efficient use of software will require functionality of scroll wheel and right clicks. Without this functionality you will be wasting both your time and the instructor's time. ($10 - $50)
- 6 inch digital calipers – Need to take precise measurements of materials and troubleshoot fit issues. Also convenient way to convert inches to millimeters. ($10 - $20)

Project materials
There will be a selection of no-cost materials available to students including

- various wood and metal stock
- plastics, paper, and plywood suitable for laser cutting
- 3D printing filament
- hardware, electronics, etc. found in Hatchery or Automation Lab

Final project materials
After student teams are assigned each team will have access to a budget to purchase materials. Amount TBA. Materials requests must be made in writing on team Trello board. If a student chooses to purchase out of pocket no reimbursement can be made.

Completed final projects will remain the property of the University of Texas and may be used for future exhibition. With instructor consent, components owned by the student that can reasonably be removed from the project (*e.g.* micro controllers, servos, etc.) may be returned to the student after the final day of class. Students use these items at their own risk. Damaged or lost items cannot not be replaced.

SOFTWARE

Digital Fabrication is not 3D modeling course nor does it require previous experience in 3D modelling. However, we are going to use a few different 3D modeling tools to manipulate and modify existing models. To do this, all students should install some software on your computer. All required software is free to students and the system requirements are modest.

Required
Autodesk Fusion 360 – We will be using Fusion 360 to create and edit our designs. It is very powerful yet accessible software.
Slicer for Fusion 360
Meshmixer – Prepare 3D prints
Cura – Software required to operate 3D printer
RetinaEngrave v3.0 – Full Spectrum Laser design and control software

Optional
Adobe Illustrator, Vectorworks, AutoCAD, Pepakura, others with instructor consent

CLASS SCHEDULE

As the course progresses we may choose to modify schedule to better facilitate student learning. Schedule modifications will be communicated to class via Canvas. Check https://utexas.box.com/v/digfab19-syllabus for most up to date version.

Week	Date	Monday	Date	Wednesday	Assignment Given	Assignment Due
1	1/21	Martin Luther King Jr Holiday	1/23	**ONBOARDING** – Craft – Additive / subtractive – Materials – 3D Sketch – Software – Safety – Final project overview – Learning resources – Meet and greet with PhyCom	**MODULES** – OH 500 & 304 – Roctopus on Lulzbot Mini	
2	1/28	DISCUSSION: Maker Culture TOPIC: Filetypes and Workflows PRACTICE: Orthographic sketches Leah Bluechly Who makes? Lynda Drawing Systems Ch 3	1/30	DISCUSSION: Design Cycle TOPIC: Small and rapid PRACTICE: Fusion 360 Roberts xi-xviii, 256-278 Lynda Fusion 360 Ch 1 -3	– File Exports (STL, DXF, and PDF) – File Imports (STL) – Foundry 3D printer cert	– OH 500 & 304 – Rocktopus on Lulzbot Mini
3	2/4	DISCUSSION: Cardboard! TOPIC: Laser cutting, nets, joints GUEST: Tim Ziegler? Roberts 34-38, 43-47 Surprisingly Awesome: Cardboard	2/6	TOPIC: Tolerances and Slicer PRACTICE: Laser Lynda Fusion 360 Ch 4 -5	Laser joinery	– File Exports (STL, DXF, and PDF) – File Imports (STL) – Foundry 3D printer cert
4	2/11	DISCUSSION: Plastics and sustainability TOPIC: FFF challenges Lynda Meshmixer PLA Filament video	2/13	TOPIC: FFF supports PRACTICE: Cura Lynda Meshmixer	3D print problem	Laser joinery
5	2/18	DISCUSSION: Plywood History of plywood in ten objects Plywood being made video Roberts 190-236	2/20	DISCUSSION: Craft TOPIC: Combined processes and assembly Pye 17-29	Laser/CNC joinery	3D print problem
6	2/25	TOPIC: Connections Roberts 52-71	2/27	TOPIC: Linkages PRACTICE: Meet with PhyCom Roberts 128-143	Servo project	Laser/CNC joinery

