



COURSE OUTLINE

Course Number DRA218	Course Title <i>3D Modeling/3D Printing</i>	Credits 3
Hours: Lecture/Lab/Other 2/ 2	Co- or Pre-requisite MET122 or approval of advisor	Implementation Sem/Year Spring 2015

DRA218 – 3D Modeling/3D Printing

An introduction to 3D solids modeling and 3D printing software. Students build a prototype solid model in SolidWorks software and Print a 3D Model using MakerBot hardware & software to explore the basic size and look of a product or machine part. 2D & 3D drawings with dimensions are also produced so that the part can built using traditional machining techniques.

2 lecture/2 laboratory hours

New,

Required Texts/Other Materials:

USB Storage Device
3 Ring Binder with Dividers
Pencils, Erasers
Small (8.5 x 11) Sketch Pad (MIN 50 SHEETS)

Revision Date: Fall 2021 **Course Coordinator:** James Maccariella, maccarij@mccc.edu

Information resources: Internet, SolidWorks online documentation (help), MakerBot online documentation (help), 3D solid modeling “how to” books to be determined by Instructor.

Other Learning Resources

Reference Material: Hand Outs Provided by Instructor with Assignment Instructions, Internet and CAD & 3D Printing Manuals & Text Books.

Course Competencies/Goals:

1. Create and understand Title Blocks, Naming Conventions, Filing Procedures, Drawing Standards (Line Types, etc.).
2. Use CAD Software – SolidWorks, AutoCAD (Commands & Techniques).
3. Create Profiles – Views, View Projection, Dimensions, Tolerance, and Scale.
4. Convert from Profiles to 3D Models – Extrude, Revolve, Sweep, Loft, etc.
5. Understand concepts of 3D printing, Setup & Post Procedures, Safety Procedures.
6. Design & Print a 3D Model, 2D & 3D drawings with Dimensions on Proper Title Block and Printed Parts.
7. Understand Prototyping – Background, Purpose & Importance, and Procedures.
8. Understand Solid Model Assemblies – Purpose, Documentation, Techniques.

Course-specific General Education Knowledge Goals and Core Skills.

General Education Knowledge Goals

Goal 1. Communication. Students will communicate effectively in both speech and writing.

Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Goal 9. Ethical Reasoning and Action. Students will understand ethical issues and situations.

MCCC Core Skills

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.

Goal C. Ethical Decision-Making. Students will recognize, analyze and assess ethical issues and situations.

Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.

Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Units of study in detail.

Unit I Introduction Basics – Title Blocks, Naming Conventions, Filing Procedures, Drawing Standards (Line Types, etc.).

Learning Objectives Competencies 1, Goal 1& 2, Skill D&E

The student will be able to...

- Insert a company logo with a relation in the Title block.
- Create an A-ANSI-MM drawing template by combining information from the C-size drawing template and A-size Sheet format.
- Create□a document template using millimeters and a document template using inches.
- Create□a document template using ANSI and a document template using ISO dimensioning standard.
- Create:□A document template for a Detached drawing and Distinguish between System Options and Document Properties as they relate to drawings and templates.
- Create a new SolidWorks File Location for a drawing template.
- Set Reference Document Properties in a drawing template.

- Create an empty C-size (ANSI) Landscape drawing template. Propagate the settings to the drawing sizes Drawing template and Sheet format to create a C-ANSI-MM drawing template.
- Develop Linked Notes to SolidWorks Properties and Custom Properties in the Sheet format.

Unit II Introduction CAD Software – SolidWorks, AutoCAD (Commands & Techniques).

Learning Objectives Competencies 2, Goal 1 & 2, Skill D&E

The student will be able to...

- Create a rough two-dimensional sketch of the basic shape of the base feature of the design.
- Apply/modify geometric relations and dimensions to the two-dimensional sketch.
- Start a SolidWorks session and navigate through the SolidWorks (UI) and extrude, revolve, or sweep the parametric two-dimensional sketch to create the base solid feature of the design.
- Add additional parametric features by identifying feature relations and complete the design.
- Perform analyses on the computer model and refine the design as needed.
- Create the desired drawing views to document the design.

Unit III Creating Profiles – Views, View Projection, Dimensions, Tolerance, and Scale.

Learning Objectives Competencies 3, Goal 1 & 2, Skill B, D&E

The student will be able to...

