Intro to Digital Fabrication

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IS 320.01
3 credits, studio
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Tuesday 10:00-3:30
dFab Studio - S120, S121
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Course Description

Digital fabrication practices have revolutionized design and manufacturing, and are literally reshaping the world around us. Increasingly these tools are being employed by artists to create works heretofore impossible or impractical to make. This class will be an exploration of computer-aided modes of fabrication and their integration into contemporary art and object making. A strong emphasis of this course will be technical training on the laser cutters, 3D printers, and CNC routers in MICA's Digital Fabrication Studio. We will also spend a considerable amount of time working in CAD (computer-aided design) and CAM (computer-aided machining) software, with a particular emphasis on Rhinoceros 3D. We will also examine the effect of this technology on our understanding of space and material, the structure of our economy and modes of production, and other social and philosophical considerations.

Student Learning Outcomes

- Students will gain a high degree of proficiency with the 3D modeling program Rhino.
- Students will learn to safely and effectively operate the laser cutters and how to determine proper settings for the given material and operation.
- Students will gain an understanding of multiple 3D printing technologies and operate filament-based 3D printers.
- Students will learn to safely and effectively operate the CNC router and how to generate toolpaths from their CAD file using RhinoCAM
- Students will think critically about emerging fabrication technologies and articulate current and future impacts on art, design, and society.
- Students will gain an understanding of digital processes and the spreading effects of computation into physical objects, lived space, and bodies.
- Students will discuss the social, economic, and artistic impact of digital fabrication technologies and the roles of their developers (software companies, hardware creators, open-source communities, and artisans), their users, and the other people and environments that are impacted or excluded.

Interdisciplinary Sculpture Program Learning Outcomes

1. Students will be able to contextualize their own work within relevant historical, theoretical and contemporary approaches.
2. Students will consider the ethical dimensions of their practice. Ethics is the relationship of the maker to the material, connecting ideas, applying them, and ultimately articulating and engaging in the relationships that result both inside and outside the work. In making their work, the student considers the impact and well-being of the social and environmental sphere both within and outside the work.
3. Students will prepare strategies to utilize their skills and abilities in terms of a post-graduate professional practice and sustainable fiscal stability.
4. Students will develop strong written and oral communication skills.
5. Students will demonstrate proficiency with a variety of media, tools, techniques and methodologies ranging from the traditional to the contemporary.

Course Progression

We will begin with Rhino and build CAD skills throughout the semester. We will progress through laser cutters and 3D printing in the first half of the semester, and focus on the CNC router in the second half. A detailed weekly schedule is available on the class website.

Unique aspects of this class

- complexity in software, hardware, and materials
- "flipped classroom" - lectures and tutorials as homework, hands on work in class
- balancing demand on resources

Required Materials (with estimated costs)

- General use:
  - Sketchbook to plan and take notes ($2-$20).
  - flash drive ($10).
  - headphones for listening to tutorials in the computer lab ($10+).
- Strongly suggested measuring devices:
  - calipers ($15+) recommendation
  - 6" ruler ($10-20) suggestion
  - measuring tape ($5-$45) good, better, best
- PPE:
  - safety glasses ($3+)
  - A mask (preferably N95 or KN95) that will not fog up your safety glasses suggestion
  - proper attire as described below ($variable).
- Materials for exercises will be predefined and provided, but materials for projects will be determined by each student. Acquiring and paying for project materials are the responsibility of the student. Costs could range from $20 - $500 for the class. One must learn to effectively design for one's budget, and also budget for one's designs. There are practical limits to this one each end, and both require proper preparation.

Grading Structure and Related Policies

Projects - 45%

There will be three projects over the course of this class. Projects will draw upon the skills built through exercises and other class activities, with each project focused on a core technology: laser cutters, 3D printers, CNC router.

Exercises - 25%

There will be a series of exercises that will allow you to focus strictly upon developing and demonstrating technical skills. Some will be software focused, others will be machine focused, but most will incorporate the two together.

Research: Web Publication and In-Class Presentation - 20%

Each student is responsible for research a topic related to digital fabrication and presenting it to the class. Topics may include a particular artist, an architecture firm, new technology, the social or economic impact of digital fabrication, possible futures, or other topics germane to the class. Topics should be approved by the instructor at least two weeks prior. Student will publish their research on the class website. Following approval from the instructor, student will then present their research to the class. Presentations dates will be established at the beginning of the course via a shared spreadsheet.

