

**ENGINEERING & DESIGN TECHNOLOGY III/IV
APRIL 2004
COURSE NUMBER 773**

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Name of Course: Engineering Design Technology III/IV
Level of Course: Honors
Prerequisites: Engineering Design Technology I & II
Grades Levels Offered to: 11 through 12
Course Number: 773
Number of Credits: 5
Revised Date and Teachers Names: Mr. Brian J. Drelick (May 2004)

Purpose:

This third and culminating level Engineering Design Technology course which will continue to provide our students with the hands on practical knowledge of how the various types of physical technologies relate to the technological society in which we live. The course will continue to emphasize the expanding need for understanding and applying the principles of structural, robotic, mechanical, fluid power, electronic, and control systems as they relate to the identification of real world needs and development of practical solutions. Furthermore, students will continue to expand on their communication, teamwork, presentation, craftsmanship, and professional skills as they approach the conclusion of their high school career.

This course concentrates on student involvement in several state and national competitions. The emphasis will continue to be on hands on, problem solving activities in which students work together in lab activities designed to reinforce the content presented and compete against other schools. The demands of these two competitions will properly serve as challenging culmination activities for these students while concurrently presenting them with the opportunity to showcase their design and communication skills amongst peers from around the state.

General Objectives:

At the conclusion of this course, the students will be able to:

1. Apply technological principles as they relate to real world applications.
2. Identify the changes in technological systems over a three year period.
3. List, describe, and implement the steps in the design process.
4. Apply the design process in order to professionally document progress.
5. Utilize a variety of different forms of presentation techniques.
6. Utilize a variety of research techniques in order to justify all possible solutions to a presented problem.
7. Apply their knowledge and understanding of structural systems in order to develop and craft functional prototypes.
8. Apply their knowledge and understanding of robotic systems to meet specified goals.
9. Apply their knowledge of electrical systems to control prototypes and perform specific functions.
10. Present the details, drawings, possible solutions, and rationales of designed products to a professional panel of judges.
11. Participate in state competitions that promote active technological literacy.
12. Develop an integrated time management plan in order to meet goals and expectations.
13. Present ideas using multiple forms of Educational Technology.
14. Identify the parts and systems which comprise radio controlled transportation.

Measurement of success in meeting these general objectives will be carried out through the following methods of assessment:

| | |
|---------------------|------------------------------------|
| Classwork/Homework | Objectives 4, 10, 13 |
| Quizzes | Objectives 1, 2, 11, 19, 21 |
| Tests | Objectives 6, 8, 9, 12, 14, 18, 23 |
| Projects/Labs | Objectives 3, 16, 17, 20, 24 |
| Class Participation | Objectives 5, 7, 15, 22 |

Method of Instruction - Standards Targeted Throughout the Curriculum

New Jersey Curriculum Content Standards and Cumulative Progress Indicators

- Demonstrate skills needed to effectively access and use technology-based materials through keyboarding, troubleshooting, retrieving, and managing information. (NJ CCCS 2.0, #3)
- Use technology and other tools to solve problems, collect data, and make decisions. (NJ CCCS 2.0, #7)
- Use technology and other tools, including word processing, spreadsheet and presentation programs, and print or graphic utilities to produce products. (NJ CCCS 2.0, #8)
- Use technology to present designs and results of investigations. (NJ CCCS 2.0, #9)
- Organize, synthesize, and evaluate information for appropriateness and completeness. (NJ CCCS 3.0, #8)
- Identify and evaluate the validity of alternative solutions. (NJ CCCS 3.0, #11)
- Apply problem solving skills to original and creative/design projects. (NJ CCCS 3.0, #15)
- Use time efficiently and effectively. (NJ CCCS 4.0, #10)

New Jersey State Technology Education Standards

- Apply values and make rational decisions about technological issues. (NJSTES 1.19)
- Design and make devices and hybrid systems that solve complex real world problems. (NJSTES 2.22)
- Develop alternative plans for redesigning devices and systems. (NJSTES 2.23)
- Utilize and modify existing devices and systems for use in the solution of new problems. (NJSTES 3.16)
- Combine different materials in the production of products. (NJSTES 3.19)
- Create computer simulations to test and explain design concepts. (NJSTES 4.14)
- Create multimedia presentations to inform others about design concepts, products, and events. (NJSTES 4.16)
- Access and search the Internet for relevant information while conducting research. (NJSTES 6.16)
- Use advanced publication methods. (NJSTES 7.38)
- Generate original ideas based on previous knowledge and research. (NJSTES 7.41)
- Acquire knowledge and skills that increase aesthetic awareness as it applies to technological design and ergonomics. (NJSTES 7.139)

