7731 ADVANCED ENGINEERING DESIGN

DATE:

INDUSTRY SECTOR: Engineering and Architecture Sector

PATHWAY: Engineering Design

CALPADS TITLE: Advanced Engineering Design (Capstone)

CALPADS CODE: 7731

HOURS:

Total	Classroom	Laboratory/CC/CVE
180	90	90

JOB TITLE	O*NET CODE	JOB TITLE	O*NET CODE
Industrial Engineers	17-2112.00	Fuel Cell Technicians	17-3029.10
Mechanical Engineering Technicians	17-3027.00	Photonics Technicians	17-3029.08
Robotics Technicians	17-3024.01	Engineers, All Other	17-2199.00

COURSE DESCRIPTION:

This capstone course further builds upon the Engineering and Architecture introduction course, and Engineering Design pathway concentrator course/s, in this sector. The capstone is the final course taken in the complete sequence of courses. This career technical education capstone course provides content, skill development and leadership training which prepare students for the world of work and to pursue further education such as industry certifications and a postsecondary degree.

A-G APPROVAL: G

ARTICULATION: None

DUAL ENROLLMENT: None

PREREQUISITES: None

METHODS OF INSTRUCTION

- Direct instruction
- Group and individual applied projects
- Multimedia
- Demonstration
- Field trips
- Guest speakers

STUDENT EVALUATION:

- Student projects
- Written work
- Exams
- Observation record of student performance
- Completion of assignment

INDUSTRY CERTIFICATION:

- None

RECOMMENDED TEXTS:

- Technology Engineering & Design by: Sharon A. Brusic, James F. Fales, Vincent F. Kuetemey

PROGRAM OF STUDY

Grade	Fall	Spring	Year	Course Type	Course Name
9, 10, 11, 12				Introductory	Introduction to Engineering and Architecture
10, 11, 12				Concentrator	7730 Intermediate Engineering Design
11, 12				Capstone	7731 Advanced Engineering Design

I.	THE WORLD OF ENGINEERING AND TECHNOLOGY	CR	Lab/ CC	Standards
	A. Introduction, Assessment and Review B. Classroom Contract C. Students Questionnaire D. Engineering Fields E. Career in Engineering	5	5	**Academic:** LS: 11-12.1 RHSS: 11-12.7 **CTE Anchor:** Career Planning and Management: 3.1, 3.2, 3.4, 3.6, 3.9 **CTE Pathway:** C1.1, C1.2
II.	**MECHANICAL DESIGN FUNDAMENTALS**	**CR**	**Lab/ CC**	**Standards**
	A. Six Simple Machines a. Moment b. Static Equilibrium c. Ideal Mechanical Advantage d. Actual Mechanical Advantage e. Efficiency B. Problem Design Activity a. Design a Six Simple Compound Machine	10	10	**Academic:** RLST: 11-12.4 A-CED: 2 **CTE Anchor:** Leadership and Teamwork: 9.3 Technical Knowledge and Skills: 10.3 **CTE Pathway:** C2.1, C2.2, C2.3
III.	**ELECTRICAL DESIGN FUNDAMENTALS**	**CR**	**Lab/ CC**	**Standards**
	A. Electrical Design Fundamentals a. Ohm's & Power Law b. Current, Voltage and Resistance c. Electrical Symbols and Schematics d. Series and Parallel Circuit Calculations e. How to Use a Multimeter f. Resistor Band Color Reading B. Design Problem a. Design & Build a Series Circuit	10	10	**Academic:** RLST: 11-12.4 A-CED: 4 A-REI: 3 **CTE Anchor:** Technology: 4.3, 4.4 Technical Knowledge and Skills: 10.3 **CTE Pathway:** C2.3, C2.2
IV.	**RENEWABLE ENERGY**	**CR**	**Lab/ CC**	**Standards**
	A. Solar Power B. Wind Power C. Geothermal Power D. Green Technology a. Photovoltaic b. Hydrogen Fuel Cells 1. Design & Build a Solar Hydrogen Cell Vehicle	5	10	**Academic:** RSIT: 11-12.7 WHSST: 11-12.6 A-CED: 4 SEP: 1 PS: PS3.A, PS3.B ETS: ETS1.A, ETS2, ETS2.A, ETS2.B **CTE Anchor:** Technology: 4.1 Leadership and Teamwork: 9.7

