Glendale Unified School District School

High School

October 6, 2020

Department:	Career Technical Education
Course Title:	Honors Robotics 5-6: Engineering Graphics
Course Code:	5514V/5515V
Grade Level(s):	10-12
School(s) Course Offered:	Glendale High School
UC/CSU Approved (Y/N, Subject):	Yes, "g" General Elective credits, honors designation
Course Credits:	10
Recommended Prerequisite:	Robotics 3-4: Engineering Technology, Computer Aided Design & Additive Manufacturing Honors
Recommended Textbook(s):	Engineering Graphics Essentials: Text and Digital Learning 5th Edition Kristie Plantenberg, SDC Publications, ISBN-13: 978-1-63057-052-l SOLIDWORKS 2019 and Engineering Graphics: An Integrated Approach, Randy H. Shih, SDC Publications, ISBN: 978-1-63057-240-2
Course Overview:	Honors Robotics 5-6: Engineering Graphics is the advanced course (3rd year) in a three-course sequence for the Engineering Technology and Product Development Industry Sector. The course deepens the skills and knowledge of an engineering student within the context of Computer Aided Drafting (CAD), modeling and design. Students use Computer Aided Design software to create engineering design packages consisting of detail, sub-assembly, assembly and installation models and drawings. These skills are applied in the context of understanding the essence of being an engineer: solving real world problems with creative and ethical solutions in teams.

First Semester-Course Content

Unit 1: **Introduction and Overview** (*5 weeks*)

STANDARDS
Anchor Standards: 1.0 , 2.1, 2.3, 2.3, 8.0, 8.1, 9.0, 9.1
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A1.0, A1.2, A2.0, B.6.0 , B6.1, C1.0, C1.1, C1.2

A. In this unit, students are introduced to elements of engineering that all engineering professions have in common: working in a team to problem solve with creative and ethical solutions. Students will learn background information about engineering professions and the critical importance of engineering ethics by studying examples of engineering design disasters that could have been avoided if engineering decisions had been made ethically rather than based on cost savings (e.g. the Challenger O-ring catastrophe). Students will practice scenarios in which they are given challenges that they can solve by working through the steps of the Engineering Design Process with their teammates.

B. Students are frequently presented with assignments, quizzes and test questions. The questions are typically true/false, multiple choice, or multiple selection in nature and often include written questions, visual diagrams and interactive web-based activities.

Unit 2: **Spatial Visualizations** (3 *weeks*)

STANDARDS
Anchor Standards: 2.6, 3.0, 4.0, 4.1, 4.4, 5.1
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A2.2, A2.3, A2.4, A4.0, C2.0, C3.2, C.5.0 , C5.1

A. Students study and practice spatial visualization skills to understand views in 2D and 3D definitions of parts in the real world. They practice by looking at real objects such as a picture frame or remote control and sketch different views of the objects to learn about the essence of orthographic projections.

B. Students are presented with practice assignments and interactive web-based activities.

Unit 3: **Engineering Graphics Fundamentals** (*11 weeks)*

STANDARDS
Anchor Standards: 2.1, 4.0, 4.1, 4.2
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A3.3, A4.1, A5.0, A6.0, C1.0, C1.1, C1.2, C6.0, C7.1

A. The basics of engineering graphics are studied and developed including understanding line types, auxiliary and section views, dimensioning and annotations and basic tolerancing. The ideas of assemblies and installation models is broadly discussed. Students learn about fasteners, standard parts, screw threads and the basics through complexities of holes (definition, placement, tolerance, and fit).

