El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	ETEC
Course Number:	18
Descriptive Title:	Engineering Design and Development
Division:	Industry and Technology
Department:	Engineering Technology
Course Disciplines:	Engineering Technology, Manufacturing Technology
Catalog Description:	In this capstone course, students work in teams to design and construct solutions to engineering problems. Emphasis will be placed on research methods, design problem statements, continuous improvement, cost analysis, prototyping, testing methods, project construction and project presentation.
Prerequisite:	Engineering Technology 10 or Engineering Technology 10A AND Engineering Technology 10B or Engineering Technology 12 or Engineering Technology 12A AND Engineering Technology 12B or Computer Aided Design/Drafting 5 with a minimum grade of C in prerequisite
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	4
Outside Study Hours:	4
Total Course Hours:	108
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	01/23/2006
Transfer UC:	Yes
Effective Date:	

General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Engineering Notebook** The student will use the United States Patent office Protocol, Engineering Notebook, for compiling design data, testing results, dates, signatures, page format, and Mechanical Drawings. **SLO #2 Research Methodology & Technology** After carefully defining a technical problem, the student will use both research methodology and technology to choose, build, validate and justify an engineering solution to a design challenge. **SLO #3 Tech Review Presentation** The student will make a formal presentation to defend their research, design criteria, prototype, applications, and conclusions to a technical review panel.
Course Objectives:	1. Use conventional libraries and the Internet as research tools and resources. 2. Explain how to research a U.S. Patent. 3. Create, simulate and test basic designs using industry standard computers and software. 4. Evaluate test results and other data for validity. 5. Interpret sketches, designs and drawings for technical content. 6. Work in teams to research, design, manufacture, test and evaluate mechanical, electronic or electromechanical assemblies. 7. Prepare portfolios to organize, display and present information. 8. Create presentations using media such as overhead transparencies, 35mm slides, digital images, PowerPoint and video.
Major Topics:	**I. SAFETY INSTRUCTION AND REVIEW TOPICS IN COMPUTER AIDED DESIGN/DRAFTING (CADD) (2 hours, Lecture)** A. Overview of hand tools and basic power tools

B. Review of CADD fundamentals

II. SAFETY LAB (4 hours, Lab)

A. Power tool safety
B. Hand tool safety

III. RESEARCH METHODS (4 hours, Lec

A. Research methods
    1. Formal research
    2. Library resources
    3. Computer-based research
    4. Contacting experts
B. Guided research
    1. Problem statement
    2. Alternative solutions
    3. Presentation methods
C. Independent research
    1. Expectations and time management
    2. Patent searches

IV. RESEARCH METHODS (8 hours, Lab)

A. Research methods exercise
B. Patent search exercise

V. PROTOTYPE DEVELOPMENT (4 hours, Lecture)

A. Design
B. Simulation
C. Rapid-Prototyping (RP)
D. Construction
E. Testing and evaluation

VI. PROTOTYPE DEVELOPMENT (8 hours, Lab)

A. Design exercise
B. Testing and evaluation exercise

VII. CAPSTONE ENGINEERING PROJECT (12 hours, Lecture)

A. Daily engineering journals
B. Sketches, models and drawings
C. Model simulation data and project photos
D. Safety, reliability and cost effectiveness

VIII. CAPSTONE ENGINEERING PROJECT (24 hours, Lab)

A. Documentation exercise
B. Reliability exercise

	IX. CAPSTONE PROJECT CONSTRUCTION (12 hours, Lecture) A. Teamwork and delegation B. Component construction C. Project assembly D. Testing and evaluation E. Protocols for writing the formal report **X. CAPSTONE PROJECT CONSTRUCTION (24 hours, Lab)** A. Tool use exercise B. Construction exercise **XI. PROJECT PRESENTATION (2 hours, Lecture)** A. PowerPoint B. Digital images **XII. PROJECT PRESENTATION (4 hours, Lab)** A. PowerPoint exercise B. Project demonstration exercise
Total Lecture Hours:	36
Total Laboratory Hours:	72
Total Hours:	108
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	Create a Standard Tessellation Lattice "STL" file in a scale within the capacity of the RP machine for the first solid model object created for your capstone project. Transmit the file to the RP machine and confirm the machine settings with your instructor before starting the part creation process.
Critical Thinking Assignment 1:	Access the United States Government Patent and Trademark Office website at www.uspto.gov and determine if there is a patent for a concept similar to the idea you have chosen for your capstone project. If you find a patent for a concept similar to your idea, write a one-page report which specifies the differences between your idea and the patent. If you did not find a patent for a concept similar to your idea, write a one-page report describing the steps you used in researching patents. Include the report in the appendix of your project portfolio and submit report to the instructor.
Critical Thinking Assignment 2:	Using a minimum of three detail models for your project, create a mechanism assembly model with necessary linkages. Using the CADD software simulation feature, perform a kinematic analysis on this model. Evaluate the results of the analysis to determine if design changes are required and obtain screen plots of the analysis. Submit assembly model file electronically to the instructor.
Other Evaluation Methods:	Class Performance Completion Laboratory Reports