Engagement - 10%

As with all classes, participation is an important part of the learning process. Insightful contributions to critiques will help your fellow classmates, and also aid in your own development as an artist. Because of the complexity

and rapid change of technology, the field of digital fabrication is one that relies upon the sharing of knowledge and multiple forms of partnership. Engaging in this community, in class and beyond, will be critical to your success in this course and is part of the life-long learning skills necessary to sustain a practice in this field.

Note: All work must be documented and posted to the student's portfolio page. The portfolio is the primary source for grading.

Late Work
Due dates for class assignments are strict. All work must be completed and ready to present at the beginning of class on the day it is due. Exercises will not be accepted after their due date. Projects will be penalized one letter grade for every week that they are late. This work is difficult and there will constantly be unexpected problems. Know this and budget your time accordingly.

Revisions
Projects may always be revised. Though the pace of this course makes it difficult to rework pieces, you are certainly encouraged to apply information learned during your critique in order to make that work stronger. Resubmitted work will be re-graded and the new score will replace the old.

Attendance
Attendance is mandatory for this class. Because part of the class is devoted to gaining progressive technical knowledge, missing class quickly creates difficulties. It is also important that you are present for class discussions of readings, which cannot be made up.

You are permitted one absence. If you fail to return from lunch break (or fail to make it to class before lunch) you will be considered absent for that class. For the reasons mentioned above, missing class will have an indirect effect on your grade. Absence, beyond the one permitted, will lower your engagement grade directly. If you have more than three absences, you will automatically fail the course. It is also important that you arrive at class and return from breaks on time. Tardiness slows down the entire class and is inconsiderate to the instructor and classmates.

If you miss a class, you are responsible for all the material covered that day. Be proactive. Review the class website. It is incumbent upon you that you get assignments, notes, handouts, readings and other information from your classmates. If you know you are going to miss a class, inform the instructor beforehand so that he can point you to some resources to help you cover what you will miss. If you miss class on a day that an assignment is due and have not made arrangements with the instructor, that assignment will be considered late.

Students with Extended Illness or Absence
In the case of extended illness or other absences that may keep the student from attending a class for more than three meetings, undergraduate students must contact the Student Development Specialist in the Division of Student Affairs or have an official disability accommodation letter issued by the Learning Resource Center that specifically addresses class absences. For students who have not been approved for academic disability accommodations, the Student Development Specialist will work with the student to determine the cause and appropriateness of the absences and subsequently notify instructors as necessary.

Graduate students must contact the instructor, director, and Associate Dean of Graduate Studies. Students in professional studies programs must contact the Associate Dean for Open Studies. The appropriate administrator will facilitate a conversation with relevant faculty to determine whether the student can achieve satisfactory academic progress, which is ultimately at the sole discretion of the faculty member.

Environmental Health and Safety (EHS)
Students are responsible to follow health and safety guidelines relevant to their individual activities, processes, and to review MICA's Emergency Operations Plan and attend EHS training. Students are required to purchase personal protection equipment (PPE) appropriate for their major or class. Those students who do not have the proper personal protection equipment will not be permitted to attend class until safe measures and personal protection are in place.

Health and Safety in this Class
Safety will be an ever-present issue, which will develop as we learn new techniques and materials throughout the semester. Like other topics in this class, your grade will be affected by demonstrating your comprehension and application of safety rules. More importantly, your physical health and safety, and that of your class and studio mates, is at stake. It is absolutely imperative that you follow rules given by the instructor, posted in the studio, and stated by the shop manager, tech, or work study. Failure to follow safety rules could result in destruction of very expensive equipment, fires, blindness, loss of body parts, or other injuries. Following the basic safety rules described in class and reinforced in the studios ensures everyone's safety. Failure to do so will not be tolerated. Egregious or repeated failure to follow safety rules will result in your removal from and failure of this class.

While less dramatic, working on computers for extended periods of time poses its own health risks. Be sure to adjust your seat properly, maintain good posture, and take breaks to give your eyes and body a break.

Dress
Come to class every week dressed to work in a fabrication studio. These rules are critical in the machine shop area, but should be a general practice for when in the Station Building.

Footwear - Open-toed shoes are never permitted. Do not wear shoes with slick soles or high heels. A solid pair of work boots/shoes are recommended.

Pants - No shorts, skirts, or dresses.

Shirt - Be sure that your shirt, and all of your clothes, fit well. Loose clothing can get caught in machinery and pull your hands and body into it.

Gloves - You should have a pair of work gloves to protect your hands while handling certain materials. Be sure to wear your gloves when you should, and don't wear them when you shouldn't. Gloves are unsafe when operating machinery that could grab the glove and pull your hand into the machine.

Hair - If you have long hair, you must tie it back while working in the shop.