B. Students are presented with practice assignments and interactive web-based activities.

Second Semester-Course Content

Unit 4: **Computer Aided Design: Sketches, Extrusions, Part Features and Advanced Modeling Features** *(14 weeks)*

STANDARDS
Anchor Standards: 4.0, 4.3, 4.4, 4.6, 5.2, 5.3
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A3.3, A4.0, A4.1, A4.2, C3.0, C3.1, C3.2, C3.3

A. In this unit students learn the foundational skills of modeling in Computer Aided Drafting (CAD) software starting from creating sketches, which includes dimensioning and fully constraining the sketches. The students will then learn to extrude sketches into solid models and edit the models with cutting features such as holes and other extruded sketch cuts. This unit will explain the several options of holes including tapping, counterbore, countersink, hole depth etc. Students will also learn other basic features such as filleting, chamfering, patterning, mirroring, etc. For advanced features, students learn how to assemble parts together with mating to save assembly files, perform more advanced features such as creating Model Based Definition models (MBD's), setting material properties, measuring volume/mass, animations, etc.

B. Students will be presented with a series of practice exercises for each of the functions listed above. As a completion of the unit, students will be given simple parts with measurements that they will model according to the skills and tools learned above.

Unit 5: **Computer Aided Drafting: Detail, Assemblies, and Installations** *(7 weeks)*

STANDARDS
Anchor Standards: 4.0, 4.3, 4.4, 4.5, 4.6, 5.2, 5.3, 5.4,
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A3.3, A4.0, 4.1, 4.2, A5.0, A6.0, A6.1 A8.0, C2.0, C2.1, C2.2, C2.3, C5.0

A. This unit will cover all the details of Drawing Packages, which consist of Detail Part Drawings, and Assembly Drawings. Students will learn the requirements, details, and tools for creating drawings with projected views based on fully constrained models. Drawing details include industry standards for title blocks, revision blocks, parts lists, bill of materials, notes lists, etc.

B. Students will be given an assembly that they will need to disassemble and measure in order to create 3D models of each piece part, assemble the 3D models, then create detail and assembly drawings of the piece parts and assembly respectively. They will then create an installation drawing explaining the steps of installation for the assembly into its location (for example modeling an engine assembly and installing into a car).

Unit 6: **Design Engineering as a Career** *(3 weeks)*

STANDARDS
Anchor Standards: 4.0, 4.3, 4.4, 4.5, 4.6, 5.2, 5.3, 5.4, 6.0, 7.0, 8.0, 8.1, 9.7, 10.0
CTE Engineering and Architecture - Engineering Design & Technology
Pathway Standards: A3.3, A4.0, 4.1, 4.2, A5.0, A6.0, A6.1 A8.0, C2.0, C2.1, C2.2, C2.3, C5.0

A. In this unit, students come to learn the various industries and sectors that offer a career in Design Engineering. Students conduct research on various types of Design Engineering employers and occupations. They document their findings in a report. Additionally, students develop a personal resume indicating their skills and qualifications gained through the class. Students gain valuable insight into Design Engineering as a career either through a field trip to an Engineering field facility such as Boeing or JPL or by a professional in the industry visiting the class as a guest speaker.

B. Professional Resume and Career Goals Presentation: In this assignment, students use word processing software to write and format a professional resume that can later be used to assist in gaining entry level employment in the design engineering industry sector. The resume lists the student's occupational objective, educational experience, software skills, hands-on skills, and certifications. The resumes are checked for proper spelling, grammar, diction, and formatting. In the Career Goals Presentation, students create slides that outline the outcomes of their research of Design Engineering fields and functions they are interested in and have found. Students will present slides, reaffirming what they have learned and enriching the research of other students.

Final Project/Exam:

1. Students will each create a Model and Drawing package for a unique Assembly Design that they will create. Design Package will include detail drawings of each detail part, assembly drawings of all assembly and sub-assemblies, and installation MBD's for assembly installations. All drawings will be created using projected views from fully

defined and constrained models. Package will contain two example parts using Model Based Definition. Students exhibit their work and reflect on their learning before a panel of industry partners.

2. Exhibition of Learning –Each student prepares and delivers an exhibit of their learning and accomplishments to a panel of industry partners. The exhibition of learning features evidence of growth in college and career readiness, student reflections on learning, as well as the final project and samples of work featured in the student's course notebook and portfolio.