# CIT Engineering II Curriculum Map

| Month | Days | Description | Labs | Engineering Tech Standards |
|---|---|---|---|---|
| | | **Unit I - Team Building** | | |
| Aug | 1 | Identify the Leader Game - intoductions, surveys, and classroom management | | 6.3, 6.4 |
| | 2 | Fill My Beaker - team game focused on communication and collaboration | x | 6.3, 6.4 |
| | 3 | Team Charades, Engineering notebook setup and rubric, reiterate engineering design process. CTSO explanation and officer selection. | | 6.1 |
| | 4 | CTSO service opportunity - organize service project | | |
| | 5 | CTSO service project | | |
| | | **Unit II - SolidWorks** | | |
| | 1 | Creating a 3D models - swept boss/base and cuts | x | 5.4 |
| | 2 | Practice 3D models - swept boss/base and cuts | x | 5.4 |
| | 3 | Creating a 3D model - lofts | x | 5.4 |
| | 4 | Practice 3D models - lofts | x | 5.4 |
| | 5 | Create drawings from 3D models | x | 1.6, 5.4 |
| | 6 | Practice creating drawings from 3D models | x | 1.6, 5.4 |
| | 7 | Assemble 3D models from given parts | x | 5.4 |
| | 8-9 | Practice assembling 3D models from given parts | x | 5.4 |
| | | **Unit III - Manufacturing** | | |
| Sept | 1 | Introduce door stop project (criteria and constraints). Describe torque and how it plays a role when using a doorstop. | | 1.2, 2.1, 2.2, 2.3, 2.4 |
| | 2 | Design doorstop using SolidWorks | x | 2.4, 2.5, 5.2, 5.4 |
| | 3 | Tool safety discussion | | |
| | 4 | Discuss manufacturing - cost of materials, efficiency of resources and time | | 1.2, 5.1 |
| | 5-7 | Manufacture doorstops | x | 2.4, 2.5, 2.6, 2.7 |
| | 8 | Test doorstops - quality assurance | x | 2.7, 2.8 |
| | 9 | "Sell" doorstops to clients (other teachers) | | 6.3 |
| | | **Unit IV - Density and Bouyancy** | | |
| | 1 | Discuss and demonstrate the force of bouyancy and why it exists | | 1.2, 4.2 |
| | 2 | Describe Archimede's principle | | 4.2 |
| | 3 | Calculate waterline | | 3.1, 3.5, 3.6, 3.7 |
| | 4-5 | Introduce tagboard boat competition (criteria and constraints). Design and construct a floating volume that can hold most weight. Determine waterline and test for accuracy | x | 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 3.1, 3.5, 3.7 |
| | 6 | Introduce cardboard boat scale model project (criteria and constraints). Design cardboard boat scale model in SolidWorks | | 2.1, 2.2, 2.3, 2.4, 5.4 |
| | 7 | Plan and measure net for creating scale model cardboard boat | x | 2.1, 2.2, 2.3, 2.4 |
| | 8-9 | Construct scale model cardboard boat, calculate and draw waterline | x | 2.4, 2.5, 2.6, 3.1, 3.5, 3.7 |

