MAKR M103: INTRODUCTION TO DIGITAL FABRICATION

Originator
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Co-Contributor(s)

Name(s)
Sadnik, Clare (csadnik)

College
Moorpark College

Discipline (CB01A)
MAKR - MakerSpace

Course Number (CB01B)
M103

Course Title (CB02)
Introduction to Digital Fabrication

Banner/Short Title
Intro to Digital Fabrication

Credit Type
Credit

Start Term
Spring 2023

Catalog Course Description
Provides foundation-level understanding of the elements and principles of three-dimensional design in both theory and practical applications using a variety of materials. Focuses on drawing, modeling and building three-dimensional physical forms from digital designs. Explores modeling simple and complex objects, surfaces and spaces and develops them physically using a laser cutter, 3D printing, and computer numerical control (CNC) milling technology.

Taxonomy of Programs (TOP) Code (CB03)
1030.00 - *Graphic Art and Design

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
(L) Letter Graded

Alternate grading methods
(O) Student Option- Letter/Pass
(P) Pass/No Pass Grading

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
35
Maximum Contact/In-Class Lecture Hours
35

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	demonstrate foundation level understanding of the elements and principles of three-dimensional design and their application in hands-on projects in digital fabrication and rapid prototyping.
2	demonstrate creative and critical thinking as they research, produce, analyze and evaluate digitally fabricated objects.
3	demonstrate design thinking and create physical prototypes of their solutions using 3D printing, Laser Cutting, and CNC Milling, so that the user can engage and react to it.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	demonstrate the ability to use equipment for laser cutting.
2	demonstrate the ability to use equipment for 3D printing.
3	demonstrate the ability to use equipment desktop CNC milling.
4	utilize 2D computer graphics programs to create vector files for export for laser cutting.
5	utilize 3D computer graphics programs to create files for the 3D prinitng export.
6	utilize 3D computer graphics programs to create files for Desktop CNC milling export.

7	utilize 3D software computer-aided design/computer-aided manufacturing (CAD/CAM) packages for additional rapid prototyping technologies.

Course Content

Lecture/Course Content

1. (20%) 3D Modeling
a. Software (Tinkercad, Fusion 360, Onshape, Blender)
b. Tools (move, scale, rotate, extrude)
c. File handling
d. Design consideration for 3D printing and milling

2. (20%) 2D Vector Graphics
a. Software (Illustrator, Gravit Designer, InkScape, Corel Draw, AutoCad)
b. Tools
c. File preparation
d. Organizing document layer

3. (15%) 3D Printing
a. Slicing, job set-up, and g-code
b. Materials
c. Printing parameters
d. File formats
e. Machine control
f. Safety protocols
g. Post print processing
h. Troubleshooting
i. Machine maintenance

4. (15%) CNC Milling
a. File preparation
b. Tool paths and g-code
c. Materials
d. File formats
e. Machine control
f. Trouble shooting
g. Post milling processing
h. Machine maintenance
i. Safety protocols

5. (15%) Laser Cutting and Engraving
a. File preparation
b. Materials
c. File formats
d. Machine control
e. Trouble shooting
f. Post milling processing
g. Machine maintenance
h. Safety protocols

6. (10%) Design Thinking
a. Theory
b. Application

7. (5%) Materials
a. Qualities and viability
i. Wood, plastics, foam fabric, paper, metal
b. Safety

Laboratory or Activity Content

1. (15%) Exercises focusing on tools and techniques
2. (15%) Vector graphic file preparation
3. (15%) 3D Modeling and file preparation
4. (15%) Laser cutter project
5. (15%) 3D printer projects
6. (15%) CNC Milling projects
7. (10%) Critiques of designs and projects

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Group projects
Journals
Objective exams
Problem-solving exams
Quizzes
Skills demonstrations
Classroom Discussion
Projects
Participation
Reports/Papers/Journals

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Class activities
Class discussions
Collaborative group work
Computer-aided presentations
Demonstrations
Distance Education
Instructor-guided use of technology
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

- The instructor will use a projector to demonstrate how to use laser cutter to computer interface to adjust the settings of the laser cutter.
- Instructor will demonstrate skills such as manually focusing the laser and load filament into the 3D printer

Representative Course Assignments

Writing Assignments

1. Write a critique of 3D designs presented by fellow students; including the design process, context, form and composition, technical execution, and resonance.
2. Describe and evaluate 3D designs seen in a virtual and traditional exhibit.

