Foundations of Technology, 4th Edition
Technology, Engineering, and Design

Course Summative Blueprint
Interpretation of Columns on EbD™ STEM Course Blueprints

No.	Heading	Column information
1	*STL* Standard/ Benchmark	The standard and benchmark addressed from *Standards for Technological Literacy* (e.g., 1A). The primary source is the appropriate column in the ***Standards Responsibility Matrix***.
2	*STL* Depth of Coverage	This is a number from 1-4, with 4 representing the greatest depth of coverage, a benchmark that is addressed to sufficient depth that it must be assessed.
3	NCTM Standard/ Enabling Statement	The **High School** NCTM Standard/Enabling Statement designation is derived from *Principles and Standards for School Mathematics* (NCTM, 2000). It is a combination of **numbers and letters** (e.g., 1A) from the **Mathematics Standards Matrix**.
4	NCTM Depth of Coverage	This is a number from 1-4, with 4 representing the greatest depth of coverage, a benchmark that is addressed to sufficient depth that it must be assessed.
5	AAAS Standard	The **High School** AAAS designation is derived from *Benchmarks for Science Literacy* (AAAS, 1993/2009). It is a combination of **numbers and letters** (e.g., 1A) from the **Science Standards Matrix**.
6	AAAS Depth of Coverage	This is a number from 1-4, with 4 representing the greatest depth of coverage, a benchmark that is addressed to sufficient depth that it must be assessed.
7	Unit Titles and Objective Statements	Statements of unit titles and specific objective. Each objective begins with an action verb and makes a complete sentence when combined with the stem "Students will learn to. . ." (The stem appears once in Column 7.) Outcome behavior in each objective statement is denoted by the verb plus its object.
8	Course Weight	Shows the relative importance of each objective and unit. Course weight is used to help determine the percentage of total class time that is spent on each objective.
9	RBT Designation (If Included)	Classification of outcome behavior in competency and objective statements in Dimensions according to the Revised Bloom's Taxonomy. (Cognitive Process Dimension: 1 Remember, 2 Understand, 3 Apply, 4 Analyze, 5 Evaluate, 6 Create) (Knowledge Dimension: A Factual Knowledge, B Conceptual Knowledge, C Procedural Knowledge)

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1	2	3	4	5	6	7	8	9
N/A	N/A	N/A	N/A	N/A	N/A	**Unit 1:** Technological Innovations and Inventions	**10%**	
1-K	2					Interpret charts and graphs that illustrate the rapidly increasing rate of technological development and diffusion.	.5%	
1-L	2					List examples of inventions and/or innovations that are the result of specific, goal-oriented research.	.5%	
1-M	2					Describe an example of a technology in which the development was driven by the profit motive and the market.	.5%	
2-CC	4					Discuss how new technologies are used to create new processes. Explain how the introduction of a new technology would change the current process used in creating a product.	1.5%	
3-G	1					Describe a technology transfer that took place when a new user applied an existing innovation developed for one purpose in a different function.	.25%	
3-H	1					Describe a technological innovation that resulted when ideas, knowledge, or skills were shared within a technology, among technologies, or across other fields.	.25%	
3-I	1					Describe the patenting process that is sometimes used to protect technological ideas.	.25%	

7-G	4			3C/H6	4	Support the statement that most technological development has been evolutionary, the result of a series of refinements to a basic invention, through an electronic presentation. Present the evolutionary history of a	2.25%	

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						technological device, specifically mentioning the original inventions and the series of refinements to that invention that led up to the given technological device. Support the statement that the human ability to shape the future comes from a capacity for generating knowledge and developing new technologies—and for communicating ideas to others.		
6-J	4			3B/M2a 3B/H2	3 2	Support the statement that a number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies. Identify how advertising, the strength of the economy, the goals of the company, and the fads of the time period contribute to the design of the product and the success or failure of the product, given various technological innovations. Describe how a technology may have effects other than those intended by the design, some of which may have been predicable and some not. Explain how the value of any given technology may be different for different groups of people and at different points in time.	2%	
10-I	4					Illustrate that research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the	1.5%	

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						marketplace by researching a specific company within the local vicinity. 1.4 Present how a company's research and development department uses specific problem-solving approaches to prepare devices and systems for the marketplace, using a specific company within the local community.		
		Alg 7F	4			Approximate and interpret rate of change from graphical and numerical data.	.5%	
		Meas 13S	3			Analyze precision and accuracy of measurements to construct and modify components as necessary to build a geodesic dome.		

