Chapter 5 – High School Technology and Engineering

MISSOURI DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION
DIVISION OF CAREER EDUCATION

Chapter 5
High School Technology and Engineering

1 — Introduction

This chapter contains the materials from the **ITEA- STEM⌖Center for Teaching and Learning™**, Foundations of Technology Education Curriculum (ITEA 2001). This document was developed by and for the **STEM⌖Center for Teaching and Learning™** consortium for use by its members. Missouri has been a Consortium member since 2001, giving Missouri the rights to utilize, copy, and distribute this product to Missouri teachers.

2 — Course Selection, Descriptions, and Rationales

There are two program options available to schools and both are copyrighted and require a contractual agreement between the local educational authority and the program entities listed with each respectively and both are eligible for Career Education Program Approval.

Option # 1 – Engineering byDesign™

Mission

We live in a technological world. Living in the twenty-first century requires much more from every individual than a basic ability to read, write, and perform simple mathematics. Technology affects every aspect of our lives, from enabling citizens to perform routine tasks to requiring that they be able to make responsible, informed decisions that affect individuals, our society, and the environment.

Citizens of today must have a basic understanding of how technology affects their world and how they exist both within and around technology. Technological literacy is fundamentally important to all students. Technological processes have become so complex that the community and schools collaborate to provide a quality technology program that prepares students for a changing technological world that is progressively more dependent on an informed, technologically literate citizenry.

"The Engineering byDesign™ Program is built on the belief that the ingenuity of children is untapped, unrealized potential that, when properly motivated, will lead to the next generation of technologists, innovators, designers, and engineers."

ITEA

Vision

The ITEA model technology program is committed to providing technological study in facilities that are safe and facilitate creativity, enabling all students to meet local, state, and national technological literacy standards. Students are prepared to engage in additional technological study in the high school years and beyond. Students will be prepared with knowledge and abilities to help them become informed, successful citizens who are able to make sense of the world in which they live. The technology program also enables students to take advantage of the technological resources in their own community.

Goals

- Provide a standards-based K-12 program that ensures that all students are technologically literate.
- Provide opportunities for all students without regard to gender or ethnic origin.
- Provide clear standards and expectations for increasing student achievement in math, science, and technology.
- Provide leadership and support that will produce continuous improvement and innovation in the program.
- Restore America's status as the leader in innovation. Provide a program that constructs learning

from a very early age and culminates in a capstone experience that leads students to become the next generation of technologists, innovators, designers, and engineers.

Organizing Principles

The EbD™ program is organized around seven principles. These principles are very large concepts that identify major content organizers for the program. In order of importance, the seven organizing principles are:

- Engineering through design improves life.
- Technology has and continues to affect everyday life.
- Technology drives invention and innovation and is a thinking and doing process.
- Technologies are combined to make technological systems.
- Technology creates issues that change the way people live and interact.
- Technology impacts society and must be assessed to determine if it is good or bad.
- Technology is the basis for improving on the past and creating the future.

The curriculum for this option is provided by **ITEA- STEM⌖Center for Teaching and Learning™**; and should be coordinated through the Missouri EbD™ State Leader. EbD™ is a copyright protected program that can only be used by contractual agreement between the local educational authority and **ITEA-STEM⌖CTL**. The Technology and Engineering program is eligible for Career Education program approval. Course description, code and sequence follows the EbD™ format:

Foundations of Technology – CD (100426) FOT Prepares students to understand and apply technological concepts and processes that are the cornerstone for the high school technology program. Group and individual activities engage student in creating ideas, developing innovations, and engineering practical solutions..

Technological Issues and Impacts – CD (100427) TII The student of technological issues and impacts allows students to develop skills in asking critical questions as well as understanding alternative viewpoints and their origins, and gives students the confidence to be involved in deciding which technologies to develop, which to use, and how to use them.

