

TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California

Course of Study

Introduction to Engineering Design 1, 2

I. INTRODUCTION

Introduction to Engineering Design students will learn to design and draw, both by hand and on computers, the basic drawings used to communicate engineering concepts and projects. The course emphasizes design conception, development and graphic communication. Students will learn principles of engineering design including orthographic projections, isometric views, sectioning and pictorial drawing. Students will have some instruction and practice in board drafting, but will use primarily CAD to develop 3-D models and solid rendering techniques using state of the art computer programs.

Students will study the materials and methods used in engineering and their design applications using scientific concepts and mathematics as it relates to engineering. Students will participate in design challenges that will require analytical thinking and complex problem solving as well as hands-on actualization. They will generate the Engineering Design drawings required for each project.

Students will develop a portfolio of their work and write summary analyses of each unit. Students will share project results by means of written reports as well as oral presentations to peers, teachers, and community professionals.

This course is highly recommended to be taken before or at the same time as Engineering Projects.

This course addresses the following Tam 21st Century goals:

The Tam 21st Century goals for student success are met by providing the student with the opportunity to develop a technical skill. This skill can lead to employment success as well as providing a foundation for greater personal and educational success. The opportunities for responsibility, creativity, and productivity are seen in student work as students produce drawings and projects using either computer aided drafting and traditional drafting techniques. The course guides students through the design process to think conceptually, solve complex problems, acquire knowledge of technology, communicate ideas wordlessly and work individually and collaboratively.

This course addresses the following Student Learning Outcomes:

1. Communicate articulately, effectively, and persuasively when speaking and writing.
2. Read and analyze material in a variety of disciplines.
3. Use technology as a tool to access information, analyze and solve problems, and communicate ideas.
5. Apply mathematical knowledge and skills to analyze and solve problems.
6. Demonstrate school-to-work/post-secondary transition skills and knowledge.

II. STUDENT LEARNING OUTCOMES

A. In Introduction to Engineering Design 1, 2, students will:

1. Use drafting instruments, CAD (computer aided drafting), and other tools to produce drawings and projects demonstrating line work, lettering, layout, geometric construction, and principles of shape and size description that include multi-view drawings, auxiliary views and isometric drawings
2. Solve design problems, working independently and collaboratively. Students will produce projects from their drawings that are both creative and complex.
3. Do oral presentations of their drafted drawings and projects for critique. They will complete a written technical analysis and description of their drawings and projects.
4. Conduct research and solve problems using the tools and technologies used by professional engineers
5. Research and utilize the engineering design process and apply it to create new products or systems that are useful to society
6. Develop the perception, and technical skills to express and communicate ideas graphically
7. Use scientific principles, mathematical skills and engineering design skills to understand and to apply to product development
8. Formulate pictorial sketches to develop ideas, solve problems, and graphically communicate with others during the design process

- B. Students will cover the following state Career Technical Education Model Curriculum Standards from the Architectural and Structural Engineering Pathway section:

From the Foundation Standards:

- 1.0 Students understand the academic content required for entry into postsecondary education and employment in the Engineering and Design sector.
- 2.0 Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts.
- 5.0 Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques.
- 10.0 Students understand the essential knowledge and skills common to all pathways in the Engineering and Design sector:

From the Pathway Standards:

- A2.0 Students understand the theoretical, practical, and contextual issues that influence design.
- A6.0 Students understand the use of computer-aided drafting and design (CADD) in developing architectural designs.
- A7.0 Students understand how to systematically complete an architectural project.
- A8.0 Students understand the methods of creating both written and digital portfolios.

III. ASSESSMENT

A. Student Assessment

Students will be graded on the accuracy and completeness of their drawings both in respect to their board and their CAD drawings. Student projects will be graded on their resemblance to the student's working drawings of each project. Student presentations will be graded on their ability to communicate articulately, effectively, and persuasively. The improvement observed during the semester and

the effort put into the course will be factored into the student's grade. A cumulative portfolio of each student's work will be kept and evaluated.

Students will be given the grading criteria and course expectations in writing at the beginning of the course.

B. Course Assessment

The class will be assessed by student feedback questionnaires at the end of each semester as well as by teacher reflections, administrative feedback and peer (community members, experts in the field, etc.) visitations.

IV. METHODS AND MATERIALS

A. Methods

For the initial part of the course, student's work will be self-paced with each student working from a plate schedule (an assignment list that builds a student's familiarity and skill with specific tools and processes in an orderly fashion that builds off the previous assignment). While working at the CAD stations, students will be working with a tutorial book and an Autodesk program that has built-in help and tutorial features. After a set number of drawings have been completed, students will be given a design challenge project to design and then build. After the project is completed, students will complete a set of "as built" drawings for presentation.

B. Materials

Students will use the professional tools of the industry for both board and CAD drawings.

At CAD stations students will be provided with appropriate tutorials, software and reference materials. At present, students are using the computer program *Inventor* by Autodesk. For the student projects, all the hand tools and materials in the production shop are available for their use.

Resource texts:

Title: Engineering Drawing and Design

Edition: Third

Publication Date: 2004

Publisher: Delmar/Thompson Publishing

Author(s): Madsen, et al

Title: Engineering Graphics Essentials

Edition: Second
Publication Date: 2006
Publisher: Schroff Development Corporation
Author(s): Kirstie Plantenberg

Title: Basic Technical Drawing
Edition: Seventh
Publication Date: 2000
Publisher: Glencoe/McGraw-Hill
Author(s): Spencer, et al

C. Technology

Computers, a plotter and a recent release of AutoCAD Inventor software. The Web-based Tutorial: CADLearning by 4D Technologies is used by students. Both the software program and the tutorials are available to students to use at home also.

D. School to Career Goals

Students will be exposed to guest speakers and job shadowing activities which will help prepare students for continued training and advanced educational opportunities in career-technical fields.

V. GENERAL INFORMATION

Each semester course of Introduction to Engineering Design 1-2 is a five credit course open to all students. This course is highly recommended to be taken before or at the same time as Engineering Projects.

A. Prerequisites

There are no prerequisites for admission to the beginning level class. A passing grade of C or better or teacher approval is required to move on to the next sequential course.

B. Requirements Met

This course may be used as elective credit towards graduation but does not meet any specific graduation requirement.

This course is accepted toward the "g" requirement for UC admissions.

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