La Cañada High School

Proposed Course Outline – Introduction to Design - Project Lead the Way

I. Course Title – Introduction to Design - Project Lead the Way

II. Grade Level(s) – Grades 9-12

III. Length/Credit – 1 Year - 10.0 units Satisfies One Year Visual and Performing Arts Graduation Requirement

IV. Preparations – Concurrent Enrollment in or Completion of LC Math 1 or its equivalent and concurrent enrollment or completion of a college-preparatory science class.

V. **Course Description**

Introduction to Engineering Design™ (IED) is an introductory high school level course that is appropriate for students who are interested in the engineering design process. The major focus of the IED course is to expose students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. IED gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB-learning challenges students to continually hone their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning, a key concept of both the new more rigorous standards, but also of LCUSD's initiatives to build more STEAM oriented elective offerings in grades 7-12.

Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, students use a state of the art 3D solid modeling design software package to help them design solutions to solve proposed problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges that increase in difficulty throughout the course. Students will also learn how to document their work, and communicate their solutions to their peers and members of the professional community.

Introduction to Engineering Design™ is one of three foundation courses in the Project Lead The Way® high school pre-engineering program. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology. In addition, the Introduction to Engineering Design curriculum will be supplemented by PLTW's Introduction to Design curriculum. The inclusion of the fundamentals of design will allow students to receive Visual and Performing Arts credit from the University of California and California State University systems. Projects for this course will focus on design factors such as aesthetics,

format, geometric shape & form, perspective drawing, scale, proportion, and presentation techniques. Students begin to use computers as a medium/tool for design of project components such as sketching techniques, orthographic drawing, 3D modeling & rendering. Assignment requirements are based on color, form and aesthetics with emphasis on the stages of the design process and critical thinking skills.

VI. Standards/ESLRs Addressed

Engineering and Architecture Pathways Standards - Career and Technical Ed. (CTE)
Introduction: Students will be engaged in an instructional program that integrates academic and technical preparation and focuses on career awareness, career exploration, and career preparation in a three course pathway that emphasize real-world, occupationally relevant experiences of significant scope and depth. To prepare students for continued training, advanced educational opportunities, and direct entry to a career, the Engineering courses pathway offers the following components: classroom, laboratory, and hands-on contextual learning; project- and work-based instruction; and leadership and interpersonal skills development. There are three Career and Technical Education standard domains that address this course proposal: the Engineering and Architecture Knowledge and Performance Anchor Standards (domain A), the Engineering and Architecture Pathway Standards related to the Engineering Technology Pathway (domain B), and the Engineering and Architecture Pathway Standards related to the Engineering Design Pathway (domain C).

I. Engineering and Architecture Knowledge and Performance Anchor Standards - Domain A
    - 1.0 Academics - Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Engineering and Architecture academic alignment matrix for identification of standards.
    - 2.0 Communications - Acquire and accurately use Engineering and Architecture sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.
    - 3.0 Career Planning and Management - Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.
    - 4.0 Technology - Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Engineering and Architecture sector workplace environment.
    - 5.0 Problem Solving and Critical Thinking - Conduct short, as well as more sustained, research projects to create alternative solutions to answer a question or solve a problem unique to the Engineering and Architecture sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.

- 6.0 Health and Safety - Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Engineering and Architecture sector workplace environment.
- 7.0 Responsibility and Flexibility - Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Engineering and Architecture sector workplace environment and community settings.
- 8.0 Ethics and Legal Responsibilities - Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.
- 9.0 Leadership and Teamwork - Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.
- 10.0 Technical Knowledge and Skills- Apply essential technical knowledge and skills common to all pathways in the Engineering and Architecture sector, following procedures when carrying out experiments or performing technical tasks.
- 11.0 Demonstration and Application - Demonstrate and apply the knowledge and skills contained in the Engineering and Architecture anchor standards, pathway standards, and performance indicators in classroom, laboratory and workplace settings, and through the SkillsUSA career technical student organization.

II. Engineering Technology Pathway Standards - Domain B

- B1.0 Communicate and interpret information clearly in industry-standard visual and written formats.
- B2.0 Demonstrate the sketching process used in concept development.
- B6.0 Employ the design process to solve analysis and design problems.
- B7.0 Understand industrial engineering processes, including the use of tools and equipment, methods of measurement, and quality assurance.
- B8.0 Understand fundamental control system design and develop systems that complete pre-programmed tasks.
- B9.0 Understand the fundamentals of systems and market influences on products as they are developed and released to production.
- B10.0 Design and construct a culminating project effectively using engineering technology.
- B11.0 Understand the methods of creating both written and digital portfolios.

