Unit 8 Advanced Computer Modeling

Unit 8 – Concepts & Objectives

Concepts	Objectives
An engineering design process involves a characteristic set of practices and steps.	• Complete a design project utilizing all steps of a design process, and find a solution that meets specific design requirements.
Brainstorming may take many forms and is used to generate a large number of innovative, creative ideas in a short time.	• Generate and document multiple ideas or solution paths to a problem through brainstorming.
Physical models are created to represent and evaluate possible solutions using prototyping technique(s) chosen based on the presentation and/or testing requirements of a potential solution.	• Construct a testable prototype of a problem solution.
Problem solutions are optimized through evaluation and reflection and should be clearly communicated.	• Identify limitations in the design process and the problem solution and recommend possible improvements or caveats.
The scientific method guides the testing and evaluation of prototypes of a problem solution.	• Analyze the performance of a design during testing and judge the solution as viable or non-viable with respect to meeting the design requirements.
An equation is a statement of equality between two quantities that can be use to describe real phenomenon and solve problems.	• Formulate equations and inequalities to represent linear**,** relationships between quantities.
Solving mathematical equations and inequalities involves a logical process of reasoning and can be accomplished using a variety of strategies and technological tools.	• Solve equations for unknown quantities by determining appropriate substitutions for variables and manipulating the equations.
Two- and three-dimensional objects share visual relationships which allow interpretation of one perspective from the other.	• Identify three dimensional objects generated by rotations of two-dimensional shapes and vice-versa.
Geometric shapes and forms are described and differentiated by their characteristic features.	• Identify and differentiate geometric constructions and constraints such as horizontal lines, vertical lines, parallel lines, perpendicular lines, colinear points, tangent lines, tangent circles, and concentric

	circles.
The style of the engineering graphics and the type of drawing views used to detail an object vary depending upon the intended use of the graphic.	• Identify the proper use of each technical drawing representation including isometric, orthographic projection, oblique, perspective, auxiliary, and section views.
Technical drawings convey information according to an established set of drawing practices which allow for detailed and universal interpretation of the drawing.	• Determine the minimum number and types of views necessary to fully detail a part. • Choose and justify the choice for the best orthographic projection of an object to use as a front view on technical drawings. • Create a set of working drawings to detail a design project. • Create specific notes on a technical drawing to convey important information about a specific feature of a detailed object, and create general notes to convey details that pertains to information presented on the entire drawing (such as units, scale, patent details, etc.
Dimensions, specific notes (such as hole and thread notes), and general notes (such as general tolerances) are included on technical drawings according to accepted practice and an established set of standards so as to convey size and location information about detailed parts, their features, and their configuration in assemblies.	• Dimension orthographic projections and section views of simple objects or parts according to a set of dimensioning standards and accepted practices. • Identify and correctly apply chain dimensioning or datum dimensioning methods to a technical drawing. • Model and annotate (with a hole note) through, clearance, blind, counter bore, and countersink holes.
A degree of variation always exists between specified dimensions and the measurement of a manufactured object which is controlled by the use of tolerances on technical drawings.	• Identify and differentiate among limit dimensions, a unilateral tolerance, and a bilateral tolerance.
Hand sketching of multiple representations to fully and accurately detail simple objects or part of objects is a technique used to convey visual and technical information about an object.	• Hand sketch orthographic projections at a given scale and in the correct orientation to fully detail an object or part using the actual object, a detailed verbal description of the object, or a pictorial an isometric view of the object.
Computer aided drafting and design (CAD) software packages facilitate virtual modeling of parts and assemblies and the creation of technical drawings. They are used to efficiently and	• Create three-dimensional solid models of parts within CAD from sketches or dimensioned drawings using appropriate geometric and dimensional constraints. • Generate CAD multi-view technical drawings, including orthographic projections, sections view(s), detail view(s), auxiliary view(s) and pictorial views, as necessary, showing appropriate scale, appropriate view selection, and correct view orientation to

accurately detail parts and assemblies according to standard engineering practice.	fully describe a part according to standard engineering practice. • Create relationships among part features and dimensions using parametric formulas. • Dimension and annotate (including specific and general notes) working drawings according to accepted engineering practice. Include dimensioning according to a set of dimensioning rules, proper hole and thread notes, proper tolerance annotation, and the inclusion of other notes necessary to fully describe a part according to standard engineering practice. • Explain each assembly constraint (including mate, flush, insert, and tangent), its role in an assembly model, and the degrees of freedom that it removes from the movement between parts. • Create assemblies of parts in CAD and use appropriate assembly constraints to create an assembly that allows correct realistic movement among parts. Manipulate the assembly model to demonstrate the movement. • Create a CAD assembly drawing. Identify each component of the assembly with identification numbers and create a parts list to detail each component using CAD. • Create an exploded view of a given assembly. Identify each component of the assembly with identification numbers, and create a parts list to detail each component using CAD. **(OPTIONAL)**
Sketches, drawings, and images are used to record and convey specific types of information depending upon the audience and the purpose of the communication.	• Create drawings or diagrams as representations of objects, ideas, events, or systems.
In order to be an effective team member, one must demonstrate positive team behaviors and act according to accepted norms, contribute to group goals according to assigned roles, and use appropriate conflict resolution strategies.	• Demonstrate positive team behaviors and contribute to a positive team dynamic.

Essential Questions (Unit-Specific)

1. How do you decide what to include in a set of working drawings? What views are needed? What other information is important?
2. How can assembly models, exploded assemblies, and animated assemblies of an object or a proposed design be used in the design process? Beyond the design process?

Essential Questions (Course-Wide)

1. How does the design process promote the development of good solutions to technical problems?
2. How can an engineer or technical professional effectively communicate ideas and solutions in a global community?

3. How do inventors and innovators impact and shape society?