Jewelry - No large or dangling jewelry should be worn in the studio.

Accessibility and Disability Services
MICA makes reasonable accommodations for qualified students with documented disabilities. The Office of Accessibility and Disability Services (ADS) facilitates equal access for students who self-identify as having a disability and provide appropriate documentation. All accommodations must be approved through ADS. If you are a student with a disability who needs accommodations in this class, please contact ADS to schedule an appointment. ADS is located in Bunting 110 and can be reached at 410-225-2416 or ads@mica.edu. Once accommodations are authorized by ADS, please provide me (your instructor) with your approved accommodation memo as soon as possible. It is the student's responsibility to make an accommodation request in a timely manner. Accommodations are not retroactive.

Title IX Notification

MICA faculty are committed to helping create a safe and open learning environment for all students. If you (or someone you know) have experienced any form of sexual misconduct, including sexual assault, dating or domestic violence, or stalking, know that help and support are available. The College strongly encourages all members of the community to take action, seek support and report incidents of sexual misconduct to the Title IX Office. Please be aware that under Title IX of the Education Amendments of 1972, I am required to disclose information about such misconduct to the Title IX Office.

If you wish to speak to a confidential employee who does not have this reporting responsibility, you can contact the Student Counseling Center, counseling@mica.edu, 410.225.2367. For more information about reporting options at MICA, please visit here.

Plagiarism

Each discipline within the arts has specific and appropriate means for students to cite or acknowledge sources and the ideas and material of others used in their own work. Students have the responsibility to become familiar with such processes and to carefully follow their use in developing original work.

Policy

MICA will not tolerate plagiarism, which is defined as claiming authorship of, or using someone else's ideas or work without proper acknowledgement. Without proper attribution, a student may NOT replicate another's work, paraphrase another's ideas, or appropriate images in a manner that violates the specific rules against plagiarism in the student's department. In addition, students may not submit the same work for credit in more than one course without the explicit approval of all of the instructors of the courses involved.

Consequences

When an instructor has evidence that a student has plagiarized work submitted for course credit, the instructor will confront the student and impose penalties that may include failing the course. In the case of a serious violation or repeated infractions from the same student, the instructor will report the infractions to the department chair or program director. Depending on the circumstances of the case, the department chair or program director may then report the student to the appropriate dean or provost, who may choose to impose further penalties, including expulsion.

Appeal Process

Students who are penalized by an instructor or department for committing plagiarism have the right to appeal the charge and penalties that ensue. Within three weeks of institutional action, the student must submit a letter of appeal to the department chairperson or program director, or relevant dean or provost related to the course for which actions were taken. The academic officer will assign three members of the relevant department/division to serve on a review panel. The panel will meet with the student and the instructor of record and will review all relevant and available materials. The panel will determine whether or not to confirm the charge and penalties. The findings of the panel are final. The panel will notify the instructor, the chairperson, division, the student, and the Office of Academic Affairs of their findings and any recommendations for change in penalties.

Artificial Intelligence Policy

At MICA, we prioritize creative expression, discovery, innovation, and experimentation and embrace the transformative power of new tools and technologies. Developing unique ideas, processes, and expressions is central to the MICA student experience. As such, AI should be used as a tool to expand, explore, and learn from—not used as a means to imitate or abbreviate educational and artistic experiences.

Generative Artificial Intelligence (AI) is evolving rapidly. The guidelines for using AI tools at MICA will vary depending on the course or context. However, some foundational policies apply institution-wide:

Plagiarism and AI: Plagiarism is defined as using others' content as your own. Generative AI is software that enables a computer to generate content. Use of content generated by various software platforms requires an approach based on ethical foundations. As such, using any kind of generative AI software to create visual or written work without citing the source or listing the prompts used, is plagiarism and is not allowed at MICA. (See the below libguide link for how to properly cite use of AI).

Course-specific guidelines: Academic programs and individual faculty are encouraged and empowered to set their own guidelines to encourage the use, exploration, or limitation of AI to support the learning objectives specific to their program, course, or assignment.

Consultation Requirement: Students must consult their instructors before integrating generative AI tools into their coursework to ensure alignment with course goals and ethical standards.

Critical Engagement: Students and faculty are urged to critically assess AI's potential to propagate misinformation, amplify biases, and infringe privacy and intellectual property rights.

Your Responsibility: When AI use is permitted, students must ensure the content generated by AI does not violate intellectual property rights, misrepresent information, or be presented as wholly original work.

By adhering to these guidelines, we can harness AI's potential responsibly and innovatively, ensuring it enhances our rich tradition of creative exploration.