III. Engineering Design Pathway Standards - Domain C

- C1.0 Understand historical and current events related to engineering design and their effects on society.
- C2.0 Understand the effective use of engineering design equipment.
- C3.0 Understand the sketching process used in concept development.
- C4.0 Understand measurement systems as they apply to engineering design.
- C5.0 Use proper projection techniques to develop orthographic drawings.
- C6.0 Understand the applications and functions of sectional views.
- C7.0 Understand the applications and functions of auxiliary views.
- C8.0 Understand and apply proper dimensioning standards to drawings.
- C9.0 Understand the tolerance relationships between mating parts.
- C10.0 Understand the methods of applying text to a drawing.
- C11.0 Understand the methods of creating both written and digital portfolios.

VII. Brief Course Outline

1. Unit 1: Design Process
    a. An Introduction to Art
    b. Introduction to a Design Process
        i. Stages of the Design Process
        ii. Style & Technique
    c. Introduction to Technical Sketching and Drawing
    d. Measurement and Statistics
    e. Project Creation: Puzzle Cube
2. Design Exercises
    a. The Elements and Principles of Design
    b. Geometric Shapes and Solids
        i. Shape and Form
    c. Dimensions and Tolerances
    d. Advanced Modeling Skills
    e. Advanced Designs
    f. Perception and expressive qualities of famous artists.
3. Reverse Engineering
    a. Visual Analysis
    b. Functional Analysis
    c. Structural Analysis
    d. Product Improvement By Design
3. Open-Ended Design Problems
    a. The Element of Color
    b. Engineering Design Ethics
    c. Design Teams
    d. Critical Analysis of Other Designs

e. Form Follows Function

VIII. Methods of Assessment

The evaluation of projects will be on-going and cumulative with the use of performance, portfolio, test, and self-report assessments. These assessments are check marks of how the students are meeting the standards set in the course and help direct the accomplishment of the project itself.

Project Assessments may include but are not limited to:

1. Presentation
2. Written/Oral Report
    - Daily Journal
    - Engineering Notebook
    - Multimedia
3. Graphic Representation
    - Orthographic representation
    - Pictorial representations
    - Schematics
    - Sketches
    - Photos
    - Diagrams
    - Video Clips
    - Graphs and Charts
    - Statistical Analysis
4. Final Product
    - Constructed Models
    - Computer Models
    - Computer Simulations
    - New standards
    - New system
    - New legislation
    - New theories
    -
5. Performance skills
    - Computer Applications (i.e., Word Processing, Spreadsheet, PowerPoint)
    - Measurement
    - Construction

Grades and Class Participation:

All work will be assessed and the students will receive points. Overall grades in the class will be by total percentage: **A=90+ B=80-89 C=70-79 D=60-69**

Grades will be based on daily class assignments, homework, notebook checks, projects, quizzes and tests. Class participation is essential to the learning process; therefore, I encourage students to attend daily.

Grades for this class will derive from the following sources:

Projects	**50 %**
Homework, Sketches, Worksheets, Engineering Notebook, Portfolio	**25 %**
Tests & Final Exam	**20 %**
Employability Skills & Work Ethic: includes participation, attendance, effort, behavior, & professional attitude	**5 %**

Employability Skills & Work Ethic Grade:

This portion of the student grade is based upon excellent daily attendance, active participation in class, no tardies, no truancies, and an excellent and positive attitude. It is also based on how well you complete your daily assignments and tasks, bring all required materials to class daily and complete assignments on time. In addition, when the teacher is talking, students are expected to stop, look, listen, and follow directions, and take notes if needed. To guide your excellent work in this area, act and behave in such a way as you believe would be most highly desirable to a prospective employer.

Attendance Policy: Attendance in this course will be treated the same way as it would be treated at a place of employment. If a student is absent, it is the student's responsibility to see the instructor to get "make-up" or "missed" information. Also, if a student is behind, he/she can set up appointment to use the computer lab before or after school, or during STEP, as is mutually agreeable to teacher and student.

Academic Honesty:

Students are expected to demonstrate honesty and integrity at all times. Each student is responsible for his or her own work, which includes test taking, homework, class assignments, individual contributions to group products, and the original creation of digital art, web pages, essays, compositions, and research papers. All work submitted by a student should be a true reflection of that student's knowledge, experience, effort and ability. It is unacceptable academic behavior to submit work that is not one's own. Refer to "Academic Honesty & Integrity" section in your student handbook. The consequences laid out in this section will be strictly adhered to in all incidents of cheating or plagiarism.

IX. Materials/Textbook(s)

Project Lead the Way - Introduction to Engineering Design Curriculum Materials, embedded, 2016

Exploring Visual Design: The Elements and Principles, Joseph A Gatto; Albert W. Porter, and Jack Selleck. Worcester, MA - Davis Publications - 2000

Engineerings Drawing and Design, David Madsen. Albany, NY - Delmar Thompson Learning, 2004

X. Seeking "a-f" Approval – Yes/No – Yes, this course will be submitted to the University of California for approval for the 2016-17 academic year in the subject domain "F" for Visual and Performing Arts credit.

XI. Seeking AP Class Approval – Yes/No – This course does NOT seek AP approval.