SAN DIEGO COMMUNITY COLLEGE DISTRICT
COLLEGE OF CONTINUING EDUCATION
COURSE OUTLINE

SECTION I

SUBJECT AREA AND COURSE NUMBER

CLTX 602

COURSE TITLE

ESSENTIAL 3D DIGITAL MANUFACTURING TOOLS

TYPE COURSE

NON- FEE   VOCATIONAL

CATALOG COURSE DESCRIPTION

This course covers basic digital drafting skills for *three-dimensional* (3D) computer-aided machines, including 3D printers, Computer Numerical Control (CNC) lasers and routers, indexers, and other emerging digital technologies. Using project and work-based learning through digital drafting software and additive-subtractive manufacturing, students develop an understanding of industry standards, the entrepreneurial mindset, and sustainable principles for employment in today's industry. (FT)

LECTURE/ LABORATORY HOURS

70 - 77

ADVISORIES

Completion of CLTX 601 Essential 2D Digital Manufacturing Tools with a grade of 'C' or better, or equivalent.

RECOMMENDED SKILL LEVEL

12th Grade Reading and Math Skills
Computer Literacy

INSTITUTIONAL STUDENT LEARNING OUTCOMES

1. Social Responsibility
    SDCCE students demonstrate interpersonal skills by learning and working cooperatively in a diverse environment.
2. Effective Communication

    SDCCE students demonstrate effective communication skills.
3. Critical Thinking
SDCCE students critically process information, make decisions, and solve problems independently or cooperatively.
4. Personal and Professional Development
SDCCE students pursue short term and life-long learning goals, mastering necessary skills and using resource management and self-advocacy skills to cope with changing situations in their lives.
5. Diversity, Equity, Inclusion, Anti-Racism, and Access
SDCCE students critically and ethically engage with local and global issues using principles of equity, civility, and compassion as they apply their knowledge and skills: exhibiting awareness, appreciation, respect, and advocacy for diverse individuals, groups, and cultures.

COURSE GOALS

1. Gain an understanding of the 3D digital manufacturing industry.
2. Gain experience with the standard tools, software, and practices of 3D digital manufacturing.
3. Apply course skills acquired to 3D digital manufacturing projects.
4. Explore the history of the 3D digital manufacturing industry.
5. Gain an understanding of key terminology used throughout digital manufacturing.
6. Explore sustainable principles and current applications within digital manufacturing.
7. Gain awareness of the relationship of digital manufacturing technologies to current economic, political, environmental, and socio-cultural factors, locally, nationally, and globally.
8. Introduction to entrepreneurship and its applicability and relevance to digital manufacturing.
9. Explore the various career options and diverse job opportunities that exist in digital manufacturing technologies, with an overview of skills, knowledge, education, and training expected for success or advancement.
10. Gain an understanding of employability skills and soft skills and their importance in the workplace.

COURSE OBJECTIVES

Upon successful completion of the course the student will be able to:

1. Navigate a 3D drafting and printing software user interface for digital manufacturing.
2. Operate the tools and various mediums used within 3D digital manufacturing.
3. Analyze and properly address digital manufacturing problems using design thinking.
4. Conceptualize and develop a 3D object using a variety of digital manufacturing techniques.
5. Recognize and use key digital manufacturing terminology.

6. Describe and demonstrate proper safety principles and practices in digital manufacturing.

7. Describe sustainable principles and practices in digital manufacturing.

8. Discuss the relationship between socio-cultural, economic, environmental, and political factors that affect industry locally, nationally, and globally.

9. Define essential entrepreneurial and soft skills and illustrate their importance for success in the workplace.

10. Interpret Intellectual property policies in digital manufacturing.

11. Identify and describe career options and job opportunities and the associated skills, education, and training necessary for success.

SECTION II

COURSE CONTENT AND SCOPE

1. Introduction to Essential 3D Digital Manufacturing Tools
    1.1. Clothing and Textiles (CLTX) programs and pathways
        1.1.1. San Diego College of Continuing Education (SDCCE) programs and pathways
        1.1.2. Credit by exam
    1.2. Course learning management system
        1.2.1. Canvas
        1.2.2. Other supporting software

2. Two-Dimensional (2D) and 3D Digital Manufacturing Compared
    2.1. History of computer-aided equipment used for 3D manufacturing
    2.2. Methods to determine appropriate application
    2.3. Current workforce needs and opportunities
    2.4. Entrepreneurial opportunities in the industry

3. 3D Rendering Software
    3.1. Computer-Aided Design and Drafting (CADD) for 3D objects
    3.2. Equipment specific software

4. Using 3D Rendering Programs
    4.1. Basic tools
    4.2. Importing existing 3D geometry
    4.3. Creating 3D geometry
    4.4. Saving versus (vs.) exporting files
    4.5. Preparing files for production
    4.6. Preparing files for outsourcing

