STEM II Overview

Content Area: **Engineering**
Course(s): **EXPLOR STEM CONCEPTS**
Time Period:
Length: **90 Days**
Status: **Published**

Cover

EAST BRUNSWICK PUBLIC SCHOOLS

East Brunswick New Jersey

Superintendent of Schools

Dr. Victor P. Valeski

BOARD OF EDUCATION

Todd Simmens, President

Vicki Becker, Vice President

Susanna Chiu

Robert Cancro

Liwu Hong

Laurie Lachs

Barbara Reiss

Chad Seyler

Meredith Shaw

Course Adoption: 2/10/1989

Curriculum Adoption: 2/10/1989

Date of Last Revision Adoption: 9/1/2017

Course Overview

COURSE DESCRIPTION

Are you interested in a fun, practical, hands-on course dealing with the technologies found in our world today? This course is designed to appeal to both males and females and will allow them to design and create solutions to various problems. This course will introduce students to the process of critical thinking as it relates to the technologies of today. The course will emphasize the application of knowledge, tools and skills to solve practical problems. Students will be responsible for properly using the design loop to solve problems they encounter; and through this process, they will have a better understanding of how materials, manufacturing, design, electronic communications, robotics, and transportation systems take their place in our world. A strong emphasis will be placed on group dynamics and cooperation in problem solving and will require the students to critically evaluate a problem they might find in today's society and by working with others, find an acceptable solution (Technology and the Design Process).

COURSE SCOPE AND SEQUENCE

-

Sequential Unit Description	Marking Period Guide	Proficiency (Summative) Assessments
UNIT 1A - Introduction to the Design Process		Folder TLA
• Course Overview		Submitted classwork
• Expectations/Procedures		Design Process Quiz
• Design Process	1	Do Nows
• Definition of Technology		TLA Part 1 Assessment
• Folder TLA		TLA Part 2 Assessment
		Do Nows
UNIT 1B – Spaghetti Tower TLA		
• Spaghetti Tower TLA		
• Use the design process		Do Nows
• Research		TLA Part 1 Assessment
• Brainstorm ideas	1	TLA Part 2 Assessment
• Design Thumbnail sketches		Spaghetti Tower TLA
• Develop a final plan for the problem statement.		
• Assess the need for modifications		

- Evaluate performance

- Formulate documentation for all stages of project.

UNIT 2 - Shoe Design TLA

- Prismatic Shoe TLA

- Create a shoe design

- Prismatic cells and shoe design.

- Test shoes

- Use the design process

- Research

- Brainstorm ideas

- Design Thumbnail sketches

- Develop a final plan for the problem statement.

- Assess the need for modifications

- Evaluate performance

- Formulate documentation for all stages of project.

1

Do Nows

TLA Part 1 Assessment

TLA Part 2 Assessment

Shoe Testing/Assessment

UNIT 3 – Wind Turbine TLA

- Wind Turbine TLA

- How turbines work

- Determine the optimum blade length, size, and style

- Design and construct a own set of wind turbine blades

- Research

- Brainstorm ideas

- Design Thumbnail sketches

- Develop a final plan for the problem

1

Do Nows

TLA Part 1 Assessment

TLA Part 2 Assessment

Turbine Testing/Assessment

statement.

- Assess the need for modifications

- Evaluate performance

- Formulate documentation for all stages of project.

UNIT 4- Mousetrap Vehicle TLA

- Mousetrap Vehicle TLA

- Machine Safety

- Vehicles and Motion principles.

- Safety Demonstration

- Safely operate class machinery

- Formulate a unique mousetrap vehicle design.

- Use the design process

2

- Research

- Brainstorm ideas

- Design Thumbnail sketches

- Develop a final plan for the problem statement.

- Assess the need for modifications

- Evaluate performance

- Formulate documentation for all stages of project.

Do Nows

Machine Safety Quiz

Automobile/Vehicle Terminology Quiz

TLA Part 1 Assessment

TLA Part 2 Assessment

Mousetrap Vehicle Testing/Assessment

UNIT 5 – Lego Minstorms (ROBOTS)

- Lego Mindstorm Robot TLA

- Identify the needed Lego pieces to follow directions to build a base robot.

2

- Choose the correct icons to design a program to move their robot.

Do Nows

Robot Challenge Rubric 1

Robot Challenge Rubric 2

- Restructure their base robot to include sensors that are integrated into the robot design.

- Explain their robot program and defend the choices they have made.

- Critique their program and apply necessary changes.

- Work collaboratively to assess other student's programs and recommend modifications.

UNIT 6 – Crash Test Vehicle TLA

- Crash Test Vehicle TLA

- Safety constraints and how they work.

- Materials and shapes and vehicle design.

- Safety demonstration

- Formulate a unique crash test vehicle design

- Use the design process

- Research

- Brainstorm ideas

- Design Thumbnail sketches

- Develop a final plan for the problem statement.