Standards of Technological Literacy from the Technology (STL) for All Americans Project and the International Technology Education Association (ITEA)

- In order to comprehend the scope of technology, students should learn that technology is closely linked to creativity, which has resulted in innovation. (STL #1, H)
- In order to recognize the core concepts of technology, students should learn that systems thinking involves considering how every part relates to others. (STL #2, N)
- In order to comprehend the attributes of design, students should learn that there is no perfect design. (STL #8, F)
- In order to comprehend the attributes of design, students should learn that the requirements for a design are made up of criteria and constraints. (STL #8, G)
- As part of learning how to apply design processes, students should be able to make two-dimensional and three-dimensional representations of the designed solution. (STL #11, J)
- In order to select, use, and understand information and communication technologies, students should learn that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (STL #17, K)

Source: International Technology Education Association (2000). *Standards for Technological Literacy*. Reston, VA: ITEA. ISBN 1-887101-02-0

Benchmarks of Project 2061

- Almost all control systems have inputs, outputs, and feedback. The essence of control is comparing information about what is happening to what people want to happen and then making appropriate adjustments. This procedure requires sensing information, processing it, and making changes. In almost all modern machines, microprocessors serve as centers of performance control. (Project 2061, #1)
- What use can be made of a large collection of information depends upon how it is organized. One of the values of computers is that they are able, on command, to reorganize information in a variety of ways, thereby enabling people to make more and better uses of the collection. (Project, 2061, #3)

Specific Behavioral Objectives and Timelines:

Unit 1: Course Introduction and Safety Guidelines

Time: 3 days

Goal:

- To introduce the students to the course expectations, discipline policy, and safety guidelines.

Objectives:

- Outline the course expectations and timeline for instruction.
- Discuss the specific discipline policy that relates to behavior in this class.
- Outline the specific safety guidelines of the classroom.

Audio-Visual Needs:

- Overhead projector
- Movie “UVEX PPE Eyewear Training Video/Technology Department Eye Safety”

Computer Needs/Use: None

Assignments:

- Movie related worksheet

Lab Activities: None

Assessment Method:

- Safety Quiz

Standards targeted via this unit:

- NJSTES 1.19
- NJSTES 7.41

Unit 2: Tool and Machine Safety

Time: 1 Week

Goal:

- To introduce students to the safe and proper operation of hand tools and power machines so that they may fabricate solutions to engineering problems. In the process of using these tools, the student will view automation and operator safety as significant engineering problems to brainstorm as well as the effect of gender or hand dominance on operations.

Objectives:

Students will be able to:

- Safely operate a band saw, scroll saw, drill press, disk and belt sander, brake, metal roller, shear, soldering gun, hand drill, etc.
- Safely use hand tools- claw hammer, screw driver, hand saw, coping saw, hack saw
- Read a metric and English ruler.

Assignments:

- Tool and Machine Safety

Lab Activities:

- Safety Demonstrations/ Safety Rules

Audio-Visual Needs:

- None

Computer Needs/Use:

- None

Assessment:

- Traditional: Safety Tests

Standards targeted via this unit:

- NJTES 3.16, 3.17, 3.18, 3.19
- NJCCCS WRS # 5
- NJCCCS 5.1

Unit 3: Review - Technology

Time: 1 Week

Goal:

- Review with the students the systems of technology education and technological literacy.

Objectives:

- Discuss technology.
- Review the difference between science and technology.
- Discuss technology as a system, and list and explain the components of these systems.
- Discuss the positive and negative impacts of different technological systems.
- Review the design loop and its impact on technological problem solving.

- Review the presentation techniques of formal documentation used in previous years.
- Review the four areas of physical technology: structures, robotics, electronics, mechanics

Audio-Visual Needs:

- Previous examples of student work
- SmartBoard technology
- Movie “The Design Process”
- Text: Hutchinson, J. and Karsnitz, J. (1994). *Design and Problem Solving in Technology*. Albany: Delmar Publishers, Inc.