				Technical Knowledge and Skills: 10.3 **CTE Pathway:** C1.1, C2.3
V.	**STRUCTURE DESIGN FUNDAMENTALS**	**CR**	**Lab/ CC**	**Standards**
	A. Statics a. Centroids b. Free Body Diagrams c. Force Vectors d. Moments e. Calculating Truss Forces 1. MD Solids Activity 2. West Point Bridge Design Activity	5	5	**Academic:** A-CED: 1, 2 CC: 1, 2, 3, 4, 6 PS: PS2.A, PS2.B, PS2.C **CTE Anchor:** Technology: 4.4 **CTE Pathway:** C2.2, C3.3
VI.	**MATERIALS PROPERTIES AND MANUFACTURING PROCESSES**	**CR**	**Lab/ CC**	**Standards**
	A. Materials History B. Materials Coposition C. Materials Classifications a. Metallic Materials b. Ceramic Materials c. Organic Materials d. Composite Materials D. Manufacturing Processes a. Casting and Foundry b. Forming c. Machining d. Joining and Assembly e. Rapid Prototyping 1. 3D Pringitng Activity	15	0	**Academic:** RHSS: 11-12.7 WHSST: 11-12.7, 11-12.8 **CTE Anchor:** Health and Safety: 6.2 **CTE Pathway:** C1.1, C2.1
VII.	**CONTROL SYSTEMS DESIGN**	**CR**	**Lab/ CC**	**Standards**
	A. Introduction to Programming Design (RobotC) a. Inputs and Outputs Programming b. Basic Outputs Programming c. Basic Inputs Programming d. While and If-Else Loops e. Variable and Functions f. Open and Closed Loop Systems g. Machine Control Design Activities 1. Marble Sorter Machine 2. Line Follower 3. Elevator	15	25	**Academic:** RSIT: 11-12.7 RHSS: 11-12.2 A-REI: 2 **CTE Anchor:** Communications: 2.4, 2.5 Career Planning and Management: 3.1 **CTE Pathway:** C2.2, C2.3, C4.2
VIII.	**FLUID POWER SYSTEM DESIGN**	**CR**	**Lab/ CC**	**Standards**
	A. Fluid Power Design Components a. Reservoirs/Receivers b. Fluid Conductors c. Pumps/Compressor d. Valves e. Actuators B. Fluid Power Schematics C. Hydraulics Systems D. Peumatics Systems	5	0	**Academic:** A-REI: 5 PS: PS2.C **CTE Anchor:** Problem Solving and Critical Thinking: 5.3 Technical Knowledge and

				Knowledge and Skills: 10.1 **CTE Pathway:** C2.1, C3.3
IX.	**ENGINEERING DESIGN PROCESS AND DOCUMENTATION**	**CR**	**Lab/ CC**	**Standards**
	A. Design Process Overview B. Develop an Engineering Report a. Technical Writing & Oral Communication b. Formal Report c. Product Presentation Using PowerPoint	5	0	**Academic:** RSIT: 11-12.2 WS: 11-12.4, 11-12.6 ETS: ETS1.A, ETS1.B, ETS1.C **CTE Anchor:** Problem Solving and Critical Thinking: 5.1, 5.2 **CTE Pathway:** C5.1
X.	**PRODUCT DESIGN DEVELOPMENT CHALLENGE**	**CR**	**Lab/ CC**	**Standards**
	A. Teams Organization B. Bag Me List 15 Items C. Identify the Necessity a. Problem Statement b. Brainstorm, Research and Generate Ideas D. Identify Criteria and Specify Constraints E. Develop Possible Solutions a. Sketches b. Decision Matrix F. Implement the Proposed Solution G. Develop a Computer Model and Physical Prototype a. Create a Computer Model b. Create Working Drawings c. Create a Computer Animation d. Prototype Constructions Using Available Recourses H. Evaluate Test Results, Make Changes & Choices I. Create the Final Design a. Product Display & Documentation Presentation b. Gantt Chart J. Final Solution Evaluation a. Does the Product Satisfy all Criteria and Constraints?	15	25	**Academic:** LS: 11-12.1, 11-12.2 G-GMD: 5 G-MG: 3 G-SRT: 1 N-Q: 1, 2, 3 SEP: 2 CC: 2, 3, 4, 5, 6, 7 **CTE Anchor:** Leadership and Teamwork: 9.1, 9.2, 9.3, 9.6, 9.7 **CTE Pathway:** C1.2, C2.1, C2.2, C2.3, C3.1, C3.2, C3.3

Entered by:

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