7	3/4	TOPIC: Motion 507 Movements Roberts 238-252	3/6	TOPIC: Nets GUEST: Tim Ziegler	Phone Jail	Servo project
8	3/11	TOPIC: Animation PRACTICE: Agreeable Sheep	3/13	TOPIC: Animation PRACTICE: 4 bar linkage Trophy Room Kickoff Skype with Meow Wolf? **TEAM ASSIGNMENTS INTRO 12:30**	Limb Concept	Phone Jail
	3/18	SPRING BREAK	3/20			
9	3/25	Trophy Room Kickoff Skype with Meow Wolf	3/27	**TEAM PITCHES**		Limb Concept
10	4/1	Group focused work	4/3	Prototype and maquettes		
11	4/8	Group focused work	4/10	Group focused work Working prototype		
12	4/15	Group focused work	4/17	Group focused work		
13	4/22	Group focused work	4/24	Group focused work		
14	4/29	Group focused work	5/1	Final day before Maker Faire Install 5/3.		
15	5/6	Tidy up	5/8	Final documentation		

COURSE FORMAT

Class time
Sprint Meetings are critical to the success of projects. They are a time to assess progress, set specific sprint goals for the next week and address any new constraints.

Lab use – PAC Safety and Stewardship
Machine time on 3D printers, laser cutter, and CNC router will be reserved in two hour blocks on Canvas. CNC router will be available only during business hours Monday through Friday, 8am to 5pm
Proximity card access to the Texas Performing Arts building and the Scenic Art Studio door 6am to 10pm daily. No one may work in the Hatchery, Automation Lab, or Scenic Art Studio alone outside standard working hours, Monday through Friday 8am to 5pm. Plan accordingly. The Loading Dock and Scenic Art Studio doors are armed at 6:00pm. If the doors are left propped open, they will trigger a silent alarm, UT PD will arrive, and we will be fined. Security will be present on Bass Concert Hall event days. Please stay contained to the Hatchery or Automation Lab during these events. *Failure to adhere to security policies may lead to expulsion from the course.*

Safety
Students must wear the following safety equipment when working with the CNC Router:

- Safety Glasses or Goggles
- Dust Mask or Respirator
- Hearing Protection
- Closed Toe Shoes

Additionally, students must be cautious of any jewelry, loose fitting clothing, and long hair around all machines. Students are not permitted to wear gloves while using machines. Students should not use equipment with which they are unfamiliar. If you have a question, please ask. Do not use equipment if you are under the influence of drugs or alcohol, hung over, sick, tired, or otherwise unfocused. Unsafe behavior will not be tolerated and may result in expulsion from the class. Keeping the labs clean, putting away tools and properly storing materials are important aspects of class safety. Proper shop maintenance will be monitored and evaluated.

Prerequisites
There are not prerequisites for this class but all students provide evidence of completion of UT Environmental Health and Safety safety training including OH 500 Machine Shop Safety and OH 304 Laser training.

Online Platforms
Each member of the class has the responsibility to become proficient in the following online tools.

- Canvas: This course management platform will be used to upload assignments and blog posts for peer assessment.
- Slack: This is and online messaging tool and should be used for primary communication for student teams. Slack should NOT be used for any grade related information or inquiries. https://digifab-physcomp.slack.com
- Tumblr: Our class website is hosted by Tumblr. Some assignments will be required to be posted here. *If you prefer not to post publicly with your real name, an alias is acceptable*. https://texasappliedarts.tumblr.com/
- Social Media: Students will be encouraged to post to social media to promote their work and network with other makers using when appropriate. Course instructors will also promote student work on the Applied Arts accounts. *If you do not wish to have images of your face or project posted publicly please notify an instructor*.
    - YouTube https://www.youtube.com/c/TexasAppliedArts
    - Facebook https://www.facebook.com/texasappliedarts
    - Twitter https://twitter.com/utappliedarts
    - Instagram https://www.instagram.com/utappliedarts/
- UT Box: This is the UT supported cloud storage service. Any file necessary for the design, planning, or production of raptor projects must be saved in the Raptor Class Share folder. Please maintain good filename and folder hygiene and version control. https://utexas.box.com/v/digfab19-class-share

ASSESSMENT AND LATE POLICY

Only instructors of record will issue final grades. However, instructors will make judgments based on data gathered from self, peer, and professional performance appraisals to provide relevant feedback and scores.

Final assignment points will be reduced 20% for every day late.

