Engineering Capstone Overview

Content Area: **Engineering**
Course(s): **ENGINEERING CAPSTONE H**
Time Period:
Length: **90 Days**
Status: **Published**

Cover

EAST BRUNSWICK PUBLIC SCHOOLS

East Brunswick New Jersey

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Course Adoption: 10/18/2012

Curriculum Adoption: 10/18/2012

Date of Last Revision Adoption: 9/1/2017

Course Overview

COURSE DESCRIPTION

Engineering Capstone Honors is our highest level pre-engineering course offered for those students who want to tackle a real-world engineering challenge. Students in this course will work in a team to develop a large scale engineering project using the skills taught in the prerequisite lower level courses. Potential projects could involve exploration of augmented reality, autonomous vehicles, remotely operated underwater/in air vehicles, national engineering competitions, or any other student inspired topic. Projects will be selected prior to enrollment by collaboration with the instructor. As what happens in the professional environment, students will be expected to be part of an engineering team that may include experts in the profession to complete the project they have developed. See the chart below for prerequisites.

COURSE SCOPE AND SEQUENCE

Sequential Unit Description	Other Pacing Guide	Proficiency (Summative) Assessments
Unit 1- The Problem • Initial design brief	3 Days	• Engineering Notebook
Unit 2- Research & Design • Constraints/Purpose • Functionality • Materials • Solutions	5 Days	• Engineering Notebook
Unit 3- Presentation of Proposals • Choosing the best solution to individual design components	5 Days	• Proposal Presentation
Unit 4- Integration of Design Components and Final Proposal • Researching conflicts in design	10 Days	• Final Design
Unit 5- Prototyping • Continued research • Fabrication • Assembly	60 Days	• Engineering Notebook o Checkpoints

Unit 6- Testing, Evaluation & Debriefing • Evaluating final prototype	7 Days	• Testing Rubric • Debrief Report

CONTENT FOCUS AREA AND COURSE NAME

Course Name: Engineering Capstone Honors

Course Number	School Numbers	Course Level	Grades(s)	Credits	Min. Per Week	Elective/Required	Initial Course Adopted
1316	050	H	11-12	2.50	210	E	05/06/2013

Textbooks and Other Resources

COURSE RESOURCES

- Computer Aided Drafting (CAD) software
- Research Databases
- Internet
- Hand tools
- Power tools
- Electronic components
- Mechanical components
- Various fasteners

Standards

TECH.8.2.12.A.1	Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
TECH.8.2.12.A.2	Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
TECH.8.2.12.A.3	Research and present information on an existing technological product that has been

	repurposed for a different function.
TECH.8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.
TECH.8.2.12.B.2	Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.
TECH.8.2.12.B.3	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
TECH.8.2.12.B.4	Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
TECH.8.2.12.B.5	Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.
TECH.8.2.12.C.1	Explain how open source technologies follow the design process.
TECH.8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
TECH.8.2.12.C.3	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
TECH.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
TECH.8.2.12.D.2	Write a feasibility study of a product to include: economic, market, technical, financial, and management factors, and provide recommendations for implementation.
TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
TECH.8.2.12.D.4	Assess the impacts of emerging technologies on developing countries.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.D.6	Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
TECH.8.2.12.E.2	Analyze the relationships between internal and external computer components.
TECH.8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

Grading and Evaluation Guidelines

GRADING PROCEDURES

In terms of proficiency level the East Brunswick grades equate to:

A Excellent - Advanced Proficient

B Good Above Average - Proficient

C Fair - Proficient

D Poor - Minimally proficient

F Failing - Partially Proficient

COURSE EVALUATION

Each quarter students will be evaluated with tests and programming assignments using a total point basis to determine the quarter average. The semester/course average will be a weighted average of the 2 quarter averages (40% each) and a final exam (20%); in a full year course, each quarter is worth 20% of a student's final grade and each exam (midterm & final) is worth 10% of the student's final grade.

Course achievement will be evaluated based on the percent of all pupils who achieve the minimum level of proficiency (final average grade) in the course. Student achievement levels above minimum proficiency will also be reported. Final grades, and where relevant mid-term and final exams, will be analyzed by staff for the total cohort and for sub-groups of students to determine course areas requiring greater support or modification.)

The following evaluation procedures will be employed to determine student performance:

Engineering Notebook- 60%

Presentations- 15%

Final Design/Prototype- 25%

Other Details

21007 Engineering Design and Development

Engineering Design and Development courses provide students with the opportunity to apply engineering research principles as they design and construct a solution to an engineering problem. Students typically develop and test solutions using computer simulations or models but eventually create a working prototype as part of the design solution.