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| | 10 | Test scale model cardboard boat for bouyancy and water line accuracy. | x | 2.7 |
| | 11 | Test and evaluate scale model cardboard boats using test tracks. | x | 2.7, 2.8 |
| Oct | 12 | Introduce cardboard boat (full scale) project (criteria and constraints). | | 1.1, 1.2 |
| | 13 | Compete in Annual Cardboard Boat Race at Flagstaff High School | x | 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 |
| | 14 | CTSO SkillsUSA Fall Leadership Conference in Phx | | 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 |
| | | **Unit V - Piston Pump** | | |
| | 1 | Describe different pumps and how they work through research | | 1.1, 1.3 |
| | 2 | Present research | | |
| | 3 | Diagnose and analyze a piston pump using a syringe - tell the story of how water flows using a piston | | 4.1, 4.3 |
| | 4 | Introduce piston pump competition (criteria and constraints). Research and diagnose a check valve | | 4.4 |
| | 5 | Brainstorm ideas for check valves and pistons | x | 2.1, 2.2, 2.3, 2.4, 4.4 |
| | 6 | Design checkvalves and pistons | x | 2.4, 2.5 |
| | 7-9 | Construct checkvalves and pistons | x | 2.4, 2.5, 2.6, 2.7 |
| | 10 | Test and evaluate checkvalves and pistons | x | 2.7, 2.8 |
| | 11 | Calculate efficiency of a pump according to capacity of piston. Choose best design and manufacture design in teams | | 2.4, 3.1, 3.3, 3.5, 3.6, 3.7 |
| Nov | 12-14 | Construct, test, problem solve and reiterate piston pump | x | 2.4, 2.5, 2.6, 2.7 |
| | 15 | Evaluate piston pump and compete for most productive piston pump. | x | 2.7, 2.8, 3.1, 3.5, 3.7 |
| | | **Unit VI - Khan Academy Programming** | | |
| | 1 | Discuss importance and benefits of learning to program. Set up khan academy account. | | 1.1, 1.4 |
| | 2 | Describe a function and parameters. Practice using functions and parameters in code. | x | 2.6, 2.7 |
| | 3-4 | Practice using different fuctions such as ellipse, rect, color, fill, text, etc | x | 2.6, 2.7 |
| | 5 | Define and use a variable in code. Practice using variables in code. | x | 2.6, 2.7 |
| | 6-7 | Create a dynamic picture using functions and variable in code. | x | 2.4, 2.5, 2.6, 2.7 |
| | 8 | Define and use if statements in code. Practice using if statements in code | x | 2.6, 2.7 |
| | 9 | Define and use if/else statements in code. Describe pros and cons of if vs if/else statements | x | 2.6, 2.7 |
| | 10-11 | Create a button, slider, or other dynamic feature | x | 2.4, 2.5, 2.6, 2.7 |
| | 12-13 | Use math functions in a program. Practice using math functions in a program. | x | 2.6, 2.7 |
| | 14 | Use while loop in code. Practice using while loop. | x | 2.6, 2.7 |

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| | 15-16 | Use for loop in code. Practice using for loop. | x | 2.6, 2.7 |
| Dec | 17 | Use an array in code. Practice using an array in code. | x | 2.6, 2.7 |
| | 18 | Introduce Holiday Greeting Card coding project (criteria and constraints) | | 2.1, 2.2, 2.3 |
| | 19-24 | Test, problem solve, reiterate code for holiday greeting card project. | x | 2.4, 2.5, 2.6, 2.7 |
| | 25 | Evaluate holiday greeting card project. | x | 2.7, 2.8 |
| | 26 | CTSO Holiday Social event | | |
| | | **Unit VII - Wind Turbines** | | |
| Jan | 1 | Discuss sustainability and energy usage. Describe and research pros and cons of wind energy as a sustainable energy source. | | 1.4, 1.5 |
| | 2 | Present research and describe how a wind turbine works. | | 6.2, 6.3 |
| | 3 | Discuss electromagnetic induction and the production of electricity through a generator. Identify three ways to increase electrical production of a generator. | | 4.1 |
| | 4 | Introduce wind turbine competition through the national KidWind Challenge. Breakdown project and create a time management plan (GANTT chart) | | 1.5, 2.1, 2.2, 2.3, 6.3, 7.1, 7.2, 7.3, 7.4 7.5 |
| | 5 | Assemble wind turbine in SolidWorks | x | 5.4 |
| | 6 | Brainstorm ideas and modify parts in SolidWorks | x | 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3, 5.4 |
| | 7-15 | Prototype, test, problem solve, and reiterate wind turbine parts created using shop tools, lasers, and 3D printers | x | 2.4, 2.5, 2.6, 2.7, 5.4, 5.6, 5.7 |
| Feb | 16-22 | Assemble and test wind turbines - collect data (rotor speed, voltage, current, power and total energy). Define problems, brainstorm solutions, reiterate. | x | 2.4, 2.5, 2.6, 2.7, 5.2 |
| | 23-24 | Change variables, test for efficiency, collect and analyze data (rotor speed, voltage, current, power and total energy) | x | 1.2, 2.6, 2.7, 2.8, 3.1, 3.5, 4.3, 5.2 |
| | 25 | Compete and present wind turbine project at the AZ regional KidWind Challenge competition. | x | 1.2, 1.3, 1.4, 1.5, 2.8, 6.1, 6.2, 6.3, 7.5 |
| | | **Unit VIII - Arduino Microprocessors** | | |
| | 1 | Introduce arduino microprocessor and its functionality. Navigate adruino and arduino IDE. | | 1.4 |
| | 2 | Compare and contrast programming in Khan Academy with Arduino IDE. Code Arduino to register and say "Hello World" | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 3 | Generate a random number and code arduino to respond to different values. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 4 | Set up a sensor circuit with a voltage divider. Analyze circuit with voltage divider. | x | 5.2, 5.5, 5.6 |
| | 5 | Use sensor circuit and code arduino to read the sensor and display the values of the sensor. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 6 | Practice creating sensor circuits and displaying the values of the sensor. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |

