ME170 Computer Aided Design
Course Outline/Syllabus

1. Course Description

This course teaches the primary methods and principles used by engineers today to define and describe the geometry and topology of engineered components. For centuries the principal method of communication between engineers and manufacturing has been the engineering drawing. Over recent times computer aided design/drafting (CAD) has evolved from a tool to aid in the preparation of drawings (2D CAD), to a method of fully defining and specifying a component, or assembly of components, in a mathematically robust geometric fully associative database (3D CAD or solid modeling). In this course, the students learn how to create these fully defined engineering models and how to correctly present them in standard 2D blueprint form (aka Engineering Drawings), 3D wireframe, 3D cosmetically shaded presentations and animations, meshed topologies for engineering analysis, and toolpath generation for component manufacture.

2. Course Specifics

Prerequisites:	None
Lecture:	Two 1 hr lectures per week.
Lab Section:	One 2 hr lab section per week
Computer Lab:	Engineering Workstation labs (and/or own computer)
CAD Software:	Autodesk's Fusion 360 (free educational license for PC or Mac) aPriori CAD integrated Design for Manufacture software (free access)
Course Book:	No required text – notes and handouts provided on class website

3. Course Topics

1) Design Process: Human Centered Design (HCD), 2D/3D freehand concept sketching (isometric and orthographic), Product Design Specification (PDS), Concept Selection (Pugh), Rapid Prototyping/3D printing, Design for Manufacture (aPriori cost analysis)

2) CAD: 2D CAD, 3D wireframe, and 3D solids and surfaces

3) Basic Part modeling: setting up datum planes, defining the coordinate systems, feature selection, parent/child relationships, dimension driven 3D sketching (include. protrusions, revolving. extruding etc), visualization (hidden lines, shaded, and perspective views)

4) Complex Parts and Surfaces: Curved surfaces and blends, shelled/molded parts, adding ribs and bosses, sheet metal modeling, creating parametric designs (include. variables, equations, forms and tables)

5) Engineering Drawings: Orthographic projections, line and text forms, section and part-section views, dimensioning and tolerancing principles and standards (incl. GD&T), ISO standard limits and fits, and compliance with ANSI standards (ASME Y14 series).

6) Assembly: Assembly constraints (mating planes and coordinates, aligning, orienting etc), exploded views, creating a Bill of Materials (BOM), interference and clearance checking, orthographic assembly drawings.

7) Engineering Property and File Creation: mass/volume properties, plot/print files, web file creation (jpg, VRML), data exchange (IGES, STL, DXF), Mesh files (FEA output), and Cutter Location Files (toolpath generation).

8) Introduction to Kinematics: Fusion Motion Analysis; Creating Animations; simulating multi-axis joints, springs, servo and force motors.

9) Design Project: Design a small product or sub-assembly. Create part models for each part, Assembly models with exploded views, Bill of Materials (BOM), a full set of blueprints / engineering drawings and a physical prototype of one key part (on 3D printers).

10) Develop and give a computer presentation, and write a design project report.

11) Program advancement topics: Ethical and Professional responsibilities of an engineer; working effectively in design teams; introduction to technical report writing.