Course Outline

DeAnza College

General Information

COURSE ID (CB01A AND CB01B)

DMT 57

COURSE TITLE (CB02)

Design for Additive Manufacturing (DfAM)

COURSE CREDIT STATUS

Credit - Degree Applicable

EFFECTIVE TERM

Fall 2022

COURSE DESCRIPTION

This course follows on a series of Additive Manufacturing (AM) classes beginning with DMT D053. The objective of this course is to present a comprehensive overview of industrial AM or 3D Printing DfAM principles. The course will cover implementation and operation options in industry production and rapid prototyping. Students will understand and be able to take full advantage of unique capabilities from AM competencies, DfAM methods, tools, and available processes. Typical DfAM methods or tools include topology optimization, design for multiscale structures (lattice or cellular structures), multi-material design, mass customization, part consolidation, and other design methods which can make use of AM-enabled features.

FACULTY REQUIREMENTS

COURSE FAMILY

Not Applicable

Course Justification

This is a major employment preparation CTE course for our Design and Manufacturing Technologies program. It belongs on the Additive Manufacturing Technology: 3D Design and Production certificate and is CSU transferable. This course is intended to better prepare our advanced level students for work in the advanced manufacturing industry in the areas of design principles for Additive Manufacturing/3D Printing as advised by our industry advisory committee.

Foothill Equivalency

DOES THE COURSE HAVE A FOOTHILL EQUIVALENT?

No

FOOTHILL COURSE ID

Formerly Statement

Course Development Options

BASIC SKILL STATUS (CB08)

Course is not a basic skills course.

GRADE OPTIONS

- Letter Grade
- Pass/No Pass

REPEAT LIMIT

0

Transferability & Gen. Ed. Options

Information below is subject to change. For the official listing of courses, their approval dates, and transfer credit limitations, check the De Anza catalog (by academic year), ASSIST.ORG (https://assist.org/) and C-ID.NET (https://c-id.net/).

TRANSFERABILITY

Transferable to CSU only

Units and Hours

Summary

MINIMUM CREDIT UNITS	4.0
MAXIMUM CREDIT UNITS	4.0

Weekly Student Hours

Type	In Class	Out of Class
Lecture Hours	4.0	8.0
Laboratory Hours	0.0	0.0

Course Student Hours

COURSE DURATION (WEEKS)

12.0

HOURS PER UNIT DIVISOR

36.0

Course In-Class (Contact) Hours

LECTURE

48.0

LABORATORY

0.0

TOTAL

48.0

Course Out-of-Class Hours

LECTURE

96.0

LABORATORY

0.0

NA

0.0

TOTAL

96.0

Prerequisite(s)

DMT 54 and DMT 60A (may be taken concurrently) or DMT 65A (may be taken concurrently) or equivalent

Corequisite(s)

Advisory(ies)

Limitation(s) on Enrollment

Entrance Skill(s)

General Course Statement(s)

Methods of Instruction

Lecture and visual aids
Discussion of assigned reading Discussion and problem solving performed in class Quiz and examination review performed in class Homework and extended projects

Assignments

A. Research and compiled reports on selected material related to additive manufacturing (AM) topics.
B. In class exercises to recognize various materials strength and design processes.
C. Manipulate CAD models for exportation to STL files and post processing.

Methods of Evaluation

A. Accuracy and Completeness of assigned reading, research projects and CAD models
B. Mid-term Examination covering assigned video lectures, textbook reading and basic Additive Manufacturing / 3D Printing. Exam will be evaluated on understanding of Additive Manufacturing / 3D Printing processes and applications as per grading rubric.
C. Final Examination evaluating student's comprehensive understanding of 3D Printing techniques and design from CAD modeling by means of accuracy and completeness of STL files as it applies to the post processing in 3D Printer software.

Essential Student Materials/Essential College Facilities

Essential Student Materials:

- None.

Essential College Facilities:

- DMT 3D Printing / CAD computer laboratory

Examples of Primary Texts and References

Author	Title	Publisher	Date/Edition	ISBN
Olaf Diegel, Axel Nordin, Damien Motte "A Practical Guide to Design for Additive Manufacturing", Springer; 1st ed. 2019 edition, ISBN-13: 978-9811382802				

Examples of Supporting Texts and References

Author	Title	Publisher
Barnatt, Christopher "3D Printing: 2nd Edition", CreateSpace Independent Publishing		
Thornburg Ph.D. David "The Invent To Learn Guide to 3D Printing in the Classroom: Recipes for Success", Constructing Modern Knowledge Press		

Learning Outcomes and Objectives

Course Objectives

- Define DfAM principles, capabilities, and optimal boundaries of advanced 3D Printing methods
- Identify the major Additive Manufacturing/3D Printing equipment and validate designs with available college technologies
- Recognize the major types of slicing software applications for various machines and how to optimize the design of end use products for form, fit and function.
- Describe 3D Printing in the context of the evolving rapid prototyping and how the intricacies of mechanical engineering CAD modeling tools to produce output data for the digital manufacturing processes
- Analyze the principles of "Design for Additive Manufacturing" and apply optimal design strategies for production of each of the available major machine types.

CSLOs

- Apply the specific knowledge of 3D Printing (AM) to analyze, compare, explain and utilize various processes of prototyping and fabrication of mechanical designs to implement DfAM technology based on current industry processes.

Outline

A. Define DfAM principles, capabilities, and optimal boundaries of advanced 3D Printing methods
    1. Blending AM with Traditional Manufacturing
    2. Parts consolidation
    3. Multi-material design
    4. Topology optimization
    5. Lattice structures
B. Identify the major Additive Manufacturing/3D Printing equipment and validate designs with available college technologies
    1. Stratasys, FDM & PolyJet technologies
    2. 3D Systems, ProJet, DLP & CJP technologies
    3. SLS (Selective Laser Sintering) and Multi Jet Fusion technologies
    4. SLA/DLP (VAT Photopolymerization)
C. Recognize the major types of slicing software applications for various machines and how to optimize the design of end use products for form, fit and function.
    1. Build preparation and slicing software
    2. Infill and lattice structures
    3. Support material types limitations and strengths
    4. Nesting and packing build volume
D. Describe 3D Printing in the context of the evolving rapid prototyping and how the intricacies of mechanical engineering CAD modeling tools to produce output data for the digital manufacturing processes
    1. Process chain for Additive Manufacturing

2. Parametric modeling systems
3. Knowledge of ISO/ASTM industry standards
4. Final AM output implications

E. Analyze the principles of “Design for Additive Manufacturing” and apply optimal design strategies for production of each of the available major machine types.
1. Material Extrusion
2. Material Jetting
3. Powder Bed Fusion
4. VAT Photopolymerization