Critical Thinking Assignments

1. Design and produce a lamp shade from laser cut printed paper.
2. Design and produce an accessory for a child's bike that would protect children from bullies.

Reading Assignments

1. Read from equipment manual on how to safely perform a cleaning of the laser cutter mirrors and lens
2. Read and comprehend definitions of key terminology from the Digital Fabrication packet provided by the instructor.

Skills Demonstrations

1. Demonstrate proper safety protocols.
2. Demonstrate the ability to complete a laser cut job from the design phase through operation of the laser cutter.

Outside Assignments

Representative Outside Assignments

create work outside of class, such as laser cut print material.
read selected articles to inform 3D topics and projects.

research visual resources and idea development for 3D projects to be worked on during lab hours. Research projects may include architecture design, furniture design, product and accessories design.

Articulation

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
Cerritos College	WMT 184	Introduction to Digital Fabrication	3
Pasadena City College	DT 8A	Introduction to Digital Design and Fabrication	3
UC Berkley	DES INV 22	Prototyping & Fabrication	3

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Folsom Lake College	MAKR 111	Digital Fabrication	3

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 2023

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Proposed

Date Proposed:
6/2023

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Beorkrem, Christopher. *Material Strategies in Digital Fabrication.* 2nd ed., Routledge, 2017.

Resource Type
Textbook

Description
Bernier, Samuel N., Tatiana Reinhard and Bertier Luyt. *Design for 3D Printing: Scanning, Creating, Editing, Remixing, and Making in Three Dimensions*. Make Community, LLC, 2015.

Resource Type
Textbook

Description
Kloski, Liza Wallach, and Nick Kloski. *Getting Started with 3D Printing: A Hands-on Guide to the Hardware, Software, and Services that Make the 3D Printing Ecosystem.* 2nd ed., Make Community, LLC, 2021.

Resource Type
Other Instructional Materials

Description
Instructor-generated Digital Fabrication Packet containing worksheets, guided activities, key terms, and machine component diagrams.

Library Resources

Assignments requiring library resources
Research using the library's print and online resources.

Sufficient Library Resources exist
Yes

Example of Assignments Requiring Library Resources
Research, using the Library's print and online resources, in the development of 3D designs for accessories for bicycles or other vehicles.

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (1%–50% online)
Hybrid (51%–99% online)

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Students may be required to post their ideas or solutions for class-related material on the course discussion boards. Students may also be required to comment on the posts of other students, including constructive criticism.
E-mail	The instructor may email students with announcements about the course or other college events and opportunities and answer student questions. Students may email questions and possibly assignments or projects, depending on the nature of the class, directly to the instructor.
Face to Face (by student request; cannot be required)	Students may have the option to visit the instructor in their office on campus for office hours or to discuss other class-related items.
Other DE (e.g., recorded lectures)	he instructor may use other instruction methods appropriate to the subject matter. For example, pre-recorded lectures may be posted perhaps leading to a class discussion on the discussion boards.
Synchronous Dialog (e.g., online chat)	The instructor may hold class in a regular schedule but in an online format using a program such as ConferZoom. Office hours may also be held in this manner or with an online chat tool.
Telephone	Students may have the option to call the instructor and/or the instructor may call students to facilitate office hours or to discuss other class-related items.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Students may be required to post their ideas or solutions for class-related material on the course discussion boards. Students may also be required to comment on the posts of other students, including constructive criticism.
E-mail	The instructor may email students with announcements about the course or other college events and opportunities and answer student questions. Students may email questions and possibly assignments or projects, depending on the nature of the class, directly to the instructor.
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Synchronous Dialog (e.g., online chat)	The instructor may hold class in a regular schedule but in an online format using a program such as ConferZoom. Office hours may also be held in this manner or with an online chat tool.
Telephone	Students may have the option to call the instructor and/or the instructor may call students to facilitate office hours or to discuss other class-related items.

Examinations

Hybrid (1%–50% online) Modality
On campus
Online

Hybrid (51%–99% online) Modality
On campus
Online

Primary Minimum Qualification
GRAPHIC ARTS

Review and Approval Dates

Department Chair
08/26/2022

Dean
08/26/2022

Technical Review
09/01/2022

Curriculum Committee
9/6/2022

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
09/22/2022

Control Number
CCC000633332

DOE/accreditation approval date
MM/DD/YYYY