Technological Design – CD (100428) TD Engineering scope, content, and professional practices are presented through practical applications. Student in engineering teams apply technology, science, and mathematics concepts and skills to solve engineering design problems and innovate design. Students research, develop, test, and analyze engineering designs using criteria as design effectiveness, public safety, human factors, and ethics.

Engineering Design – CD (100431) ED Offers students the opportunity to understand and apply knowledge and skills required to create and transform ideas and concepts into a product that satisfies specific customer requirements. Students will experience design engineering in the creation, synthesis, iteration, and presentation of design solutions and will coordinate and interact in authentic ways to produce the form, fit, and functions documentation, with appropriate models to completely define a product. Highly rigorous.

Advanced Design Applications – CD (100429) ADA The goal is to provide an engineering or technical base for high school students who plan to continue their education in technical or engineering programs at the community college or university level.

Advanced Technological Applications – CD (100430) ATA The goal is to provide an engineering or technical base for high school students who plan to continue their education in technical or engineering programs at the community college or university level.

Option # 2 – Project Lead The Way© -- Engineering

Mission

Project Lead The Way© (PLTW©) mission is to ensure that America succeeds in the increasingly high-tech and high-skill global economy, by partnering with middle schools and high schools to prepare students to become the most innovative and productive in the world.

Overview

PLTW© is the nation's leading provider of rigorous and innovative Science, Technology, Engineering and Math (STEM) education for middle schools and high schools. PLTW's comprehensive curriculum, which is collaboratively developed by PLTW teachers, University educators, engineering and biomedical professionals, and school administrators, emphasizes critical thinking, creativity, innovation and real-world problem solving. The hands-on, project-based program engages students on multiple levels, exposes them to areas of study that they typically do not pursue, and provides them with a foundation and proven path to college and career success in STEM related fields.

The curriculum for this option is provided by Project Lead the Way© (PLTW©) and should be coordinated through the Missouri PLTW© State Leader. PLTW© is a copyright protected program that can only be used by contractual agreement between the local educational authority and PLTW©. The Engineering program is eligible for Career Education program approval. Course description, code and sequence follows the PLTW© format: Principles of Engineering, Introduction to Engineering Design, Computer Integrated Manufacturing, Digital Electronics, and a capstone course, Engineering Design and Development.

Foundation Courses

Introduction to Engineering Design© – CD (100405) IED This is a course that teaches problem-solving skills using a design development process. Models of product solutions are created, analyzed and communicated using solid modeling computer design software.

Principles of Engineering© – CD (100404) POE This is a course that helps students understand the field of engineering/engineering technology. Exploring various technology systems and manufacturing processes help students learn how engineers and technicians use math, science and technology in an engineering problem solving process to benefit people. The course also includes concerns about social and political consequences of technological change.

Digital Electronics© CD (100406) DE This is a course in applied logic that encompasses the application of electronic circuits and devices. Computer simulation software is used to design and test digital circuitry prior to the actual construction of circuits and devices.

Capstone Course

Engineering Design and Development© – CD (100422) EDD An engineering research course in which students work in teams to research, design and construct a solution to an open-ended engineering problem. Students apply principles developed in the four preceding courses and are guided by a community mentor. They must present progress reports, submit a final written report and defend their solutions to a panel of outside reviewers at the end of the school year.

Specialty Courses (4) (Optional)

Computer Integrated Manufacturing© – CD (100407) CIM This is a course that applies principles of robotics and automation. The course builds on computer solid modeling skills developed in Introduction to Engineering Design, and Design and Drawing for Production. Students use CNC equipment to produce actual models of their three-dimensional designs. Fundamental concepts of robotics used in automated manufacturing, and design analysis are included.

Civil Engineering and Architecture© – CD (100408) CEA Teams of students collaborate on the development of community-based building projects and conceptual design for project presentations.

Aerospace Engineering© – CD (100409) AE Students learn about aerodynamics, astronautics, space-life sciences, and systems engineering through hands-on engineering problems and projects.

Biotechnology Engineering© – CD (100410) BE Students apply biological and engineering concepts related to biomechanics, genetic engineering, and forensics.