ENGINEERING DESIGN - ROBOTICS I

LENGTH OF TIME: meets daily for one semester

GRADE LEVEL: 10-12

COURSE STANDARDS:
Students will:

1. Demonstrate an understanding of the tasks involved in technical product development. (PA Academic Std 3.1a, 3.2d, 3.6b-c, 3.7a-c; Natl. Standards 1-11,13,16-20)

432036368. Continue to refine the problem solving procedure developed in Engineering Design I and II, the Systems Approach to problem solving. (PA Academic Std 3.1a-b, 3.2d, 3.6b-c, 3.7a-c; Natl. Standards 1-11,13,16-20)

432036480. Create a well-organized Design Brief that communicates to the reader the entire design process used to define and develop a solution. (PA Academic Std 3.1a, 3.2d, 3.7a-c; Natl. Standards 1-11,13,16-20)

432014024. Orally and visually communicate to a group the design-build process, through the development of a multimedia presentation. (PA Academic Std 3.1a, 3.2d, 3.6b-c, 3.7a-c; Natl. Standards 1-11,13,16-20)

432014025. Design, build and test a working prototype that incorporates mechanical, electrical and robotic systems that will compete in a competition. (PA Academic Std 3.1a, 3.2d, 3.4c, 3.6b-c, 3.7a-c; Natl. Standards 1-11,13,16-20)

432012680. Gain an understanding of the role of technology in society including the technical aspects, the environment leading to its development and the technology's economic, social and environmental impact on society. (PA Academic Std 3.8a-c; Natl. Standards 1-11,13-20)

432013184. Develop an understanding of the need for personal and group time-management through the development of efficient and productive work habits. (PA Academic Std 3.1a, 3.2d, 3.6b, 3.7a; Natl. Standards 1-11,13,16-20)

432013240. Access, interpret, organize and analyze information using a variety of sources including computer search software, on-line information databases and other members of society. (PA Academic Std 3.1a, 3.2d, 3.6b, 3.7a-c; Natl. Standards 1-11,13,16-20)

432012288. Demonstrate that they can work effectively with others and will work effectively with others through the development of productive interpersonal skills. (PA Academic Std 3.8a-c; Natl. Standards 1-11,13,16-20)

432012792. Develop an understanding regarding the various careers associated with the development of electrical, mechanical and robotic technology and investigate individual career opportunities based on specific personal interests. (PA Academic Std 3.8a-c; Natl. Standards 1-11,13-20)

432013352. Use computer spreadsheet, word-processing, presentation software and computer aided design software packages in the solving of the problem. (PA Academic Std 3.1a, 3.2d, 3.6a, 3.7a-c; Natl. Standards 1-11,13,16-20)

RELATED PA ACADEMIC STANDARDS FOR SCIENCE AND TECHNOLOGY

3.1 Unifying Themes
- A. Systems
- B. Models

3.2 Inquiry and Design
- D. Problem Solving in Technology

3.4 Physical Science, Chemistry and Physics
- C. Forces and Motion

3.6 Technology Education
- A. Biotechnology
- B. Information Technology
- C. Physical Technologies

3.7 Technological Devices
- A. Tools
- B. Instruments
- C. Computer Operations

3.8 Science, Technology and Human Endeavors
- A. Constraints
- B. Meeting Human Needs
- C. Consequences and Impacts

NATIONAL TECHNOLOGY STANDARDS

The students will develop an understanding of:

1. The Characteristics and Scope of Technology.
2. The Core Concepts of Technology.
3. The Relationships among Technologies and the connections between technology and other fields.
4. The cultural, social, economic, and political effects of technology.
5. The effects of technology on the environment.
6. The role of society in the development of and use of technology.
7. The influence of technology on history.
8. The Attributes of design.
9. Engineering Design.
10. The role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11. Apply the design process.
12. Use and maintain technological products and systems.
13. Assessing the impact of products and systems.
14. Medical technologies.
15. Agricultural and relate Biotechnologies.
16. Energy and Power Technologies.
17. Information and Communication Technologies.

