

NFC ACADEMY



COURSE OVERVIEW

Engineering and Design is part of the STEM (Science, Technology, Engineering, and Mathematics) education and career path. By building real-world problem-solving and critical-thinking skills, students learn how to innovate and design new products and improve existing products. Students are introduced to the engineering design process to build new products and to the reverse engineering process, which enables engineers to adjust any existing product.

Parallels and analogies from Scriptural examples will firmly seat the course in Bible truth, since God is the master engineer, designer, and creator of everything. Popular topics and issues that are politically controversial will be explored from a Biblical perspective.

A second and equally important emphasis will address how fluid power is used by engineers to make difficult maneuvers easier, increasing efficiency and minimizing effects on the environment. Students will then identify how engineering and design have a direct impact on environmental sustainability and economic greening, with Bible principles incorporated when appropriate. Finally, students will incorporate the engineering design process, environmental life cycle, and green engineering principles to create a decision matrix to learn how to solve environmental issues, while identifying how following God's original principles would have avoided producing those issues in the first place.

OBJECTIVES

- Understand the basic STEM requirements of engineers and the skills required for the occupation.

- Define and understand how forces are transmitted with fluid systems to build efficiency and increase sustainability. With this knowledge, students can solve a problem with a new design solution using fluid power.
- Utilize sketching skills and techniques to produce detailed sketches of components in the design of a real-world object to scale. This allows students to determine the feasibility of a product or design.
- Use the engineering design process and reverse engineering techniques and apply them to a design. They will be able to create and use decision matrices to make design decisions based on logic and analysis. Students will be able to identify and research environmental issues and challenges with respect to energy and air quality.
- Identify and analyze the environmental life cycle of a product or process to solve sustainability challenges for social and industrial environmental issues.

Engineering and Design Course Requirements

It is helpful if students are familiar with renewable and nonrenewable resources.

Many of the principles discussed in this course can be better addressed through the use of broken machines, toys, and electronics. Collection of these materials prior to the course will greatly help the student in the course.

Engineering and Design Course Outline

Unit 1: Introduction to Engineering and Design and the Design Process

- Chapter 1: Introduction to Design Opportunities
 - Design Opportunities All Around Us
 - Design Improvements
 - Improvements of Everyday Items
 - Project: Creating a Product Discussion Forum
 - Project: Model or Prototype Suggestion Presentation
- Chapter 2: Fundamentals of Engineering
 - Basic Engineering Concepts

- Choosing Materials for Design
- Application of Materials
- Project: Researching Materials Designs
- Project: Designing a Destructive Test

Unit 2: Fluid Systems: Energy and Power Technologies in Engineering

- Chapter 1: Introduction to Fluid Power
 - Fluid Power Systems
 - Fluid Power Devices
 - Designing Fluid Power Systems for Future Developments
 - Project: Researching a Fluid Power System Goal
 - Project: Creating a Fluid Power System for the Future
- Chapter 2: Fluid Power Applications and Capabilities
 - Common Applications for Fluid Power Systems
 - Efficient Fluid Power Designs
 - Designing a Fluid Power Lifting System
 - Project: Identifying Fluid Power in Daily Life
 - Project: Designing a Fluid Power Lift System

Unit 3: Modeling and Sketching

- Chapter 1: Introduction to Design and Technical Sketches
 - Introduction to Technical Sketching and Drawing
 - Geometric Shapes and Solids in Engineering
 - Drawing to Scale
 - Project: Interview an Engineer About Sketching
 - Project: Creating a Technical Sketch of an Everyday Object to Scale
- Chapter 2: Sketch Modeling
 - The Applications for Modeling in Engineering
 - Modeling and Prototypes
 - Designing a Sketch Model
 - Project: Researching Model Uses in Remote or Dangerous Locations
 - Project: Presenting a Sketch Model of a Designed Pet Toy

Unit 4: Reverse Engineering

- Chapter 1: Introduction to Reverse Engineering
 - Reverse Engineering: Visual Analysis
 - Reverse Engineering: Functional Analysis
 - Reverse Engineering: Structural Analysis
 - Project: Creating a Function Structure Diagram or Product Teardown Chart
 - Project: Creating a Morphological Matrix
- Chapter 2: Using Reverse Engineering for Product Improvement
 - Finding the Product: The Reverse Engineering and Design Process Applied
 - Implementing the Procedure: Reverse Engineering a Product
 - Calculating the Process: Materials, Time, and Cost for Improvement
 - Project: Reverse Engineering Documentation and Presentation
 - Project: Researching Materials, Time, and Cost for Product Modifications

Unit 5: Engineering to Improve Sustainability

- Chapter 1: Introduction to Environmental Engineering
 - Environmental Engineering Introduction
 - Energy and Air Quality
 - Green Buildings and Green Initiatives
 - Project: Researching a Local Sustainability Issue
 - Project: LEED Ratings for Building Construction
- Chapter 2: Environmental Life Cycle and Green Engineering Design
 - Environmental Assessment and Impacts
 - Green Design Principles: Systems and Environment
 - Incorporating Green Engineering Principles
 - Project: Researching Life Cycles for Assessment
 - Project: Creating a Decision Matrix for an Environmental Issue

GRADING INFORMATION

GRADING COMPONENTS

Lessons	35%
Quizzes	25%
Projects	10%
Tests	30%

GRADING SCALE

100-90	A
89-80	B
79-70	C
69-60	D
Below 60	F