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N/A	N/A	N/A	N/A	N/A	N/A	**Unit 2:** The Engineering Design P	**30%**	
8-H	4	Alg5L Alg6F Geo11X	3 3 4			Apply the steps of the design process including defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, and communicating results. Draw reasonable conclusions about a situation being modeled. Analyze the cross sections of three-dimensional objects and spaces from different perspectives.	3%	
8-I	3					Describe a design problem that does not clearly define all criteria and constraints. 4.3	1%	
8-J	3					Demonstrate how to check or test a design in order to redefine and improve the design.	1%	
8-K	3					Describe a design where the requirements, such as criteria, constraints, and efficiency, compete with each other.	1%	
9-I	4	Alg5L Geo11AA	3 4	2B/H1 3A/M3	3 3	Identify the design principles used in a current design, collect data on the effectiveness of the design principles used, and propose a redesign using a design process. Use mathematical modeling aids in technological design by simulating how a proposed system might behave. Identify human values and limitations when using scientific knowledge to solve practical design problems.	4%	

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						Use symbolic algebra to represent and explain mathematical relationships. 4.2 Use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture. 4.4		
9-J	3					Describe the importance of creativity, resourcefulness, and the ability to visualize and think abstractly when engaged in engineering design.	1%	
9-K	3					Demonstrate the use of a prototype to test a design concept.	1%	
9-L	3					List three factors that must be considered when engaged in engineering design.	1%	
11-N	4	Alg6F	3	3A/M3 3B/M1	3 3	Distinguish the criteria and constraints and reflect on how the criteria and constraints affected their final solution. Identify pertinent information needed to solve a given problem on two or more case studies. Draw reasonable conclusions about a situation being modeled. Explain how design usually requires taking into account not only physical and biological constraints, but also economic, political, social, ethical and aesthetic ones. Identify human values and limitations when using scientific knowledge to solve practical design problems.	5%	
11-O	4	Alg5L Geo11X Geo11AA	3 4 4	2B/H1	3	Use prototypes and models to ensure quality, efficiency, and productivity of their final product. Demonstrate how mathematical modeling	3%	

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						aids are used when simulating how a proposed system might behave. Use symbolic algebra to represent and explain mathematical relationships. Analyze the cross sections of three-dimensional objects and spaces from different perspectives. Use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture. 4.4		
11-R	4	Geo8M Geo11X Geo11W	4 4 4			Communicate their observation, processes, and results of the entire design process and the final solution, using appropriate verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. Analyze properties and determine attributes of two- and three-dimensional objects. Analyze the cross sections of three-dimensional objects and spaces from different perspectives. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools.	4%	
12-P	4	Alg6F	3			Collect data and information and use computers and calculators to organize, process, and present the collected data and information. Draw reasonable conclusions about a situation being modeled.	3%	
12-L	4					Present their completion of the design process through a presentation with two	1%	

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						target audiences, using appropriate oral and written techniques.		
13-J	4					Collect information and evaluate its quality.	1%	

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N/A	N/A	N/A	N/A	N/A	N/A	**Unit 3:** The Designed World	**40%**	
15-K	4			12D/H7 2B/M1	3 3	Identify, for a specific food, fiber, fuel, chemical or other agriculture product, the systems individuals, corporations, financial institutions and government use to produce and regulate the specific product. Use tables, charts, and graphs in making arguments and claims in oral, written, and visual presentations.	2%	
1-J	4			3C/M8	3	Identify technology and processes designed for specific functions of a given system. 5.1 Explain that scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.	2%	
18-J	4			8C/H2 3C/M8	4 3	Identify the transportation utilized within a given system such as manufacturing, construction, communication, health and safety, or agricultural. Describe the advantages and disadvantages to consider when selecting fuels to be used in a transportation system. Explain that scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.	3%	
16-K	4			4BH8 4E/H1 8C/H8	4 3 3	Categorize examples given by the teacher into the major forms: thermal, radiant, electrical, mechanical, chemical, and nuclear.	3%	

