PATHWAY TO LEARNING ENGINEERING

Siemens Engineering Design

A secondary school course featuring NX X Essentials

Technical content standards

Engineering design process

- Create and maintain an engineering notebook for daily reflections, research and prototype creation documentation
- Apply design and problem solving as an iterative process incorporating science, mathematics and engineering to optimally convert resources to meet a stated objective
- Communicate solutions using technical writing skills, including correct spelling, proper grammar and relevant vocabulary
- Assume and conduct a role in the smooth running of a team working toward solving a problem
- Assemble a quantitative plan for completing the project
- Assume responsibility for becoming a leader and taking responsibility for actions, decisions, products and policies in governing a project
- Evaluate the need for and costs of resources necessary for completing a project

Sketching

- Create sketches using basic shapes such as lines, circles and ellipses
- Communicate ideas to a group by using sketches and other documentation
- Apply isometric and orthographic sketches to add clarity to design
- Create sketches to communicate basic ideas during the design process

3D solid modeling/fabrication and printing

- Apply geometric relationships between lines and shapes to create a mathematical database to describe design ideas
- Create solid models using concepts of parametric modeling
- Analyze models for determining appropriate engineering design features
- Develop strategies for creating solid models to develop design solutions
- Apply the concepts of digital prototyping to accelerate the time between ideation and completed project

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- Access, generate, process and transfer information using appropriate technologies
- Design and create a model using additive manufacturing (AM) technology sometimes called a rapid prototyping system
- Apply new principles of more rapid and less costly development and deployment of new materials
- Use rapid prototyping/additive manufacturing to create complex parts designed in NX X Essentials software, which is part of the Siemens Xcelerator business platform of software, hardware and services

Renderings, working drawings and design presentations

- Create renderings to communicate design ideas and engineering principles to the general public
- Generate an image from a model using light, texture and shading to propose product appearance
- Apply rendering techniques to create presentations of design for a nontechnical audience

Assembly modeling, documentation, exploded assemblies and BOMS

- Conduct model documentation as the process for recording details such as size, material composition and instructions for assembling, installing and servicing, analyzing and developing the process that describes a model for communicating ideas
- Create a bill-of-materials (BOM) to communicate materials and other information about a design

Reverse engineering and engineering features

- Apply the principles of design for manufacturing, enabling the efficient and effective production of products
- Apply the green principles of design for eventual disassembly and resource recovery
- Investigate activities that a business conducts to make a discovery that can either lead to developing new products or procedures, or to improve existing products or procedures, and to know the new approaches to rapid development and deployment that saves time and is more efficient
- Disassemble a product into its parts, use precision measurement to create sketches, drawings and models of the product and identify the basic processes, systems, designs and materials used in the manufacture of the product

Simple machines

- Use mathematical analysis, scientific inquiry and engineering design to develop solutions to open-ended problems
- Access, generate, process and transfer information using the right technologies
- Apply the design process to a mechanical system
- Read and analyze detailed descriptions of machinery and provide a concise summary for documentation purposes
- Assign mathematical relationships to analyze mechanical advantages
- Apply problem-solving methodology in creating unique solutions to mechanical motion problems
- Assign mathematical relationships to analyze mechanical advantage

Mechanical systems

- Use mathematical analysis, scientific inquiry and engineering design to develop solutions to open-ended problems
- Access, generate, process and transfer information using appropriate technologies
- Apply the design process to create a mechanical system
- Read and analyze detailed descriptions of machinery and provide a concise summary for documentation purposes
- Assign mathematical relationships to schematics to apply forces
- Apply problem-solving methodology in creating unique solutions to mechanical motion problems
- Design a system of elements that manage power to accomplish a task that involves defined movement

Structures and forces

- Create models that are mathematical or physical systems set up to obey certain specified conditions that are used to understand study or evaluate a design or system
- Conduct model analysis using finite element analysis (FEA) and simulations as a detailed examination of the elements, structure or behavior of a physical system under certain conditions
- Assign mathematical relationships to schematics to apply forces
- Conduct a systematic study of the relationship of the material, members and the construction of the structure when loaded to determine the resulting deflections and forces
- Apply knowledge of stress to the design of a problem solution
- Analyze strength of materials to predict behavior of solid bodies subjected to various types of loading to determine the stresses, strains and displacements caused by the loading
- Predict loads exerted on a product, machine or structure during any foreseeable use to determine safety
- Analyze complex structures by breaking them down into components
- Test scale models to verify the strength predictions made based on mathematical models

Engineering systems

- Use mathematical analysis, scientific inquiry and engineering design to develop solutions to open-ended problems
- Select and defend a material for use in a product, explaining material properties and characterization based on manufacturing processes, chemical composition, internal defects, temperature, previous loading, dimensions and other factors

Career awareness and development

- Analyze the educational requirements, skills and abilities required for professionals in the referenced career fields
- Research the job outlook, demand for new employees and salary ranges for the referenced careers

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For additional numbers, click here.

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