FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Civil Engineering and Architecture (Project Lead the Way)

Date: November 2008 **Subject Area: Career and Technology**

Proposed Grade Level(s): 11 – 12 **Course Length: 1 Year**

Grading: A-F **Number of Credits: 5 per semester**

Prerequisites: Having passed Principles of Engineering with a C or better, previously taken or are currently enrolled in a college prep math course.

COURSE DESCRIPTION:

The CEA course is intended to serve as the specialization course within the Engineering course sequence. The course is structured to enable all students to have a variety of experiences that will provide an overview of both fields. Students work in teams, exploring hands-on projects and activities to learn the characteristics of civil engineering and architecture.

The major focus of the Civil Engineering and Architecture™ (CEA) course is a long-term project that involves the development of a local property site. As students learn about various aspects of civil engineering and architecture, they apply what they learn to the design and development of this property. The course provides freedom to the students to develop the property as a simulation or to students to model the real-world experiences that civil engineers and architects experience when developing property.

The course of study includes:

- The Roles of Civil Engineers and Architects
- Project Planning
- Site Planning
- Building Design
- Project Documentation and Presentation

GENERAL GOALS/PURPOSES:

- To prepare the engineering oriented student for a possible college engineering courses.
- To learn the basic theories and processes of Civil and Architectural Engineering.
- To develop a logical step-wise method of problem solving.
- To use hands-on experience to devise a design and to use that design on local property

STUDENT READING COMPONENT:

- Students will read technical documents, textbooks, research from the internet and the library.

STUDENT WRITING COMPONENT:

- Students will generate detailed reports about the property they are to develop.

STUDENT ORAL COMPONENT:

- Students will give oral presentations through out the year on what they are developing.

STUDENT MATH COMPONENT:

- Students will apply Algebra 1, Geometry, Algebra 2 and Trig pre-cal concepts to the development of their project.

DETAILED UNITS OF INSTRUCTION:

Unit 1: Overview of Civil Engineering and Architecture

Time Days: 5 days

Lesson 1.1: Civil Engineering and Architecture Overview

1.1.1-Civil Engineering
1.1.2-Architecture
1.1.3-Historical implications
1.1.4-Introduction to Roles of All Players/Stakeholders
1.1.5-Responsibilities and ethics

Unit 2: Introduction to Projects

Time Days: 25 days

Lesson 2.1: Overview of Project Design

2.1.1-Purpose
2.1.2-Design Project Scenario (snapshot program requirements and teaming)

Lesson 2.2: Project Documentation

2.2.1-Portfolio Components
2.2.2-Sketching
2.2.3-Journals
2.2.4-Specifications Manual
2.2.5-Working Drawings

Unit 3: Project Planning

Time Days: 15 days

Lesson 3.1: Site Information

3.1.1-Site Selection
- 3.1.1.1History of Site
- 3.1.1.2Site Visit
- 3.1.1.3Identify Neighboring Properties
- 3.1.1.4Suitability of the site

3.1.2-Regulations
- 3.1.2.1-Municipal Regulations
- 3.1.2.2-Archaeological Considerations
- 3.1.2.3-Environmental Limitations
- 3.1.2.4-Covenants, Deed, and Zoning Restrictions

3.1.3-Viability Analysis
- 3.1.3.1-Surroundings
- 3.1.3.2-Infrastructure
- 3.1.3.3-Traffic Flow Analysis
- 3.1.3.4-Utilities
- 3.1.3.5-Local considerations/constraints—neighbors, zoning

3.1.3.6-Lot Size

Lesson 3.2: Development Options, Selection of Project, and Revisiting Viability Analysis

3.2.1-Development
3.2.2-Residential
3.2.3-Commercial
3.2.4-Industrial
3.2.5-Public/Private Assembly Places
3.2.6-Plan Unit Development (PUD)

Unit 4: Site Planning

Time Days: 40 days

Lesson 4.1: Description of Property

4.1.1-Surveying
4.1.2-Maps
4.1.3-Metes and Bounds System
4.1.4-Lot and Block System

Lesson 4.2: Site Plan Requirements

4.2.1-Topography
4.2.2-Number of Spaces
4.2.3-Types of Spaces
4.2.4-Sizes of Spaces
4.2.5-Activities in Spaces
4.2.6-Amenities
4.2.7-Special Needs
4.2.8-Support Facilities
4.2.9-Detached Buildings

Lesson 4.3: Site Plan Layout

4.3.1-Wetland Identification and Protection
4.3.2-Frontage
4.3.3-Easements, Utility Right of Ways, Setbacks
4.3.4-Utility Availability and Corridors
4.3.5-Building Size and Orientation

Lesson 4.4: Public Ingress and Egress

4.4.1-Roadways
4.4.2-Pathways
4.4.3-Sidewalks
4.4.4-Off-Street Parking
4.4.5-Signage and Markings
4.4.6-Lighting
4.4.7-Universal Access

Lesson 4.5: Site Grading

4.5.1-Identification of Sub-Surface Conditions
4.5.2-Topographic design
4.5.3-Top Soil
4.5.4-Storm Water Management
4.5.5-Cut and Fill Balances
4.5.6-Excavation

Lesson 4.6: Utilities

- 4.6.1-Water Supply
- 4.6.2-Wastewater
- 4.6.3-Electrical
- 4.6.4-Gas
- 4.6.5-Cable
- 4.6.6-Telephone

Lesson 4.7: Landscaping

- 4.7.1-Function
- 4.7.2-Green space
- 4.7.3-Xeriscape—self sufficient without need of additional water
- 4.7.4-Irrigation systems