Computer Needs/Use:

- None

Assignments:

- None

Lab Activities:

- None

Assessment Method:

- Authentic: *Teacher Observation*
- Traditional: *Review Quiz*

Standards targeted via this unit:

- NJ CCCS 3.0,#8
- NJSTES 7.139
- STL #1, H
- STL #2, N
- STL #8, F

Unit 4: Engineering Code of Conduct

Time: 3 Days

Goal:

- Introduce the students to the “Engineering Code of Conduct”
- Comparisons to misconduct in financial world
- Gravity of misconduct (lawsuits, personal danger, professional stunting)
- To understand that good designs may fail
- Understand the least negative solution may be the best solution.

Objectives:

Students will be able to:

- Develop as a class, an engineering code of conduct.
- Research current engineering codes of conducts.
- Understand why an engineering code of conduct is needed.

Assignments:

- Brainstorm a code of conduct
- Research via the internet current codes of conducts used in industry
- Identify the differences between the student code of conduct and the industry models.

Lab Activities:

- Develop a mutually agreed upon, engineering code of conduct.
- Guest speakers
- Field of Engineering Power Point Presentation

Audio-Visual Needs:

- None

Computer Needs/Use:

- CPU
- Internet access

Assessment Method:

- Authentic: Teacher observation
- Traditional: Code of conduct/class participation

Standards targeted via this unit:

- NJCCCS- WRS #1

Unit 5: Higher Education and Careers

Time: 1.5 Weeks

Goal:

- To allow the student time to examine higher education requirements for a variety of career possibilities.
- To demonstrate the importance of mathematical and scientific knowledge and skills.
- To allow students to realize the differences of salaries based on fields and versus courses taken (BS, MS < PhD & licenses PE, Professor of Engineering).
- To allow the student to understand there are many engineering fields.

Objectives:

Students will be able to:

- Identify institutes of higher education with engineering degree programs.
- Identify the many career opportunities an engineering degree supports. Vision of their daily life.
- Identify throughout the course the roll of mathematics and scientific knowledge/skills.
- Identify what produce a larger income.
- Identify careers where engineering thinking would play a vital role.

Assignments:

- Research higher education institutes and scholarships for women
- Research careers in engineering
- Use math and scientific knowledge/skills to solve an engineering design problem.
- Current research on career salaries
- Create a resume during this course.

Lab Activities:

- Field of Engineering Power Point Presentation
- Discuss Co-op options and company internships
- Bridges career research software
- Discuss daily life with guest speakers: What is their daily life like? Work indoors, outdoors; travel, Office work, Visit customers, Team work or alone, Specialists, paper and computer or physical work with equipment.

Audio-Visual Needs:

- VCR/Tapes- Engineering Fields

Computer Needs/Use:

- Internet, Computers, Presentation Software, Projector

Assessment Method:

- Authentic: Documentation/Presentation
- Traditional: Essay, Teacher observation

Standards targeted via this unit:

- NJCCCS WRS 1

Unit 6: Review – Technical Documentation

Time: 1 Week

Goal:

- Review with the students several elements of technical documentation, including layout, rationale, design, content, presentation, organization, and color.

Objectives:

- State the four design principles.
- Review orthographic projection and isometric drawing.
- Propose strengths and weaknesses of previous student work.
- Propose changes and suggestions as suggested through specific project specifications.

Audio-Visual Needs:

- Journal
- Photos
- SmartBoard technology

Computer Needs/Use:

- Instructor: PowerPoint Presentation
- Students: Internet research/Previous examples of student work

Assignments:

- Classwork: *Assessment/Suggestion Worksheet*

Lab Activities:

- None

Assessment Method:

- Authentic: Teacher observations, ability to retain information from last year
- Traditional: Class participation

Standards targeted via this unit:

- NJ CCCS 2.0, #7
- NJ CCCS 2.0, #9
- Project 2061, #3

Unit 7: Comprehensive State Competitive Events

Time: 25 Weeks

Goal:

- Apply the major concepts introduced in previous years to the design, develop, and testing of multiple state competitive events.

Objectives:

- Apply the knowledge of physical technology to the design and development of working prototypes.
- Implement the design process in order to develop a working solution to a real world problem.
- Develop an accurate and practical time management log.
- Utilize different forms of educational technology to design and present solutions to the presented problems.

Audio-Visual Needs:

- Various websites
- Previous examples of student work

- Community resources
- Smartboard technology
- Hewitt, Paul. Conceptual Physics. (Addison-Wesley Publishing Company, New York.) 1997. ISBN 0-201-46697-X.