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						List three natural resources that are readily renewable, three that are renewable only at great cost, and three that are not renewable at all. Trace the conversion of energy from one form to another within an electronic device. 5.1 Describe how energy is conserved within an electronic device.		
16-J	4	Alg5K Alg5L Meas12M	3 3 3	4B/H8	4	Diagram how a power plant converts energy from one form to another while conserving energy. Explain that the earth has many natural resources of great importance to human life. Make decisions about units and scales that are appropriate for problem situations involving measurement. List three natural resources that are readily renewable, three that are renewable only at great cost, and three that are not renewable at all.	3%	
16-M	1					List five renewable and five nonrenewable energy resources.	1%	
16-N	3					Describe a power system, such as a car and identify the source of energy, the process, and the load.	1%	
17-L	4					Identify the inputs, processes, and outputs associated with a given information and communication system.	3%	
17-M	4					Identify examples of how information and communication systems allow information to be transferred from human to human, human	3%	

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						to machine, machine to human, and machine to machine.		
17-N	1					Demonstrate the use of an information and communication system to inform, persuade, entertain, control, manage, or educate. 5.4	1%	
17-O	4					Identify the function of the source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination for information and communication systems.	3%	
17-Q	3			12D/H7	3	Demonstrate the use of visual, auditory, and tactile stimuli to communicate using symbols, measurement, conventions, icons, graphic images, and language. Use tables, charts, and graphs in making arguments and claims in oral, written, and visual presentations.	1%	
19-M	4					Classify materials as natural, synthetic, or mixed based on the mechanical, thermal, and electrical properties of the material.	3%	
19-O	3					List three products that are manufactured using each of the following manufacturing systems: customized production, batch production, and continuous production.	1%	
19-P	3	Meas12M	3	2B/M1	3	Select a manufactured product and explain how the interchangeability of parts increases the effectiveness of manufacturing processes. Explain that mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.	1%	
20-K	4	Alg5K	3	2B/M1	3	Identify the appropriate assembly procedures	3%	

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		Alg5L Meas12M	3 3	3C/M8	3	to create a structure based on the supplied resources, the given budget of the project, and the skills of the workers. Write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency—mentally or with paper and pencil in simple cases and using technology in all cases. Use symbolic algebra to represent and explain mathematical relationships. Make decisions about units and scales that are appropriate for problem situations involving measurement. Explain that mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face. Explain that scientific laws, engineering principles, properties of materials, and construction techniques must be taken into account in designing engineering solutions to problems.		
20-J	4			2B/M1	3	Identify the components of the infrastructure that assist in the function of the school within the students' local community. Explain that mathematics is helpful in almost every kind of human endeavor—from laying bricks to prescribing medicine or drawing a face.	3%	
14-L	4			6E/H3a	4	Identify the medicine, telecommunications, virtual presence, computer engineering,	3%	

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						informatics, artificial intelligence, robotics, materials science, and perceptual psychology that integrate to complete the problem solution to a given case study scenario. Provide examples of new medical techniques and efficient health care delivery systems, that allow human beings a better chance of staying healthy. Analyze the dietary and sanitation needs of an area that has just experienced a natural disaster such as an earthquake, tsunami, or flood.		

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N/A	N/A	N/A	N/A	N/A	N/A	**Unit 4:** Systems	**10%**	
12-M	4			3B/M4a 11A/H2	3 4	Diagnose a system that is malfunctioning and distinguish tools, materials, machines, and knowledge to repair it. Use tools, materials, machines, and knowledge to repair a system or product that is malfunctioning. Explain that systems fail because they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. Identify an opportunity for redesign of a product and choose to reverse engineer the design flaw. Define a system by identifying its subsystems, its relationship to other systems, and the intended input and output of the system. Troubleshoot common mechanical and electrical systems, checking for possible causes of malfunction, and decide whether to fix it or get help from an expert.	3%	
12-N	4			3B/M4b 12C/H1*	3 4	Design a troubleshooting diagram and manual for another user to maintain the safe and proper operation of a system or product. Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision. Explain that the most common ways to	2%	

						prevent failure are pretesting of parts and		

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						procedures, overdesign, and redundancy. Follow instructions in manuals or seek help from an experienced user to learn how to operate new mechanical or electrical devices.		
12-O	4					Operate systems so that they function in the way they were designed. Identify the safe procedures and directions so a new user can recognize the input, process, output, feedback components of, and operate two different systems.	2%	
2-X	4	Alg 5K	2	3B/M3a 3C/M8 11A/H2	4 2 3	Explain that systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems. Use systems in the design and development of technology. Differentiate between larger technological, social or environmental systems from smaller components and subsystems. Identify the various systems embedded within the larger system (technological, social or environmental), using the language of the core technologies (input, process, output, feedback). Calculate algebraic equations representing scientific principles related to a design challenge to refine a solution to the problem.	3%	

