URBANDALE COMMUNITY SCHOOL DISTRICT

Course Title: **Introduction to Engineering Design**

Description: Introduction to Engineering Design (IED) is a high school level course that is appropriate for students who are interested in design engineering, other fields of engineering, or another technical career. Students use a problem-solving model to improve existing products and invent new ones. They learn how to apply this model to solve problems in and out of the classroom. Using sophisticated 3D modeling software, students communicate the details of the products. Emphasis is placed on analyzing potential solutions and communicating ideas to others.

IED is one of the 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.

Reporting Topic	Grade Level Standards	Competency Statement
Engineering Design Process	● Students will develop the abilities to apply the design process. (11.9-12.P) ● Students will develop an understanding of engineering design.(9.9-12.K)	Students will be able to understand and apply the engineering design process.
Technical Sketching	● Students will develop an understanding of and be able to select and use information and communication technologies. (17.9-12.P)	Students can create and apply technical drawing representations of a design.
Measurement and Statistics	● Reason quantitatively and use units to solve problems. (N-Q.A) ○ 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N-Q.A.1) (DOK 1,2) ○ 2. Define appropriate quantities for the purpose of descriptive modeling. (N-Q.A.2) (DOK 1,2) ○ 3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N-Q.A.3) (DOK 1,2) (N.Q.1-3) ● Interpreting Categorical and Quantitative Data (S.ID.1-4) ● Students will develop the abilities to apply the design process. (11.9-12.P)	Students can make precise measurements using various systems of measurement and perform statistical calculations when analyzing and evaluating a design.

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Geometry of Design	● Apply geometric concepts in modeling situations (G-MG.A) ○ 2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).(G-MG.A.2) (DOK 1,2) ○ 3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; ● Explain volume formulas and use them to solve problems (G-GMD.A) ○ 3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.(G-GMD.A.3) (DOK 1,2) ● Students will develop the abilities to use and maintain technological products and systems. (12.9-12.P)	Students can identify and calculate various 2D and 3D geometries as well as physical properties used in design.
Documentation	● Students will develop the abilities to use and maintain technological products and systems. (12.9-12.L) ● Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate. (12.9-12.L) ● Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (12.9-12.L)	Students can create a set of working drawings and identify and differentiate between various annotations on engineering designs.
Beginning Modeling	● Summarize, represent, and interpret data on two categorical and quantitative variables (SID.B) ○ 6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. (SID.B.6) (DOK 1,2) Interpret linear models (S-ID.C) ○ 7. Interpret the slope (rate of change) and the intertercept (constant term) of a linear model in the context of the data. (S-ID.C.7) (DOK 1,2) ● Students will develop the abilities to apply the design process. (11.9-12.R)	Students will develop and/or use graphical, computer, physical and mathematical models as appropriate to represent or solve problems
Advanced Computer Modeling	● Students will develop the abilities to use and maintain technological products and systems. (12.9-12.P) ● Students will develop the abilities to apply the design process. (11.9-12.R)	Students will use advanced modeling features to create 3D solid models of complex parts and assemblies within CAD using appropriate geometric and dimensional constraints.

Reverse Engineering	• Students will develop the abilities to apply the design process. (11.9-12.R)	Students can explain and perform a reverse engineering process which includes discovery, documentation, investigation, and product improvement.