Computer Needs/Use:

- Internet research
- Microsoft PowerPoint
- Schematic Software
- Smartboard Technology
- Rendering Software

Assignments:

- None

Lab Activities:

- Design and development of working prototype.
- Oral Presentations locally and at Event site

Assessment:

- Authentic: Teacher observations
- Traditional: Testing and Documentation Evaluation

Standards targeted via this unit:

- NJ CCCS 2.0, #3
- NJ CCCS 2.0, #8
- NJ CCCS 3.0, #11
- NJ CCCS 4.0, #10
- NJSTES 3.19
- NJSTES 2.23
- STL #1, H
- STL #8, F
- STL #8, G
- STL #11, J
- Project 2061, #3

Unit 8: Final Open Ended Project

Time: 10 Weeks

Goal:

- Students will have input to the nature of a final project which will serve to culminate the knowledge and experience acquired over the three year cycle to successfully design and develop a solution to a real world problem.

Objectives:

- Implement the steps in the design process.
- Utilize a variety of forms of presentation techniques.
- Apply acquired knowledge into the development of a working prototype.
- Implement the teamwork performance model to maximize group efficiency.
- Introduce a variety of different materials for usage and processing.

Audio-Visual Needs:

- SmartBoard technology

Computer Needs/Use:

- Rendering Software
- Internet Research

- Schematic Software

Assignments:

- Design rationale statement
- Working drawing approval
- Incremental due dates

Lab Activities:

- Design and development of working prototype.

Assessment Method:

- Authentic: Teacher observations
- Traditional: Design of final product, class participation and diligence

Standards targeted via this unit:

- NJ CCCS 2.0, #3
- NJ CCCS 2.0, #8
- NJ CCCS 3.0, #11
- NJ CCCS 4.0, #10
- NJSTES 3.19
- NJSTES 2.23
- STL #1, H
- STL #8, F
- STL #8, G
- STL #11, J
- Project 2061, #3

Materials/Resources:

Text: None

Labs:

- Several TSA Activities
- State Design Challenge
- Physical Technology Culminating Activity

People: None

Audio-Visual:

- SmartBoard technology
- Presentation techniques
- Multiple models
- Previous student work
- Pertinent publications

Assessment:

The assessment of student progress in the objectives cited on the previous pages will be primarily by, but not limited to, the following criteria.

| | |
|--------------------|-----|
| Classwork/Homework | 10% |
| Quizzes | 10% |
| Tests | 15% |
| Projects/Labs | 35% |

Class Participation 30%

Periodic evaluation of objectives and this curriculum guide:

With the evaluation of a new text every five years, administration requests a curriculum re-write in: **2009**

Special Course Policies:

Success in this course will be based on a variety of factors, however the instructor will most directly assess the student's performance in comprehensive design and problem solving activities, teamwork performance, and class participation as the means of determining a grade. A typical week in class will consist of formal instruction on a variety of material, students working in groups to complete work pertaining to the lecture, research and development, teamwork to generate possible solutions to and solve problems, and in some cases the development of different products and prototypes. Quizzes and tests will be given to re-emphasize and assess the student's understanding of the presented information.

Supplementary Readings and Instructors Bibliography:

Hewitt, Paul. Conceptual Physics. (Addison-Wesley Publishing Company, New York.) 1997. ISBN 0-201-46697-X

Karsnitz, John and Hutchinson, John. Design and Problem Solving in Technology. (Delmar Publishers, Albany, New York.) 1994. ISBN 0-8273-5244-1.

Smith, Howard. Understanding Technology. (Goodheart-Wilcox Company, Tinley Park, Illinois). 1998. ISBN 1-56637-374-3.

Wright, Thomas. Technology Systems. (Goodheart-Wilcox Company, Tinley Park, Illinois). 1966. ISBN1-56637-263-1.

Homework, Extra Credit Policy:

Due to the periodic nature of homework in this course, homework will be not be accepted late unless a legitimate excuse exists. Extra credit will be available during the design and problem solving activities in the form of additional research/development and competitive events.

Web pages that support learning:

www.tsawww.org
www.panasonic.com/creativdesign
www.rubgoldberg.com
www.rctek.com
www.teanj.com
www.iteawww.com

Lab/Classroom set up and special needs:

This course will be taught implementing a variety of different and state of the art instructional technologies such as:

- Multiple computers
- Multiple workbenches
- SmartBoard technology
- Projection screen and device
- Portable laptops and projectors
- Electrical outlets
- Testing area
- Teamwork areas
- Scanner and digital cameras