- Assess the need for modifications

- Evaluate performance

- Formulate documentation for all stages of project.

2

Do Nows

TLA Part 1 Assessment

TLA Part 2 Assessment

Crash Test Vehicle Testing/Assessment

UNIT 7 – Solar Vehicle TLA

- Solar Vehicle TLA

- Vocabulary related to solar energy and SPV

- Construct their SPV using the supplies provided

- Use the design process

- Research

- Brainstorm ideas

- Design Thumbnail sketches

- Develop a final plan for the problem statement.

- Assess the need for modifications

- Evaluate performance

- Formulate documentation for all stages of project.

Do Nows

Solar Energy Terminology Quiz

TLA Part 1 Assessment

TLA Part 2 Assessment

Solar Vehicle Testing/Assessment

CONTENT FOCUS AREA AND COURSE NAME

Course Name: Exploring Technological Concepts, #2340

Course Number	School Numbers	Course Level	Grade(s)	Credits	Min. Per Week	Elective/Required	Initial Course Adopted
2340	55	S	8-9	2.50	210	E	04/21/86

Textbooks and Other Resources
Web Sites

http://staffweb.peoriaud.k12.az.us.davidhill/chrpg.html

Teacher created handouts

Safety and Instructional Videos

Standards

LA.RH.9-10.2	Determine the theme, central ideas, key information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.
LA.RH.9-10.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history and the social sciences; analyze the cumulative impact of specific word choices on meaning and tone.
LA.RH.9-10.5	Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
LA.RH.9-10.10	By the end of grade 10, read and comprehend history/social studies texts in the grades 9-10 text complexity band independently and proficiently.
LA.RST.9-10.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LA.RST.9-10.8	Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
LA.RST.9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
LA.RST.9-10.10	By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

12.9.3.ST.1	Apply engineering skills in a project that requires project management, process control and quality assurance.
12.9.3.ST.2	Use technology to acquire, manipulate, analyze and report data.
12.9.3.IT-PRG.4	Demonstrate the effective use of software development tools to develop software applications.
12.9.3.IT-PRG.6	Program a computer application using the appropriate programming language.
12.9.3.IT-WD.3	Write product specifications that define the scope of work aligned to customer requirements.
12.9.3.IT-WD.4	Demonstrate the effective use of tools for digital communication production, development and project management.
12.9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
12.9.3.ST-ET.2	Display and communicate STEM information.
12.9.3.ST-ET.3	Apply processes and concepts for the use of technological tools in STEM.
12.9.3.ST-ET.4	Apply the elements of the design process.
12.9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
12.9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.2	Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.D.1	Understand and model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics including appropriate use of social media.
TECH.8.1.8.D.2	Demonstrate the application of appropriate citations to digital content.
TECH.8.1.8.D.3	Demonstrate an understanding of fair use and Creative Commons to intellectual property.
TECH.8.1.12.A.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
TECH.8.1.12.C.CS3	Develop cultural understanding and global awareness by engaging with learners of other cultures.
TECH.8.1.12.D.5	Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.
TECH.8.2.8.A.1	Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e., telephone for communication - smart phone for mobility needs).
TECH.8.2.8.A.2	Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.
TECH.8.2.8.A.4	Redesign an existing product that impacts the environment to lessen its impact(s) on the

TECH.8.2.8.B.2	Identify the desired and undesired consequences from the use of a product or system.
TECH.8.2.8.C.2	Explain the need for optimization in a design process.
TECH.8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
TECH.8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
TECH.8.2.8.C.5a	Explain the interdependence of a subsystem that operates as part of a system.
TECH.8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
TECH.8.2.8.D.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
TECH.8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
TECH.8.2.8.E.3	Develop an algorithm to solve an assigned problem using a specified set of commands and use peer review to critique the solution.
TECH.8.2.8.E.4	Use appropriate terms in conversation (e.g., programming, language, data, RAM, ROM, Boolean logic terms).
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.C.1	Explain how open source technologies follow the design process.
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.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
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.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).

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

The final course proficiency grade will be based on students' performance throughout the course based on the identified New Jersey Learning Standards for career and technical education and consumer, family and life skills (CPI's up to and including grade twelve). Students' individual grades will be based on performance on the Units of Instruction.

COURSE EVALUATION

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.

Grading – Grading is based on rubrics that are given to students at the onset of the projects. All work/projects are weighted the same and based on 100 points.

- Projects (TLAs) 55%

- Do Nows 15%

- Participation 15%

- Classwork/Quizzes15%

The goal of this course is for a minimum of 95% of the total number of enrolled students to attain at least the minimum proficiency level.

Other Details

71051 Technological Literacy

Technological Literacy courses expose students to the communication, transportation, energy, production, biotechnology, and integrated technology systems and processes that affect their lives. The study of these processes enables students to better understand technological systems and their applications and uses.