

# Unit 1 Design Process

## Unit 1 – Concepts & Objectives

| Concepts   | Objectives  |
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| An engineering design process involves a characteristic set of practices and steps.  | <ul style="list-style-type: none"> <li>Identify and define the terminology used in engineering design and development.</li> <li>Identify the steps in an engineering design process and summarize the activities involved in each step of the process.</li> <li>Complete a design project utilizing all steps of a design process, and find a solution that meets specific design requirements.</li> </ul>                |
| Research derived from a variety of sources (including subject matter experts) is used to facilitate effective development and evaluation of a design problem and a successful solution to the problem. | <ul style="list-style-type: none"> <li>Utilize research tools and resources (such as the Internet; media centers; market research; professional journals; printed, electronic, and multimedia resources; etc.) to gather and interpret information to develop an effective design brief.</li> </ul>   |
| A problem and the requirements for a successful solution to the problem should be clearly communicated and justified.  | <ul style="list-style-type: none"> <li>Define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders.</li> <li>Present and justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution.</li> <li>Write a design brief to communicate the problem, problem constraints, and solution criteria.</li> </ul> |
| Brainstorming may take many forms and is used to generate a large number of innovative, creative ideas in a short time.  | <ul style="list-style-type: none"> <li>Generate and document multiple ideas or solution paths to a problem through brainstorming.</li> </ul>  |
| A solution path is selected and justified by evaluating and comparing competing design solutions based on jointly developed and agreed-upon design criteria and constraints.                           | <ul style="list-style-type: none"> <li>Clearly justify and validate a selected solution path.</li> </ul>  |
| 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.          | <ul style="list-style-type: none"> <li>Construct a testable prototype of a problem solution.</li> </ul>   |
| Problem solutions are optimized through evaluation and reflection and should be clearly communicated.  | <ul style="list-style-type: none"> <li>Describe the design process used in the solution of a particular problem and reflect on all steps of the design process.</li> <li>Justify and validate a problem solution.</li> <li>Identify limitations in the design process and the problem solution and recommend possible improvements or caveats.</li> </ul>   |
| The scientific method  | <ul style="list-style-type: none"> <li>Analyze the performance of a design during testing and judge the</li> </ul>  |

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| guides the testing and evaluation of prototypes of a problem solution.   | solution as viable or non-viable with respect to meeting the design requirements.  |
| Geometric shapes and forms are described and differentiated by their characteristic features.  | <ul style="list-style-type: none"> <li>• Explain the concept of proportion and how it relates to freehand sketching.</li> </ul>  |
| Hand sketching of multiple representations to fully and accurately detail simple objects or parts of objects is a technique used to convey visual and technical information about an object. | <ul style="list-style-type: none"> <li>• Generate non-technical concept sketches to represent objects or convey design ideas.</li> </ul>   |
| Technical professionals clearly and accurately document and report their work using technical writing practice in multiple forms.  | <ul style="list-style-type: none"> <li>• Organize and express thoughts and information in a clear and concise manner.</li> <li>• Adjust voice and writing style to align with audience and purpose.</li> <li>• Support design ideas using a variety of convincing evidence.</li> <li>• Utilize an engineering notebook to clearly and accurately document the design process according to accepted standards and protocols to prove the origin and chronology of a design.</li> <li>• Document information sources using appropriate formats.</li> </ul> |
| Specific oral communication techniques are used to effectively convey information and communicate with an audience.  | <ul style="list-style-type: none"> <li>• Deliver organized oral presentations of work tailored to the audience.</li> <li>• Establish objectives for the presentation that are appropriate for the audience.</li> <li>• Facilitate engaging and purposeful dialog with the audience.</li> </ul>   |
| Sketches, drawings, and images are used to record and convey specific types of information depending upon the audience and the purpose of the communication.                                 | <ul style="list-style-type: none"> <li>• Create drawings or diagrams as representations of objects, ideas, events, or systems.</li> <li>• Select and utilize technology (software and hardware) to create high impact visual aids.</li> <li>• Use presentation software effectively to support oral presentations.</li> </ul>  |
| Engineering has a global impact on society and the environment.  | <ul style="list-style-type: none"> <li>• Define and differentiate invention and innovation.</li> <li>• Assess the development of an engineered product and discuss its impact on society and the environment.</li> <li>• Identify and discuss a Grand Challenge for Engineering (as identified by the National Academy of Engineering) and its potential impact on society and the environment.</li> </ul>   |
| Engineering consists of a variety of specialist sub-fields, with each contributing in different ways to the design and development of solutions to different types of problems.              | <ul style="list-style-type: none"> <li>• Identify and differentiate between mechanical, electrical, civil, and chemical engineering fields.</li> <li>• Describe the contributions of engineers from different engineering fields in the design and development of a product, system, or technology.</li> </ul>   |
| 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,            | <ul style="list-style-type: none"> <li>• Demonstrate positive team behaviors and contribute to a positive team dynamic.</li> </ul>   |

and use appropriate conflict resolution strategies.

### **Essential Questions (Unit-Specific)**

1. How might we create the best possible solution to a problem?
2. What is the most effective way to generate potential solutions to a problem? How many alternate solutions should you generate?
3. What are the most pressing engineering/technical problems of our time?
4. What is an engineer? What types of work do engineers do?

### **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?