



Military Engineering 5-6 Syllabus

Course Goals

1 Physics Concepts and Applications

Students learn the basics of physics, including Newton's laws and projectile motion. They will apply this knowledge through the construction of miniature catapult structures and subsequent analysis of their functions.

2 History of Engineering Design

Students learn about the progression of military and ballistics technology starting in the ancient era up until the end of the Middle Ages. Students will identify the context that these engineering breakthroughs arose from, and recognize the evolution of this technology as part of the engineering design process.

3 Design, Fabrication, and Testing

Students work in small teams to build and test their projects, including identifying issues and troubleshooting as they arise. Students will demonstrate their understanding of this process through the design, prototyping, testing, and execution of an original catapult design.

Course Topics

1 Ancient Era Siege Weapons

1.1 Brief History of Siege Warfare

1.2 Basic Physics

2 The Birth of Siege Warfare

2.1 Ancient Greece

2.2 Projectile Motion

3 Viking Siege!

3.1 History of the Vikings

3.2 Building with Triangles

4 Alexander the Great and Torsion Catapults

4.1 The Conquests of Alexander the Great

4.2 The Torsion Spring and Lithobolos

5 The Romans

6 Julius Caesar

7 The Crusades

8 The Middle Ages

9 Castle Siege

Course Schedule

Day 1

Introduction and Ice Breaker

Students learn about the course, their instructor, and each other. In addition, classroom and safety rules will be established.

Brief History of Siege Warfare

Students learn about the basics of siege warfare, as well as be introduced to the timeline of siege history.

Introductory Physics

Students are introduced to the concepts of acceleration, projectile motion, force, and mass.

Introduction to the Engineering Design Process

Students are introduced to engineering and the steps of the engineering design process.

Project: Spring Engine

Students construct a "Spring Engine," one of the earliest and simplest siege weapons.

Day 2

Ancient Greek History and Culture

Students learn about the different forms of government in ancient Greece, as well as how the Greeks developed siege engines and siege warfare.

Projectile Motion

Students learn an overview of projectile motion.

Physics of Crossbows

Students learn the mechanics and physics of bows and crossbows, including the engineering behind crossbows, advantages and disadvantages of crossbows, potential energy, elastic potential energy, kinetic energy, and tension.

Project: Gastraphetes

Students reinforce their lessons on projectile motion and the physics of crossbows through the construction of a crossbow to simulate "Gastraphetes," an ancient Greek siege weapon.

Day 3**Viking Culture**

Students learn about Viking technology, as well as the history of Viking culture, including raids and sieges. Students analyze Viking culture and contrast Viking warfare with that of the mainland Europeans.

Building with Triangles

Students learn about the importance of triangles in engineering and architectural designs and identify triangles in structures that are familiar to them. Students then apply this information to their own engineering design.

Project: Viking Catapult

Students put their lessons on Viking warfare and the strength of triangles into practice by constructing and utilizing a Viking catapult.

Day 4**Alexander the Great: History and Engineering**

Students learn about the history of Alexander the Great, his contributions to military technology, and engineering developments still in use today. Students identify the inventions and engineering leaps made during his time.

Project: Slingshot

Students construct a "Lithobolos"-style slingshot in recreation of the catapults designed by Alexander the Great's core of engineers.

Day 5**Roman Army and Catapults**

Students engage with Roman history and engineering and learn the basics of Roman military and siege strategy.

Project: Ballista

Students learn about the engineering behind the ballista and apply this knowledge to building their own miniature version of the siege weapon.

Day 6**Julius Caesar - Conqueror of Gaul**

Students see the topics covered in the previous day's lessons in action and analyze Caesar's conquest of Gaul from an engineering perspective.

Forces

Students learn about forces in the context of Newton's Laws, as well as the concepts of compression, tension, torque, centripetal force, friction, and gravity. Students apply this knowledge by analyzing the trajectories of different objects when shot by a replica onager and recognize the torsion mechanics of an onager.

Project: Onager

Students construct an onager.

Day 7

The Crusades

Students learn about the battles of Jerusalem in the Crusades, the military endeavors involved in the Crusades, and the military machines developed as Europe emerged from the Dark Ages.

Project: Perriere

Students construct a replica of the perriere, a Middle Ages-era siege weapon.

Day 8

Medieval Life

Students learn about the Middle Ages, the concepts of chivalry, medieval castles, and the military technology developed during this time.

Project: Popsicle Stick Catapult

Students construct a lever-based catapult that is a combination between a torsion and gravity catapult.

Day 9

Project: Trebuchet

Students construct a trebuchet in order to understand these middle age technologies.

Final Project – Design a Catapult

Students design their own catapult according to a list of specifications given to them by the instructor. They design, prototype, test, and iterate on the design, before competing against each other for the catapult that flies the furthest.

Day 10

Final Project – Design a Catapult

Students design their own catapult according to a list of specifications given to them by the instructor. They design, prototype, test, and iterate on the design, before competing against each other for the catapult that flies the furthest.

Competition

Students demonstrate their final project.

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Updated on 1/13/2021