18. Transportation Technologies.
19. Manufacturing Technologies.
20. Construction Technologies.

PERFORMANCE ASSESSMENTS:

Students will demonstrate achievement of the standards by:

1. Designing and analyzing solutions to technical problems. (Course Standard 1)

432013296. Creating solutions to the engineering problem using the systems approach. The systems approach will be documented in the design brief through the use of graphic diagrams (Course Standard 2)

432012344. Creating, organizing, and submitting a design brief that justifies the steps taken in solving the engineering problem. The design brief will utilize professional publishing techniques such as digital images, CAD drawings and graphs. (Standard 3)

432013688. Creating and presenting the information as it appears in the design brief. The presentation will be created using power point and incorporate digital images, scanned images, music and other visuals. (Course Standard 4)

432013744. Designing, building, testing and competing with a prototype that has mechanical, electrical and robotic systems located within the overall design. (Course Standard5)

432012512. Researching products and designs that incorporate similar technologies in their overall design solutions. (Course Standard 6)

432013408. Designing and creating individual and group task lists that have time factors imbedded in the final product. These will appear in the form of a calendar using MS Pub. (Course Standard 7)

432013800. Designing and creating an evaluation/testing procedure that serves as a data collection sheet. Information will be gathered from personal observations, data, online resources, and professionals. (Course Standard 8)

432012904. Working collaborately with their partner in the development of the solution to the problem that will lead to the creation of a satisfactory design brief, working prototype and presentation. (Course Standard 9)

432012848. Researching careers that are associated with their design solutions. These careers will be documented in the design brief. (Course Standard 10)

432012849. Creating the design brief and presentation using these software packages: Word, Excel, Power point, Publisher, Inventor, AutoCad, and Solidworks. (Course Standard 11)

DESCRIPTION OF COURSE:

In previous Engineering Design courses, the instructor defined all of the tasks associated with problem clarification/understanding, brainstorming, concept testing and refinement, prototype definition, material choice, prototype construction, prototype testing, data collection and interpretation, product refinement, documentation and presentation. This course challenges the student to recall this process and define for themselves the tasks necessary to successfully define, develop, test and present a working prototype . In the preceding Engineering Design courses students were introduced to mechanical and electrical systems. They will be introduced to robotic systems that will also incorporate

the programming language pbasic. The end of the course culminating activity will be a competition that will pit each team against each other.
Communication, whether written or through oral presentation, is highly stressed with the students. All students are encouraged to research, gain and identify key information resources whether the source is other students, outside libraries, local businesses, adult community members, or Internet resources. Through their design brief, students can then site these resources in substantiating the decisions made and the actions taken.

TITLES OF UNITS:

1. Review Group Dynamics & the Problem Solving Procedure .5 Week
432013464. Exploration of Individual Career Interests/Goals .5 Week
432013465. Design Brief .5 Week
432013466. Mechanical Systems 1 Week
432013467. Electrical Systems 1 Week
432013468. Robotic Systems 1 Week
432013469. Manufacturing 1 Week
432013470. Evalution/Testing .5 Week
432013856. Design Project 11 Weeks
10. Presentation 1 Week

SAMPLE INSTRUCTIONAL STRATEGIES:

1. Problem Solving/Brainstorming
2. Cooperative Learning/Team Building Strategies
3. Research Skills
4. Writing Skills

432014864. Presentation Skills
432014865. Hands on Activities in Manufacturing, electronics, and Robotics
432014866. Modeling
432014867. Organizing Data

MATERIALS:

432015200. Innovation First Control Systems
432015201. Parallax Inc. (Pbasic Program)
432015202. Computer Lab
432015203. Manufacturing Lab
432015204. Instructor Created materials
432015205. MS Office l

432015206. Solidworks
432015207. Inventor 5.0
432015208. AutoCad
432015209. Scanner
432015210. Digital Cameras
432014640. Industry specific publications.

METHODS OF ASSISTANCE AND ENRICHMENT:
1. Lutron Electronics
2. Amplifier Research
3. BAE Systems
4. Custom Finishers
5. FIRST Robotics Organization

All of these companies provide mentoring opportunities for both the student and the instructor.

PORTFOLIO DEVELOPMENT:
Design Briefs demonstrating technical problem solving through technical concept analysis, the use of computer word processing, spreadsheet and drawing packages, organization, time management and writing communication skills are an outcome of the Engineering Design curriculum and a strong portfolio entry. The design brief addresses specific research skills as well as higher order thinking skills through the information gathering, synthesis and dissemination process.

METHODS OF EVALUATION:
1. Design Brief – rubric
2. Prototype – rubric
3. Presentation - rubric

INTEGRATED ACTIVITIES:
1. Concept

Robotic systems integration with electronics and mechanical systems.
Transferring information from disciplines such as geometry to computer aided design.

432015256. Communications
Computer Aided Design
Brochures
Design Brief
Presentations
Research

432015312. Thinking/Problem Solving
Solving problems using the systems approach.
Analyzing Data to create and refine solutions.
Brainstorming solutions

432015032. Application of Knowledge
Creation of the design brief
Creation of a working prototype
Programming integration in the control system
Editing prior work
Construction of three-dimensional models

432015648. Interpersonal Skills
Working with another student on a design project.
Demonstrate skills of communication with other groups