5. Creating Digital Files
    5.1. Using a 3D object to collect measurements and dimensions
    5.2. Methods for creating a digital rendering
    5.3. 3D scanning
    5.4. General mathematics of 3D objects

6. From a Digital Object to a Tangible Object
    6.1.   Repairing found geometries
    6.2.   Methods for augmenting geometries
    6.3.   Process of manufacturing from digital files

7. Computer Assisted Machining (CAM) Programs
    7.1.   Manufacturer-specific software
    7.2.   CAD plugin software
    7.3.   3D Postprocess (gcode)
    7.4.   Slicers

8. Applying Additive and Subtractive Technologies
    8.1.   Best uses of additive or subtractive technologies
    8.2.   Additive materials: polymers, metals, composites
    8.3.   Subtractive tooling and best material combinations

9. Safety and Sustainability
    9.1.   Personal safety and hazards
    9.2.   Machine safety and preventative maintenance
    9.3.   Material hazards and waste management
    9.4.   Material sourcing ethics and sustainability

10. Intellectual Property Policy
    10.1.   Definition
    10.2.   Forms of property registration

11. Soft and Entrepreneurial Skills
    11.1.   Definition
    11.2.   Acquisition
    11.3.   Application

APPROPRIATE READINGS

Appropriate readings may include, but are not limited to, textbooks, workbooks, instructor written materials, trade publications, periodicals, magazines, internet articles, resource manuals, case studies, state of industry reports, videos, and tutorials related to 3D digital manufacturing. For example, the student uses **TCT Magazine** online to locate and read an article related to the weekly class topic.

WRITING ASSIGNMENTS

Appropriate writing assignments may include, but are not limited to:

1. Maintaining a portfolio of class notes, technique samples, and assignments
2. Create an order of operation sheet to complete a 3D object project correctly and efficiently.
3. Analyze and write a report on industry case studies using 3D manufacturing technologies.

OUTSIDE ASSIGNMENTS

Outside assignments may include, but are not limited to:

1. Internet research, watching audio-visual materials, reading articles, and referenced resources in further exploration of a class topic.
2. Independent research and observation on developments and latest trends in the digital manufacturing industry.
3. Practical application of essential digital skills in software outside of class meetings.
4. Practical application of sustainable best practices learned in class.

APPROPRIATE ASSIGNMENTS THAT DEMONSTRATE CRITICAL THINKING

Assignments demonstrating critical thinking may include, but are not limited to:

1. Practicing a disciplined, systematic approach to problem solving through 3D digital applications.
2. Learning how to analyze a problem and develop design solutions through research, analysis, and evaluation.

EVALUATION

A student's competency will be based on multiple measures of performance. Assessment will measure the development of independent critical thinking and 3D digitally aided manufacturing skills. Evaluation of the student's ability will be based on, but not limited to, the following criteria:

1. Perform in a variety of activities and assignments.
2. Complete written and practical examinations and projects.
3. Contribute to class and group discussions.
4. Maintain attendance and punctuality per current policy.
5. Demonstrate ability to work independently and as a team member.

Upon successful completion of all courses included in the program, a Certificate of Program Completion will be issued.

METHOD OF INSTRUCTION

Methods of instruction may include, but are not limited to:

1. Classroom and streamed lectures
2. Demonstrations
3. Laboratory
4. Classroom, virtual, or online discussions

5. Web-based resources
6. Work-based learning opportunities
7. Job shadowing
8. Field trips
9. Guest speakers
10. Audio-Visual resources
11. Video resources
12. Collaborative learning
13. Individual/small group instruction

This course, or sections of this course, may be offered through distance education.

TEXTS AND SUPPLIES

3D Printing Failures: How to Diagnose and Repair ALL Desktop 3D Printing Issues, Sean
    Aranda, independently published, current edition
The Art of Digital Fabrication: STEAM Projects for the Makerspace and Art Studio, Erin E.
    Riley, Constructing Modern Knowledge Press, current edition
*Additive Knowledge: Everything you need to know about 3D Printing, 3D Scanning and 3D
    Modeling*, Adam Rehak, independently published, current edition
3D Printing and Additive Manufacturing: Principles and Applications, Chee Kai Chua, Kah Fai
    Leong, WSPC, current edition

Supplies:
Supplies as listed on the syllabus and time outside of instructional hours are needed to
complete projects and portfolios. At least a 32GB USB flash drive is required. It is highly
recommended to have a computer or laptop available for use outside of the campus classroom
and lab.

PREPARED BY: Shirley Pierson, MFA.   DATE January 2024

Instructors must meet all requirements stated in Policy 5500 (Student Rights, Responsibilities
and Administrative Due Process), and the Attendance Policy set forth in the Continuing
Education Catalog.

REFERENCES:

San Diego Community College District Policy 5500
California Community Colleges, Title 5, Section 55002
Continuing Education Catalog