Lesson 4.8: Water Supply and Wastewater Management

- 4.8.1-Water
- 4.8.2-Wastewater
- 4.8.3-Management methods

Unit 5: Architecture

Time Days: 50 days

Lesson 5.1: Architectural styles

- 5.1.1-Structural style
- 5.1.2-Building material, color, proportion, and rhythm

Lesson 5.2: Floor Plans

- 5.2.1-Arrangement of Spaces
- 5.2.2-Building Envelope
- 5.2.3-Windows
- 5.2.4-Doors
- 5.2.5-Wall Types
- 5.2.6-Floor Types
- 5.2.7-Equipment Layout
- 5.2.8-Universal Accessibility
- 5.2.9-Vertical transport

Lesson 5.3: Energy Systems

- 5.3.1-Minimum Code Requirements
- 5.3.2-Green Building Options
- 5.3.3-Smart Building Technologies
- 5.3.4-Utility Cost Analysis
- 5.3.5-Emerging Custom Measures

Lesson 5.4: Elevations

- 5.4.1-Exterior
- 5.4.2-Interior

Lesson 5.5 Sections and Details

- 5.5.1-Identification
- 5.5.2-Building Section
- 5.5.3-Wall Section

5.5.4-Construction Details

Lesson 5.6: Schedules

5.6.1-Door and Window Schedules
5.6.2-Finish Schedules

Lesson 5.7: Mechanical, Electrical, and Protection Systems

5.7.1-Plumbing
5.7.2-HVAC
5.7.3-Electrical systems
5.7.4-Power Requirements
5.7.5-Electrical Plan
5.7.6-Lighting Plan
5.7.7-Protection Systems
5.7.8-Fire, Smoke, and Gas Detection Systems
5.7.9-Fire Suppression Systems
5.7.10-Security Systems

Unit 6: Structural Engineering

Time Days: 20 days

Lesson 6.1: Introduction to Structural Engineering

6.1.1-Structural Engineering
6.1.2-Various Loads
6.1.3-Wind Loads
6.1.4-Snow Loads
6.1.5-Dead Loads
6.1.6-Live Loads

Lesson 6.2: Roof Systems

6.2.1-Materials
6.2.2-Types of trusses
6.2.3-Load Calculations for roof members
6.2.4-Architectural styles

Lesson 6.3: Columns and Beams

6.3.1-Materials
6.3.2-Loading
6.3.3-Fire Proofing
6.3.4-Connections
6.3.5-Column schedules
6.3.6-Sizing of members

Lesson 6.4: Foundations

6.4.1-Types
6.4.2-Soil Bearing Capacities
6.4.3-Drainage
6.4.4-Piers
6.4.5-Settling

Unit 7: Presentations and Reviews

Time Days: 20 days

Lesson 7.1: Critiques and Reviews

7.1.1-Self Assessment
7.1.2-Peer Review
7.1.3-Public Exhibit
7.1.4-Interviews
7.1.5-Competitions

Lesson 7.2: Final Presentations

7.2.1-Peer
7.2.2-School panel
7.2.3-Parents
7.2.4-School board
7.2.5-Other community groups

SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:

Civil Engineering and Architecture Overview

Standards for Technological Literacy

- **Standard 9:** Students will develop an understanding of engineering design.
- **BM J:** Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- **BM L:** The process of engineering design takes into account a number of factors.

National Science Education Standards

Unifying Concepts and Processes: As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes.

- **Evidence, models, and explanation**
- **Form and function**

Science and Technology Content Standard E: As a result of activities in grades 9-12, all students should develop

- **Abilities of technological design**
  - Propose designs and choose between alternative solutions
- **Understandings about science and technology**
  - Creativity, imagination, and a good knowledge base are all required in the work of science and technology
  - Science and technology are pursued for different purposes. Scientific inquiry is driven by the desire to understand the natural world, and technological design is driven by the need to meet human needs and solve human problems.

History and Nature of Science Content Standard G: As a result of activities in grades 9-12, all students should develop

- **Historical perspectives**
  - The daily work of science and engineering results in incremental advances in our understanding of the world and our ability to meet human needs and aspirations

Principles and Standards for School Mathematics

Problem Solving: Instructional programs from pre-kindergarten through grade 12 should enable all students to apply and adapt a variety of appropriate strategies to solve problems.

Connections: Instructional programs from pre-kindergarten through grade 12 should enable all students to recognize and apply mathematics in

contexts outside of mathematics.

Standards for the English Language Arts

Standard 1:	Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment.
Standard 5:	Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
Standard 8:	Students use a variety of technological and informational resources (e.g., libraries, database, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
Standard 12:	Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE AND/OR CST'S

Math and Science

LAB FEE, IF REQUIRED: None

DISTRICT ESLRs TO BE ADDRESSED:
Students will be:

- **Self-Directed Learners:** Students will be expected to take responsibility for their learning by participating in class activities, projects and discussions. Students will be expected to keep up with homework and project prep assignments
- **Constructive Thinkers:** Students will participate in cooperative groups for project assignments and in class activities. They will be expected to collaborate with each other in developing class concepts.
- **Effective Communicators:** Students will actively participate in classroom discussions on a regular basis. Students will present oral reports of all projects the complete.
- **Collaborative Workers:** Students will participate in cooperative groups for projects and in class activities. They will be expected to collaborate with each other in developing class concepts.
- **Quality Producers/Performers:** Assessment of class work requires students to be quality producers in order to be successful in class.
- **Responsible Citizens:** In order to become responsible citizens, students will use their knowledge of math, engineering and scientific inquiry to make informed decisions relating to engineering and the environment in their daily lives.