1. **Credits and contact hours:** 3
2. **Textbook:** N/A  
   **Supplemental Materials:** N/A  
   **Computer Requirements:** Windows PC preferable
3. **Course Information**  
   a. **Description:** The course outlines modern solid modeling design, analysis, simulation, and manufacturing of mechanical systems. Theoretical focus is given to fundamental Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) concepts. These are sustained by numerous practical examples to provide the student with intensive hands-on experience with CAD/CAM. Implementations use the Creo design package (PTC Inc.). The objective of this course is to prepare the students to utilize powerful digital design, simulation, and manufacturing tools to use in classes, projects, and future work. The materials learned will help engineers to develop a product from the stage of the research and development, into prototype developments, and final commercial product developments  
   b. **Prerequisite or Co-requisite:** N/A
4. **Goals:** Specific goals for the course  
   a. **Instructional Outcomes:** The course has an intensive schedule covering aspects of solid modeling design, assemblies, mechanism design, dynamics, structural analysis, simulation, and manufacturing spanning an entire range of product development, from creative concept through detailed product definition to prototype development and serviceability.  
   b. **Student Outcomes:** Knowledge acquired will likely reflect in the way that students express and implement engineering ideas. The following outcome criteria apply:  
      1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics  
      2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors  
      3. An ability to communicate effectively with a range of audiences  
      4. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
5. **Topics to be Covered:**  
   1. **Computer Aided Design Overview**  
      a. Introduction  
      b. Design Process Overview  
      c. CAD Environment, Packages, and Architectures  
   2. **Basic Part Modeling**  
      a. Geometric Features  
      b. Three-Dimensional Operations  
      c. Sketch Based 3-D Genesis  
      d. Iterative Design Methods  
      e. Sketched Features  
      f. Placed Features  
   3. **Static Assembly Modeling**  
      a. Degrees of Freedom and Assembly Constraints  
      b. Geometric Relations and Parameters  
      c. Geometric Instancing
d. Bottom-Up Design Concepts  
e. Top-Down Designs  

4. Allowances and Tolerances  
a. Introduction and Applications  
b. Definitions  

5. Engineering Drawing and Detailing  
a. Standards, Formats, Unit Systems  
b. Projection Views  
c. Isometric Representations  
d. Cross Sections  
e. Exploded Views, Bills of Materials  

6. Part and Assembly Modeling  
a. Geometric Patterns  
b. Sweep and Blend Operations  
c. Iterative Design Concepts  
d. Parent-child relationships  
e. Feature and Group Operations  
f. Standard Components  
g. Flexible Geometry  

7. Mechanism Design and Simulation  
a. Model - Analyze - Results Overview  
b. Degrees of Freedom and Constraints  
c. Mechanism Connections  
d. Kinematic Analysis  
e. Dynamic Modeling  
f. Mechanism Synthesis  

8. Structural Simulation and Analysis  
a. Finite / Geometric Element Methods  
b. Materials and Material Properties  
c. Idealized Models  
d. Structural Loads, Constraints, Analyses  
e. Result Processing and Display  

9. Feasibility Studies and Design Optimizations  
a. Measurement Features  
b. Analysis Features  
c. Studies and Analyses  

10. Computer Numerical Control Manufacturing (CNC)  
a. CNC Equipment and Programming Overview  
b. Manufacturing Model Concepts: Operations, Workcells, Sequences  
c. NC Simulation, Post Processing, Executing CNC Operations