	Matching Items Multiple Choice Other Exams Performance Exams Quizzes Term or Other Papers True/False Written Homework
Instructional Methods:	Demonstration Discussion Group Activities Guest Speaker Lab Lecture Multimedia presentations Role play/simulation
If other:	Video presentations Computer simulations
Work Outside of Class:	Journal (done on a continuing basis throughout the semester) Problem solving activity Required reading Study
If Other:	
Up-To-Date Representative Textbooks:	Michael Hacker. Engineering and Technology. 1st ed. Cengage Learning, 2010. DISCIPLINE STANDARD
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	1. Flash drive 2. Supplies needed for term project
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Engineering Technology-10 or Engineering Technology-10A AND Engineering Technology-10B or Engineering Technology-12 or

	Engineering Technology-12A AND Engineering Technology-12B or Computer Aided Design/Drafting-5
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Ability to select appropriate materials to satisfy design requirements.** ETEC 10 - Compare and contrast essential components contained in a basic mechanical system. ETEC 10 - Identify the application of commonly used mechanisms, such as levers, wheels, pulleys, screws and gears. ETEC 10 - Evaluate the properties, characteristics and application of materials commonly used in manufacturing. ETEC 10A -Document design ideas graphically and in writing. ETEC 10B - Specify destructive and non-destructive means of testing materials commonly used in manufacturing. ETEC 10B - Explain the effects that stress has on a material and explain how a particular material will react. ETEC 10B - Evaluate the properties, characteristics and application of materials commonly used in manufacturing. ETEC 12 - Compare and contrast manufacturing materials and production processes. ETEC 12A - Produce two-dimensional drawings and three-dimensional models using Computer Aided Design and Drafting (CADD) software. ETEC 12B - Compare and contrast manufacturing materials and production processes. CADD 5 - Utilize AutoCAD software to produce 2D mechanical drawings. CADD 5 - Utilize AutoCAD software to create 2D drawings using geometrical construction. CADD 5 - Prepare drawings using orthographic projection both manually sketched and completed with AutoCAD software. CADD 5 - Sketch isometric drawings. CADD 5 - Utilize correct dimensioning practices on orthographic projection drawings. **Ability to create 2D working drawings and 3D models with CADD software and ability to interpret dimensions and tolerances on engineering drawings.** ETEC 10 - Document design ideas graphically and in writing. ETEC 10A - Document design ideas graphically and in writing.

	ETEC 10B - Evaluate the properties, characteristics and application of materials commonly used in manufacturing. ETEC 12 - Modify features on engineering drawings and models. ETEC 12 - Produce two-dimensional drawings and three-dimensional models using Computer Aided Design and Drafting (CADD) software. ETEC 12 - Identify geometric constraints in three-dimensional models. ETEC 12 - Apply dimensions and tolerances in accordance with industry standards. ETEC 12 - Integrate proper sketching techniques and styles in the creation of engineering drawings. ETEC 12A - Produce two-dimensional drawings and three-dimensional models using Computer Aided Design and Drafting (CADD) software. ETEC 12A - Identify geometric constraints in three-dimensional models. ETEC 12A - Integrate proper sketching techniques and styles in the creation of engineering drawings. ETEC 12B - Modify features on engineering drawings and models. ETEC 12B - Apply dimensions and tolerances in accordance with industry standards. CADD 5 - Utilize AutoCAD software to produce 2D mechanical drawings. CADD 5 - Utilize AutoCAD software to create 2D drawings using geometrical construction. CADD 5 - Prepare drawings using orthographic projection both manually sketched and completed with AutoCAD software. CADD 5 - Create basic 3D drawings with AutoCAD software.
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Steve Cocca and Eric Carlson
Date:	02/22/2016
Original Board Approval Date:	01/23/2006
Last Reviewed and/or Revised by:	Steve Cocca
Date:	11/16/2021
Last Board Approval Date:	