- Create Simple Extruded Solid Models
- Understand the Basic Parametric Modeling Procedure
- Create 2-D Sketches
- Understand the “Shape before Size” Approach for solid modeling
- Use the Dynamic Viewing Commands
- Create and Edit Parametric Dimensions

Unit IV Conversion from Profiles to 3D Models

Learning Objectives Competencies 4, Goal 1 & 2, Skill D&E

The student will be able to...

- Extruded Boss/Base, Instant3D, Extruded Cut,
- Revolved Boss/Base, Revolved Cut, Dome,
- Shell, Circular Pattern and Fillet.
- Understanding of the Mold tools: Scale,
- Parting Lines, Parting Surfaces, Shut-off
- Surfaces, Tooling Split and Draft.

Unit V Introduction 3D Printing & MakerBot Printer – Concepts of 3D printing, Setup & Post Procedures, Safety Procedures.

Learning Objectives Competencies 5, Goal 1 & 2, Skill D&E

The student will be able to...

- Set up 3d printer (MakerBot) and understand how it works
- Understand Build Area size & limitations
- Learn the basics printer concepts and print a designed object
- Understand the safety standards associated with 3D printer set up, operation and post printing

Unit VI Fasteners & Threads

Learning Objectives Competencies 3, Goal 1.2 & 4, Skill D&E

The student will be able to...

- Identify fastener types (bolts, studs, etc.)
- Identify thread types, forms, sizes, etc.
- Understand thread terminology (threads per inch, pitch, etc.)
- Identify thread standards (UNF, UNC, etc.)

Unit VII Prototyping – Background, Purpose & Importance, Procedures.

Learning Objectives Competencies 7, Goal 1& 2, Skill D&E

The student will be able to...

- Understand the Background, Purpose & Importance of prototyping (modeling)
- Understand Form Study Prototype (Model Building) that will allow designers to explore the basic size, look and feel of a product without simulating the actual function or exact visual appearance of the product.
- Assess ergonomic factors and provide insight into visual aspects of the product's final form.

Unit VIII Solid Model Assemblies – Purpose, Documentation, Techniques.

Learning Objectives Competencies 8, Goal 1& 2, Skill D&E

The student will be able to...

- Control the display of solid models.
- Construct a 3D section plane through a solid model.
- Adjust the size and location of section planes.
- Create a dynamic section of a 3D solid model.
- Construct 2D and 3D section blocks.
- Create a flat, 2D projection of a 3D solid model.
- Create a multiview layout of a solid model using **SOLVIEW** and **SOLDRAW**.
- Construct a profile of a solid using **SOLPROF**.
- Perform an analysis of a solid model.
- Export and import solid model data.
- Provide a parts list and material information.

Evaluation of student learning:

Quizzes	20%
Orthographic Projections	20%
Mid Term Project	20%
Final Project	30%
Attendance	10%

Mid Term Project – Competencies 1-6, Goal 1& 2, Skill B,D&E

Design & Print a 3D Model consisting of 2 Mating Parts. Deliverables: 2D & 3D drawings with Dimensions on Proper Title Block, Assembly Drawing with Parts List and Printed Parts. Students will be provided a scoring matrix and sample drawings at the start of the project. This will make it clear what is required and the areas they will be graded on. (See attached documents).

Final Project – Competencies 1-8, Goal 1& 2, Skill B,D&E

Design & Print a 3D Model consisting of 4 Mating Parts plus Hardware (Screws, Bolts, etc.). Deliverables: 2D & 3D drawings with Dimensions on Proper Title Block, Assembly Drawing with Parts List and Printed Parts. Students will be provided a scoring matrix and sample drawings at the start of the project. This will make it clear what is required and the areas they will be graded on. (See attached documents).

Academic Integrity Statement:

Students are expected to comply with the college-wide requirements for academic integrity. Mercer County Community College is committed to Academic Integrity—the honest, fair, and continuing pursuit of knowledge, free from fraud or deception. This implies that students are expected to be responsible for their own work. Presenting another individual's work as one's own and receiving excessive help from another individual will qualify as a violation of Academic Integrity. The entire policy on Academic Integrity is located in the Student handbook and is found on the college website (http://www.mccc.edu/admissions_policies_integrity.shtml).

Special Needs Students Statement

Any student in this class who has special needs because of a disability is entitled to receive accommodations. Eligible students at Mercer County Community College are assured services under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you believe you are eligible for services, please contact Arlene Stinson, the Director of Academic Support Services. Ms. Stinson's office is LB221, and she can be reached at (609) 570-3525.