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N/A	N/A	N/A	N/A	N/A	N/A	**Unit 5:** Lunar Plant Growth Chamber (NASA)	**10%**	
1-E	(Grades 3-5)			3A/H2	3	Describe how creative thinking and economic and cultural influences shape technological development at NASA.	.25%	
1-G	(Grade 6-7)	Meas12M Meas13S Data14J	3 3 3	3A/H1 3C/H1	3 3	Explain how the exploration of new lands, particularly the Moon and other planets, is based on human needs and the ability to be creative. Explain how NASA has developed new transportation processes based on new vehicle designs. Describe a social and an economic force that influenced the development of the Constellation Program. Make decisions about units and scales that are appropriate for problem situations involving measurement. Analyze precision, accuracy, and approximate error in measurement situations. Compare and contrast the differences among various kinds of studies and which types of inferences can legitimately be drawn from each.	.25%	
2-X	4	Process21C	3	2B/H1	3	Apply systems-thinking principles to the engineering design process. Apply mathematical modeling to simulate how a system would theoretically behave.	1%	
2-Y	3			3B/H3 9D/H8 11A/H3	3 3 4	Describe how one component within the NASA transportation system can impact a NASA mission.	.5%	

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						Describe a complex system in the NASA Transportation Cycle that has layers of controls. Demonstrate a physical or mathematical model used to estimate the probability of real-world events. Describe two examples of feedback in the successful operation of the NASA Transportation Cycle.		
2-Z	3					Describe the spin-off technologies that are a direct result of the NASA space program. Describe that the selection of the appropriate means of transportation involves tradeoffs between competing values.	.5%	
2-CC	4	Number1R Meas12M Meas13S	3 4 3			Describe the basic operating principles behind the Ares V in transporting cargo to the lunar surface. Describe the basic operating principles behind the Ares I in transporting crew members to the lunar surface and back to Earth. Develop an understanding of large numbers and recognize and appropriately use expo-nential, scientific, and calculator notation. Make decisions about units and scales that are appropriate for problem situations involving measurement. Analyze precision, accuracy, and approximate error in measurement situations.	1%	
2-EE	(Adv HS)			3B/H1	4	Explain that the management of transportation systems includes the process	1%	

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						of planning, organizing, and controlling the transportation cycle. Use a mathematical modeling aid to simulate how a proposed system would behave. 6.4		
11-P	3	Number1R Proces18B 21C	3 3 3	2B/H1 3B/H6 9D/H8	3 3 3	Evaluate a design by using conceptual, physical, and mathematical models. Describe mathematical testing procedures that NASA completes to ensure that the Ares I and Ares V operate successfully. Test a system through the use of small scale models. Use a physical model to estimate the probability of real-world events. Develop an understanding of large numbers and recognize and appropriately use expo-nential, scientific, and calculator notation. Solve problems that arise in mathematics and in other contexts. Apply mathematics in contexts outside of mathematics.	1%	
11-Q	3	Geo11W Meas12M Process18B Process21C	4 4 2 2			Apply the engineering design process to solve a problem. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools. Make decisions about units and scales that are appropriate for problem situations involving measurement. Solve problems that arise in mathematics and in other contexts. Apply mathematics in contexts outside of mathematics.	.5%	

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11-R	4	Geo11W Process18B Process18C	4 2 3			Evaluate a design by using conceptual, physical, and mathematical models. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools. Solve problems that arise in mathematics and in other contexts. Apply and adapt a variety of appropriate strategies to solve problems.	1%	
12-O	4			11A/H3	4	Operate systems so they function the way they were designed. Identify the feedback from successful operation of a designed system.	1%	
18-J	4					Explain that transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communications, health, safety and agriculture. Describe examples for each mode of transportation, such as highways, waterways, railways, and space, which are integrated to move people and goods.	1%	
18-K	(Adv HS)					Describe that intermodalism is the use of various modes of transportation as parts of an interconnected system to move people and goods. Describe the specific intermodal forms of transportation NASA uses to move goods and people. Describe how one component within the NASA transportation system can impact a NASA mission. Explain how the NASA transportation cycle	1%	

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						contributes to NASA achieving the mission.		