Dependability and Readiness—80 points
After teams are assigned, collaborators should arrive to meetings on time and ready to present a progress report with visuals and/or prototypes. Students attendance in class is not only for their own benefit. All teams will benefit from engaged respondents.
Onboarding—15 points (satisfactory/no credit)

- 5 points: OH 500 Machine Shop Safety and OH 304 Laser Safety
- 5 points: 30 second introduction video
- 5 points: Pre-course survey

Clean up and Stewardship of workspace—15 points
Attendance—50 points (56 possible)

- The class will depend on engagement from all members of the class.
- To incentivize attendance a single question quiz will be given. Quizzes count for 2 points each (satisfactory/no credit).

Assignments—80 points
Skill builders—10 points each x 8 weeks *(satisfactory/no credit)*

Engagement, Performance, and Growth—80 points
Evaluation criteria will include key competencies including: goal setting, decision making and critical thinking, effective communication, problem solving, relationship management, analytical thinking, accuracy and attention to detail, producing results, flexibility and adaptability, teamwork, quality of failure, and followership.

- 40 points: (5 points midterm + 35 points final) Self Evaluations
- 40 points: (5 points midterm + 35 points final) Instructor Evaluation

Final Project—80 points

- 20 points: execution
- 20 points: participation
- 20 points: peer evaluation
- 20 points: documentation

Grading Scale:

A	92.5 - 100	C	72.5 - 76.49
A-	89.5 - 92.49	C-	69.5 - 72.49
B+	86.5 - 89.49	D+	66.5 - 69.49
B	82.5 - 86.49	D	62.5 - 66.49
B-	79.5 - 82.49	D-	59.5 - 62.49
C+	76.5 - 79.49	F	0 - 59.49

Accommodations
The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-6441 TTY.

Risk Statement
*Caution: Students participating in Department of Theatre & Dance classes do so at their own risk. As with any physical activity, there is always the chance of personal injury occurring during the normal conduct of Production Lab and Advanced Production Lab. The instructor is not responsible for student injuries or accidents, which may occur during the normal conduct of classes.

University of Texas Honor Code:
The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community.

Use of E-mail for Official Correspondence to Students:
All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at

Title IX:
The University encourages affected individuals to promptly report incidents of sex and gender discrimination, sexual harassment, sexual assault, sexual misconduct, interpersonal violence, and stalking as provided in this policy. The University also encourages individuals who may have witnessed instances of prohibited conduct to report such information as outlined in this policy.
Responsible employees of the University are required to promptly report incidents of prohibited conduct. The University will respond to all reports made under this policy. The University will conduct a prompt, fair, and impartial investigation and resolution for complaints and, where appropriate, issue remedial measures and/or sanctions.
Please be advised that I am considered a "responsible employee" at UT. As such, I am required to report any incidents of sexual harassment or assault to the UT Title IX Coordinator. If you would like to have a confidential conversation about sexual misconduct, please contact the UT Counseling and Mental Health Center at (512) 471-3515 to schedule an appointment. The CMHC crisis line is (512) 471-CALL (2255) . You may also call Austin SafePlace 24/7 at (512) 267-SAFE (7233).
http://www.utexas.edu/its/policies/emailnotify.html.

Documented Disability Statement:
Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone). Faculty are not required to provide accommodations without an official accommodation letter from SSD.

§ Please notify instructors as quickly as possible if the material being presented in class is not accessible (e.g., instructional videos need captioning, course packets are not readable for proper alternative text conversion, etc.).

§ Please notify instructors as early in the semester as possible if disability-related accommodations for field trips are required. Advanced notice will permit the arrangement of accommodations on the given day (e.g., transportation, site accessibility, etc.).

§ Contact Services for Students with Disabilities at 471-6259 (voice) or 1-866-329-3986 (video phone) or reference SSD's website for more disability-related information: http://www.utexas.edu/diversity/ddce/ssd/for_cstudents.php **Behavior Concerns Advice Line (BCAL):** If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual's behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal.

Q drop Policy: The State of Texas has enacted a law that limits the number of course drops for academic reasons to six (6). As stated in Senate Bill 1231: "Beginning with the fall 2007 academic term, an institution of higher education may not permit an undergraduate student a total of more than six dropped courses, including any course a transfer student has dropped at another institution of higher education, unless the student shows good cause for dropping more than that number."

Religious Holidays:
By UT Austin policy, you must notify instructors of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Changes:
This syllabus is subject to change upon the discretion of the instructors.