**CHAMP Course Map**

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| **Course Name:** CAD 262 – Intro to 3D Printing |
| **Instructor Name:** Community College of Denver | **Date:** December 2016 |
| Course Competencies:1. Identify the types of 3D printing equipment used in the industry.
2. Compare and contrast the different 3D printers used in the industry.
3. Discuss the history of 3D printing and the advancement of the technology in the industry.
4. Identify the materials used in the construction of printed 3D models given the technology provided.
5. Establish proper safety requirements per the technology and materials used.
6. Construct CAD models with varying thicknesses and scales to analyze strengths and weaknesses of 3D printed models.
7. Analyze the strengths of models printed in various linear angles.
8. Produce a basic 3D model using computer aided drafting and design software.
9. Generate and or export 3D model files using STL, VRML, WRL, DXF, RVT, MAX, DWG, etc. (3d printing compatible) file formats.
10. Import 3D model file formats within the software program necessary to 3D print from specific technology.
11. Edit a 3D model using the 3D printer software provided.
12. Design and create advanced 3D software generated models in various CAD software programs.
13. Revise CAD models when necessary for generating 3D printed usable models.
14. Prepare printed models for various techniques required in the post printing methods.
15. Discuss proper handling of 3D printed models.
16. Discuss proper disposal of unused materials which may be hazardous or require proper end use elimination.
17. Maintain proper procedures for changing out materials and cleaning of the equipment.
18. Perform regular maintenance on the equipment used to create 3D models.
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**Course Materials (Text, Edition and any other publisher items)**

**Textbooks and/or Resources:** **Engineering Drawing and Design 6th Edition, Madson and Madson, 2016**

**Resources:**

| **Module # and Title** | **CCNS Competencies** | **Content, Activities or Challenges****(Learner Interaction** **& Engagement)**  | **Assessments, Rubrics (Feedback)** | **Publish to OER** |
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| Module 1:Introduction and History of 3D Printing |  | 1. Introduction and History
2. Uses of 3D Printing PowerPoint
3. Lecture on Industrial Uses of 3D Printing
	1. Car prototyping
	2. Medical
	3. Jewelry
	4. Custom machinery
4. Assignment: Quiz
5. Lecture on Personal Uses of 3D Printing
	1. Fixing miscellaneous items
	2. Prosumer level
	3. Printed self-miniatures
	4. Custom brackets
	5. Cheap prosthetics
 | Assignment: Quiz: Create 6 sided nut with dimensions. Should be no more than a 10 min brain exercise. | * Syllabus and Outline
* Uses of 3D Printing PowerPoint
* Module 1 Quiz Assignment
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| Module 2:Types of Printers and Materials |  | 1. Types of Printers PowerPoint
2. Lecture on types of Printers
3. Links and Videos
	1. <https://imgur.com/a/t5UZ8>
	2. <https://www.youtube.com/watch?v=XC6UoqwkTqk>
	3. <http://www.smithsonianmag.com/innovation/coming-2015-faster-sharper-way-3d-print-180952090/>
	4. <http://www.ted.com/talks/joe_desimone_what_if_3d_printing_was_25x_faster#t-512339>
	5. <https://www.youtube.com/watch?v=PG9nti_A08Y>
	6. <http://www.designboom.com/technology/metal-3d-printer-by-joris-laarman-lab-creates-gravity-defying-sculptures-02-21-2014/>
	7. <https://www.youtube.com/watch?v=DQ5Elbvvr1M>
	8. <https://3dprint.com/100229/apis-cor-3d-printer-buildings/>
	9. <https://www.ted.com/talks/skylar_tibbits_the_emergence_of_4d_printing?language=en#t-436844>
	10. <http://www.extremetech.com/extreme/143552-3d-printing-with-metal-the-final-frontier-of-additive-manufacturing>
4. Hands-on Assignment: Take apart $10 electronic and describe the different manufacturing components involved including materials used and processes.
5. Presentation Assignment: Present to class the deconstructed electronic part.
6. Lecture on Types of Materials
	1. Plastics
	2. Metals
	3. Photopolymers
	4. Wax
	5. Food
7. Lecture on when to use Additive Manufacturing
8. Set Up Printer and Calibrate
9. Essay Assignment: Pros & Cons of Additive Manufacturing
 | * Hands-on Assignment
* Presentation Assignment
* Essay Assignment
 | * + Types of Printers PowerPoint
	+ Module 2 Essay Assignment
	+ <https://imgur.com/a/t5UZ8>
	+ <https://www.youtube.com/watch?v=XC6UoqwkTqk>
	+ <http://www.smithsonianmag.com/innovation/coming-2015-faster-sharper-way-3d-print-180952090/>
	+ <http://www.ted.com/talks/joe_desimone_what_if_3d_printing_was_25x_faster#t-512339>
	+ <https://www.youtube.com/watch?v=PG9nti_A08Y>
	+ <http://www.designboom.com/technology/metal-3d-printer-by-joris-laarman-lab-creates-gravity-defying-sculptures-02-21-2014/>
	+ <https://www.youtube.com/watch?v=DQ5Elbvvr1M>
	+ <https://3dprint.com/100229/apis-cor-3d-printer-buildings/>
	+ <https://www.ted.com/talks/skylar_tibbits_the_emergence_of_4d_printing?language=en#t-436844>
	+ <http://www.extremetech.com/extreme/143552-3d-printing-with-metal-the-final-frontier-of-additive-manufacturing>
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| Module 3:File Types |  | 1. Lecture on File Types
	1. Obj
	2. stl
	3. dwg
	4. iges
	5. sldprt
	6. step
2. Lecture on loading and exporting files
	1. thingiverse
	2. grabcad
	3. pinshape
	4. youmagine
3. Hands On Assignment: Download any file from <http://www.thingiverse.com/>, fix, orient for build.
4. Printing
 | Hands On Assignment  | Link: <http://www.thingiverse.com/>  |
| Module 4:Tolerancing |  | 1. Lecture on Types of Post Processing
	1. Powder-based
	2. FDM
	3. Removal of Supports
	4. Vapor Bath
2. Essay Assignment: Design an experiment to test tolerancing
3. Lecture on Part Analysis for Printing
	1. Support files
	2. Minimum thickness and radii
	3. Scale
	4. GD&T
4. Printing Assignment: Print test pieces
5. Lecture on Assembly Tolerancing
6. View Manufacturing Project Example PowerPoint
 | * Module 4 Design Tolerancing Essay Assignment
* Printing Assignment
 | * Module 4 Design Tolerancing Essay Assignment
* Manufacturing Project Example PowerPoint
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| Module 5:Final Project |  | 1. Final Project Assignment:
	1. Find component to customize
	2. Design
	3. Print
2. Quiz: A revised version of the original 6 sided nut now to include a matching bolt that works together within the printers tolerances. 10 min or so to design
3. Presentation of Final Project
 | 1. Final Project Assignments:
	1. Print Final Project
	2. Quiz
	3. Presentation
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