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| | 7 | Create an LED circuit. Control the LED circuit by coding the arduino. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 8 | Dim an LED using pulse width modulation. Describe pulse width modulation. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 9 | Code a multiLED in Arduino IDE and control the colors through code. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 10 | Describe a servo and code servo to move. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 11 | Practice coding a servo and displaying values | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| March | 12-14 | Use sensors (inputs) and control LED's and servo through coding the Arduino | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 15 | Introduce arduino project (criteria and constraints). Break down project and create a GANTT chart | | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 7.1, 7.2, 7.3 |
| | 16-21 | Brainstorm, code, prototype, test and reiterate code and physical arduino model. | x | 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 22 | Evaluate arduino project | x | 2.8, 6.1 |
| | | **Unit IX - Energy Transformations** | | |
| | 1 | Introduce rube goldberg project (criteria and constraints). Discuss types of energy. Brainstorm ideas for energy sources. | | 1.1, 2.1, 2.2, 2.3 |
| | 2 | Calculate energy from gravitational sources, chemical sources, and mechanical sources. | | 3.1, 3.5, 3.7, 4.1, 4.3 |
| | 3 | Practice energy calculations and brainstorm energy transitions | | 2.1, 2.3, 3.1, 3.5, 4.1, 4.3 |
| | 4 | Develop overall idea rube goldberg idea as a team. Present the idea to the client. | | 2.4 |
| | 5 | Break down project into parts and assign parts to different team members. Create a project management chart (GANTT chart). | | 2.5, 6.3, 7.1, 7.2, 7.3 |
| April | 6-15 | Design, prototype, test, problem solve, and reiterate individual parts. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 16 | Present working part to client and evaluate. | x | 2.7, 2.8 |
| | 17-22 | Assemble and test team rube goldberg project. Problem solve transitions. | x | 2.1, 2.3, 2.4, 2.5, 2.6, 2.7 |
| | 23 | Present and evaluate rube goldberg project. | x | 2.7, 2.8, 7.5 |
| | 24 | Calculate energy and summarize success of project. | | 3.1, 3.5, 4.1, 4.3 |
| | | **Unit X - Chemical Reaction** | | |
| | 1 | Describe and demo how a gas cannon works. | | 1.1, 4.4 |
| | 2 | Write the chemical story of each step in the gas cannon process. | | 4.1 |
| | 3 | Introduce gas cannon competition (criteria and constraints). Brainstorm gas cannon idea and projectile ideas | | 2.1, 2.2, 2.3 |
| | 4 | Discuss impulse momentum and how it plays a role in launching projectile. Determine how to create the most efficient projectile. | | 1.2, 2.3, 2.4 |

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| May | 5 | Discuss rocket flight and flight stability in terms of center of mass and center of pressure. Design rocket. | x | 2.3, 2.4 |
| | 6 | Design adjustable cannon and frame. | x | 2.3, 2.4 |
| | 7-11 | Build and construct frame, cannon and projectile from design plans | x | 2.4, 2.5, 2.6, 2.7 |
| | 12-15 | Test different fuel sources and collect distance data. | x | 2.7, 2.8, 3.2, 3.5 |
| | 16 | Analyze test results and calculate the distance per mole ratio to determine best results. | x | 3.1, 3.5 |
| | 17 | Evaluate gas cannon. Compete for best distance per mole ratio. | x | 2.7, 2.8 |
| | 18 | CTSO end of year social event | | |
| | | | | |
| | | **123 out of 167 (scheduled) days working with technology, SolidWorks, shop tools, and 3D printers. 74% of time will be spent in labs.** | | |